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**RECINSCAN: INGREDIENTS SCANNER FOR RECIPE
RECOMMENDATIONS OF KAPAMPANGAN DISHES
UTILIZING YOLOV9 ALGORITHM**

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**RECINSCAN: INGREDIENTS SCANNER FOR RECIPE
RECOMMENDATIONS OF KAPAMPANGAN DISHES
UTILIZING YOLOV9 ALGORITHM**

A thesis submitted to the faculty of College of Computing
and Information Sciences in candidacy for the Degree of
Bachelor of Science in Computer Science
(Application Development Elective Track)

DEPARTMENT OF COMPUTER SCIENCE

BY

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**RECINSCAN: INGREDIENTS SCANNER FOR RECIPE
RECOMMENDATIONS OF KAPAMPANGAN DISHES
UTILIZING YOLOV9 ALGORITHM**

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ABSTRACT

ReclnScan relates to food ingredient scanning. It enables individuals to scan available ingredients with a snap of a button. The study was developed to assist users in identifying the ingredients they have on hand and provide accurate recipe suggestions based on the scan results. The system was developed using Agile methodology, allowing for iterative improvements throughout the development cycle. Evaluation of the YOLOv9 model yielded a 50.10% accuracy rate in identifying raw ingredients, indicating that the implemented approach is moderately effective for real-time ingredient detection. Additionally, the ISO 25010 systems evaluation produced favorable outcomes, revealing that users found the system functional and capable of delivering expected results. To design, develop, and refine ReclnScan, the study employed a comprehensive approach that combined experimental, developmental, and descriptive research methodologies. Experimental research assessed the model's performance through hyperparameter tuning and testing under varied conditions. Developmental research documented the iterative enhancement of the application based on performance metrics and user feedback, focusing on detection accuracy and recipe relevance. Descriptive research involved user surveys and observational studies to evaluate the system's usability and alignment with user expectations. The Functional Requirements were as met as expected and the Non-Functional Requirements showed that the system can handle 200 people at most. The survey result majorly showed a score of 3.51-4.50 with a verbal interpretation of "Very Good" both from the end-user and IT experts. These methods ensured that ReclnScan was both technically sound and user-centered. Future recommendations include further model training to enhance accuracy, the addition of accessibility features, and full implementation of a mobile version for broader usability.

Keyword: *ReclnScan, YOLOv9, raw ingredients, Kapampangan recipe, Kapampangan dishes*

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TABLE OF CONTENTS

	Page
ABSTRACT	vi
ACKNOWLEDGEMENTS	vii
TABLE OF CONTENTS	viii
LIST OF FIGURES	xi
LIST OF TABLES	xiv
LIST OF APPENDICES	xvi
LIST OF ABBREVIATION	xvii
LIST OF EQUATIONS	xxi
CHAPTER I: INTRODUCTION	
Project Context	21
Purpose and Description of the Study	23
Objectives of the Study	25
General Objective	25
Specific Objectives	28
Scope and Limitations	30
Definition of Terms	32
Chapter 2: REVIEW OF RELATED LITERATURE AND STUDIES	
Machine Learning	35
Object Detection Algorithm	39
Yolov9 Algorithm	40
Recommendation Systems	40

Pampanga Cuisine	43
Benchmark	45
Synthesis	48
Conceptual Model of the Study	49
Chapter 3: RESEARCH METHODOLOGY		
Research Design	53
Research Methodology	54
Planning	55
Design	57
Wireframes	63
High Fidelity	73
Development	79
Algorithm Development and Model Training	80
ReclnScan Application	82
Algorithm and Model Integration	85
Testing	86
System Testing	88
Deployment	91
Review	94
Chapter 4: RESULTS AND DISCUSSION		
Preliminary Examination	100
Model Evaluation	102
Classification Accuracies	102

Model Performance Analysis and Discussion	104
Testing Results	109
Functional Testing Requirements	110
Non-Functional Testing Requirements	112
Throughput Test	113
Load Test	115
Stress Test	117
Project Evaluation	121
Application Evaluation Results	122
Evaluation Result per Metric	123
End User Survey Results	123
End User Evaluation Results	131
IT Experts Survey Result	133
IT Experts Evaluation Results	141
Synthesis	143
Chapter 5: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS	
Summary of Findings	145
Conclusion	146
Recommendations	148
REFERENCES	150

LIST OF FIGURES

Figure 1 Overview of the solution	35
Figure 2 Steps in Machine Vision	38
Figure 3 Input-Process-Output Diagram	50
Figure 4 Agile Software Development Life Cycle	54
Figure 5 Scan Module	63
Figure 6 Loading Module	64
Figure 7 Recommendation Module	65
Figure 8 Recipe Instruction Module	66
Figure 9 Use Case Diagram of RecInScan	67
Figure 10 Activity Diagram	68
Figure 11 Context Flow Diagram	69
Figure 12 Data Flow Diagram Level 0	70
Figure 13 Child Diagram Level 4.0	71
Figure 14 Entity Relationship Diagram	72
Figure 15 Ingredient Scanner with YOLOv9 algorithm	73
Figure 16 User-Friendly Menu Interface	74
Figure 17 Scan page	75
Figure 18 Detect Page	76
Figure 19 Detect Page	77
Figure 20 Recommend Page	77
Figure 21 Artificial Intelligence Chat Page	78

Figure 22 RecInScan Process Flowchart	84
Figure 23 Confusion Matrix of the Trained Model	103
Figure 24 Functional Suitability Evaluation Results - Functional Appropriateness	124
Figure 25 Functional Suitability Evaluation Results - Functional Completeness	124
Figure 26 Functional Suitability Evaluation Results - Functional Correctness	125
Figure 27 Performance Efficiency Evaluation Results - Time Behaviour	126
Figure 28 Performance Efficiency Evaluation Results - Capacity	127
Figure 29 Performance Efficiency Evaluation Results - Resource Utilization	128
Figure 30 Interaction Capability Evaluation Results - Appropriateness Recognizability	129
Figure 31 Interaction Capability Evaluation Results - Operability	130
Figure 32 Interaction Capability Evaluation Results - User Error Protection	131
Figure 33 Functional Suitability - Functional Appropriateness (IT EXPERT)	133
Figure 34 Functional Suitability - Functional Completeness (IT EXPERT)	134
Figure 35 Functional Suitability Evaluation Results - Functional Correctness (IT EXPERT)	135
Figure 36 Performance Efficiency Evaluation Results - Time Behaviour (IT EXPERT)	136

Figure 37 Performance Efficiency Evaluation Results - Capacity (IT EXPERT)	137
Figure 38 Performance Efficiency Evaluation Results - Resource Utilization (IT EXPERT)	138
Figure 39 Interaction Capability Evaluation Results - Appropriateness Recognizability (IT EXPERT)	139
Figure 40 Interaction Capability Evaluation Results - Operability (IT EXPERT)	140
Figure 41 Interaction Capability Evaluation Results - User Error Protection	141

LIST OF TABLES

Table 1 Evaluation of Accuracy	36
Table 2 Evaluation of Precision	37
Table 3 Benchmark on Object Detection Algorithm	45
Table 4 Benchmark about YOLOv9 and Object Detection Algorithms	46
Table 5 User Story	59
Table 6 Training Configuration Overview	80
Table 7 Functional Requirements	89
Table 8 Non-functional Requirements	90
Table 9 ISO 25010 Requirements	94
Table 10 Likert Scale Numerical Interpretation	97
Table 11 Verbal Interpretation	98
Table 12 Classification Report	104
Table 13 Functional Requirements Testing Outcome	110
Table 14 Throughput Test Result	113
Table 15 Load Test 1 Result	115
Table 16 Load Test 2 Result	116
Table 17 Stress Test Result 1	118
Table 18 Stress Test Result 2	118

Table 19 Stress Test Result 3	118
Table 20 Summary of Non Functional Requirement Testing	119
Table 21 Verbal Interpretation	122
Table 22 Mean Rating per Metric by End Users	132
Table 23 Mean Rating per Metric by IT Experts	142
Table 24 List of Account (account_list_table)	156
Table 25 List of Dishes (dishes_table)	156
Table 26 Account History (account_history_table)	157
Table 27 Ingredients (ingredients)	158
Table 28 List of Ingredients (ingredients_list)	158
Table 29 List of recipes (recipe_table)	158

LIST OF APPENDICES

Model Source Code	154
Database Dictionary	156
Evaluation Tool	160
Certificate of Approval	186
IT Expert Documentation	187
Grammarians Acceptance and Certificate	220
Turnitin Certificate	222
User Manual	223
Curriculum Vitae	282

LIST OF ABBREVIATIONS

Abbreviation	Meaning
AI	Artificial Intelligence
API	Application Programming Interface
CFD	Context Flow Diagram
CI/CD	Continuous Integration / Continuous Deployment
CNN	Convolutional Neural Networks
CPU	Central Processing Unit
CSS	Cascading Style Sheets
DFD	Data Flow Diagram
ERD	Entity-Relational Diagram
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
ie	id est
IPO	Input Process Output

ISO	International Organization for Standardization
js	JavaScript
MYSQL	MySQL Database Management System
OS	Operating System
PC	Personal Computer
ReclnScan	Recipe Ingredient Scanner
SDLC	Software Development Life Cycle
SQL	Structured Query Language
UI	User Interface
UX	User Experience
WSGI	Web Server Gateway Interface
XAMPP	Cross-Platform, Apache, MySQL/MariaDB, PHP, and Perl
YOLOv9	You Only Look Once Version 9

LIST OF EQUATIONS

Equation 1 Accuracy Formula	86
Equation 2 Precision Formula	87
Equation 3 Recall Formula	87
Equation 4 F1-Score Formula	87
Equation 5 Total Requests Formula	114
Equation 6 Target Throughput Formula	114

CHAPTER 1

INTRODUCTION

The Philippines' culinary capital, Pampanga, possesses a deep-rooted cooking tradition that defines its cultural identity. Iconic Filipino dishes trace their origins to this province, demonstrating its residents' culinary skills. The wide range of cooking methods used for its meals creates a demand for equipment to help professional chefs and home cooks during meal preparation. Food recommendation applications address this need; Many existing applications require users to input or select ingredients manually and are often limited to specific platforms, such as Android. A cross-platform application with features like ingredient scanning through image uploads presents an opportunity to create a more accessible and user-friendly solution, allowing individuals to engage with the app regardless of their device.

Recent advancements in real-time object detection, such as the YOLOv9 model, present opportunities for improving food recommendation applications. According to Yaseen, M. (2024), YOLOv9 addresses challenges like information loss and gradient instability through innovations like Generalized Efficient Layer Aggregation Network or GELAN and Programmable Gradient Information or PGI, making it suitable for ingredient recognition tasks. In addition, the projected rise in one-person households, coupled with the growing number of individuals with restricted kitchen skills, as highlighted by Turakhia, M. et al. (2022), reflects the increasing need for apps that support ingredient identification and recipe

generation. The apps can potentially empower the users, particularly new beginners, to acquire kitchen skills and confidence, filling an essential void in the current food technology landscape

Project Context

The Kapampangan cuisine, originating from Pampanga, has been recognized as the gastronomic center of the Philippines since the Spanish colonial era. The indigenous population learned their culinary practices directly from the Spanish, resulting in a cuisine with strong European influences. These combinations include the Filipino version of the Spanish paella, now known as Bringhe, and the Morcon beef roulade. With the development of computer vision technology, the growing visibility of Kapampangan cuisine has posed a considerable challenge for research in the field.

The food options for the Kapampangan cuisine are said to be overwhelming in their variety, and numerous dishes have become famous beyond the Pampanga province. So popular are the dishes that widespread popularity has made it harder and harder to determine the authentic representations of the region of origin. Food recommendation websites have proven helpful for professional chefs and amateur home cooks in enabling easier identification and preparation of authentic regional food.. Although these apps are handy, many do not have advanced features like ingredient scanning via image recognition. They are limited to Android operating systems with a minimum version of 4.4. Further development of more feature-laden and flexible

apps would significantly improve accessibility and enrich the user experience for more people. This limitation limits the use of these apps to those who run on other systems or less powerful hardware, thus creating an accessibility and usability gap.

The primary objective of this research is to develop a food ingredient scanning application designed to enhance users' cooking experience. This innovative application revolutionizes recipe discovery by leveraging the advanced object detection capabilities of the YOLOv9 model. Users can capture ingredients with the use of their camera, and the system will be able to accurately identify them, providing personalized recipe recommendations that maximize the usage of ingredients. The application is hosted on a cloud-based web platform, and it ensures seamless accessibility across all devices and operating systems, helping break down the barrier for culinary exploration.

Current studies in the field of computer science and Kapampangan cuisine reveal a lack of customized solutions for culinary practitioners. Applications such as SuperCook—Recipe Generation require users to enter the recipes they seek manually, hindering efficiency. The researchers are dedicated to help enhance the input process, making it more efficient, and provide clear guidance to handle any recipe scenario confidently.

To help enhance the accessibility for a wider range of users, which include the chefs and home cooks, the researchers actively explore approaches to streamline the input process. By addressing the current limitations of food

recommendation applications, such as the platform dependency and limited availability, this study aims to promote greater usability and inclusivity across different operating systems and user environments.

By developing a specialized model focusing on kapampangan dishes, it would present an opportunity to enhance or utilize more specific recipes and improved ways of identifying other kinds of recipes. Home cooks and users of the application may also find that their culinary expertise at home may be hindered with the unfamiliarity of kapampangan dishes. These problems may be addressed by catering the users to a food recommendation system focusing on kapampangan-based dishes, and be utilized as a figurehead for more specific food recommendation systems.

Purpose and Description of the Study

To address existing challenges in food recommendation applications, the study introduces the development of an ingredient scanner that is used to enhance the accuracy and convenience of ingredient input, which improves the overall user experience.

The model for the application will employ advanced computer vision techniques, namely the ingredient detection model. This will be used to match kapampangan dishes and recommend these recipes to the user. The primary objective or goal of the application is solved by training the YOLOv9 model with a diverse dataset of different ingredients, from spices and condiments, main ingredients like meat and vegetables, and secondary ingredients. This is utilized

as a way for users to use what available ingredients they have at their home, and turn them into kapampangan dishes. Key modules of RecInScan include using YOLOv9 as the object detection algorithm, detection of ingredients, recipe recommendation, and chatbot for the overall application, with a key web-hosted application as a general hub for users to use the application.

The primary purpose of the study is to design, develop, and validate a specialized object detection algorithm, specifically with the use of YOLOv9, specifically designed for image capturing of raw ingredient products. This purpose aligns with the need to address the limitations in existing technologies when applied. By achieving this purpose, the researchers aim to provide home cooks, chefs, and enthusiasts with a valuable tool for maximizing their ingredients.

This study has important implications for both the culinary field and the broader domain of computer technology. The application offers a promising solution to enhance food recommendation platforms. It provides users with comprehensive, step-by-step guides for preparing their recipes, elevating the overall user experience. Moreover, it contributes to the field of computer science by addressing the challenges posed by the food recommendation system in terms of recipe recommendation. The development of this model may also extend to other domains with similar image analysis requirements, such as healthcare and warehouse. This research aims to integrate Kapampangan cuisine with state-of-the-art technology, thereby enhancing food recommendation applications and contributing to advancements in computer vision.

Objectives of the Study

The study's general objective is to design and develop RECINSCAN: Ingredients Scanner for Recipe Recommendations of Kapampangan Dishes Utilizing YOLOv9 Algorithm.

Specific Objectives

To fulfill the main objective of this project, the authors constructed the following specific objectives:

1. Examine and understand the basic web-based and object detection algorithm, focusing on YOLOv9
2. Explore existing systems or applications of object detection algorithms, focusing on YOLOv9, that are relevant to the development of RecInScan
3. Analyze, understand, and perform preprocessing activities on the data gathered to develop an ingredient scanner and recipe recommendation system.
4. Train and evaluate the object detection model using the following evaluation metrics
 - A. Confusion Matrix
 - B. Classification Report
 - a. Accuracy
 - b. Precision
 - c. Recall
 - d. F1-Score
5. Design and develop a web-based application with the following key features:

- a. Ingredient Scanner with YOLOv9 Algorithm—the application's main key feature. The application implements the YOLOv9 algorithm to identify scanned ingredients.
 - b. User-Friendly Menu Interface - an easy-to-use and navigate user interface.
 - c. Scan Page - user scan page. This is where the user will upload or scan images of their recipe
 - d. Detect Page - This is where the user will be able to see the detected ingredients and could add more ingredients by uploading an image or manually inputting ingredients
 - e. Recommend Page - The recommend page will suggest dishes once the user is finished with the detect ingredients screen, and with that, the user will be able to choose a dish and get the recipe of the selected dish
 - f. AI Chatbot—is designed to facilitate quick, interactive conversations focused on Pampanga's culture and cuisine, providing users with easy access to relevant information in real time. This feature aims to engage users with informative dialogue about local traditions and food.
6. Test the functional (based on test cases) and non-functional aspects of the system
- A. Functional Requirement
- a. Interfacing with external APIs or systems

- b. User Authentication
- c. Allowing users to upload/download files

B. Non-functional Requirements

- a. Performance Efficiency Test
 - i. Throughput Test
 - ii. Load Test
 - iii. Stress Test

7. Evaluate the system using:

- A. a set of metrics based on the ISO 25010 standards which focuses on:
 - a. Performance Efficiency
 - i. Time Behaviour
 - ii. Capacity
 - iii. Resource Utilization
 - b. Interaction Capability
 - i. Appropriateness Recognizability
 - ii. Operability
 - iii. User Error Protection
 - c. Functional Suitability
 - i. Functional Appropriateness
 - ii. Functional Completeness
 - iii. Functional Correctness

B. User Evaluation using Likert Scale

8. Implement and deploy the system.

Scope and Limitations

The core focus of this research revolves around applying the object detection algorithm, specifically adapted for scanning the ingredients that would recommend recipes. This algorithm forms the backbone of the application's scanning recognition capabilities.

The application begins with a simple and intuitive interface that offers a smooth navigation of all operations, with a responsive and clean design that allows a smooth transition between scanning, detection, and recipe suggestions on both desktop and mobile platforms. In its nature, the Ingredient Scanner utilizes YOLOv9 for real-time ingredient detection, with the capability to take or upload a photo, where the app recognizes multiple ingredients in real-time with high accuracy, with the ability to adapt to varied conditions. Users can upload or capture images on the Scan Page with a drag-and-drop feature and image preview for clarity before submission. The system instantly processes the image, showing the recognized ingredients and their respective confidence levels. Users may edit the ingredient list by taking an additional photo or manually adding any missing ingredients, with a confirmation step to guarantee correctness before proceeding. After constructing the final ingredient list, the system suggests recipes from Pampanga, in which users can search, filter based on dietary needs, and select a dish, each having a complete step-by-step preparation guide. The AI Chatbot also further promotes user interaction by answering questions about Pampanga's culinary culture and traditions, as well as providing

information on local dishes, cooking procedures, and ingredient substitutes in English and Filipino through natural language processing.

The present study's geographical coverage is the Makati and Taguig City respondents. Data collection, testing, and user interaction are expected to occur within this defined geographical region.

The study encompasses data collected and system development activities conducted from August 2024 to May 2025. It acknowledges that the study may not consider technological advancements beyond this temporal scope.

The study employs a range of tools and technologies to design and develop the application. These tools include:

- a. Visual Studio Code v.1.96.4
- b. Python v3.12.5
- c. Mysql database engine v10.4.32 - MariaDB
- d. YoloV9 Ultralytics Library - v8.3.28
- e. HTML5
- f. JQuery v3.6.9, CSS, Bootstrap v5.1.3, and Font Awesome v6.1.1
- g. TensorFlow Library - v2.18.0
- h. Flask - v3.0.3
- g. CUDA Toolkit and cuDNN - v11.8
- h. Hostinger

Limitations

Despite the study's objectives, certain limitations should be acknowledged:

This study heavily relies on the YOLOv9 algorithm for its effectiveness, as the core functionalities of the application depend on its object detection capabilities to scan and identify ingredients accurately. With that in mind, it was chosen to see how the algorithm detects and classifies ingredients. This will be the main key as to how it is recognized without failing. The algorithm is also tested depending on the objectives, namely accuracy, precision, recall and F1-score. Other techniques are utilized to see metrics of the algorithm in varying conditions, such as the model looking at images at different angles, different blurring, and other preprocessing techniques that the algorithm is tested upon.

Ensuring stable functionality of the YOLOv9 algorithm, through high quality training of data, an optimized model architecture, and consideration of diverse environmental conditions can help improve the overall effectiveness of the application. Accurate identification and classification of ingredients by the YOLOv9 algorithm directly contribute to the application's ability to generate reliable and precise results of ingredients, which help improve its practical utility and better with user experience.

Furthermore, false positives or false negatives in detection can lead to underperformance and incorrect output, which could compromise the user experience and reliability of the application.

The findings and outcomes of this research pertain specifically to the context, geographical area, and time frame defined within the study's scope. While designed to be broadly available as a recipe ingredient scanner, user demographics may influence the system's effectiveness. Further testing and refinement are necessary to confirm its adaptability across various settings and audiences.

The study only used various ingredients categorized into different groups. For the Main ingredients, There are beef brisket, beef eye round, chicken liver, chicken thigh meat, crab, flank steak, frog, ground pork, pork belly, pork butt, pork ear, pork face, and pork skin. Under Main/Common are eggs, glutinous rice, and rice flour. The Secondary ingredients include all-purpose cream, bay leaf, brown sugar, butter, cake flour, carrot, cheese, chorizo de Bilbao, coconut milk, cornstarch, dill pickle (either sweet pickled cucumber or pickled dill), fish sauce, flour, grated cheese, green bell pepper, green chili, green peas, guava, hard boiled eggs, hotdogs, liver spread, mirin, natural red food color, onion leeks, oregano, pickled dill, potato, raisin, red bell pepper, red chili, taro, tomato, tomato paste, tomato sauce, turmeric powder, Tusino curing powder, and water spinach. For Secondary/Common, the researchers find calamansi, lemon, and onion. The Main/Secondary/Common category includes garlic. Common ingredients include annatto powder, baking powder, black pepper, calamansi juice, salt, soy sauce, sugar, vinegar, vegetable oil, water, and white onion.

The performance of the YOLOv9 model in the ingredient scanner is influenced by the operating system's ability to manage GPU resources, handle memory allocation, and support deep learning frameworks. Since TensorFlow (v2.18.0) and YOLOv9 (v8.3.28) rely on CUDA Toolkit and cuDNN (v11.8) for acceleration, OS limitations on GPU access can impact real-time object detection. Windows may have compatibility issues with specific CUDA versions, while Linux offers better support for deep-learning workloads. Additionally, OS-level memory restrictions can limit VRAM usage, affecting the speed and accuracy of image processing. Flask (v3.0.3), running on Hostinger, is also affected by thread management and file system access policies, which can slow (API) responses if the OS imposes constraints. Security policies and network restrictions may further limit dataset processing and model inference. To ensure optimal performance, deploying the model on a Linux-based system with properly configured dependencies and GPU support is recommended.

External factors, including network connectivity, hardware limitations, and variations in user behaviors, are beyond the study's control but may influence the application's real-world performance.

Definition of Terms

This section of the paper defines significant terminologies that were utilized to fully comprehend the various concepts of the overall project.

Object detection algorithm, **YOLOv9**, **model**, **non-max suppression threshold**, and **false positives** are all key concepts in computer vision and machine learning that power RecInScan's ingredient scanning feature. The **object detection algorithm** is a technique that enables machines to identify and locate objects within images by drawing **bounding boxes** around them. **YOLOv9** is the ninth generation of a real-time object detection model known for its speed and accuracy, ideal for detecting kitchen ingredients in live feeds. A trained **model** like YOLOv9 processes input images to predict and classify ingredients. To ensure clear detection, techniques like **non-max suppression** remove overlapping boxes by keeping only the most confident prediction, while minimizing **false positives**, which are incorrect detections that lower system reliability.

Machine learning algorithms, **dataset**, and **data preprocessing** relate to the development and training of these models. **Machine learning algorithms** automatically learn patterns from large amounts of data, improving their decision-making without explicit programming. A **dataset** is a curated, labeled collection of images and data points—such as ingredient pictures with tags—used to train and test the model. Before training, **data preprocessing** cleans and formats raw data to make it suitable for learning, which enhances the accuracy and efficiency of the models.

RecInScan, **recipe recommendation system**, **web application**, **user side**, **cloud service**, **database**, **primary key**, and **foreign key** describe the application ecosystem and data architecture. **RecInScan** is a **web application** accessible via browsers, designed to scan ingredients and provide tailored recipes through its **recipe recommendation system**. Users interact with the **user side** interface, built with front-end technologies like HTML, CSS, and JavaScript. The application and data are hosted on **cloud services**, providing scalability and accessibility. A **database** stores user info and ingredient data, organized with **primary keys** that uniquely identify records and **foreign keys** that link related tables, enabling complex data relationships.

Lastly, **CI/CD (Continuous Integration and Continuous Deployment)**, **virtual private server (VPS)**, **data migration**, and **code freeze** pertain to software development and deployment. **CI/CD** automates code integration, testing, and deployment to streamline updates and ensure reliability. Applications are often hosted on a **VPS**, which offers dedicated resources and greater control than shared hosting. When upgrading or changing systems, **data migration** safely transfers data to new platforms. A **code freeze** is a development milestone where no new changes are made, allowing final testing and stabilization before release.

CHAPTER 2

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter provides historical background and context for exploring existing articles related to the research objective. To achieve this, the researchers researched past articles covering the basic knowledge, fundamentals, and improvements associated with this research study. This will establish the topics' key concepts, theories, strengths, and limitations to delve deeper into discovering the research gaps within these articles.

Machine Learning

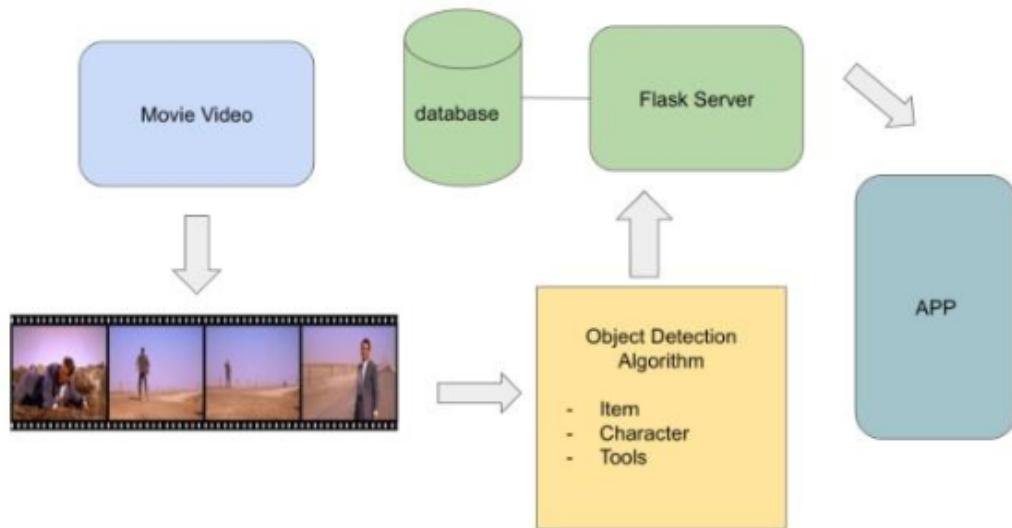


Figure 1 Overview of the solution

Recent studies highlight advancements in object detection techniques and their applications in various fields. In Figure 1, Han et al. (2022) created an

application for film students that utilizes object detection algorithms to identify movie props, revealing good performance in classifying objects despite challenges with partially visible items; however, the application's simplistic user interface may hinder user engagement.

Table 1 Evaluation of Accuracy

Number of images	SSD	RCNN	F-RCN N	YOLOv 2	YOLOv 3	Proposed
100	77	82	90	91	93	95
200	81	85	92	93	95	97
300	83	87	93	95	96	98
400	85	91	95	96	97	98.5
500	87	93	96	97	98	99

Accuracy refers to the extent to which a measured or predicted value aligns with the true or actual value, particularly in the presence of noise or uncertainty. Table 1 presents a detailed analysis of the accuracy achieved by the proposed method, highlighting its performance in distinguishing true signals from noise. This evaluation demonstrates the model's reliability and effectiveness in delivering precise results under realistic conditions.

Table 2 Evaluation of Precision

Number of images	SSD	RCNN	F-RCN N	YOLOv 2	YOLOv 3	Proposed
100	73	77	82	85	88	90
200	75	78	86	87	89	93
300	77	79	88	90	93	95
400	79	80	89	92	94	96
500	81	82	91	93	95	98

Precision refers to the consistency of repeated measurements, indicating how closely the results align with each other when the same process is performed under similar conditions, even in the presence of noise. Table 2 presents the precision analysis of the proposed technique, showcasing its ability to deliver stable and repeatable outcomes across multiple trials. This consistency is essential for validating the reliability of the model in practical applications.

In Table 1 and Table 2, Mohandoss et al. (2023) developed an improved YOLOv3 network integrated with MobileNet to enhance real-time object recognition and classification in dynamic environments, demonstrating high accuracy and robustness while reducing computational time. Additionally, Rahul et al. (2023) underscored the importance of performance evaluation metrics in machine learning, detailing key metrics like R² score and confusion matrix to assess model effectiveness, particularly in financial applications where accuracy is critical. These studies reflect ongoing innovation in object detection and

machine vision, with implications for various industries and future research directions.

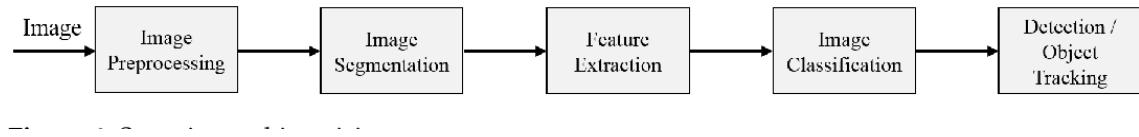


Figure 2 Steps in Machine Vision

As seen from figure 2, Manakitsa et al. (2024) has emphasized the significance in the development of AI with machine vision, he advocated research for human-like robotic vision and touch. He also addressed the need for regulatory frameworks to manage technological advancements responsibly. Lastly, from the study of Khan et al., (2021), He emphasized what is the role of machine learning (ML) in image processing, this highlights the complexity of feeding data into computer system. The process starts with image acquisition, wherein the image is loaded and prepared for further analysis. The key phases are of detection and recognition, then image objects. Neural Networks (NN) have also been identified as among the top algorithms used in Machine Learning. Major corporations like Amazon, Microsoft, Facebook, and Google use NN in numerous applications, such as recommendation systems, translation, face detection, as well as spam filtering.

Deep learning, a branch of AI that has garnered much attention from researchers, is also the paper's focus. While ML has advanced in computer

vision, there are still research areas that remain unexplored.

Object Detection Algorithm

Recent advancements in object detection algorithms have significantly enhanced various applications. The study of Duan et al. (2023) introduces a novel small-object detection algorithm utilizing a camera sensor integrated with artificial intelligence, setting it apart from traditional camera sensor systems. The study identifies and addresses challenges in the newly released YOLOv8 and existing small-object detection algorithms by proposing new feature fusion methods and network architectures, significantly enhancing the network's learning capacity. The algorithm's performance was evaluated using the Visdrone, TinyPerson, and PASCAL VOC2007 datasets. Experimental analysis demonstrated the feasibility and effectiveness of the proposed optimizations, with the DC-YOLOv8 achieving superior performance.. Zhang et al. (2021) enhanced shellfish detection accuracy by integrating Dense-Net and optimizing proposal merging with Soft-NMS, improving robustness against challenges like illumination variations. Pan et al. (2024) introduced an enhanced Faster R-CNN algorithm for detecting GUI issues, achieving 87.3% accuracy by replacing VGG-16 with ResNet-50 and using a feature pyramid network. Flores-Calero et al. (2024) compared the performance of the YOLO algorithm for traffic sign detection between 2016 and 2022 regarding handling issues such as geographical differences and worn-out signs. Besides, Casas et al. (2024) compared YOLOv5 and YOLOv8. They determined that YOLOv5 outperformed

in precision and recall, and YOLOv8 in detecting dark smoke, suggesting future research in tuning these models to achieve optimal performance in environmental monitoring.

Yolov9 Algorithm

Yaseen et al. (2024) introduced YOLOv9, enhancing real-time object detection with PGI and GELAN, achieving significant improvements in accuracy and computational efficiency over YOLOv8. Deng et al. (2024) also reported on a new blueberry canopy dataset, finding that YOLOv9-c outperformed YOLOv8I with a mean Average Precision of 91.7%. Saptoka et al (2024). Evaluated various YOLO configurations for detecting green apples, revealing that YOLOv9 excelled in precision and recall metrics. Wang et al. (2024) developed the MAR-YOLOv9 model to enhance domain adaptability in agricultural scenarios, achieving superior performance in challenging conditions. Yangkai et al.'s (2024) study focused on optimizing training parameters for YOLOv9 models, identifying optimal learning rates and batch sizes for improved performance with limited resources. Lastly, Zhu et al. (2024) introduced an enhanced YOLOv9-DeepSORT model for tracking wild birds, achieving an overall recognition accuracy of 81.3%, further expanding the application range of YOLO models in conservation efforts.

Recommendation Systems

Turakhia et al. (2022) predict a massive increase in single-person

households over the next decade, with a substantial percentage of millennials who do not possess basic cooking skills. As this group increases, individuals must learn basic cooking skills. Most new cooks struggle to read ingredients and comprehend recipes, which can become challenging as they begin cooking. The research conducted by Mehrdad et al. (2023) emphasizes the role of food recommendation systems in encouraging healthier lifestyles by integrating health and nutrition aspects with user preferences. They propose a novel health-aware food recommendation model that operates through collaborative-based and ingredient-based rating predictions, effectively recommending top-N healthy foods based on nutritional content and user ratings, and demonstrating superior performance in precision, recall, F1 score, AUC, and NDCG metrics compared to existing systems. Complementarily, Jon et al. (2023) conducted a systematic literature review on Food Recommender Systems (FRS), examining recommendation methods, algorithms, datasets, and evaluation techniques. Jon noted the increased relevance of FRS due to information overload from sites that share their recipe. Identifying content-based filtering was used as the predominant method to utilize despite the limitations in personalization, while also highlighting the trend toward personalized graph-based approaches and with the use of ML algorithms which are then used for generating the recommendations. From the study of Melese, A. (2021). She discussed that the hybrid recommendation system enhances the recommendation by addressing the user preferences and also personalization. It combines the content-based and collaborative filtering techniques to be able to analyze the datasets that

contain user information. The datasets were split into training and testing sets for the performance evaluation, which utilizes the ML algorithm to be able to assess the effectiveness of the system. The system was able to successfully recommend restaurants and food based on different factors such as price, quantity, ratings, and location. The study emphasizes the need for further improvements to enhance performance and fully realize personalized recommendations. Rostami et al. (2022) proposed that with the increasing popularity of the Internet, recommender systems have become integral to various lifestyle applications, including food recommendations. This paper introduces a novel hybrid food recommender system that addresses limitations in previous models, such as ignoring ingredients, time stamps, cold start users, and food items. The proposed system combines user-based and content-based models, incorporating time information, trust networks, and user communities to enhance recommendation accuracy. The approach includes two phases: a food content-based recommendation using graph clustering, and a user-based recommendation with a deep learning approach for clustering. The system outperformed state-of-the-art models (LDA, HAFR, FGCN) based on five metrics: Precision, Recall, F1, AUC, and NDCG. Future improvements will incorporate user-side information (e.g., age, gender, health status) to personalize recommendations further and address nutritional needs for non-infectious diseases.

Pampanga Cuisine

Morales et al. (2023) provided a cultural explanation of authentic Kapampangan dishes such as Sisig, Pindang, and Tocino, which are consumed in local fiestas and have become popular worldwide through media coverage, food blogging, and TV shows. These dishes, based on Pampanga's agricultural fertility and historical experience, are expressions of the people's culinary heritage and resourcefulness. Family-run restaurants are key to maintaining these cultural landscapes, blending traditional recipes and new techniques while embracing the impact of colonialism and globalization. Similarly, Giray et al. (2021) depict the authentic Kapampangan dining experience at Atching Lillian's Kusinang Matua, where global visitors have a chance to savor traditional fare and witness how Kapampangans innovatively modify their preparation techniques. The research underscores the application of substitute ingredients in times of shortage and the role of religious tradition in influencing food preparation techniques, emphasizing the rich gastronomic heritage of the region as well as the specific preference for sweetness. Together, these findings support the significance of Kapampangean cuisine in examining regional identity and cultural landscapes, as the study of Leuterio et al. (2021) suggests. The transmission of food culture is fading in younger generations, who focus more on academic and socio-economic interests rather than traditional cultural knowledge. Informal conversations and observations continue to be the best means of conveying culinary traditions, particularly during celebratory events such as fiestas and family celebrations. However, urban migration and the growing popularity of fast

food culture challenge interest in traditional food knowledge. Still, community engagement and communication are essential in maintaining the Kapampangan culinary identity and in supporting social advancement, as the study of Raniezes et al. (2023) suggests. The Hapag-Kainan Framework is in the context of Pampanga's rich culinary heritage, forged by centuries of Spanish, American, Japanese, Chinese, and Malay influences. Kapampangan cuisine is inherently a synthesis of ancient practice and creative reinterpretation, as seen in such iconic dishes as sisig and tocino that are both heir to tradition and reinterpreted aesthetically. The food industry is a pillar of the region's economic life, driven by talented chefs and rich natural resources. Still, issues such as foreign input dependency underscore the imperative of sustainable practice. In modern challenges, the Kapampangans remain deeply committed to the culinary art, viewing food not just as sustenance, but as a means of identity-making, social bonding, and cultural expression. Implementing the Hapag-Kainan Framework successfully captures this dynamic tension of history, sustainability, and creativity, enriching Kapampangan gastronomy studies. Finally, Manapsal et al. (2022) investigates the development of the Kapampangan language, its importance, its usage during the colonial era, and its current status as an endangered language. It suggests that the Pampanga provincial government, working together with the Department of Education, should implement the Kapampangan language as the medium of instruction from Kindergarten through Grade 12 and recognize it as one of the official languages of the province. It sees the necessity of creating a Kapampangan Studies Center to further develop

and preserve the language. The research emphasizes preserving Philippine languages as national identity and cultural heritage, encouraging the promotion of Kapampangan conservation via educational policy and active local stakeholders' participation, including parents. Moreover, the research suggests further investigation into the historical development and structure of the Kapampangan language and how it is interrelated with other disciplines like public administration, political science, and linguistics.

Table 3 Benchmark on Object Detection Algorithms

Paper	Proponents	Algorithm	Accuracy
RecipeIS—Recipe Recommendation System Based on Recognition of Food Ingredients	M. Rodrigues, Filipe Fidalgo, Ângela Oliveira (2023)	Inception-v3, Inception-v4 AlexNet	95.5%
Candidate Generation for Meal Recommendation System	L. Viktor, Yeremenko, Terenchuk	B. S. SVD, Deep, Wide Deep&Wide	71%
CR-YOLOv9: Improved YOLOv9 Multi-Stage Strawberry Fruit Maturity Detection Application Integrated with CRNET	R. Ye, G. Shao, Q. Gao, H. Zhang, T. Li	CR-YOLOv9	97.52
Automatic Vehicle Accident Detection and Classification from Images: A Comparison of YOLOv9 and YOLO-NAS Algorithms	A. N. Nusari, I. Ozbek, E. A. Oral	YOLOv9-C	92.7%

The existing literature on object detection algorithms reveals a range of applications and differing levels of accuracy among the approaches. For example, the RecipeIS system developed by Rodrigues et al. (2023) implements Inception-v3, Inception-v4, and AlexNet algorithms, achieving a high accuracy rate of 95.5% in identifying food ingredients for recipe recommendation. In contrast, the meal recommendation system by Viktor et al., which utilizes SVD, Deep, and Deep&Wide models, reported a lower accuracy of 71%. Furthermore, the CR-YOLOv9 algorithm, as presented by Ye et al. (2023), has been specially optimized for detecting the maturity of strawberries, achieving a high accuracy of 97.52%. Finally, Nusari et al. (2023) conducted a comparison of the YOLOv9-C and YOLO-NAS algorithms for the automatic detection of vehicle accidents, with YOLOv9-C showcasing a robust accuracy of 92.7%. These studies highlight the flexibility and promise of sophisticated object detection algorithms across different fields, emphasizing their effectiveness in diverse scenarios, ranging from food ingredient identification to fruit maturity assessment and accident detection.

Table 4 Benchmark on YOLOv9 and Object Detection Algorithms.

Title	Proponents	Description
YOLOv9-Enabled Vehicle Detection for Urban Security and Forensics Applications	Murat, Bakirci., Irem, Bayraktar. (2024).	The YOLOv9-enabled vehicle detection algorithm can significantly enhance urban security.

CNN-Based Visible Ingredients Recognition in a Food Image Using Decision-Making Schemes.	Kun, Fu., Ying, Dai., Ziyi, Zhu. (2023).	Ingredient recognition in food images is tackled by a structured approach using CNNs. The proposed method is effective in detecting food image recognition.
Ingredients to Recipe: A YOLO-based Object Detector and Recommendation System via Clustering Approach	Gambhire, Swati, Sampatrao., Mihir, Soni. (2023).	A solution was proposed to the challenge of meal planning using a YOLO-based object detection algorithm. It is a valuable tool for creating healthier meals.

Table 4 presents existing literature work on the implementation of YOLOv9 and other object detection models across domains. Murat and Bakirci (2024) discuss the application of a vehicle detection algorithm using YOLOv9, dramatically improving urban security as well as forensic uses. Fu et al. (2023) utilize CNN-based methods for visible ingredient recognition in food images, presenting a real-world method for food item identification in images. Finally, Gambhire et al. (2023) suggest a YOLO-based meal planning object detection system that incorporates clustering algorithms to suggest healthier recipes using ingredient identification. These works identify the adaptability and efficiency of YOLOv9 and other associated algorithms in improving security, food detection, and meal planning, illustrating their wide scope across various areas of application.

Despite these advances, some glaring research gaps exist in the literature on object detection algorithms. One of them is the lack of proper examination of the performance of YOLOv9 under a range of environmental conditions and datasets, which would be a rich source of information on its robustness and flexibility. Although earlier research has reported high accuracy in specific

applications, there is a pressing need for longitudinal studies on such models' long-term effectiveness and scalability in dynamic environments. Furthermore, the evaluation of socio-economic factors affecting the adoption and effectiveness of object detection systems is not sufficiently examined, and this is an important area for future research. This discussion emphasizes the need for ongoing research to bridge these gaps and build knowledge around object detection technologies in various environments, eventually translating into their broader applicability and effectiveness.

Synthesis

The growing body of literature on object detection algorithms illustrates their broad applicability and evolving effectiveness across a variety of domains. High-performance models such as YOLOv9, Inception, and AlexNet have demonstrated considerable success in areas including food ingredient identification, fruit maturity assessment, vehicle accident detection, and urban surveillance. For example, Rodrigues et al. (2023) reported a 95.5% accuracy using Inception-based architectures for food ingredient recognition in the RecipeIS system. Similarly, Ye et al. (2023) achieved a 97.52% accuracy in detecting strawberry maturity using the CR-YOLOv9 model, while Nusari et al. (2023) reported 92.7% accuracy in accident detection using YOLOv9-C. Applications of YOLO-based models continue to expand, with Gambhire et al. (2023) integrating clustering techniques into a YOLO-based meal planning system, and Murat and Bakirci (2024) enhancing urban security through

YOLOv9-driven vehicle detection. These studies reinforce the adaptability and precision of object detection systems in addressing complex, real-world challenges. Despite these advances, notable research gaps persist. A critical limitation is the insufficient evaluation of YOLOv9's robustness across diverse environmental conditions and heterogeneous datasets. Moreover, the literature lacks longitudinal analyses that assess the long-term scalability and effectiveness of these models in dynamic settings. Another underexplored area is the influence of socio-economic factors on the deployment and efficacy of object detection systems, which could inform more equitable and sustainable technology adoption. These findings underscore the importance of continued investigation into the contextual performance of object detection algorithms. Future research should aim to enhance model generalizability, evaluate long-term application outcomes, and integrate interdisciplinary perspectives to ensure these technologies deliver meaningful and inclusive impact across domains.

Conceptual Model of the Study

This section will act as a reference and emphasize the insights gained from the research and their application in the advancement of RecInScan. It illustrates the process of developing the application throughout the entire process, including the identification of requirements, the various phases of designing and deploying machine learning algorithms, all the way to creating a precise and reliable tool that leverages ingredient scanning.

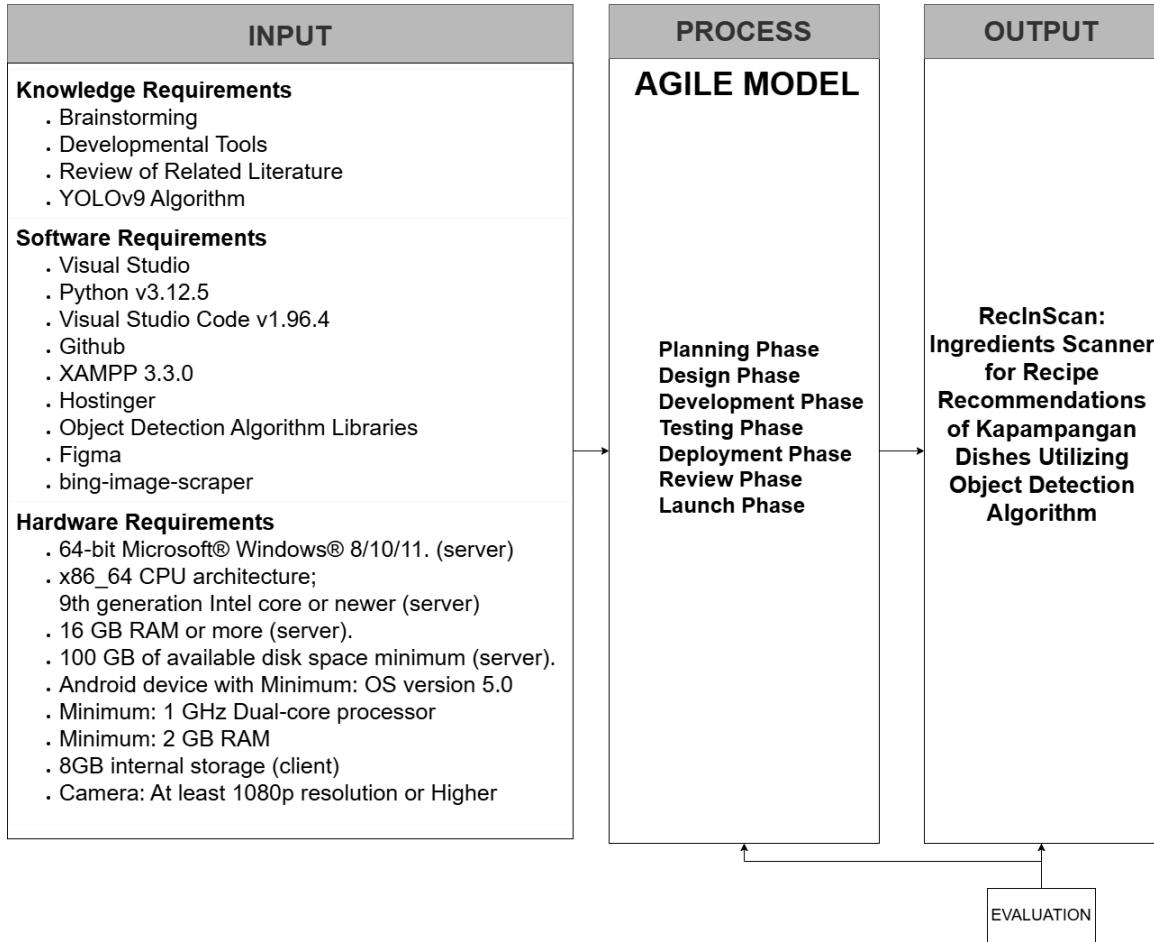


Figure 3 Input-Process-Output Diagram

The development of the ReclnScan system necessitated various inputs categorized into knowledge, software, and hardware requirements. Knowledge requirements included foundational activities such as brainstorming sessions, the use of developmental tools, the review of related literature, and the integration of the YOLOv9 (You Only Look Once version 9) algorithm for object detection. Software tools essential to development encompassed Visual Studio, Python version 3.12.5, Visual Studio Code (v1.96.4), GitHub for version control, and XAMPP 3.3.0 for local server deployment. Hosting services, object detection algorithm libraries, Figma for UI/UX design, and the Bing-image-scaper tool

were also pivotal. Hardware requirements were divided between server and client needs, including a 64-bit Microsoft® Windows® 8/10/11 operating system, a 9th generation Intel Core or newer processor, at least 16 GB of RAM, and a minimum of 100 GB of disk space for server deployment. For client-side devices, Android OS version 5.0 or higher with a minimum of a 1 GHz dual-core processor, 2 GB RAM, and 8 GB of internal storage were necessary, alongside a camera with at least 1080p resolution to support object detection.

The system was developed using the Agile Model, a flexible and iterative software development methodology that allows for continuous feedback and enhancement throughout the project lifecycle. The Agile process was divided into several phases, each focusing on a specific aspect of development. The Planning Phase involved defining project goals, gathering requirements, and setting timelines. During the Design Phase, system architecture, data flow, and interface layouts were established. The Development Phase focused on coding and integrating software components, followed by the Testing Phase, where functionality and performance were rigorously evaluated. After ensuring reliability, the Deployment Phase facilitated the transfer of the application to a live environment. The Review Phase provided opportunities for feedback and improvements, culminating in the Launch Phase, where the final product was released to the intended users.

The final output of this development process is ReclnScan, an innovative ingredient scanning application that provides users with recipe recommendations

for Kapampangan dishes by utilizing a sophisticated object detection algorithm. The system leverages image recognition capabilities to identify ingredients captured through a device's camera and matches them to a curated database of Kapampangan cuisine. By employing YOLOv9 for real-time object detection, RecInScan enhances the culinary experience of users by simplifying the cooking process and promoting local cuisine. This tool not only assists users in deciding what dishes they can prepare based on available ingredients but also supports cultural preservation through the digitization and promotion of traditional recipes.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter presents the necessary procedures for collecting and analyzing the data gathered by the researchers. It elaborates on the research design to be used and establishes procedures that can prove the efficiency of the study's algorithm. The contents of this chapter specify the approach to be taken in terms of research and development for the study.

Research Design

The study integrates experimental, developmental, and descriptive research methodologies to thoroughly design, refine, and evaluate RecInScan, focusing on ingredient recognition and Kapampangan dish recommendations. Experimental research is used to fine-tune the YOLOv9 model, either by testing its performance in ingredient detection in different conditions, such as blurring, lighting, and other types of backgrounds, to optimize the overall effectiveness of the model. Developmental research focuses on the improvement of the application, looking for findings from the experimental research and user feedback that may enhance features like detection of ingredients, recipe suggestions, and every part of user interaction. Finally, Descriptive research focuses on feedback gathering, either through user surveys, observations, and evaluations. All of these methodologies put RecInScan in a reliable, robust and

useful tool for people that need to find kapampangan dishes or experimenting with their own ingredients.

Research Methodology

The methodology used will be the Agile methodology in order to break down the project into goal-driven and realistic phases. Due to Agile's iterative nature, it can be used as a way to improve continuous development of RecInScan. It allows the researchers to collaborate on the application and focus on the objectives throughout the project. The Agile methodology is then broken down into seven phases: plan, design, development, testing, deployment, and review. Throughout this chapter, the phases will be broken down and explained.

Agile Methodology

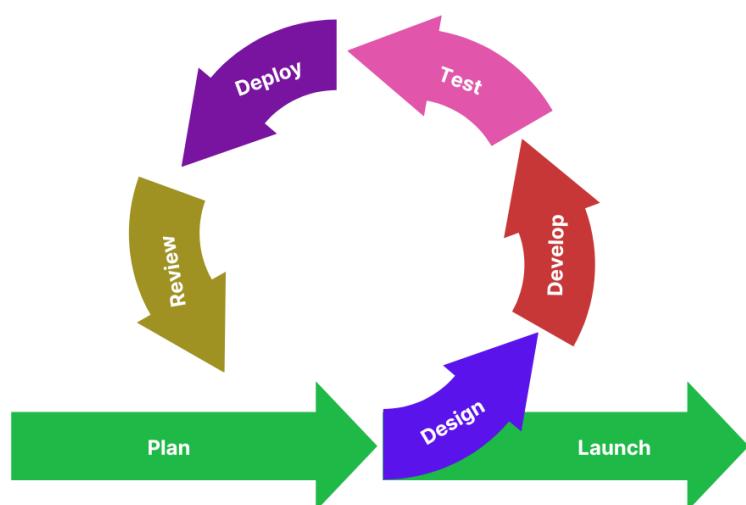


Figure 4 Agile Software Development Life Cycle

Figure 4 Agile Software Development Life Cycle. The Agile methodology guides the development of ReclnScan, which is used to make the application flexible, easy to change and develop in a steady manner. This process begins with planning, allowing the researchers to plan out objectives in developing ReclnScan. This is followed by design, where initial designs, wireframes, and functionalities are created, moving on to development, ReclnScan's core functions such as the ingredient scanner, application, and recipe recommendation system is developed. Testing allows the researchers to evaluate the system, fix bugs and fine-tune the model even further. Deployment prepares the system for wide access and the internet. The Review phase then incorporates feedback from users, and refines ReclnScan further with changes.

Planning

To properly develop ReclnScan, it needs to answer the research problem, wherein it is to create a web-based application that allows users to get recipe recommendations using an object detection model. The overall project scope of the application includes model training, application development, including database connection, and fine-tuning including optimization for the YOLOv9 object detection model.

Agile, as a methodology, is integrated into the research by breaking the development into sprints where improvements can be made to the User Interface (UI), User Experience (UX) and application performance. Furthermore, Agile planning enables system evaluation through user comments and suggestions,

which may be done in the review phase. Each phase allows a new release, improving the core features of the application, which is driven by these suggestions. Ultimately, RecInScan is improved as the project goes on, until the final release of the application.

Uncertainty and scope creep is defined and given solutions according to the Agile methodology's flexibility as each change in requirements, either through user survey or system evaluation. The evaluation would be reviewed, and, if given the green light, is integrated into RecInScan. Communication and collaboration challenges during development are mitigated by best practices on using the Agile Methodology, either through continuous integration or continuous deployment. However, since tasks are generally complex and can be unpredictable in terms of time, it cannot be ensured that development is easy. But by using the Agile methodology, effects of this can be lessened, as well as better forecasting.

The goals of RecInScan involve development of an application that uses an ingredient detection model alongside a recipe recommendation system. YOLOv9 is used as the main model to accurately detect ingredients. The study's scope includes computer vision model training, full-stack development, mobile accessibility, and database integration. The Application Programming Interface is used for a feature called the Chatbot, supporting Filipino and English languages, and will be developed later on. An Initial product backlog is then used and maintain to showcase key requirements of RecInScan like the image scan

functionality, integrating the model, and logic of the recipe recommendation module. Each task or item is prioritized based on difficulty, impact on the application and to users, and researcher and stakeholder requirements.

Different stakeholders and users are interviewed or surveyed to influence improvements and evaluate the accuracy of the model. This also includes UI design, and user experience, to refine and maintain RecInScan. All of these are created as tasks for the researchers to develop the application.

Over time, the project is developed, initializing how the application works and adapting to unexpected problems or bugs which may include dataset limitations or model training inefficiencies. During this phase, each agile sprint builds the application, with releases aligning with the development of RecInScan. Initially, core functions were developed, and later versions focused on improving the accuracy of the model, enhancing the user interface, and making responsive design for the mobile version.

Tools and techniques used in the planning of the application include to-do-lists to track the tasks and using GitHub/Version control systems for code management. Each tool is then effectively used for evaluation of RecInScan.

Design

To begin the design phase, it will focus on building the ingredient recognition model as it is the first core feature of the application. Data processing for the model is then done, and recipe suggestions based on recipes by

kapampangan chefs. The application is developed in the meantime. This includes the key components: responsive user interface including mobile view, backend service for image processing, database for storing data, an API for chatbot and user-to-system communication, web hosting for the website, and lastly, the YOLOv9 model to capture ingredients based on pictures uploaded. Each component contains data required for the users to scan ingredients, process them, and generate recipe suggestions.

The system architecture of RecInScan contains various components, each composed as a module. Figma is used to design the front-end, with UI/UX principles in mind. HyperText Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript make up the UI of RecInScan, while the backend is developed in Python, which is responsible for logic and request processing from the user. The database is then used to store recipe data, as well as user account details, dish history of said user, and the overall scannable ingredient list.. The web server is hosted on Hostinger with Ubuntu Server operating system (OS), using Nginx as a reverse proxy and Gunicorn as the application server to run the Flask application in Python. Lastly, the YOLOv9 model, powering the ingredient detection feature. These components communicate through direct means, the frontend communicating through the backend via Hypertext Transfer Protocol (HTTP) requests, running through a Virtual Private Server (VPS) to provide scalability for growing usage. The architecture of the application is designed to be flexible and scalable, aligning with Agile practices.

Table 5 User Story

#	Epic	Persona	Goal (I want to)	Expected Result (So that)
A.	Sign up Module	As a user	Create an account on the system with the following details: - Email - Username - Password	I can register my personal details and hold credentials to access the system.
B.	Sign In Module	As a User	Login an account on the system	I can access the features and applicability of the system.
C.	Index Page	As a User	Directed to a landing page after logging in	I can quickly access information about the application and proceed to the home page.
D.	Home Page	As a user	See what dishes I can look to eat for the week	I can quickly gain access to recipes should I want to cook recipes.
			See the ingredients and procedure after selecting a recipe	I can quickly cook the recipe that I want.
	Feature: Navigation bar		Navigate through the following features in all of the pages such as: - Scanning - Recipe List - Profile - AI Chat - About us	I can navigate through the features that the application has to offer.
E.	Scan Page	As a user	Upload an image containing ingredients that I have on hand	I can show the application what ingredients I have for cooking.

		Receive confirmation that I have uploaded an image to be appended in the application.	I can confirm that I have said ingredients for the application.
		Choose a different image to be appended in the application	I can make changes when I accidentally upload the wrong ingredients.
F.	Detect Page	As a user Know what ingredients I have scanned in the application	I can verify the ingredients that I have on hand.
		Add ingredients on the application manually	I can add ingredients that the application has missed in the image
		See the image that I have scanned with ingredients that have been detected	I can verify that the image that I have chosen for scanning is correct.
		Add another image to be appended into the system	I can add more ingredients that I haven't shown to the system.
E.	Recommend Page	As a user See what recipes I can cook with the ingredients I have given	I can cook using the ingredients that I have given to the system.
		Add the dish to a log of recipes that I have cooked in my account	I can keep a history and track what I have cooked.
		Receive confirmation that I have added the recipe to the log of recipes.	I know that I have added the dish to the log.
G.	Recipe List	As a User See what available recipes that are in the system	I can verify what kapampangan dishes are available for cooking.
H.	Profile Page	As a user Set preferences based on what I am allergic to	I can avoid recipes that I cannot eat or cook because of complications.

			Log out of the system	I can use the application at a later time
I.	AI Chat Page	As a user	Ask for assistance through an interactive AI chat	that I can get real-time help, ask questions, and receive personalized recommendations or guidance in an engaging and efficient way.
J.	Login Page (Admin)	As an administrator	Login using credentials that I have been given	I can access the admin page and manage system settings and recipe data.
K.	Admin Dashboard	As an Administrator	Know what dishes are available in the ReclnScan application	I can verify what recipes are available in the system.
			Add dishes to the ReclnScan application	I can add recipes that are catered to pampanga.
			Search for a recipe in the application	I can find specific recipes that I can either edit or delete.
			Remove a recipe in the application	I can keep my recipe collection up-to-date and organized by deleting unwanted or outdated recipes.
L.	Add Recipe Page	As an Administrator	Add a recipe with the following essential details: - Dish name - Author - Serving Size - Cook Time - Cooking Instructions - Image - Type of food - Ingredients - Measurement of Ingredient - Type of ingredient component	I can add more kapampangan dishes and store them for future reference.

M.	Edit Recipe Page	As an Administrator	Edit a recipe with the following essential details: - Dish name - Author - Serving Size - Cook Time - Cooking Instructions - Image - Type of food - Ingredients - Measurement of Ingredient - Type of ingredient component	I can edit the dishes that I have stored or update the dish if it becomes outdated.
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Table 5 User Story for RecInScan details the User Story for the RecInScan application. It is a vital element of the Agile development process, encapsulating the key functionalities that guide how users interact with the system from start to finish. In Agile methodology, user stories serve as user-centered narratives that help the development team focus on delivering features that address real-world needs in a logical and incremental manner. This table outlines a sequential flow of core functionalities, beginning with account creation and login for secure and personalized access, followed by ingredient scanning that utilizes machine learning and computer vision models specifically trained to recognize commonly used Kapampangan ingredients. When this happens, the system will then recommend recipes from Pampanga, curated by kapampangan chefs. This allows users to prepare meals based on what they already have at home, reducing food waste and allowing for local culinary development. To manage the recipes, an admin side is used to update, delete, or create recipes. The user

story is defined with acceptance criteria that serve as benchmarks for the application, defining the usability of RecInScan.

Wireframes

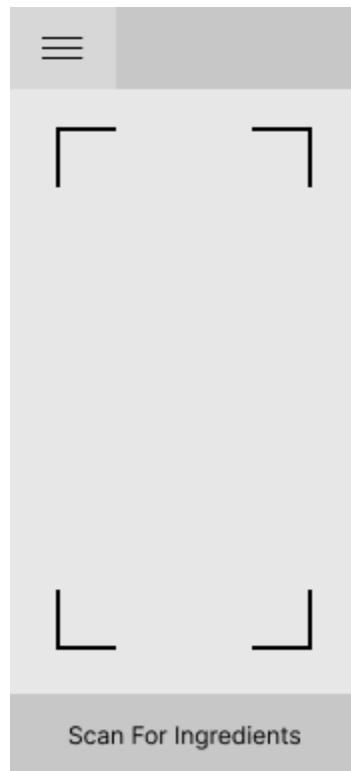


Figure 5 Scan Module

Figure 5 Scan Module illustrates the initial design of the Scan module, which enables users to identify ingredients through image processing or camera use. The initial idea of the scan module is that the user may scan ingredients using their camera. They can then process the ingredients in the next part, and get a detailed list of the ingredients that they have.



Looking For Recipes..



Figure 6 Loading Module

Figure 6 Loading Module shows the wireframe of the loading module, with the idea that it would be for a user-friendly design. It visualizes the system's progress of processing data, with the usage of a loading animation or progress bar.



Figure 7 Recommendation Module

Figure 7 Recommendation Module illustrates the initial design of the module responsible for creating recipe recommendations that are based on kapampangan dishes. After the system has processed the ingredients, the user will be given a list that will show the recommended recipes that the user may cook. Since RecInScan depends on ingredients to scan for recipes, the scanned ingredients will take priority first, and the topmost recipe will best fit the user's ingredient requirements. This would allow the user to have the best match as to what recipes they may serve for the day.



Figure 8 Recipe Instruction Module

Figure 8 Recipe Instruction Module shows the recipe instruction module of RecInScan. This guides the user to recreating the recipes that they have chosen, in a style of a cookbook format. This module dynamically displays ingredients and step-by-step instructions after the application detects an ingredient using its AI-powered scanner. Once an ingredient—like "string beans"—is identified, RecInScan recommends a relevant recipe, such as *Adobong Sitaw*, and presents its complete preparation steps in a structured, readable format. The clear layout, including checkboxes for each ingredient and instruction, allows users to track their progress as they cook, minimizing confusion and enhancing usability, which

coincides with the goal of RecInScan being able to serve users' best matching recipes with their ingredients.

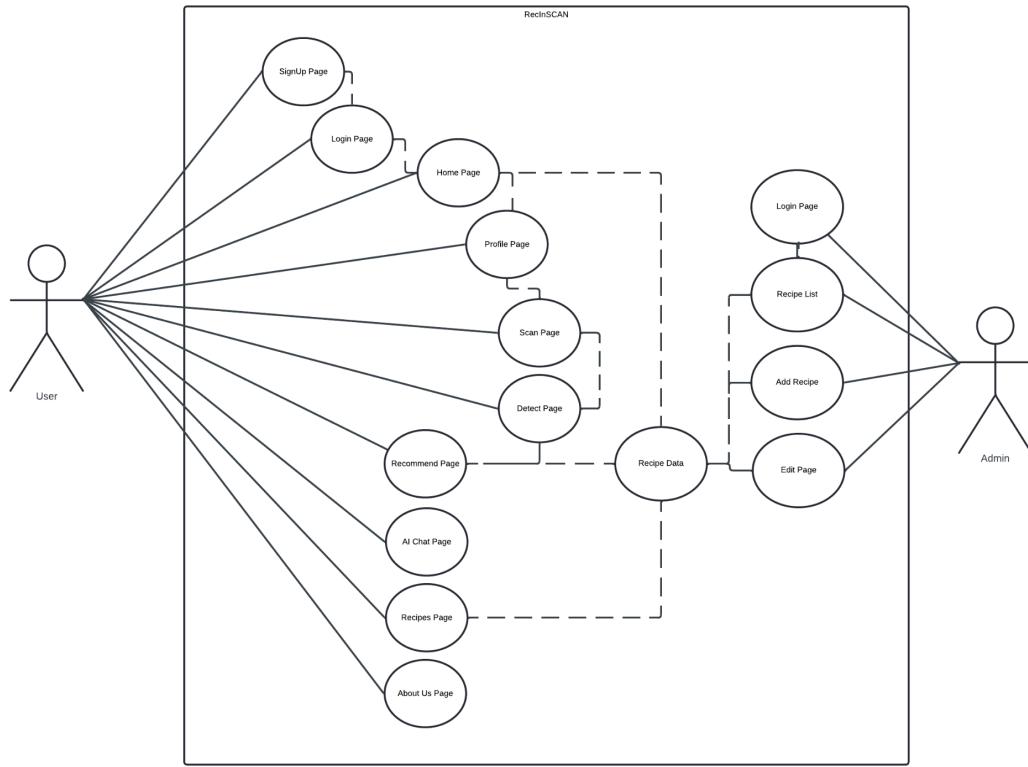


Figure 9 Use Case Diagram of RecInScan

Figure 9 Use Case Diagram illustrates the interactions between Users and Admins within the RecInScan system. Users can sign up, log in, and access various features such as the Home Page, Profile Page, Scan Page, and Detect Page for ingredient recognition. Based on detected ingredients, they can receive recipe recommendations through the Recommend Page and explore more options via the Recipes Page. Additional functionalities include interacting with the AI Chat Page and accessing general information through the About Us Page.

On the admin side, the admin manages recipe-related content first by logging in through the Admin Login Page, which presents them into the Recipe List. They may use the Add Recipe and Edit Page functionalities to change or add recipes which will be used as a way to manage recipes without having to hardcode. The Detect Page then connects with Recipe Data, which matches the ingredients that the users have on their end with the database containing curated kapampangan dishes.

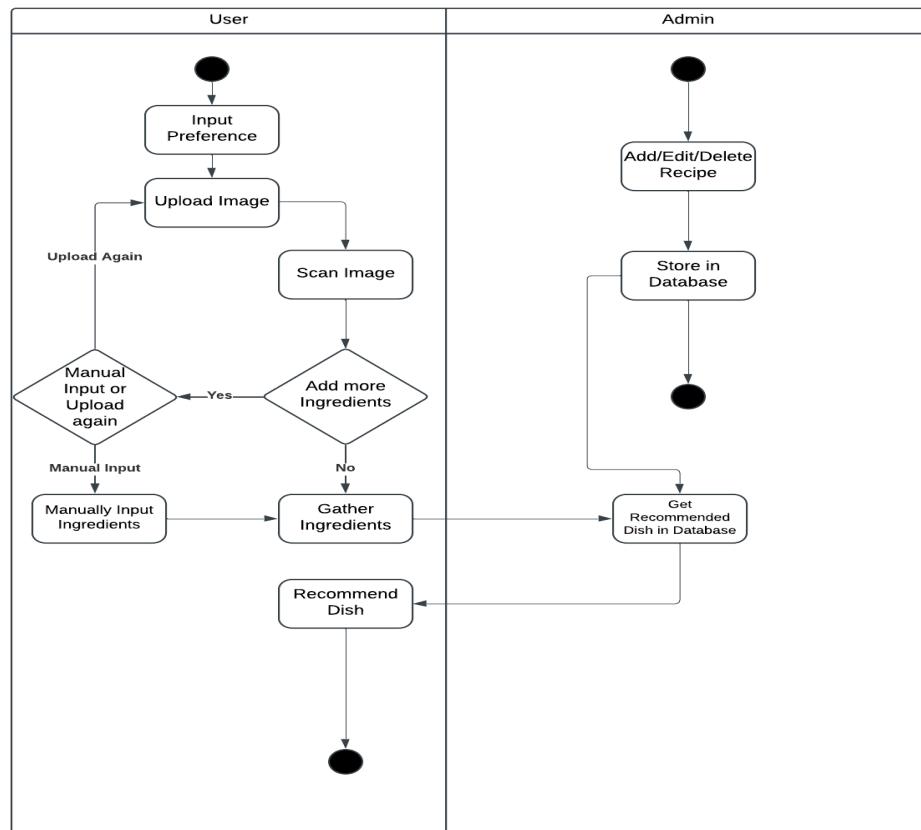


Figure 10 Activity Diagram

Figure 10 Activity Diagram shows the flow of Users and Admins in the

system, and how they interact with each other. The user starts the process by using their camera, which in line is connected to their personal preferences, such as excluding certain ingredients from the recipe suggestions due to allergies. If the image does not contain the desired ingredients, the user may manually input ingredients or upload a different image. Once the ingredients are gathered, the system then recommends a dish that the admin has curated on the database. On the other hand, the admin manages recipes, with the option to create, read, update, or delete recipes. This is stored in the database, and in turn is added into the recommended dishes, connecting both the admin and the user side of the system.

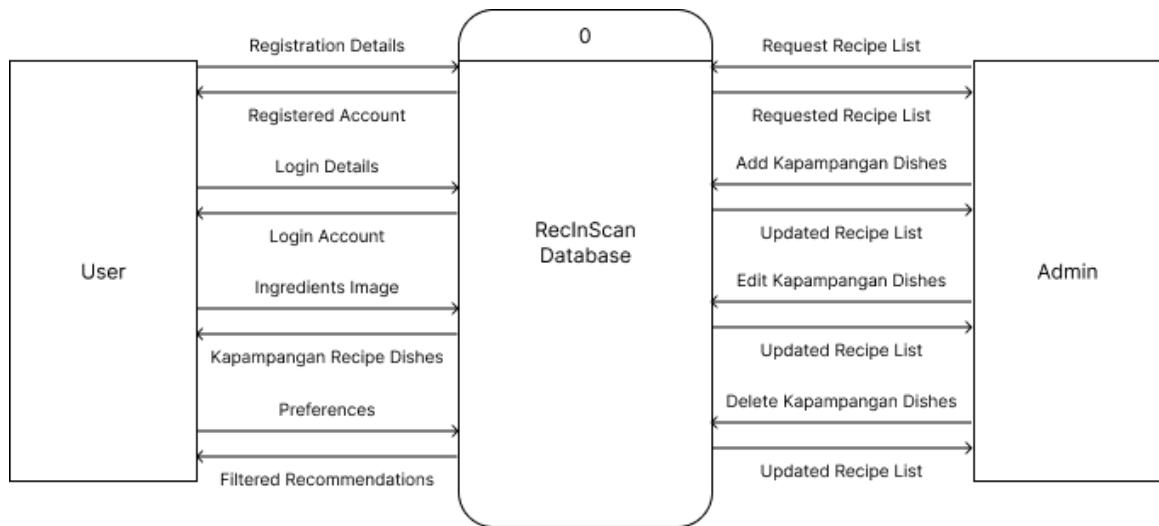


Figure 11 Context Flow Diagram

Figure 11 Context Flow Diagram presents the flow of context between the user side and admin side. This deals with how data is processed and exchanged, particularly, users on the system may login, register, present ingredients, get

recipe recommendations, add preferences to exclude ingredients, and get recommendations based on filtered recommendations. Admins can manage recipes by being able to read the recipe list and add, edit, and delete recipes, which updates the recipe list. Overall, this shows the connection of both admins and users, and is all interconnected through the database of RecInScan.

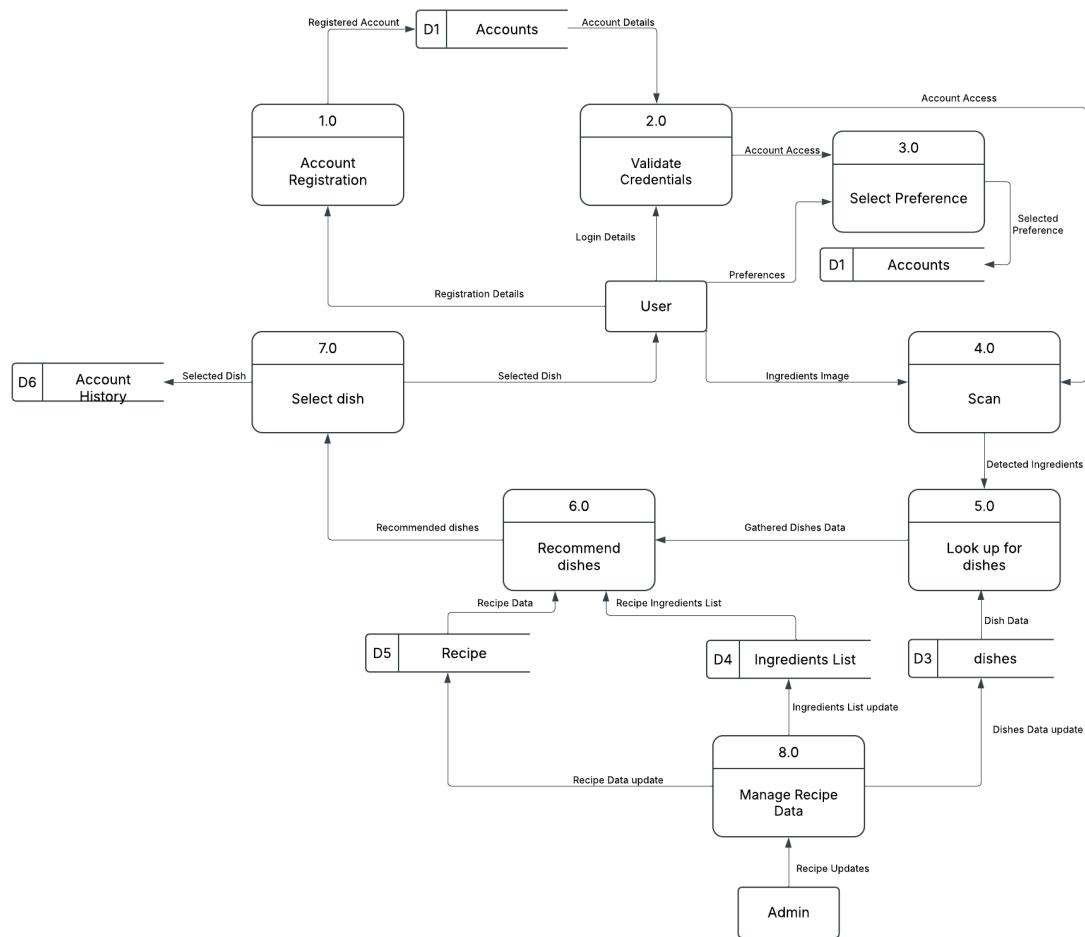


Figure 12 Data Flow Diagram Level 0

Figure 12 Data Flow Diagram Level 0 of RecInScan presents a structured user journey from account registration to dish selection. Unlike the old one, which

directly starts with ingredient scanning, this version introduces user authentication via Account Registration (1.0) and Login (2.0), allowing for personalized preferences (3.0). The scanning process (4.0) remains central, but the flow is structured, linking ingredient detection to dish lookup (5.0) and recommendation (6.0) before users select a dish (7.0). The integration of Accounts (D1), Ingredients List (D4), and Recipe Data (D5) ensures a robust system, maintaining user history (D6) for tracking interactions. This approach enhances user engagement by incorporating preference-based recommendations while maintaining the original goal of accurate ingredient recognition and dish suggestions.

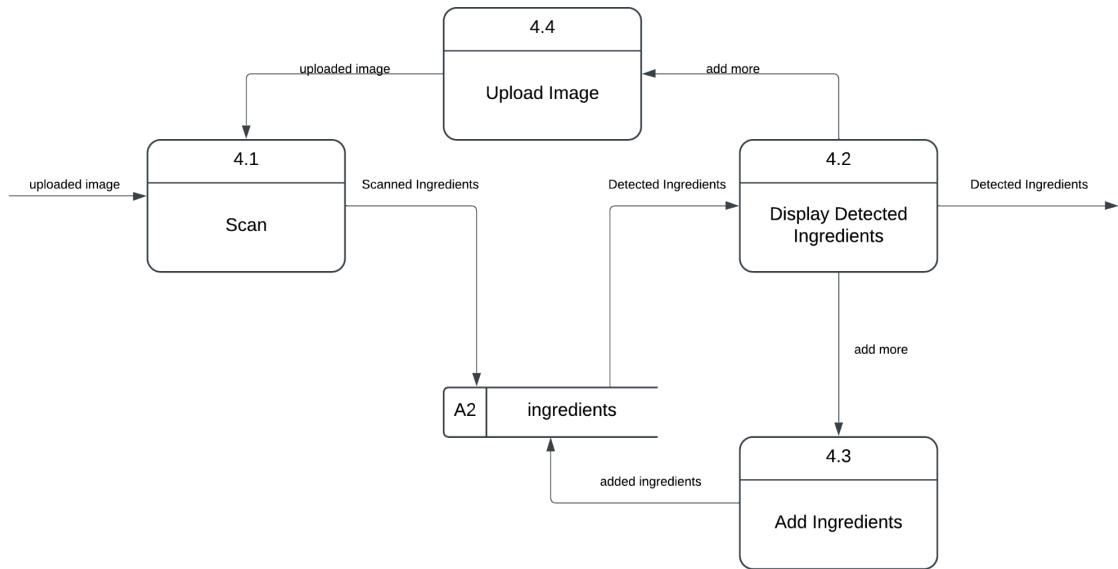


Figure 13 Child Diagram Level 4.0

Figure 13 Child Diagram Level 4.0 outlines the ingredient detection and management process, beginning with image scanning (4.1). The system

processes the scanned ingredients and sends the results to the Display Detected Ingredients (4.2) module, allowing users to verify or modify the detected items. The Upload Image (4.4) allows users to add more ingredients by adding images. Alternatively, users may add ingredients manually via Add Ingredients (4.3), both of these features update the stored ingredient data (A2). This overall shows how the user may be able to detect ingredients and manage them.

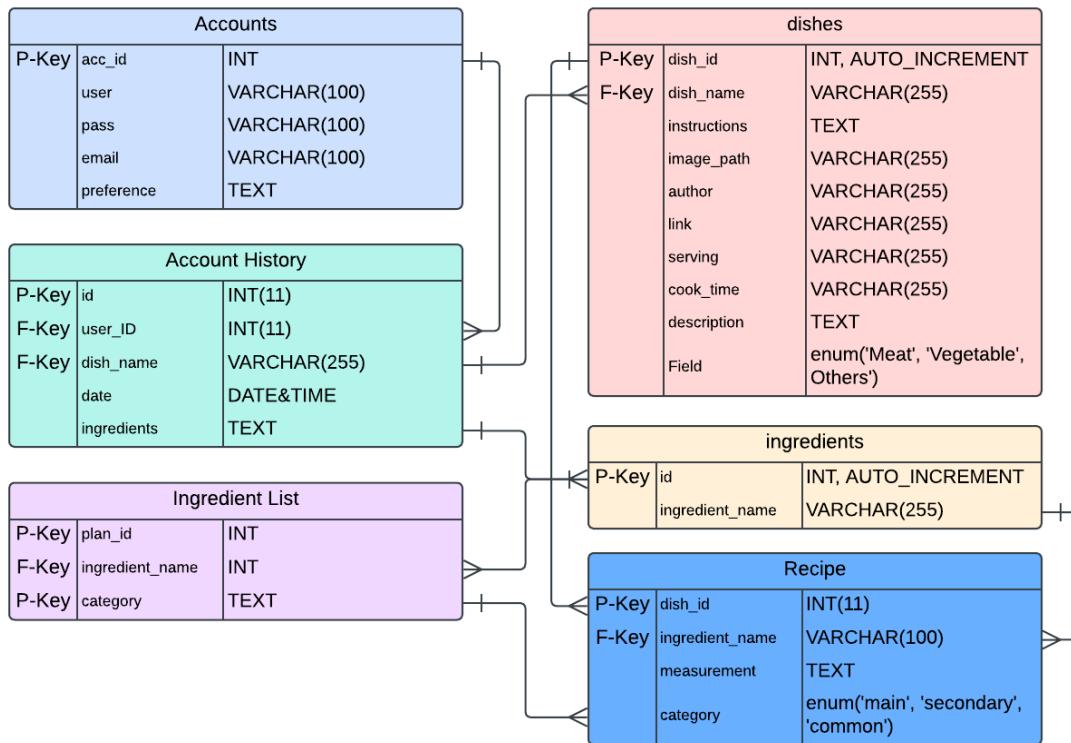


Figure 14 Entity Relationship Diagram

Figure 14 Entity Relationship Diagram visually illustrates the structure of the RecInScan database, and the relationship of each table. There are six main tables on the application: Accounts, Account History, Ingredient List, dishes, ingredients, and Recipe.

High Fidelity

The design of ReclnScan focuses on meeting its specific requirements and achieving its specific objectives while offering a smooth and easy-to-use interface. Hence, the system's key features are designed to capture the essence of a recipe recommendation system that provides delicious kapampangan dishes.

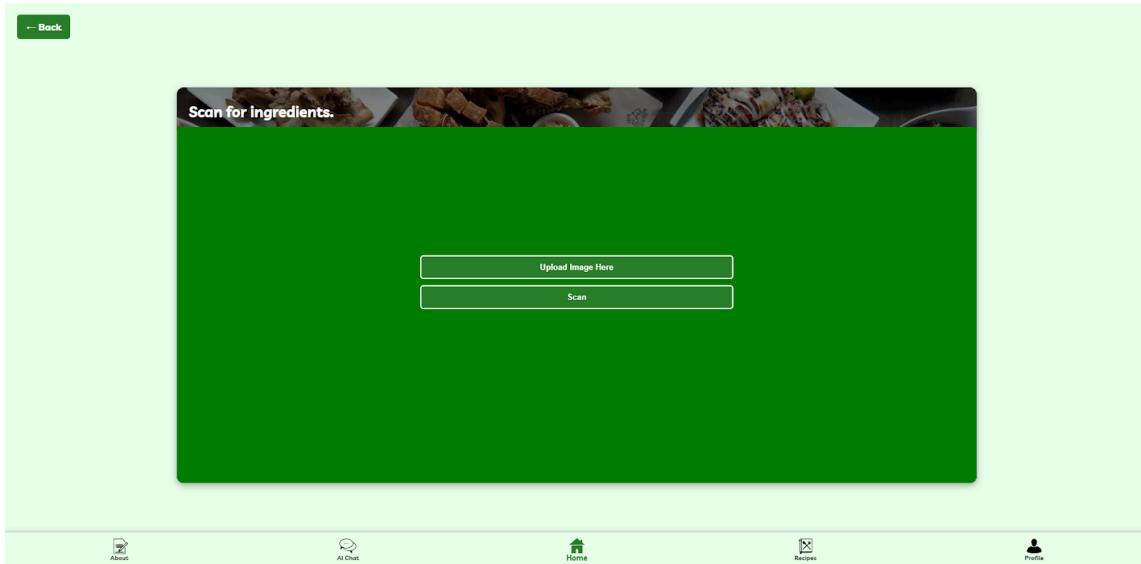


Figure 15 Ingredient Scanner with YOLOv9 algorithm

Figure 15 showcases the ingredient scanner. The user will be shown this page whenever they click on the scan link. The YOLOv9 algorithm is embedded in this page, which is activated after clicking the scan button. The user will first choose an image to be scanned, click on the scan button, then the YOLOv9

algorithm will detect ingredients that can be used in various kapampangan recipes.

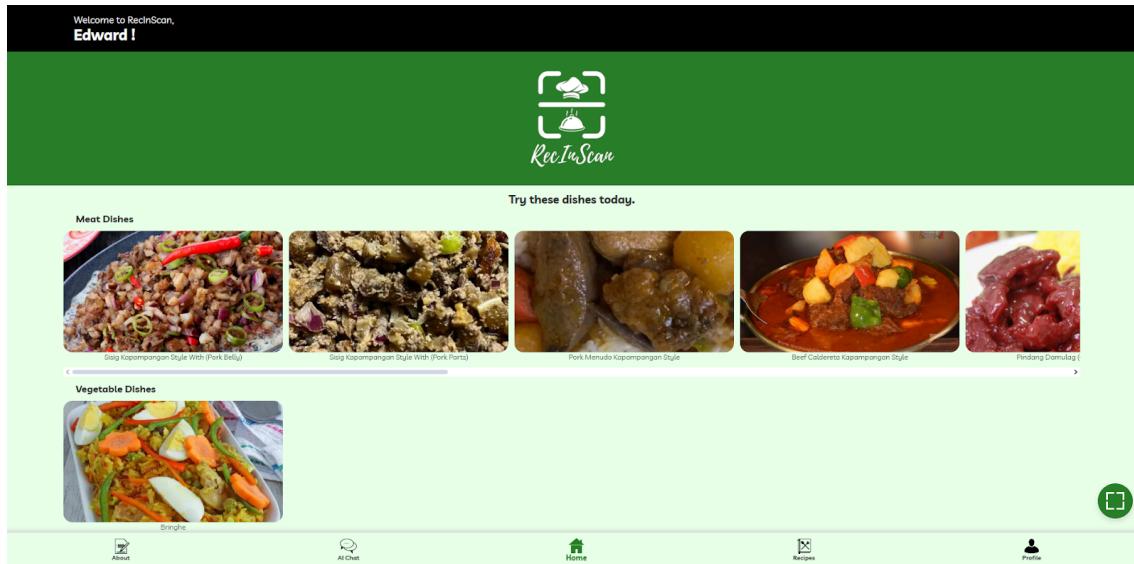


Figure 16 User Friendly Menu Interface

Figure 16 User Friendly Menu Interface illustrates the design and layout of the menu interface for RecInScan, which highlights the structured template and the user-friendly approach. The interface is intentionally designed to provide seamless navigation, allowing users to interact with the application effortlessly. With clear labels, organized sections, and intuitive icons ensure that users can quickly access features such as ingredient scanning, and recipe recommendations. It will minimize the learning curve, making it accessible to first time and returning users. Individuals can efficiently utilize RecInScan's features without unnecessary complexity.

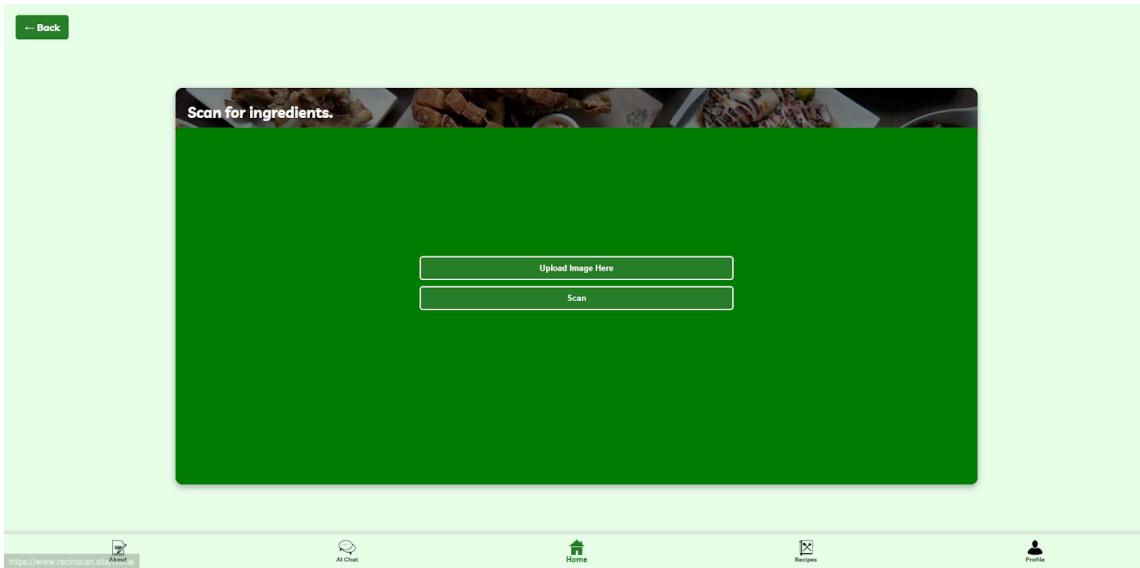


Figure 17 Scan page

Figure 17 Scan page shows the ingredient scan page. In this page, the user will be able to scan their ingredients to show into the system. The process begins when the user clicks on the "Upload Image" button, prompting them to either select an image from their device's file picker or take a photo using their mobile phone. Once the image is selected, it is appended to the system, allowing the user to review it. After confirming the correct image, the user clicks the "Scan" button, triggering the system's AI-powered ingredient detection. The system then analyzes the image, identifies the ingredients, and displays them on the screen. If any ingredient is missing or incorrectly detected, the user has the option to manually adjust the list before proceeding to receive recipe recommendations.

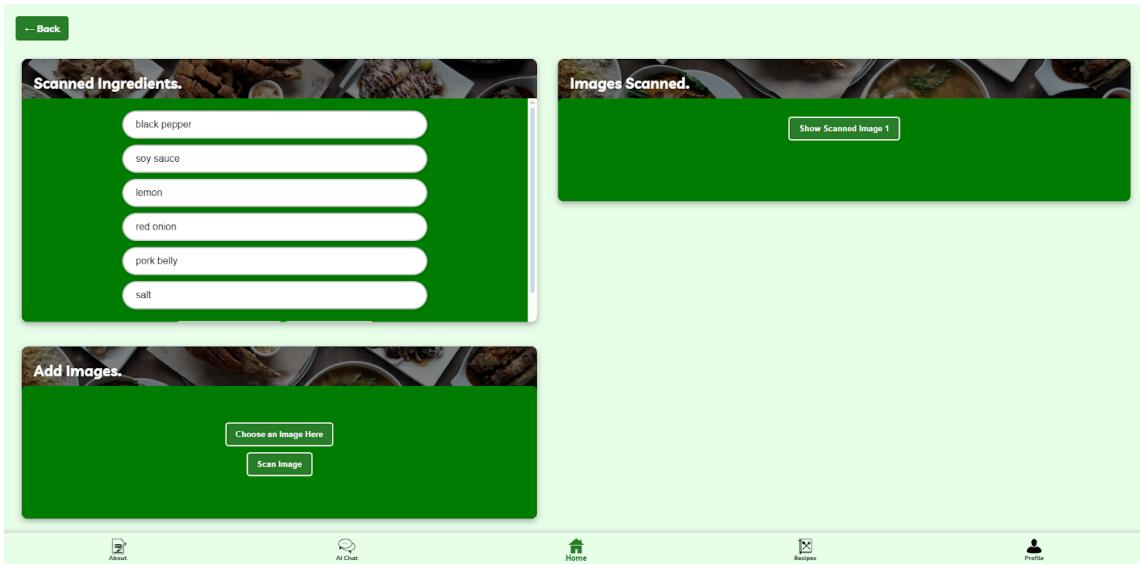


Figure 18 Detect Page

Figure 18 shows the ingredients that the application has detected for the image that the user has chosen or taken. Users can manually add the ingredient that they want to add, as well as show the scanned image they have chosen. The user may also choose an image to add more ingredients into the list, by first clicking on choose image, then scan image to process the image for ingredients. Finally, the user can click on Recommend Recipe to check for recipes that the user can cook.

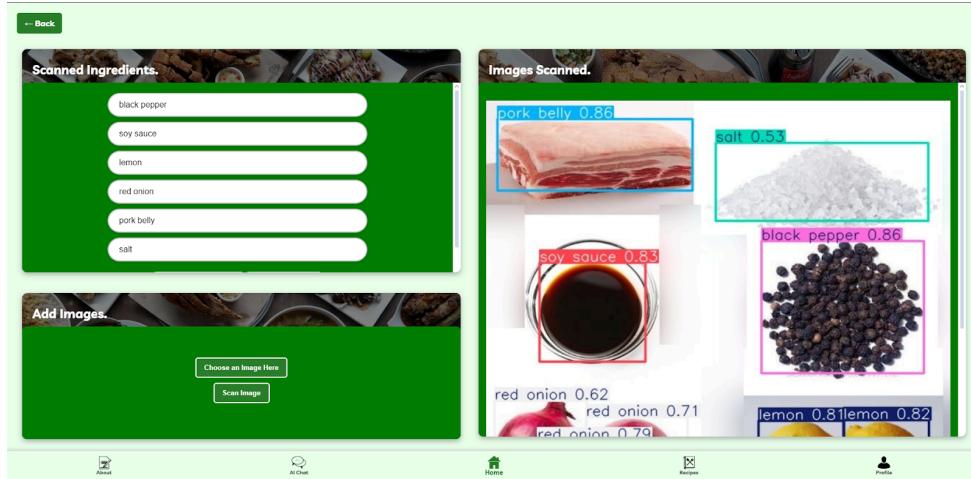


Figure 19 Detect Page

Figure 19 Detects the application detecting ingredients. In this case, the user has clicked 'Show Scanned Image 1' to show the image they have used to scan the ingredients. From here, the user can either recommend a recipe, hide the scanned image or choose an image to add to the list of ingredients.

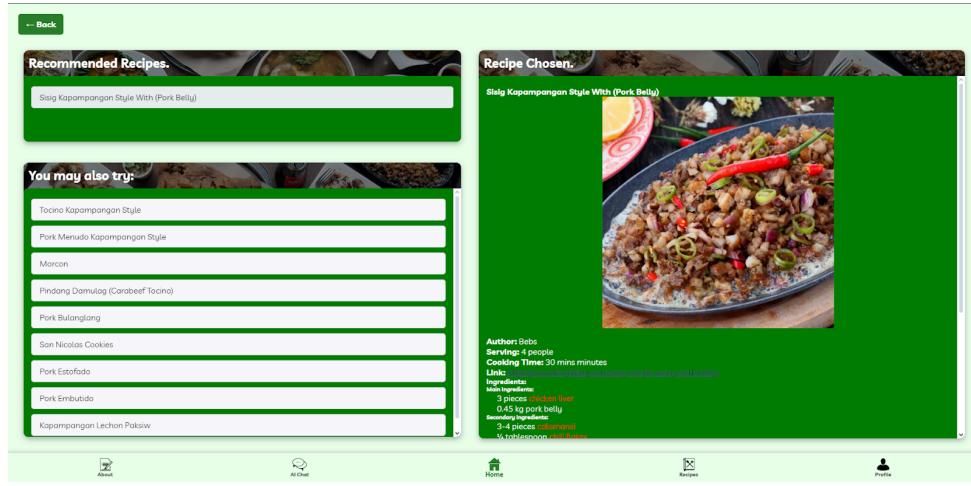


Figure 20 Recommend Page

Figure 20 Recommend Page shows the application's recommendation system, showcasing what the user can cook. The user can click on any of the

recipes listed above to click them and show the recipe that they have chosen. On the right, the user may view the name of the recipe, the author, ingredients required, and the procedure of cooking the recipe. The user can then save the recipe and log it into the account, which is sent to the meal plan.

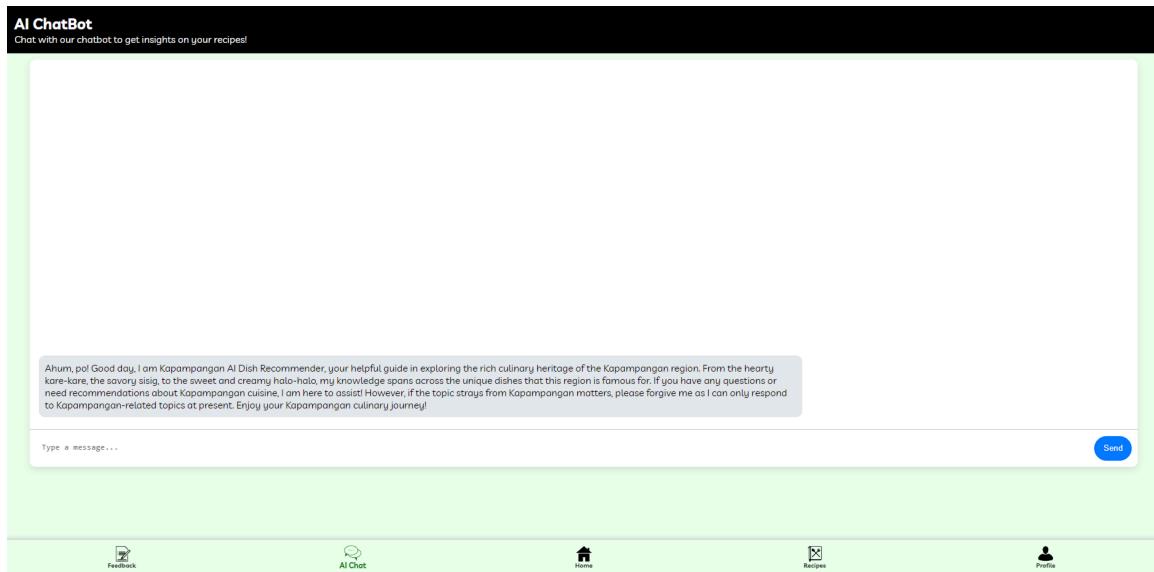


Figure 21 Artificial Intelligence Chat Page

Figure 21 Artificial Intelligence Chat Page displays the application's AI Chatbot, which assists users by providing information on Pampanga dishes, cooking techniques, and ingredient substitutions. Using natural language processing, the chatbot engages in conversations with users, offering personalized recipe suggestions based on detected ingredients. It enhances the user experience by answering questions in both English and Filipino, making it easy for users to explore and learn about local cuisine.

The research methodology will embrace an Agile approach, focusing on iterative development, frequent testing, and stakeholder engagement. The research will utilize a combination of case studies and experiments to evaluate the system's performance in real-world scenarios. Each sprint will involve testing prototypes or algorithms, followed by sprint reviews and retrospectives to gather feedback from key stakeholders such as Arnis practitioners and end-users. This feedback will directly inform the refinement of the application's features and algorithms. Data collection will be continuous, with performance metrics and user interaction data being analyzed to validate hypotheses and assess system effectiveness. Through regular feedback loops, the design will be iteratively adjusted to ensure the application meets user needs and research objectives.

Development

The Development Phase transforms RecInScan by implementing the aforementioned initial designs and algorithm presented for the system. It is implemented in a web-based environment, as well as the YOLOv9 model which includes adding preprocessing and varied datasets. In addition to this, agile principles guide the iterative process, ensuring continuous improvements based on feedback and testing, with regular review meetings to assess the progress along this phase. To meet the goal, which is to develop RecInScan as a fully fledged application, the researchers apply the algorithm, application and design into a single entity.

Algorithm Development and Model Training

The YOLOv9 model was selected for ingredient detection due to its real-time object detection capabilities and high accuracy. It was trained using a dataset of approximately 9,000 images, scraped using bing-image-scraper, collecting from bing images, which primarily focus on ingredients used in Kapampangan dishes. For the model to detect ingredients properly, data cleaning was done. This involves removing duplicate images, removing blurry or irrelevant images from the scraped images. This totals the image counts to 6000 annotated images. The dataset is then split into 80% training, 10% validation, and 10% testing sets. Training is conducted in a GPU-powered environment, with a batch size of 16 and 150 epochs, with mixed-precision training to optimize speed and efficiency. YOLOv9 is then evaluated based on accuracy, precision, recall, and F1-score according to the specific objectives. If the model is insufficient, fine-tuning and retraining is done to the model. If it is sufficient, It is then deployed to the RecInScan application.

Table 6 Training Configuration Overview

Parameter	Value
Total Images (Dataset)	Est. 6000 Images
Training Split (80%)	4800 Images
Validation Split (10%)	600 Images
Test Split (10%)	600 Images
Batch Size	16
Epochs	150

Iterations per Epoch	300 (4800 / 16)
Total Iterations	450,000 (350 x 150)
Training Type	Mixed Precision
Environment	GPU-Accelerated

Table 6 Training Configuration Overview shows the overview of the parameters set for YOLOv9. This includes the total images, training, validation and test split, the batch size, number of epochs, iterations of each epoch, total iterations training type and environment. Total images represent the amount of images that will be used for training, split by 4800 for training, 600 for validation, and 600 for test split. The batch size is set to 16, with epochs set to 150, having iterations for 300, formulated from the batch size to the training split. In total, there are 450,000 iterations for the entirety of training, with training type of mixed precision to speed up the process, and GPU-accelerated environment to train the model in a GPU environment rather than a CPU. This would allow the model to train significantly faster and be able to reciprocate the datasets faster if needed.

Challenges in the model training include training time, variance of datasets, and limitations of the GPU-accelerated environment. These were realized as time went on in the training process. To address variance of datasets, certain classes were lowered in total. Training time was reduced by optimizing the batch size, and allowing other optimizations to be used in the training environment.

Through the Agile methodology, past cycles improve the application over time, with each fine-tune and optimization made to refresh the model, which are

evaluated based on the specific objectives. Additionally, through user and stakeholder feedback, it shows the need for better detection in challenging conditions, leading to improved data augmentation techniques and real-world image testing.

RecInScan Application

The purpose of RecInScan is designed to assist users by generating recipe recommendations based on available ingredients. These will either be home cooks, chefs or people looking for recipes based on the ingredients they could have lying around their home. It is developed as a web-based application using Python for the back-end, integrating flask as its framework. The front-end was built with HTML, CSS, and JavaScript to provide a responsive and intuitive user experience. The system follows a client-server architecture, where the front-end sends image data to the back-end, which processes it using the trained YOLOv9 model and returns detected ingredients for recipe recommendations. leveraging its deep learning capabilities to enhance object detection accuracy.

In database management, MySQL (Version 5.2.1) and Apache (Version 2.4.58) were utilized to store user data, dish history, ingredient lists, and recipe details. The first designs, wireframes, are designed in Figma before being implemented through HTML and CSS as the user interface. For version control, GitHub was used, in line with the agile methodology for CI/CD integration. Hostinger was chosen to host the web application, and normal review meetings for optimization, as well as documentation updates.

The architecture of the RecInScan application is built as a client-server style. The front-end and back end work together to process the ingredients detected through the camera into recipe recommendations from the database. This is operated on a Virtual Private Server (VPS) to allow the server in optimal conditions when multiple users are in place. The back-end is implemented using Flask as the core web framework responsible for application logic, Hypertext Transfer Protocol (HTTP) requests, the connection between the front-end and the ingredient detection model, which also enables image uploads and model inference. Gunicorn is then used as the Web Server Gateway Interface (WSGI) server, which handles the communications between the front-end and back end. Connected with this, Nginx serves as the front desk of handling requests for Gunicorn, to optimize delivery of static content.

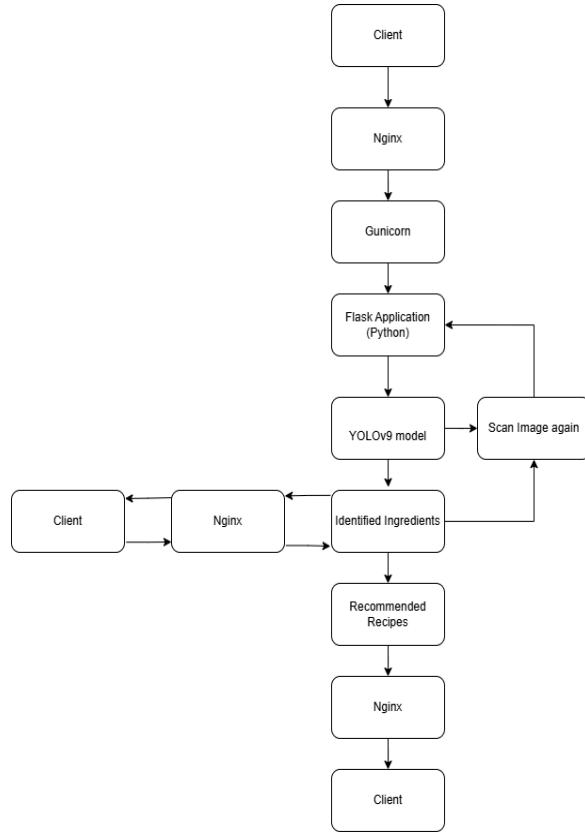


Figure 22 ReclnScan Process Flowchart

Figure 22 ReclnScan Process Flowchart follows a structured request-response cycle, first receiving a request from the client (web browser or mobile device) to access the application. Nginx forwards this request to Gunicorn, which runs the Flask application. The application then processes the request, interacting with the YOLOv9 model to detect ingredients from the provided image. Once the detection is complete, the model returns the processed results, including identified ingredients and recommended recipes. Finally, these results are sent back to the client via (Nginx).

Core features of the application include user registration, ingredient scanning, recipe recommendation, and preference listing. The user registration

was implemented using HTML forms, utilizing The UI design was implemented with responsive design principles in mind to ensure that the application can be used both in PC and mobile screens. This includes forms, buttons, and links. Forms are designed with intuitive field labeling, input validation, and clear error messages to enhance user experience. for each field, it is sized accordingly to make it resizable and responsive, with a focus for mobile screens. Button UI and link UI are changed accordingly to focus on mobile screens, so users have an easier time interacting with the application, at least referring to consistency and accessibility on many different devices.

Algorithm and Model Integration

ReInScan is powered by YOLOv9, which has been chosen as the model for detecting ingredients. This is seamed into Flask to allow users to upload images, and these may be processed and passed to the model on the application as detection results. These identified items are then used by Flask to match the pampanga-curated recipe database, returning recipes for the user display.

Development and Deployment focuses on GitHub, where the CI/CD integration pipeline is manually deployed in each cycle the application goes through. The updates are managed through normal GitHub functions, like pull requests and branching. To test these changes, the researchers may develop the application on their end, and push them to the live system.

Ultimately, the entirety of the development phase created ReInScan, an application that detects ingredients filtered by preferences, processes them,

returns detected ingredients, and finally, returns recipe suggestions for users to cook kapampangan dishes. With the proper feedback cycles and testing, it was then improved by the researchers and developers of the application.

Testing

The testing phase focuses on the specific objectives of the application, particularly, accuracy, precision, recall, F1-Score, and confusion matrix. The YOLOv9 model is tested and validated using the aforementioned splits, 600 for test and 600 for validation, which returns the results of the evaluated model. Validation techniques such as K-fold cross-validation and hold-out validation ensured the model generalizes well to new data.

$$\text{Accuracy} = \frac{P*R}{P+R-(P*R)}$$

Equation 1 Accuracy Formula

Accuracy is calculated by multiplying the values of Precision and Recall; divided by the difference between the sum of P and R and their product. The Accuracy measured the overall correctness by comparing correct predictions to total predictions. The precision is calculated by getting the summation of all classes.

$$\text{Precision} = \frac{\sum_{i=1}^n Pi}{n}$$

Equation 2 Precision Formula

Precision is evaluated as how the model detected ingredients, and this is optimized by looking for false positives.

$$\text{Recall} = \frac{P*R}{P+R-(P*R)}$$

Equation 3 Recall Formula

To get the recall, the summation of the classes is required. It is then evaluated based on how the model is effective in detecting ingredients, specifically, false negatives.

$$\text{F1-Score} = \frac{\sum_{i=1}^n F1i}{n}$$

Equation 4 F1-Score Formula

To get the F1-Score, all of the classes are added together, and balances the precision and recall. This considers both false positives and false negatives as a way to evaluate the model.

Lastly, the confusion matrix breaks down the YOLOv9's performance for each ingredient. This overall shows the true positives, false positives, false negatives, and true negatives. In each sprint or cycle, these are used to evaluate and fine-tune the model to look for inconsistencies and problems with

classification, in order to accurately find ingredients as inputted by users accurately. For example, calamansi may be identified as a leafy green, like dills, to which the only difference would be the texture and shape of the ingredient. Another would be the similarity between pineapple juice and lemon, which the only similarity is the color. This information allows the researchers to adjust datasets, deciding if it is required to add more, or lessen, as a way to lessen class bias.

To get the datasets, it was sourced from bing images, as publicly available images. Specifically, each class was trained with at least 150 images, and this would add more as preprocessing is done, like auto-orient, 320x320 image resolution, and image variations added to the dataset, such as blurring, cropping, rotation, brightness and exposure.

Performance analysis showed an 85-89% accuracy in optimal conditions but declined to 60-70% with blurred, too many, poor image quality or overlapping ingredients. Refinements included hyperparameter tuning, data augmentation, and additional training samples, leading to a 5% improvement in F1-score. System testing verified seamless integration between the UI, web hosting, and backend processing.

System Testing

The evaluation phase ensures that ReInScan's ingredient detection model and integrated system function accurately, efficiently, and reliably in real-world scenarios. Evaluation is necessary to measure the model's

performance, validate its ability to solve the intended problem, and ensure that it generalizes well across diverse conditions. By systematically testing both the algorithm and the user-facing components, potential shortcomings are identified and addressed, enhancing the application's effectiveness and usability.

Table 7 Functional Requirements

No.	Module/Component	Expected Outcome
1	User Authentication	<ul style="list-style-type: none"> 1. The user will be able to use their credentials to access the application. 2. After logging in, users will have access to all areas of the web application, including the ingredient scanner, recipe recommendations, and account settings. 3. Any new user will be able to easily create an account, with appropriate validation for email and password security.
2	Interfacing with external APIs or systems	<ul style="list-style-type: none"> 1. RecInScan will successfully interface with external APIs (ingredient detection and external database) for functionality. 2. The system will correctly authenticate and handle any API responses, with a focus on reliability and interacting with external services.. 3. The user will be able to send a message to the AI chatbot for further information within the system.
3	Allowing users to upload/download files	<ul style="list-style-type: none"> 1. Users will be able to upload images containing ingredients via a simple, intuitive interface. 2. Upon uploading, the system will promptly process the images using the ingredient detection model (YOLOv9) and accurately identify the ingredients within the image. 3. RecInScan will provide feedback to the user, confirming the ingredients detected and displaying them clearly on the page. 4. The system will notify users if the image processing fails or if no ingredients are detected, prompting them to try a different image. 5. Users will be able to upload additional images to further expand the list of identified ingredients, allowing for a dynamic and evolving ingredient set.

Table 7 Functional requirements lists the functional requirements of the application, focusing on the features of the application, such as user authentication, ingredient detection, recipe recommendation, Flask, Gunicorn, and other APIs, and the ability for users to upload files. User authentication deals with the database, seeing if the correct credentials match with the correct user profile, along with login, logout and registration protocols. Interfacing with external APIs deal with the connection of the chatbot, to which the researchers verify if the API is functioning as intended, especially on the correct response. The image upload process is tested for ingredient detections, looking for misclassifications or mismatches, ability to upload further images, and other requirements for the process. Additionally, the recipe recommendation process is verified for matching ingredients and matching preferences from the user.

Table 8 Non-functional Requirements

No.	Criteria	Expected Outcome
1.	Throughput Test	<ul style="list-style-type: none"> 1. RecInScan properly processes at least three images per second for ingredient detection under normal load. 2. RecInScan generates recipe recommendations after detecting ingredients in images. 3. The model detects ingredients quickly, within 5 seconds.
2.	Load Test	<ul style="list-style-type: none"> 1. RecInScan functions correctly while an expected number of users access the website. 2. RecInScan scans images correctly while multiple users send images simultaneously, at least two. 3. RecInScan generates proper recipe recommendations when an expected number of users are using the feature.

3. Stress Test	<ol style="list-style-type: none"> 1. RecInScan handles a high user load. 2. RecInScan scans images for ingredients sent by multiple users simultaneously. 3. RecInScan generates proper recipe recommendations when multiple users ask for recipe recommendations.
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Table 8 Non-functional requirements testing was conducted to evaluate the system's performance, security, and usability. In throughput, the researchers look at response times at different load conditions. Load testing looks into the amount of users and the system's performance when there are many users, and stress testing verifies the accuracy and correctness of detected ingredients during load. The difference of the non-functional to the functional is that non-functional looks into the performance of the system.

The challenges identified were many, images could misclassify detected ingredients, and response times slow down during high traffic. For this reason, different techniques were used, such as using a camera instead of real-time scanning for ingredients. The researchers also looked into server configurations to look for enhancements and processing speed improvements.

Deployment

The deployment phase of RecInScan signifies the start from development of the system to the deployment accessible to the users of the internet. In this stage, configurations are done to deploy the system into a web-hosted environment, while looking for bugs or optimizations that can be done for the next

phase. Objectively, the purpose of the deployment phase is to deploy ReInScan, and confirm if the application is ready for deployment.

Deployment preparation is as follows: Data migration for data transferring, including recipe recommendations and the trained YOLOv9 algorithm, a code freeze to restrict modifications to the production code, and a review for the codebase. Each of these steps are done to see if the features are functioning as expected and that there are no bugs or problems that may occur. The application is then deployed in the production environment, along with the server, database and other services that the application requires. In terms of security, data encryption and user authentication are done through hashing. Later on, the researchers will deploy system monitoring tools to track performance and user interaction with the system, to which users are also given a user manual for the usage of the application.

ReInScan is deployed on hostinger, which is required to minimize cost and assures that the system mitigates any load balancing problems. This is also in line with the system's requirements, which is a stable backend server supporting MySQL for ingredient and recipe data, chatbot support, database management system, and necessary security support for user privacy purposes.

In the deployment, certain problems and challenges came up, such as compatibility. The hosting environment, Hostinger, took time to understand and learn, whilst dealing with database migration to make sure that the databases were correct. To deal with these problems, the researchers configured the server

settings and optimized the deployment process while troubleshooting network related issues.

After deployment, the researchers monitored and maintained the application, checking for bugs and errors needed to be addressed while testing. This goes back to the functional and non-functional requirements, where each would be retested according to these objectives. Server uptime, API request success rates and resources of the system are monitored as the application is deployed.

In line with the objectives and requirements, a user manual was created to guide users on how to use the application. The documents contain varied information about the application, from the about page to the profile page, which is comprehensively written as to not miss any part of the application. In addition to this, a video demonstration was made to showcase the features of the application, for a much more modern and faster way of understanding how RecInScan works. This method allows the researchers to help users understand the application.

With all of the steps done above, this will let RecInScan complete the deployment phase, from deployment requirements to post-deployment requirements. All while monitoring the application's performance, stability and load usage while multiple users are uploading images. This will give the researchers insight as to what problems may occur during the deployment process and see what is really demanded by the application. And when these

problems are identified, many fixes and optimizations will be done to ReclnScan, which come up in the next cycle as per the Agile Methodology. With the objectives in mind, this pushes ReclnScan to its final phase, and once again starts a new cycle if required to do so.

Review

The review phase for ReclnScan is where the researchers review and recheck the assessment based on the objectives and requirements of ReclnScan. Reviews will be done based on the ISO 20510 standards, and look into user evaluations of the application to add into the plan phase. This phase also looks for usability, and finds recommendations for future versions of the system. Should it be required, the phase will go back to the plan phase to reassess and adjust parameters that the application or model requires.

Table 9 ISO 25010 Requirements

No.	Criteria	Requirements
1.	Functional Suitability	
	Functional Appropriateness	<ul style="list-style-type: none"> 1. ReclnScan helps find recipes using the ingredients you have at home by scanning them with your phone and suggesting personalized dishes. 2. ReclnScan accurately scans ingredients, ensuring that the detected items are correctly identified and relevant to the recipe, thereby providing reliable recipe suggestions. 3. ReclnScan simplifies meal preparation by offering an intuitive and efficient way to identify ingredients and recommend recipes, making cooking easier and more convenient for users.
	Functional Completeness	<ul style="list-style-type: none"> 1. ReclnScan enables users to create and customize their profiles by inputting profile information 2. ReclnScan provides users with an extensive

	<p>selection of recipe suggestions tailored to the ingredients they have on hand.</p> <p>3. RecInScan provides users with an extensive selection of recipe suggestions tailored to the ingredients they have on hand.</p>
Functional Correctness	<p>1. RecInScan securely stores and displays the user's login and profile information, providing a smooth and personalized experience each time the user uses the app.</p> <p>2. RecInScan accurately scans ingredients and works without errors, providing users with reliable recipe recommendations.</p> <p>3. RecInScan performs consistently across all its features, ensuring users can smoothly navigate and use the app without encountering errors.</p>
2. Performance Efficiency	
Time Behaviour	<p>1. RecInScan delivers consistent performance, allowing users to confidently rely on the app for accurate results and a hassle-free experience every time</p> <p>2. RecInScan delivers fast and responsive performance, loading pages in just a few seconds, ensuring a smooth and efficient user experience.</p> <p>3. RecInScan can easily recognize various ingredients used in Pampanga cuisine, helping users accurately identify and understand traditional local ingredients.</p>
Capacity	<p>1. RecInScan ensures that users can move through their tasks quickly and effortlessly, making the entire process more efficient and enjoyable.</p> <p>2. RecInScan can simultaneously handle multiple ingredient scans and recipe searches without slowing down or crashing.</p> <p>3. RecInScan remains responsive and functional even when multiple users access it simultaneously for scanning and recipe recommendations.</p>
Resource Utilization	<p>1. RecInScan operates seamlessly, even when other applications or websites are open.</p> <p>2. RecInScan operates smoothly and efficiently, ensuring that your device's overall performance remains unaffected.</p> <p>3. RecInScan efficiently uses your device's resources, such as memory and battery, ensuring it doesn't slow down or drain power during use</p>
3. Interaction Capability	
Appropriateness Recognizability	<p>1. RecInScan offers personalized recipes that help you create delicious dishes with ease, all based on</p>

	<p>the ingredients scanned.</p> <ol style="list-style-type: none"> 2. ReclnScan presents information in a simple and easy-to-understand way, making sure users can quickly get the details they need. 3. ReclnScan helps users make informed choices with confidence, ensuring they always know exactly what they're working with.
Operability	<ol style="list-style-type: none"> 1. ReclnScan is designed to be simple, making it really easy for users to navigate and use without any hassle. 2. ReclnScan provides easy-to-follow instructions to help users navigate and use the web application. 3. ReclnScan provides helpful guides that show users which pages to visit next, making it easy to explore the app. 4. ReclnScan's layout is straightforward, making it easy to navigate between features like scanning ingredients or browsing recipes.
User Error Protection	<ol style="list-style-type: none"> 1. ReclnScan uses asterisks (*) to highlight the fields you must fill out. This ensures that all necessary information is provided, making the process easier. 2. ReclnScan encourages users to fill in any additional information by offering helpful prompts and reminders. 3. ReclnScan provides clear warnings or alerts when users enter incorrect information, helping them correct mistakes before proceeding.

Table 9 ISO 20510 requirements explains the ISO 20510 standards that the researchers have chosen for ReclnScan. Three criteria are chosen, namely functional suitability, performance behavior, and interaction capability, respectively. For functional suitability, the researchers deal with Functional Appropriateness, Functional Completeness and Functional Correctness, and overall deal with usability and how usable the application is to users. Performance behavior focuses on the performance of the system, with Time Behaviour, Capacity and Resource utilization as the main focus. Then, interaction capability contains Appropriateness Recognizability, Operability, and User Error

Protection. This criteria focuses on dealing with interactions with the system and if they are appropriate and minimal to the requirements.

International Organization for Standardization Systems Evaluation

The evaluation of the ISO 20510 usability requirements was gathered using a five-point Likert scale. Each of the sub-criteria in each criteria was summated, and scored to make an average, and according to the end calculation, is given a verbal interpretation. This would ultimately highlight the application's strengths and weaknesses, to which it can be used in the next phase if ReclnScan requires so. It also serves as a guide for the researchers in this case.

Table 10 Likert Scale Numerical Interpretation

Scale	Verbal Interpretation
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

Table 10 Likert Scale Numerical Interpretation shows the numerical interpretation of the likert scale used to measure the participants' agreement based on the ISO 20510 requirements. It ranges from 5 to 1, with 5 being Strongly Agree to 1 being Strongly Disagree. Each of the likert scale's numerical interpretations are then summed up for each criteria to serve as a verbal interpretation.

Table 11 Verbal Interpretation

Mean Ratings	Verbal Interpretation
4.51 and above	Excellent
3.51 - 4.50	Very Good
2.51 - 3.50	Good
1.51 - 2.50	Fair
1.50 and below	Poor

Table 11 To evaluate the application, or evaluate the survey, the researchers used the weighted mean method where the numerical interpretations are summed up and are correlated to a verbal interpretation. After computing the weighted mean, each criteria were interpreted and classified according to their score. Scores from 4.51 to 5.00 were noted as “Excellent”, 3.51 to 4.50 as “Very Good”, 2.51 to 3.50 as “Good”, 1.51 to 2.50 as “Fair”, and 1.00 to 1.50 as “Poor”. The survey will be distributed among IT experts and various home cooks to serve as the focus of the survey. The results of the survey will allow the researchers to scale upon the next cycle of the application, and add improvements when required. Additionally, in the survey, suggestions and comments are opened up to see what improvements may be made to the system as time goes.

Ultimately, the review phase shows what the application’s overall evaluation, strengths and weaknesses, and improvement areas are. This phase also allows the researchers to evaluate the application and serve as a gateway for the next cycle for RecInScan. From here, the cycle would repeat again, and

each laid out requirement during this phase are sent for review and are reevaluated until RecInScan has finally reached its final version.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter unveils the research findings, presenting a structured overview aligned with the study's objectives. The subsequent discussion critically analyzes the implications and significance of the results, offering a nuanced understanding of the study's contributions to the field. This chapter serves as the intellectual core of the thesis, setting the stage for conclusions and suggesting future research avenues.

Preliminary Examination

1. Examine and understand the process of a food ingredient recommendation system using YOLOv9.

The researchers carried out a thorough review of the literature regarding food ingredient recommendation systems. They analyzed research papers, studies, and scholarly articles to uncover common practices, methodologies, and strategies utilized in the development of food recommendation systems and the incorporation of YOLOv9. To tackle challenges associated with food recommendation, this study introduces a web application that employs object detection techniques to tailor recommendations and propose recipes from renowned Kapampangan cuisine. This benchmarking process enabled them to identify research gaps and prioritize these areas for additional exploration, with

the goal of addressing the recognized deficiencies.

2. Explore existing systems or applications relevant to the project.

To investigate current systems or applications related to the project, the researchers utilized survey questionnaires to collect user feedback, interviewed professional chefs with expertise in Kapampangan cuisine, and compared similar platforms. The benchmarking analysis revealed shared features, distinctive functionalities, and potential areas for enhancement. By analyzing these existing systems, valuable insights into their strengths, weaknesses, and key characteristics were obtained. These findings informed the creation of the food recommendation system that meets user requirements and adheres to the methodologies typically employed in existing platforms.

3. Analyze, understand, and perform preprocessing activities on data gathered for the development of RecInScan

The data collected for creating RecInScan was meticulously analyzed and prepared to guarantee its quality and uniformity. The cleaning process involved eliminating invalid entries and ensuring that every image included annotations. The images were adjusted to a resolution of 640x640, and contrast enhancements were applied through contrast stretching to enhance clarity. In order to improve the dataset and facilitate more effective model training, augmentations were implemented, resulting in three variations for each training example. These alterations comprised random cropping with a maximum zoom of 10%, rotation ranging from -10° to +10°, brightness modifications between

-10% and +10%, exposure adjustments of -5% to +5%, and minor blurring of up to 1.8 pixels. These preprocessing activities ensured that the dataset was properly structured, diversified, and optimized for the next stages of RecInScan's development.

Model Evaluation

After conducting several tests to reach the objective of identifying the raw ingredients scanned, various performance metrics are applied to the trained model to confirm that the system has fulfilled the aim of accurately recognizing the user's ingredient.

The performance metrics are utilized to validate the trained model and implement a YOLOv9 algorithm that can evaluate raw ingredients to accurately scan and suggest recipes

Classification Accuracies

The confusion matrix serves as a means to assess the effectiveness of classification models by illustrating prediction results and highlighting errors in classification (Bang & Park, 2024; Zhao et al., 2024). By offering a visual depiction of how closely a model's predictions match the actual outcomes, researchers can understand areas that need enhancement to ensure accurate identification of the raw ingredient being analyzed.

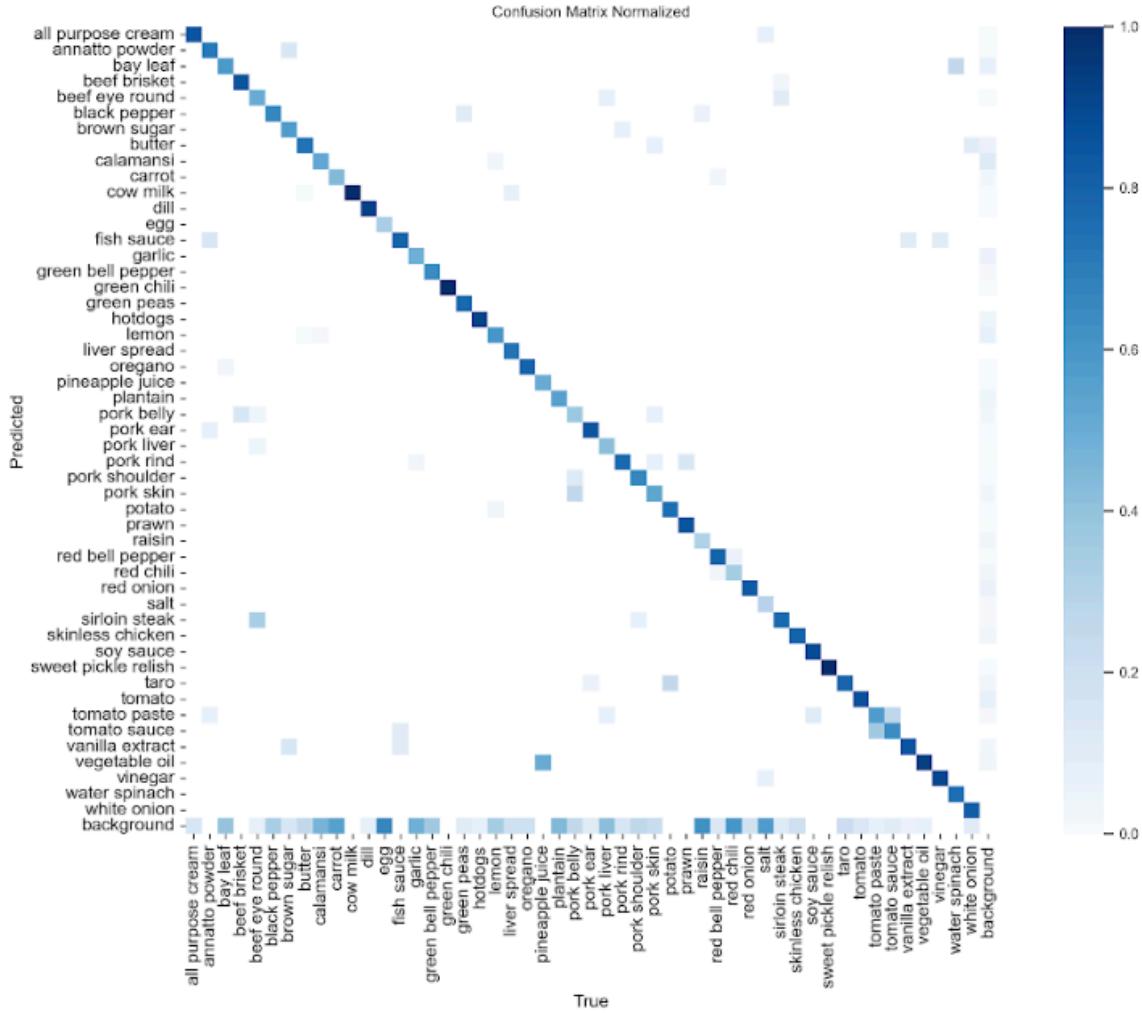


Figure 23 Confusion Matrix of the Trained Model

Figure 23 presents the normalized confusion matrix for the trained YOLOv9 model, illustrating its classification effectiveness across various ingredient categories. The diagonal element signifies instances that were correctly classified, with deeper blue shades representing greater accuracy, while off-diagonal entries reveal misclassifications caused by issues like visual similarities, variations in lighting, or occlusions. This matrix serves to assess model performance by pinpointing ingredient classes that are often confused,

offering valuable insights for enhancements such as dataset augmentation, rebalancing

Model Performance Analysis and Discussion

The assessment of the mode's evaluation accuracy yielded an average score of 50.10%. The analysis of the classification outcomes based on the utilized metrics is provided in Table 12 of the Classification Report.

Table 12 Classification Report

Category	Ingredients	Images	Precision (P)	Recall	F1-Score	Accuracy
secondary	All purpose cream	13	0.686	0.756	0.7194	0.561
common	Annatto powder	12	0.777	0.749	0.7632	0.616
secondary	Bay leaf	20	0.499	0.528	0.5127	0.345
main	Beef brisket	7	0.635	0.995	0.7754	0.345
main	Beef eye round	13	0.729	0.458	0.5627	0.394
common	Black pepper	5	0.686	0.667	0.6760	0.511
secondary	Brown sugar	7	0.931	0.714	0.8083	0.678
secondary	Butter	31	0.732	0.675	0.7022	0.541
secondary /common	Calamansi	20	0.508	0.507	0.5073	0.340
secondary	Carrot	8	0.544	0.278	0.3678	0.225
secondary	Cow milk	7	0.637	1	0.7781	0.637
secondary	Dill	12	0.872	0.769	0.8176	0.691
main/ common	Egg	1	0.619	0.333	0.4333	0.276

secondary	Fish Sauce	9	0.764	0.8	0.7818	0.641
common	Garlic	11	0.492	0.457	0.4739	0.310
secondary	Green Bell Pepper	7	0.534	0.571	0.5519	0.381
secondary	Green Chili	3	0.724	0.537	0.6164	0.446
secondary	Green Peas	9	0.947	0.667	0.7826	0.643
secondary	Hotdogs	7	0.345	0.833	0.4879	0.323
secondary /common	Lemon	18	0.525	0.624	0.5704	0.399
secondary	Liver Spread	13	0.799	0.667	0.7270	0.571
secondary	Oregano	5	0.601	0.8	0.6864	0.522
secondary	Pineapple Juice	4	0.515	0.75	0.6106	0.440
secondary	Plantain	5	0.666	0.443	0.5323	0.362
main	Pork Belly	7	0.396	0.5	0.4420	0.284
main	Pork Ear	10	0.833	0.895	0.8628	0.759
main	Pork Liver	6	0.481	0.333	0.3936	0.245
main	Pork Rind	12	0.699	0.846	0.7657	0.620
main	Pork Shoulder	10	0.754	0.667	0.7077	0.548
main	Pork Skin	8	0.531	0.385	0.4462	0.287
secondary	Potato	2	0.565	0.75	0.6444	0.475
main	Prawn	5	0.541	0.51	0.5248	0.356
secondary	Raisin	5	0.591	0.312	0.4088	0.257
secondary	Red Bell Pepper	14	0.753	0.767	0.7599	0.613
secondary	Red Chili	12	0.476	0.312	0.3767	0.232
common	Red Onion	19	0.59	0.804	0.6805	0.516
common	Salt	11	0.466	0.286	0.3542	0.215
main	Sirloin Steak	20	0.836	0.837	0.8364	0.719

main	Skinless Chicken	10	0.718	0.706	0.7118	0.553
common	Soy Sauce	5	0.883	0.84	0.8608	0.756
secondary	Sweet Pickle Relish	12	0.883	1	0.9377	0.883
secondary	Taro	11	0.758	0.811	0.7835	0.644
secondary	Tomato	8	0.472	0.867	0.6111	0.440
secondary	Tomato Paste	12	0.479	0.571	0.5209	0.352
secondary	Tomato Sauce	9	0.529	0.636	0.5778	0.406
secondary	Vanilla Extract	15	0.631	0.947	0.7574	0.609
common	Vegetable Oil	39	0.776	0.841	0.8071	0.677
common	Vinegar	7	0.746	0.9	0.8159	0.689
secondary	Water Spinach	4	0.919	1	0.9577	0.919
common	White Onion	4	0.973	0.818	0.8891	0.8
	Total	926	average: 0.661	averag e 0.674	average: 0.6536	0.501

Table 12 shows ReclnScan’s training and was developed using a dataset derived from images, with the model optimized for accuracy and precision through the evaluation of several performance metrics. These metrics include Precision, Recall, and F1-Score. Precision quantifies the proportion of correctly predicted positive instances out of all positive predictions made by the model. Recall, on the other hand, measures the proportion of actual positive instances that were correctly identified. The F1-Score provides a harmonic mean of Precision and Recall, offering a single, comprehensive measure of model performance.

The following section discusses the detailed accuracy results of the metrics used in developing the system.

$$\text{Accuracy} = \frac{P*R}{P+R-(P*R)}$$

$$\text{Accuracy} = \frac{0.661*0.6744}{0.661+0.674-(0.661*0.674)}$$

$$\text{Accuracy} = 50.10\%$$

Accuracy measures the performance of the model; as such, it is the ratio of correctly classified samples and the total number of samples (Islam et al., 2022). In Figure 23 from the Confusion Matrix. Bringing the accuracy to 50.10%. This means that 50.10% of the time, the model can correctly classify whether the model is scanning a raw ingredient correctly or incorrectly.

$$\text{Precision} = \frac{\sum_{i=1}^n P_i}{n}$$

$$\text{Precision} = \frac{\sum_{i=1}^{50} P_i}{50}$$

$$\text{Precision} = 66.09\%$$

Average Precision measures how accurate the model's positive

predictions are. It is solved by taking the proportion Precision of all the classes and dividing by the amount of class (Islam et al., 2022). In Figure 23, Since the training from ultralytics gave the result of each class metrics, The researchers calculated for the average instead. The average precision showed 66.09%, This means that 66.09% of the time, the model is either correct or incorrect when it predicts that the user has scanned a raw ingredient.

$$\text{Recall} = \frac{\sum_{i=1}^n R_i}{n}$$

$$\text{Recall} = \frac{\sum_{i=1}^{50} R_i}{50}$$

$$\text{Recall} = 67.44\%$$

Recall measures the effectiveness of the model in identifying all relevant instances, meaning it represents the proportion of correctly identified positive samples- true positives- out of all actual positive samples, which is the sum of the true positives and false negatives (Islam et al., 2022) In Figure 23, Since the training from ultralytics gave the result of each class metrics. The researcher computed for the average recall instead, bringing a recall average of 67.44%. This means that 67.44% of the time, the model is detecting the raw ingredient as correct.

$$F1\ Score = \frac{\sum_{i=1}^n F1i}{n}$$

$$F1\ Score = \frac{\sum_{i=1}^n F1i}{50}$$

$$F1\ Score = 65.36\%$$

F1 Score measures the harmonic mean of precision and recall, balancing the two metrics by having both metrics contribute equally to the final score (Islam et al., 2022). This provides a more balanced representation of the model by ensuring that both metrics are taken into account. A high F1 score will indicate that a model has both great precision and recall. Since the training from ultralytics gave the result of each class metrics. The researcher computed for the average F1-score instead, bringing an F1-score average of 65.36%. This means that the model generally provides a good balance in identifying raw ingredients.

Testing Results

To ensure the capabilities of ReclnScan, a comprehensive testing process was conducted, including functional tests that covered the functionality of the system's components and features, and non-functional tests that evaluated the system's performance and behavior.

Functional Testing Requirements

Functional testing verifies that the system satisfies its functional requirements by examining whether each feature performs as intended.

Table 13 Functional Requirements Testing Outcome

No.	Module/Component	Expected Outcome	Actual Outcome	Remarks
1	User Authentication	The user will be able to use their credentials to access the application.	As Expected	Passed
		After logging in, users will have access to all areas of the web application, including the ingredient scanner, recipe recommendations, and account settings.	As Expected	Passed
		Any new user will be able to easily create an account, with appropriate validation for email and password security.	As Expected	Passed
2	Interfacing with external APIs or systems	ReInScan will successfully interface with external APIs (ingredient detection and external database) to enhance functionality.	As Expected	Passed
		The system will correctly authenticate and handle any API responses, ensuring reliability and smooth user interaction with external services.	As Expected	Passed
		The user will be able to send a message to the AI chatbot.	As Expected	Passed

3	Allowing users to upload/download files	<p>Users will be able to upload images containing ingredients via a simple, intuitive interface.</p> <p>Upon uploading, the system will promptly process the images using the ingredient detection model (YOLOv9) and accurately identify the ingredients within the image.</p> <p>ReInScan will provide feedback to the user, confirming the ingredients detected and displaying them clearly on the page.</p> <p>The system will notify users if the image processing fails or if no ingredients are detected, prompting them to try a different image.</p> <p>Users will be able to upload additional images to further expand the list of identified ingredients, allowing for a dynamic and evolving ingredient set.</p>	As Expected	Passed
			As Expected	Passed
			As Expected	Passed
			As Expected	Passed
			As Expected	Passed

Table 13 presents the results of functional requirements testing for various components of the application, detailing the expected and actual outcomes to assess whether the system meets its intended functionality. Functional requirements define the essential operations of the application, such as user authentication, interfacing with external APIs, and image uploading. Each component was tested to ensure it behaves as expected under normal usage. The user authentication module confirmed that users could log in, access all

features, and register securely. Interfacing with external systems, including ingredient detection APIs and the AI chatbot, worked reliably and returned appropriate responses. The image upload feature functioned accurately, allowing users to upload ingredient images, receive real-time feedback using the YOLOv9 model, and handle failed image processing gracefully. Across all modules, the actual outcomes matched the expected outcomes, indicating that the application reliably fulfills its functional requirements without errors or unexpected behavior.

Non-Functional Testing Requirements

In non-functional testing, the website was tested with three tests: Throughput, Load Test, and Stress Test. These tests were performed using Apache JMeter. In the following results of these tests are columns that can explain and show the performance of the website on the three tests.

The first column “Label” shows the name of the web pages available within the web application. The “# Samples” column is the number of threads or users that visited the web page. “Average” column is the average time the web page responds to the users’ request. “Min” and “Max” columns are the minimum and maximum instance of response time of a web page. “Std. Dev.” shows how much the response times for the web pages vary. “Error %” shows which web page resulted in crashes when visited by a thread or user. “Throughput” are the amount of requests being received by a web page. “Received” and “Sent” are the amount of data being sent and received by the system. Lastly, “Avg. Bytes” column is the average size of the data per requests made by each user or thread

in the JMeter test. These findings enabled the researchers to comprehend the effectiveness of the web application.

Throughput Test

Throughput is a critical metric that measures the rate at which the application processes requests, typically expressed as requests or transactions per second (RPS or TPS). It quantifies the system's ability to handle a specified number of operations within a given time frame, offering insights into its efficiency and scalability.

Table 14 Throughput Test Result

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/s	Sent KB/s	Avg. Bytes
index	1000	540	194	19447	669.90	0.10	6.2	41.57	2.97	6832
Forgot Pass	1000	488	194	1574	281.88	0.00	6.2	34.67	2.92	5691
Home	1000	480	195	1775	286.02	0.10	6.2	41.02	2.84	6746
ScanAgain	1000	875	272	2058	386.67	0.10	6.2	41.01	2.90	6751
Scan	1000	537	193	2047	325.40	0.10	6.2	40.99	2.84	6746
Recommend	1000	481	195	1640	280.63	100.00	6.2	4.62	2.39	761
Profile	1000	489	194	1696	287.36	0.10	6.2	40.99	2.88	6749
Recipes	1000	493	194	1744	287.64	0.10	6.2	40.99	2.88	6749
Chat	1000	500	194	1732	303.26	0.10	6.2	40.97	2.84	6476
About	1000	494	193	1747	298.30	0.10	6.2	40.95	2.85	6747
TOTAL	10000	538	193	19447	376.94	10.08	61.3	362.46	27.92	6052

In the JMeter system, throughput testing is done. Before this test, 50 threads are done after ramping it up for 1 minute. This will loop over 20 times, thus multiplying 20 and 60 calculates the duration to 10 minutes. These parameters will allow the throughput for the test to be calculated, with the following formula:

$$\text{Total Requests} = \text{threads} \times \text{loop count}$$

Equation 5 Total Requests Formula

$$\text{total request} = \text{users} \times \text{loop count} = 50 \times 20 = 1000$$

The total number of requests is determined by multiplying the user or thread count for the simulation test by the loop count, which represents how many times each user will execute a test scenario. This calculation indicates the load the system will need to manage during the testing phase. The configuration for the test included 50 threads and a loop count of 20, resulting in a total request count of 1000 when calculating the target throughput.

$$\text{Target Throughput} = \frac{\text{total requests}}{\text{throughput time}}$$

Equation 6 Target Throughput Formula

$$\text{Target Throughput} = \frac{1000}{60} = 1.67 \text{ requests/seconds}$$

The target throughput is solved by dividing the total number of requests with the throughput time or duration over which the test will run in seconds. With 1000 requests and an overall duration of five minutes or 600 seconds, the

calculated target throughput is 1.67 requests per second.

Load Test

Load testing is a type of performance testing that evaluates how an application performs under expected or anticipated levels of load, typically by simulating the behavior of multiple users or transactions accessing the system simultaneously

Table 15 Load Test 1 Result

Label	# Samples	Average Response Time	Max Response Time	Error %	Throughput (req/s)
index	6581	2602	5100	0.00	7.3
Forgot Pass	6559	2595	22376	0.05	7.3
Home	6540	2557	21264	0.02	7.2
ScanAgain	6519	2963	21310	0.05	7.2
Scan	6492	2606	21269	0.03	7.2
Recommend	6470	2565	21275	100.00	7.2
Profile	6458	2617	22225	0.08	7.2
Recipes	6437	2625	24021	0.06	7.1
Chat	6420	2596	21232	0.03	7.1
About	6403	2596	23349	0.05	7.1
TOTAL	64879	2632	24021	10.01	71.8

Table 15, the researchers considered a different configuration to test the site's maximum user count that can maintain stability. For the first test in the load test, configurations are; 200 threads, a ramp-up time of 90 seconds or 1 minute

and 30 seconds, and a duration of 900 seconds or 10 minutes. Here, most of the “Error %” column is <1%, meaning that even with increasing the number of users to 200, the system can still manage to function.

Table 16 Load Test 2 Result

Label	# Samples	Average Response Time	Max Response Time	Error %	Throughput (req/s)
index	7855	2814	24433	16.08	8.7
Forgot Pass	7822	2724	40320	17.17	8.7
Home	7795	2788	40304	16.90	8.6
ScanAgain	7771	3084	25451	16.61	8.6
Scan	7745	2235	24697	34.19	8.6
Recommend	7727	2920	28306	100.11	8.5
Profile	7705	2697	26165	18.01	8.5
Recipes	7681	2799	25028	17.37	8.4
Chat	7650	2784	36277	17.79	8.5
About	7627	2768	22838	18.29	8.5
TOTAL	77378	2761	40320	27.23	84.3

In the second load test at Table 16, the number of threads are reconfigured to be increased to 250, and the results became apparent that with just an increase of 50 users to the system, the researchers managed to figure out that the maximum users the system can handle is at most 200. By looking at the “Error %” column, all of the system’s endpoints are experiencing errors. This is because the system is meeting the limit of its user capacity.

Stress Test

Stress testing is a type of performance testing that involves deliberately pushing an application beyond its normal or expected operational capacity to determine its breaking point and assess how it behaves under extreme conditions

Table 17 Stress Test Result 1

Label	# Samples	Average Response Time	Max Response Time	Error %	Throughput (req/s)
index	2251	1196	21260	0.04	7.5
Forgot Pass	2245	1187	21252	0.04	7.5
Home	2235	1158	2904	0.00	7.4
ScanAgain	2222	1523	3266	0.00	7.4
Scan	2212	1191	2977	0.00	7.4
Recommend	2201	1179	24152	100.00	7.3
Profile	2189	1197	21291	0.05	7.3
Recipes	2173	1185	21238	0.05	7.3
Chat	2166	1166	21256	0.05	7.2
About	2161	1183	21258	0.09	7.2
TOTAL	22055	1217	24152	10.01	73.2

In the stress test as shown at Table 17, JMeter is configured to use the following; 100 threads, a ramp-up time of 60 seconds or 1 minute, and a duration of 300 seconds or 5 minutes. Reviewing the results with the given configuration, the system is running smoothly as “Error%” mostly has 0%.

Table 18 Stress Test Result 2

Label	# Samples	Average Response Time	Max Response Time	Error %	Throughput (req/s)
index	2282	2405	4675	0.00	7.5
Forgot Pass	2262	2403	21147	0.04	7.5
Home	2232	2419	4908	0.00	7.4
ScanAgain	2213	2810	5418	0.00	7.3
Scan	2193	2466	4792	0.00	7.3
Recommend	2174	2445	4380	100.00	7.2
Profile	2146	2440	21333	0.05	7.2
Recipes	2128	2427	4171	0.00	7.1
Chat	2116	2475	4294	0.00	7.1
About	2102	2474	4580	0.00	7.0
TOTAL	21848	2476	21333	9.96	72.2

Table 18 Stress Test Result 2 JMeter is configured to use the following; 200 threads, a ramp-up time of 60 seconds or 1 minute, and a duration of 300 seconds or 5 minutes. Reviewing the results with the given configuration, the system is running smoothly as “Error%” mostly has 0%.

Table 19 Stress Test Result 3

Label	# Samples	Average Response Time	Max Response Time	Error %	Throughput (req/s)
index	2522	3398	33517	13.40	7.9
Forgot Pass	2491	3426	36280	13.45	8.1
Home	2453	3364	28311	14.06	8.1
ScanAgain	2427	3756	34389	14.46	7.9

Scan	2396	2924	34422	28.21	7.9
Recommend	2373	3602	38659	100.00	7.2
Profile	2347	3253	21480	14.06	7.8
Recipes	2323	3441	36264	14.21	7.4
Chat	2293	3458	33892	14.78	7.5
About	2263	3585	28329	13.39	7.2
TOTAL	23888	3420	38659	23.95	72.6

In the third test of the stress test at Table 19, the researchers increased the number of users to 300, and here the system was unable to handle the user traffic that comes with 300 users. In the “Error %” column, it is seen that most of the endpoints in the website are unable to handle that much user traffic. This resulted in the errors of the system.

In all of the tests between throughput, load test, and stress test, the RecInScan endpoint was always 100% in the “Error %” column. The likely scenario for this to be the case is because JMeter only visited the system’s endpoints using HTTP request ‘GET’ method and that the The RecInScan page requires input from the Scan endpoint to operate correctly. Since JMeter only accesses these endpoints without supplying any input, it is likely that RecInScan fails during the test due to the absence of necessary inputs.

Table 20 Summary of Non Functional Requirement Testing

Test Type	Total Requests	Average Response Time	Max Response Time	Error %	Max Time
Throughput Test	10000	538	19447	10.08%	61.3

Load Test 1	64879	2632	24021	10.01%	71.8
Load Test 2	77378	2761	40320	27.23%	84.3
Stress Test 1	22055	1217	24152	10.01%	73.2
Stress Test 2	21848	2476	21333	9.96%	72.2.72.6
Stress Test 3	23888	3420	38659	23.95%	

The performance evaluation of the system was conducted through a series of throughput, load, and stress tests, with results summarized in Table 20. The total number of requests processed varied significantly across tests, ranging from 10,000 in the throughput test to over 77,000 in load test 2, reflecting different operational intensities. Average response times demonstrated an increasing trend as the test intensity escalated. The throughput test recorded the lowest average response time at 538 milliseconds, whereas stress test 3 exhibited the highest average latency at 3,420 milliseconds. This escalation indicates the system's degradation in response efficiency under heavier workloads. Maximum response times showed notable spikes, particularly in load test 2, reaching up to 40,320 milliseconds, suggesting occasional latency peaks under extreme conditions. Error rates remained relatively low (around 10%) in most tests but significantly increased during load test 2 and stress test 3, with error percentages of 27.23% and 23.95% respectively. This indicates potential stability issues under very high stress. Throughput measurements, reflecting the number of requests handled per second, ranged from 61.3 requests/sec in the throughput test to 84.3 requests/sec during load test 2, illustrating the system's capacity to handle increased demand before experiencing performance degradation. In summary, the system performs reliably under moderate load,

maintaining acceptable response times and error rates. However, under extreme load and stress conditions, response times increase substantially, and error rates rise, highlighting areas for optimization in scalability and robustness to enhance overall system performance.

Project Evaluation

The project, ReInScan, has undergone a system evaluation conducted through an online survey via Google Forms. The survey questionnaire sought to gain insights and feedback essential to the enhancement of ReInScan, gathering the respondents' thoughts on how well the system conformed to the ISO 25010 standards of Functional Suitability, Interaction Capability, and Performance Efficiency. During the dissemination of the survey, the website link and demonstration of the web application was provided in order to present the system's overall features and functionalities to the end-users and IT experts.

The respondents of the project evaluation consisted of IT experts, chef, and individuals with a general interest in cooking also known as home cooks that were between the ages of 18 and 59—as defined by the scope of the study—amassing a total number of 62 respondents with 52 end-users and 10 IT experts. Respondents were sampled through purposive and convenience sampling to ensure that participants would be within the age range limit and that the study would achieve the target goal of 50 respondents. As non-probability sampling methods, both approaches enabled the researchers to quickly gather responses. Although these approaches may not fully ensure that the sample is

representative of the overall population, they provide valuable insights from specific groups directly pertinent to improving ReclnScan. As such, careful consideration of potential selection bias can help enhance the applicability and generalization of the findings of the study.

Application Evaluation Results

This section discusses the overall results of the system evaluation in order to understand the general perspective of the respondents to the proposed system considering each metric of the ISO/IEC 25010.

Table 21 Verbal Interpretation

Mean Ratings	Verbal Interpretation
4.51 and above	Excellent
3.51 - 4.50	Very Good
2.51 - 3.50	Good
1.51 - 2.50	Fair
1.50 and below	Poor

The results were analyzed through the use of a weighted mean approach, wherein the number of responses per point in the Likert scale was divided by the total number of responses, and then multiplied to the assigned weight of the point (from 1 for Unsatisfied to 5 for Very Satisfied). These values were then added to generate a sum for each survey question, with questions under each sub-characteristic being averaged to get the total mean rating for the ISO 25010

characteristic.

Table 21 shows the predetermined range of interpretation. The average was then compared to predetermined ranges to establish a verbal interpretation: scores from 4.51 and above are Excellent, scores from 3.51 to 4.50 are Very Good, scores from 2.51 to 3.50 are Good, scores from 1.51 to 2.50 are Fair, and scores from 1.50 and below are Poor.

Evaluation Result per Metric

The evaluation results per metric indicate that the system demonstrates high functional suitability, acceptable performance efficiency, and strong interaction capability, aligning well with the intended design objectives.

End User Survey Results

A. Functional Appropriateness - refers to the extent to which ReclnScan's features are designed to help users scan ingredients effectively, ensuring that the app meets their needs for this task.

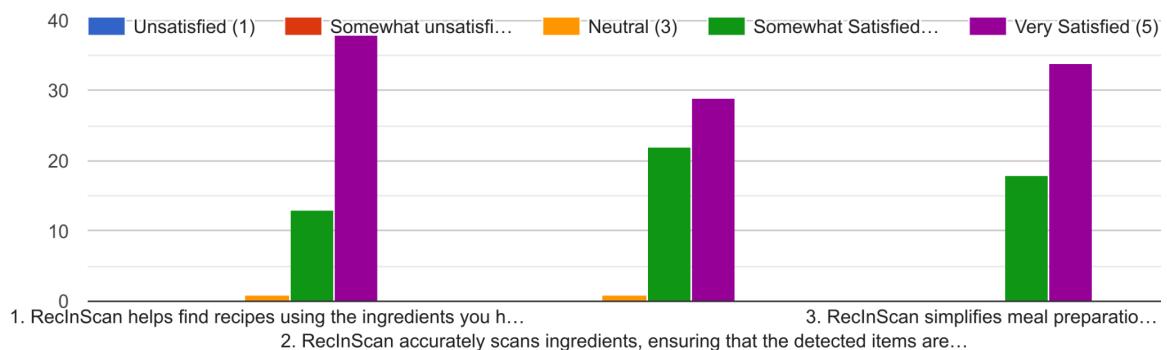


Figure 24 Functional Suitability Evaluation Results - Functional Appropriateness

In the figure above, most of the respondents were very satisfied with the system's functional appropriateness. Questions in this part of the survey represent the degree to which the system can function according to what is expected during user registration, login, scanning, recommendation page, and profile management. A 4.63 score tells the researchers that the system's functionality is suitable for the intended end users.

B. Functional Completeness - refers to the extent to which ReclnScan covers all the essential features that users expect from a food recommendation app, ensuring it meets their needs effectively.

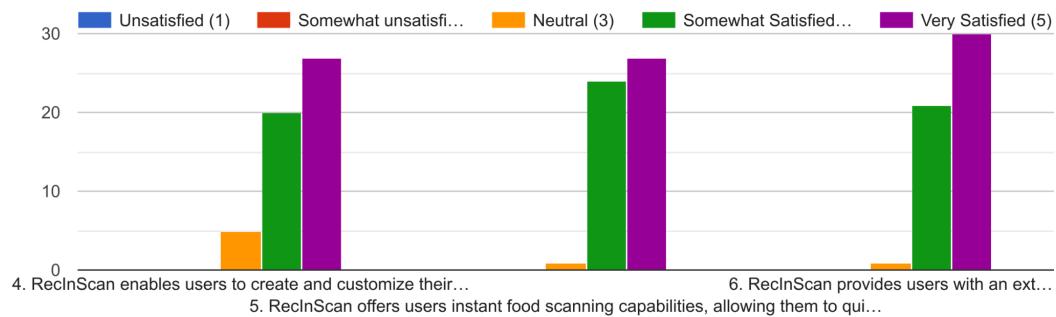


Figure 25 Functional Suitability Evaluation Results - Functional Completeness

In the figure above, most of the respondents were very satisfied with the system's functional completeness. Questions in this part of the survey represent the degree to which the system covers all the essential features that users expect from a food recommendation app, ensuring it meets their needs effectively.. A 4.5 score tells the researchers that the system's functionality is suitable for the intended end users.

C. Functional Correctness - refers to the extent to which ReclnScan provides accurate results and works without errors, making sure it meets user needs effectively

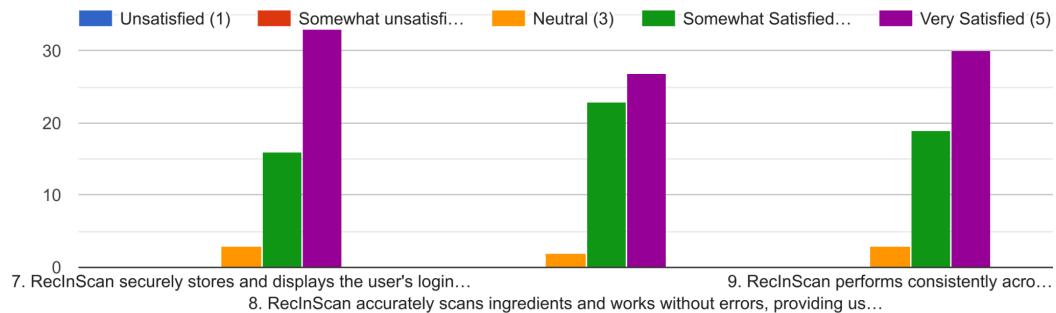


Figure 26 Functional Suitability Evaluation Results - Functional Correctness

In the figure above, most of the respondents were very satisfied with the system's functional correctness. Questions in this part of the survey to which ReclnScan provides accurate results and works without errors, making sure it meets user needs effectively. A 4.52 score tells the researchers that the system's functionality is suitable for the intended end users.

A. Time behaviour - refers to the extent to which ReInScan responds to user requests and processes information, ensuring that everything happens without delays for a smooth experience

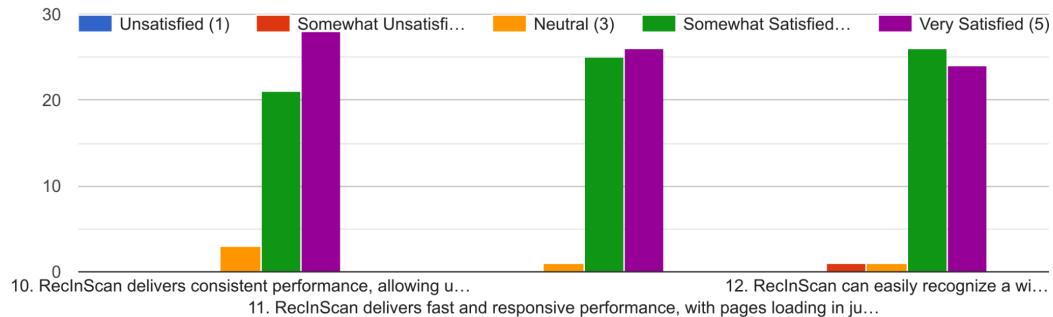


Figure 27 Performance Efficiency Evaluation Results - Time Behaviour

In the figure above, most of the respondents were very satisfied with the system's performance efficiency. Questions in this part of the survey represent to which ReInScan responds to user requests and processes information, ensuring that everything happens without delays for a smooth experience. A 4.55 score tells the researchers that the system's performance is suitable for the intended end users.

B. Capacity - refers to the extent to which RecInScan handles a growing number of users and requests without slowing down, ensuring that it works well when many people are using it at the same time.

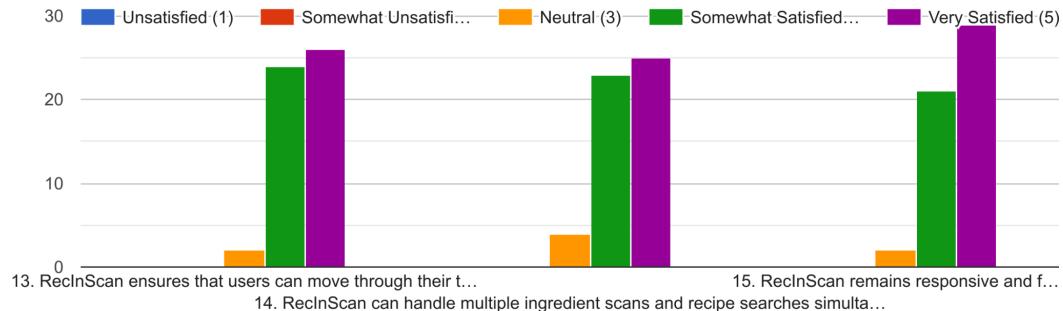


Figure 28 Performance Efficiency Evaluation Results - Capacity

In the figure above, most of the respondents were very satisfied with the system's performance efficiency. Questions in this part of the survey represent to which RecInScan handles a growing number of users and requests without slowing down, ensuring that it works smoothly even when many people are using it at the same time. A 4.46 score tells the researchers that the system's performance is suitable for the intended end users.

C. Resource Utilization - Resource Utilization refers to the extent to which ReclnScan uses your device's resources, such as memory and battery, whi...low down your device or drain its battery quickly.

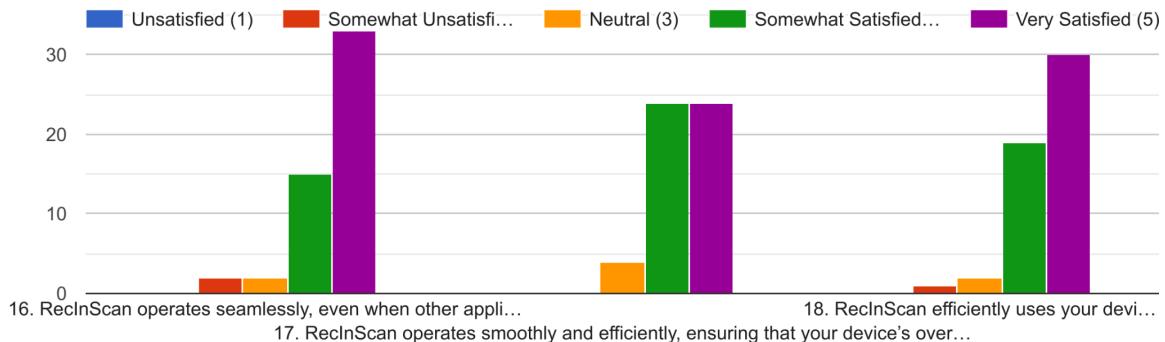


Figure 29 Performance Efficiency Evaluation Results - Resource Utilization

In the figure above, most of the respondents were very satisfied with the system's performance efficiency. Questions in this part of the survey focus on how efficiently ReclnScan utilizes your device's resources, such as memory and battery, ensuring smooth performance and optimal energy use while the app is running. A 4.46 score tells the researchers that the system's performance is suitable for the intended end users.

A. Appropriateness Recognizability - Refers to the ease with which users can determine whether RecInScan meets their needs, such as assisting them in finding recipes or effectively scanning ingredients.

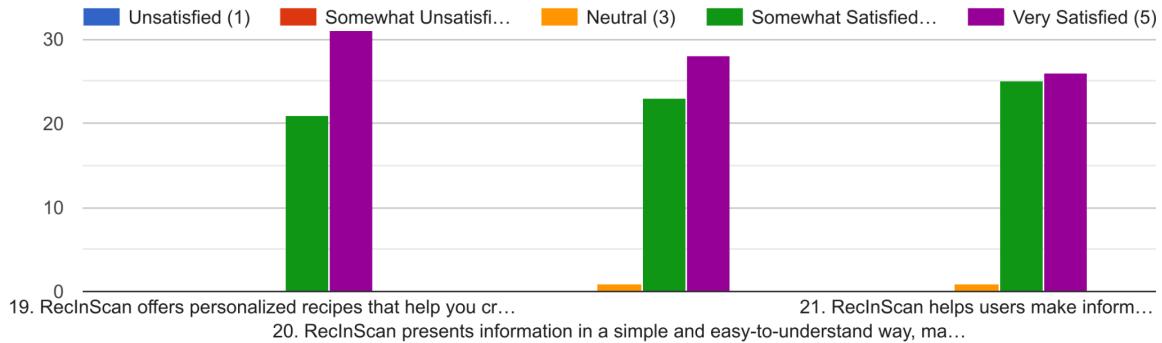


Figure 30 Interaction Capability Evaluation Results - Appropriateness Recognizability

In the figure above, most of the respondents were very satisfied with the system's interaction capability. Questions in this part of the survey represent the ease with which users can determine whether RecInScan meets their needs, such as assisting them in finding recipes or effectively scanning ingredients. A 4.53 score tells the researchers that the system's interaction is suitable for the intended end users.

B. Operability - Refers to the ease and simplicity with which users can utilize RecInScan's features, such as signing up, logging in, scanning ingredient..., ensuring a seamless and user-friendly experience.

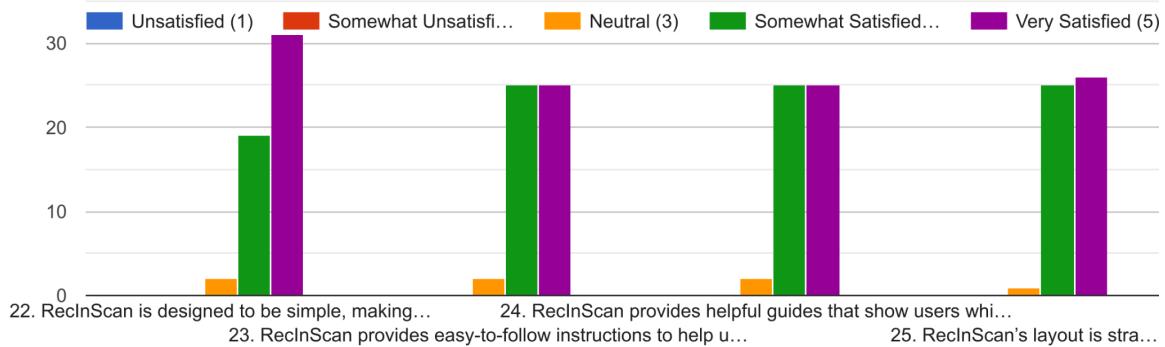


Figure 31 Interaction Capability Evaluation Results - Operability

In the figure above, most of the respondents were satisfied with the system's functional appropriateness. Questions in this part of the survey represent the ease and simplicity with which users can utilize RecInScan's features, such as signing up, logging in, scanning ingredients, and viewing recipe recommendations, ensuring a seamless and user-friendly experience. A 4.48 score tells the researchers that the system's interaction is suitable for the intended end users.

C. User Error Protection - Refers to the effectiveness of RecInScan in preventing user mistakes by offering guidance, such as clear instructions, warning messages for recipes, ensuring a smoother user experience.

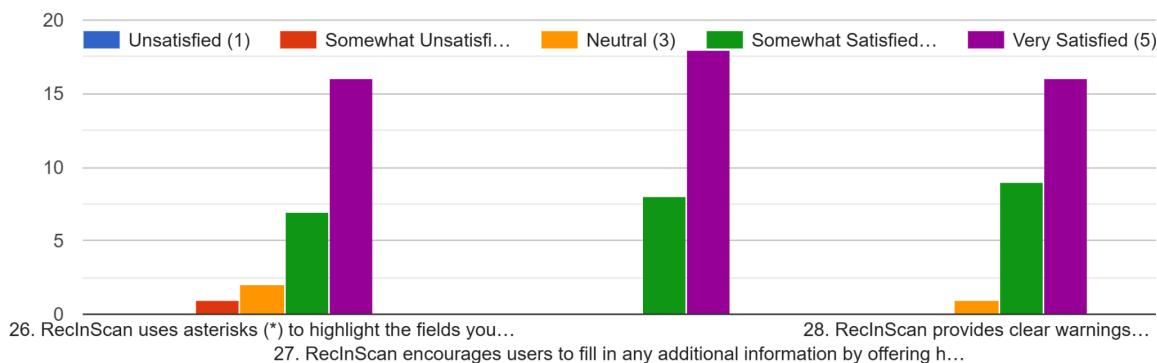


Figure 32 Interaction Capability Evaluation Results - User Error Protection

In the figure above, most of the respondents were very satisfied with the system's functional appropriateness. Questions in this part of the survey represent the degree to the effectiveness of RecInScan in preventing user mistakes by offering guidance, such as clear instructions, warning messages, or correcting invalid inputs during tasks like scanning ingredients or searching for recipes, ensuring a smoother user experience. A 4.47 score tells the researchers that the system's functionality is suitable for the intended end users.

End User Evaluation Results

End user evaluation results refer to the feedback and data collected from users who interact with the application during usability and acceptance testing phases. These results are pivotal in assessing how well the application meets user expectations, functional requirements, and overall user experience goals.

Table 22 Mean Rating per Metric by End Users

Metrics	Mean Ratings	Verbal Interpretation
Functional Suitability	4.55	Excellent
Functional Appropriateness	4.63	Excellent
Functional Completeness	4.5	Very Good
Functional Correctness	4.52	Excellent
Performance Efficiency	4.49	Very Good
Time Behaviour	4.55	Excellent
Capacity	4.46	Very Good
Resource Utilization	4.46	Very Good
Interaction Capability	4.5	Very Good
Appropriateness Recognizability	4.53	Excellent
Operability	4.48	Very Good
User Error Protection	4.47	Very Good
Average	4.51	Excellent

Table 22 displays the per metric mean rating of the respondents to the system, displaying the average rating and its verbal interpretation for each metric of the ISO 25010 that was measured in the survey. Out of 52 end user respondents, the results show that Functional Suitability achieved the highest rating (4.55 or Excellent) while Performance Efficiency received the lowest (4.49 or Very Good). All mean ratings were in the range to be considered as Very

Good, meaning that RecInScan acquired a highly positive rating from its respondents.

IT Experts Survey Result

A. Functional Appropriateness - refers to the extent to which RecInScan's features are designed to help users scan ingredients effectively, ensuring that the app meets their needs for this task.

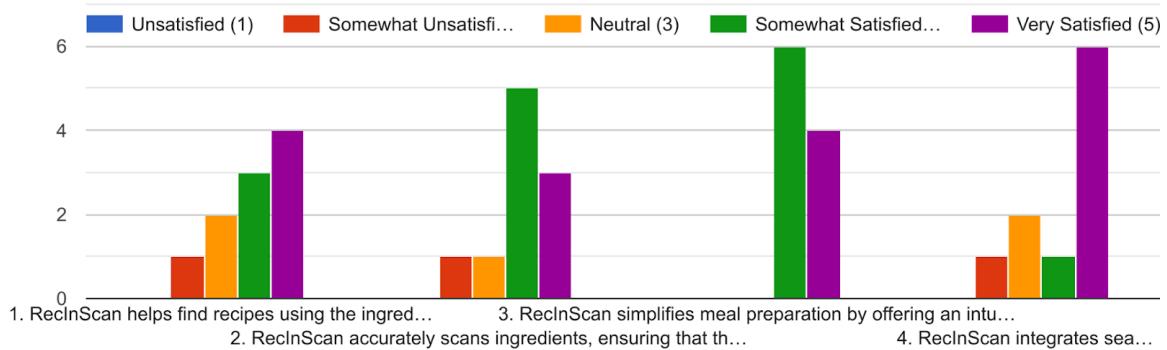


Figure 33 Functional Suitability - Functional Appropriateness (IT EXPERT)

In the figure above, most of the IT experts were somewhat satisfied with the system's functional appropriateness. Questions in this part of the survey represent the degree to which the system can function according to what is expected during user registration, login, scanning, recommendation page, and profile management. A 4.15 score tells the researchers that the system's functionality is suitable for the intended end users.

B. Functional Completeness - refers to the extent to which RecInScan covers all the essential features that users expect from a food recommendation app, ensuring it meets their needs effectively.

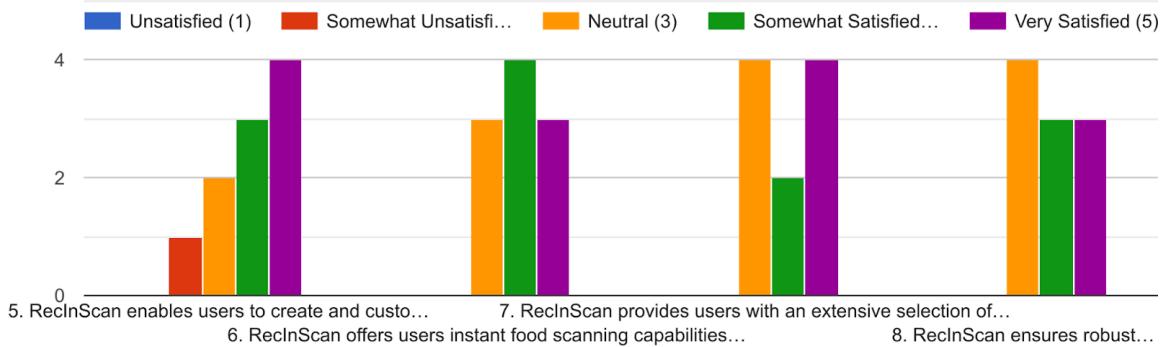


Figure 34 Functional Suitability - Functional Completeness (IT EXPERT)

In the figure above, most of the IT experts were somewhat satisfied with the system's functional completeness. Questions in this part of the survey represent the degree to which the system covers all the essential features that users expect from a food recommendation app, ensuring it meets their needs effectively.. A 3.98 score tells the researchers that the system's functionality is suitable for the intended end users.

B. Functional Completeness - refers to the extent to which ReInScan covers all the essential features that users expect from a food recommendation app, ensuring it meets their needs effectively.

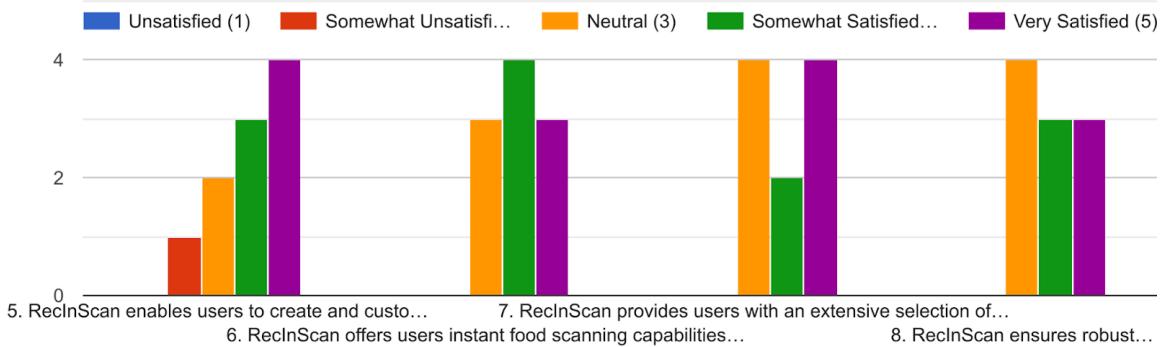


Figure 35 Functional Suitability Evaluation Results - Functional Correctness (IT EXPERT)

In the figure above, most of the IT Experts were somewhat satisfied with the system's functional correctness. Questions in this part of the survey to which ReInScan provides accurate results and works without errors, making sure it meets user needs effectively. A 3.88 score tells the researchers that the system's functionality is suitable for the intended end users.

A. Time behaviour - refers to the extent to which ReInScan responds to user requests and processes information, ensuring that everything happens without delays for a smooth experience

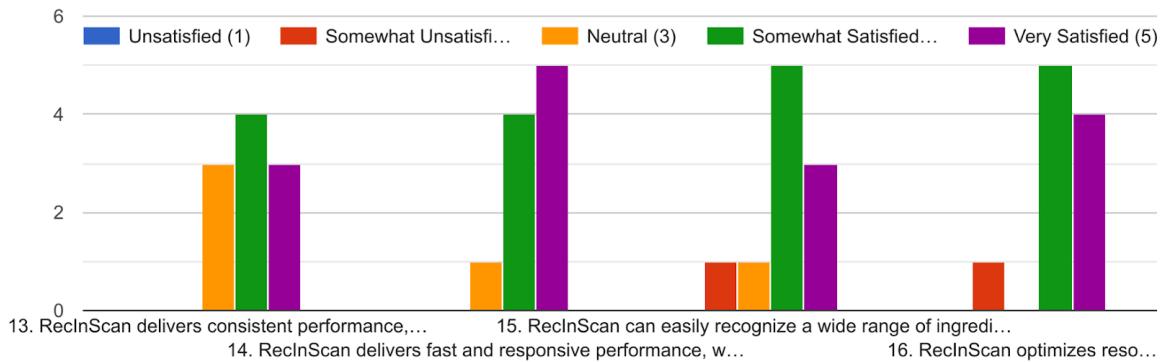


Figure 36 Performance Efficiency Evaluation Results - Time Behaviour (IT EXPERT)

In the figure above, most of the IT Experts were somewhat satisfied with the system's performance efficiency. Questions in this part of the survey represent to which ReInScan responds to user requests and processes information, ensuring that everything happens without delays for a smooth experience. A 4.15 score tells the researchers that the system's performance is suitable for the intended end users.

B. Capacity - refers to the extent to which ReclnScan handles a growing number of users and requests without slowing down, ensuring that it works when many people are using it at the same time.

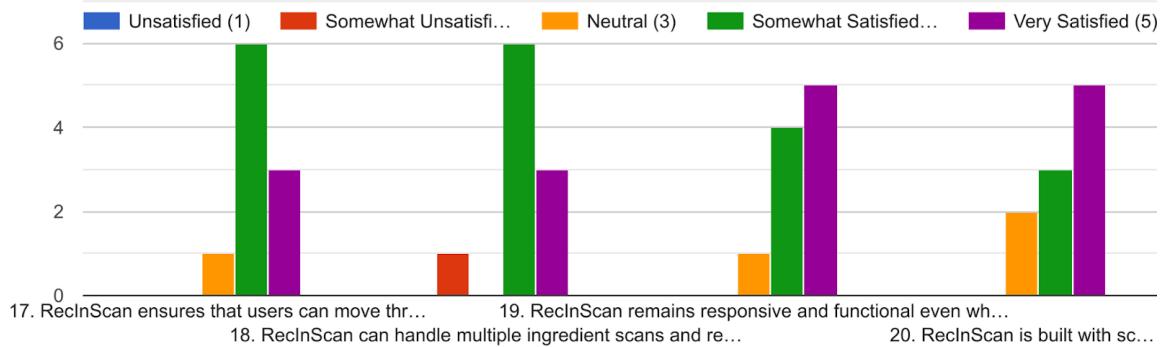


Figure 37 Performance Efficiency Evaluation Results - Capacity (IT EXPERT)

In the figure above, most of the IT Experts were somewhat satisfied with the system's performance efficiency. Questions in this part of the survey represent to which ReclnScan handles a growing number of users and requests without slowing down, ensuring that it works smoothly even when many people are using it at the same time. A 4.25 score tells the researchers that the system's performance is suitable for the intended end users.

C. Resource Utilization - Resource Utilization refers to the extent to which ReclnScan uses your device's resources, such as memory and battery, whi...low down your device or drain its battery quickly.

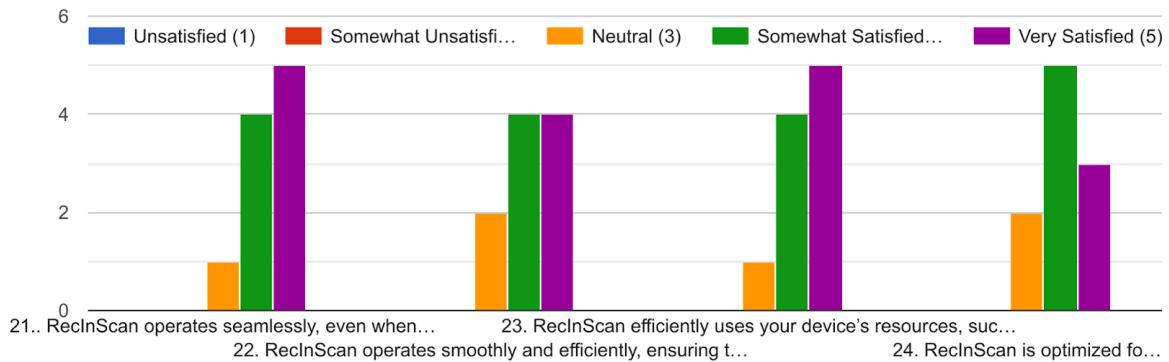


Figure 38 Performance Efficiency Evaluation Results - Resource Utilization (IT EXPERT)

In the figure above, most of the IT Experts were somewhat satisfied with the system's performance efficiency. Questions in this part of the survey represent to which ReclnScan uses your device's resources, such as memory and battery, while you're using it, ensuring that it doesn't slow down your device or drain its battery quickly. A 4.28 score tells the researchers that the system's performance is suitable for the intended end users.

A. Appropriateness Recognizability - Refers to the ease with which users can determine whether ReInScan meets their needs, such as assisting them in finding recipes or effectively scanning ingredients.

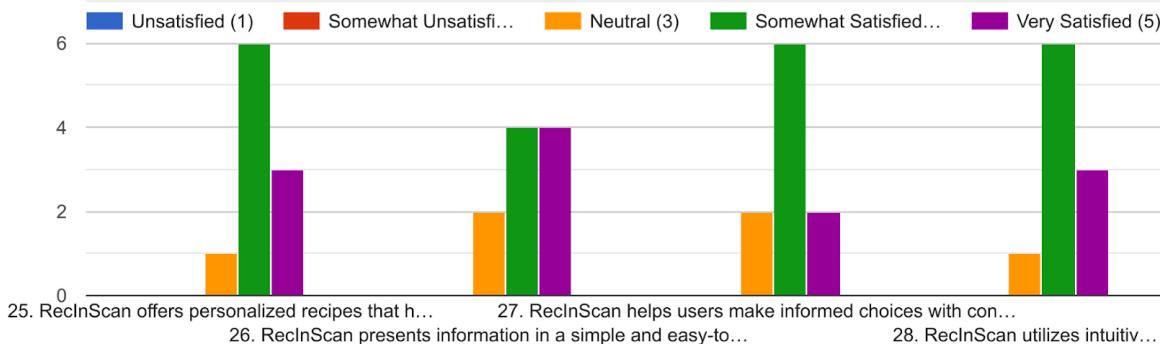


Figure 39 Interaction Capability Evaluation Results - Appropriateness Recognizability (IT EXPERT)

In the figure above, most of the IT Experts were somewhat satisfied with the system's interaction capability. Questions in this part of the survey represent the ease with which users can determine whether ReInScan meets their needs, such as assisting them in finding recipes or effectively scanning ingredients. A 4.15 score tells the researchers that the system's interaction is suitable for the intended end users.

B. Operability - Refers to the ease and simplicity with which users can utilize RecInScan's features, such as signing up, logging in, scanning ingredients, and viewing ...ations, ensuring a seamless and user-friendly experience.

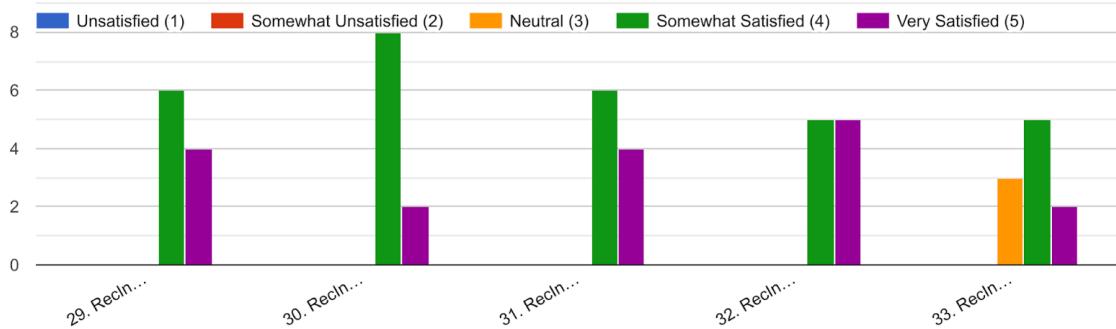


Figure 40 Interaction Capability Evaluation Results - Operability (IT EXPERT)

In the figure above, most of the IT Experts were somewhat satisfied with the system's functional appropriateness. Questions in this part of the survey represent the ease and simplicity with which users can utilize RecInScan's features, such as signing up, logging in, scanning ingredients, and viewing recipe recommendations, ensuring a seamless and user-friendly experience. A 4.28 score tells the researchers that the system's interaction is suitable for the intended end users.

C. User Error Protection - Refers to the effectiveness of RecInScan in preventing user mistakes by offering guidance, such as clear instructions, warning messages for recipes, ensuring a smoother user experience.

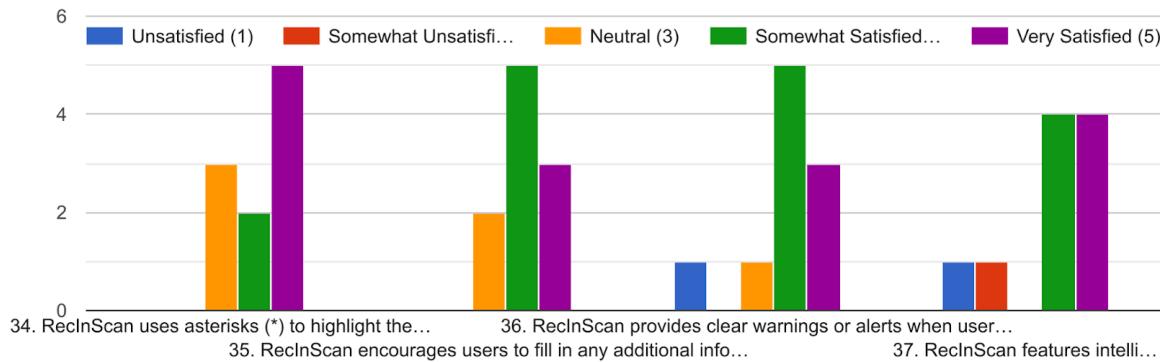


Figure 41 Interaction Capability Evaluation Results - User Error Protection

In the figure above, most of the IT Experts were somewhat satisfied with the system's functional appropriateness. Questions in this part of the survey represent the degree to the effectiveness of RecInScan in preventing user mistakes by offering guidance, such as clear instructions, warning messages, or correcting invalid inputs during tasks like scanning ingredients or searching for recipes, ensuring a smoother user experience. A 4.3 score tells the researchers that the system's functionality is suitable for the intended end users.

IT Expert Evaluation Results

The IT expert evaluation results refer to the feedback and performance data gathered from a group of ten IT professionals who participated in testing the application.

Table 23 Mean Rating per Metric by IT Experts

Metrics	Mean Ratings	Verbal Interpretation
Functional Suitability	4.00	Very Good
Functional Appropriateness	4.15	Excellent
Functional Completeness	3.98	Very Good
Functional Correctness	3.88	Very Good
Performance Efficiency	4.23	Very Good
Time Behaviour	4.15	Very Good
Capacity	4.25	Very Good
Resource Utilization	4.28	Very Good
Interaction Capability	4.24	Very Good
Appropriateness Recognizability	4.15	Very Good
Operability	4.28	Very Good
User Error Protection	4.3	Very Good
Average	4.16	Very Good

Table 23 displays the per metric mean rating of the respondents to the system, displaying the average rating and its verbal interpretation for each metric of the ISO 25010 that was measured in the survey. Out of 10 IT expert respondents, the results show that Interaction Capability achieved the highest rating (4.24 or Very Good) while Functional Suitability received the lowest (4.00 or Very Good). All mean ratings were in the range to be considered as Very Good, meaning that RecInScan acquired a positive rating from its IT Experts..

Synthesis

The system's functional testing also shows that the system passes for most of its intended functionality. It demonstrates that the system works from its most individual level, the interaction between its components and endpoints, and as a whole system that works together to deliver a service suitable to its users. The results show that after testing the key features of the system, it performed as expected of it.

The results for the system's non-functional tells the researchers that the system can meet its throughput baseline and even handle slightly more requests from its users. During testing it is expected to meet 1.67 requests/second but handled about 61.3 requests/second during the end of the test. During the load test of the system, it is discovered that the maximum user capacity the system can handle before crashing is 200 users. During the stress test, it is also discovered that at the 200 user limit the system is not going to be able to handle more user traffic as requests will slow down and cause system errors and crashing.

Finally, the results from the system evaluation survey gave the researchers a 4.50 average score for satisfactory functional approval from the intended end users. This means that the intended end users of the system will be very satisfied when they use the system. The respondents from this survey had very few comments and suggestions to give to the system's improvement. That

being said, by studying the different testing sections in Figures 4.2 - 4.7, The researchers can improve the lowest scorer, which is Performance Efficiency, to meet the standard of its counterparts.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

Summary of Findings

This study focused on the development of RecInScan, which aims to solve ingredient scanning by using the YOLOv9 algorithm.

A review of related studies showed that YOLOv9, among alternatives such as YOLOv8 and YOLOv10, is a viable object detection algorithm for ingredient scanning. Upon capturing the image of ingredients, YOLOv9 is used to determine the captured ingredients, and then YOLOv9 determines each ingredient. The system will display recommended recipes depending on the scanned ingredients. The YOLOv9 model yielded a 50.10% accuracy, indicating that it can correctly scan raw ingredients from a user in real-time.

Throughout its development, RecInScan underwent rigorous testing to ensure that each feature behaved as expected and that different components integrated well. Functional testing was performed to verify if the functionality of each feature (user authentication, interfacing with external APIs or systems, and allowing users to upload/download files) achieved its expected results. By conducting test cases, it was found that RecInScan worked as intended. The non-functionality of the system was evaluated using different performance tests. The throughput test revealed that the system can handle an average of 61.3 requests per second, higher than the calculated throughput of 1.67 requests per

second. This means that ReInScan can handle slightly more requests than what is expected. The load test and stress test showed that the system can handle up to 200 concurrent users, meaning that the system can reliably perform its functions when up to 200 individuals are accessing and utilizing the system.

An ISO 25010 Systems Evaluation was conducted using a five-point Likert scale survey via Google Forms to determine how potential users perceive the application's overall functionality, interaction capability, and performance efficiency. Out of fifty-two end user respondents, the functionality suitability of the system gained a mean rating of 4.55, the performance efficiency gained a mean rating of 4.46, and the interaction capability gained a rating of 4.5. The system is, on average, good at a total mean rating of 4.50, with the verbal interpretation of Very Good. Ten IT experts also participated in the survey, wherein their inputs yielded an average mean rating of 3.87 for the ISO metrics. These results show that the intended users of ReInScan would be satisfied when they use the system. Even so, there is room for improvement by focusing on delivering a better user experience regarding the system's performance efficiency.

Conclusion

To conclude, the researchers examined the process of the YOLOv9 model and raw ingredients scanning. Explored and studied object detection algorithms to understand and learn the most beneficial for the development of ReInScan. The researchers also analyzed and performed various preprocessing tasks to help improve the model's performance. The previous steps were made to begin

the development of ReclnScan. To develop ReclnScan, the researchers used the knowledge gained from studying and testing the different algorithms and landed on the YOLOv9 model, the researchers then feed the data gathered and preprocessed into the machine for training and testing, after which it was then evaluated using metrics such as average accuracy which resulted in 50.10%, average precision with 66.09%, average recall with 67.44%, and average f1-score with 66.75%. The system was then built to be served on a web browser.

The researchers developed and designed a user-friendly website that would provide a great user experience. The web application is hosted on a VPS (Hostinger), with Nginx as a reverse proxy for request forwarding, load balancing, and security. At the same time, Gunicorn manages Flask requests with multiple workers, and Apache handles HTTP requests and serves content. The backend, built with Flask, integrates YOLOv9 for ingredient detection and uses MySQL to store user data, scanned ingredients, and recipes, with hashing to ensure secure authentication. The frontend is developed using HTML, CSS, and JavaScript, with Figma aiding in UI/UX design. GitHub is used for version control, ensuring efficient collaboration, while Nginx + Gunicorn optimize request handling and app performance. The researchers then integrated the YOLOv9 algorithm into the created website. The researchers tested the website's functionality and non-functionality, showing satisfactory results. Then, the researchers evaluated the system using ISO 25010 standards and received a 4.58 approval score. Lastly, the system can be deployed via Hostinger to allow other users to access the system through the internet.

Recommendations

The previous discussions presented the methods and process in designing and developing RecInScan and the system's general acceptability to the respondents. The findings revealed several opportunities for enhancement that could be adapted in future studies related to YOLOv9 applied to a food ingredient scanner. As such, the researchers recommend the following:

- Further improve and increase the dataset's size to improve the model's accuracy in scanning raw ingredients.
- To enhance the variety of choices available to users, consider incorporating recipes beyond the traditional Kapampangan dishes. Including a broader range of regional and international recipes will broaden the appeal and provide users with more diverse culinary options. By doing so, you can cater to a larger audience with varying tastes and preferences, creating a more comprehensive and engaging cooking experience.
- To enhance user accessibility and engagement, consider developing a mobile version of RecInScan, leveraging smartphone features like the camera and offline capabilities for on-the-go recipe scanning and personalized suggestions.
- To ensure the platform is accessible to users of different abilities, it is recommended that additional accessibility features be included in the system, such as voice control for hands-free navigation, text-to-speech for

recipe instructions, customizable font sizes, high-contrast modes, and screen reader compatibility.

- It is recommended to improve the visual legibility of the user interface, specifically by enhancing font color contrast for missing ingredients and increasing line spacing in the recipe instructions. Additionally, making recipe history items clickable to allow easy access to full recipe details will further improve usability. These changes will enhance readability and overall user experience, making the application more accessible and intuitive.

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APPENDIX A

MODEL SOURCE CODE

```
# Import necessary libraries
import torch
from ultralytics import YOLO # Ensure YOLO is imported

if __name__ == '__main__':
    # Clear CUDA cache
    torch.cuda.empty_cache()

    # Check for CUDA and set the device
    device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')
    print(f"Using device: {device}")

    # Load the YOLO model and move to GPU if available
    model = YOLO("yolov9c.pt").to(device) # Ensure your model path is correct

    # Start training
    results = model.train(
        data="C:/Users/Carlos Ivan/Desktop/Model-Training/data.yaml", # Path to
        dataset YAML
        epochs=125,          # 150 is a good balance; 200 might be overkill
        imgsz=480,           # Increase image size for better accuracy (320 is too
        small)
        batch=16,            # 16 is safer for a 6GB GPU; 30 may cause OOM errors
        half=True,           # Mixed precision for better speed/memory efficiency
        workers=2,            # Lower workers to prevent overloading GPU
        patience=40,          # 50 is enough to detect stagnation
    )
```

```
cos_lr=True,      # Cosine LR scheduler for better convergence
device=0,         # Explicitly set GPU device
optimizer="AdamW", # More stable than SGD for object detection
lr0=0.001,        # Initial learning rate
lrf=0.01,         # Final learning rate factor
momentum=0.937,   # Momentum, tuned for YOLO models
weight_decay=0.0005, # Helps generalization
dropout=0.1,       # Adds slight regularization to prevent overfitting
amp=True          # Auto mixed precision (safer than half=True)

)
```

APPENDIX B

Database Dictionary

Table 24: List of Account (account_list_table)

Column Name	Data Type	Description	Constraints
acc_id	INT	Unique identifier for each user account.	Primary Key (P-Key)
user	VARCHAR(100)	Username for the account.	None
pass	VARCHAR(100)	Password for the account.	None
email	VARCHAR(100)	Email address associated with the account.	None
preference	TEXT	Filtered preferences of the user	None

Table 25: List of Dishes (dishes_table)

Column Name	Data Type	Description	Constraints
id	INT, AUTO_INCREMENT	Unique identifier for each dish.	Primary Key (P-Key)
dish_name	VARCHAR(255)	Name of the dish.	Foreign Key (dish_name)
instructions	TEXT	Cooking instructions for the dish.	None
image_path	VARCHAR(255)	Path to the image file for the dish.	None
author	VARCHAR(255)	Author of the dish	None

recipe.

link	VARCHAR(255)	Link to the dish recipe online.	None
serving	VARCHAR(255)	Serving size information.	None
cook_time	VARCHAR(255)	Total cooking time for the dish.	None
description	TEXT	Description of the dish	None
Field	enum('Meat', 'Vegetable', Others')	Specifies whether the dish is Meat, Vegetable or others.	None

Table 26: Account History (account_history_table)

Column Name	Data Type	Description	Constraints
history_id	INT	Unique identifier for account history.	Primary Key (P-Key)
acc_id	INT	Account identifier linking to Account List.acc_id List.	Foreign Key (Account
dish_id	INT	Dish identifier linking to dishes table.	Foreign Key (dishes.id)
date	DATE&TIME	Date and time of activity.	None
ingredients	TEXT	Shows the ingredients of the dish.	None

Table 27: Ingredients (ingredients)

Column Name	Data Type	Description	Constraints
id	INT, AUTO_INCREMENT	Unique identifier for each ingredient.	Primary Key (P-Key)
ingredient_name	VARCHAR(255)	Name of the ingredient.	None

Table 28: List of Ingredients (ingredients_list)

Column Name	Data Type	Description	Constraints
plan_id	INT, AUTO_INCREMENT	Unique identifier for each ingredient.	Primary Key (P-Key)
ingredient_name	VARCHAR(255)	Name of the ingredient.	Foreign Key (ingredients.id)
category	TEXT	Category of each ingredient	Primary Key (P-Key)

Table 29: List of recipes (recipe_table)

Column Name	Data Type	Description	Constraints
dish_id	INT	Unique identifier linking to the dishes table.	Foreign Key (dishes.id)
ingredient_name	VARCHAR(100)	Name of the ingredient.	Foreign Key (ingredients.ingredient_name)

measurement	VARCHAR(100)	Quantity or unit of the ingredient.	None
category	ENUM('main', 'secondary', 'common')	Type of ingredient in the recipe.	None

APPENDIX C

EVALUATION TOOL

RESEARCH TITLE: RecInScan: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS OF KAPAMPANGAN DISHES UTILIZING YOLOV9 ALGORITHM

Dear Participants,

We appreciate your willingness to participate in our study focused on “RecInScan: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS OF KAPAMPANGAN DISHES UTILIZING YOLOV9 ALGORITHM”. Your participation is invaluable as we seek to gain insights and feedback essential to the enhancement of this innovative educational platform, ultimately improving user engagement and interaction. The research instrument has been thoughtfully crafted to collect comprehensive information regarding the study's objectives, your experiences, and your suggestions for refining this. Your contributions play a pivotal role in the success of our study.

We understand that your time is valuable, and we assure you that your responses will be treated with the utmost confidentiality and used solely for research purposes. There are no right or wrong answers; we are interested in capturing your honest experiences and opinions. Please take your time to complete the instrument thoroughly. Your input will be invaluable in guiding our

research and contributing to the development of a solution that can significantly improve learning and engagement within your organization. Thank you for your participation and for being an essential part of this exciting research endeavor.

RESEARCHERS:

Famisaran, Carlos Ivan M.

Periña, James Clark A.

Salonga, Edward M.

Purpose of this study:

The purpose of conducting this study is to design and develop RecInScan, a mobile application that is tailor to aid home cooks and chefs. The study aims to help home cooks and chefs come up with kapampangan recipes by scanning the ingredients that they have at home and RecInScan will recommend recipes according to the ingredients scanned. The implementation of RecInScan is intended to significantly improve the dish that the home cook and chef can prepare. Your decision to participate in this study is completely voluntary. If you decide to not participate in this study, it will not affect the relationship, care, services, or benefits to which you are entitled. Moreover, participating in this study will not have any bearing on the faculty performance or the faculty evaluation of the department heads, Dean, or students.

Description of the Research:

Being a participant in this study, you will be asked about your insights, perceptions, and suggestions based on your experience in ReclnScan. The primary respondents are home cooks and chefs, whose experiences, knowledge, and capability in culinary cooking are assessed using a quantitative research approach.

Voluntary Participation:

Your decision to participate in this study is completely voluntary. If you decide to not participate in this study, it will not affect the relationship, care, services, or benefits to which you are entitled. Moreover, participating in this study will not have any bearing on the faculty performance or the faculty evaluation of the department heads, Dean, or students.

Risks and Inconveniences:

The study shall have a minimal risk; particularly in the inconvenience of the participants for taking thie 10-minute data-gathering. Discomfort may also be experienced especially when you are not used to using an application intended to help with cooking or coming up with a recipe. Hence, if the questions are uncomfortable with you, you may opt not to answer the question or take part in

the survey especially when the questions are too personal and make you uncomfortable.

Potential Benefits:

Participants in this study will gain a deeper understanding and appreciation of how AI integration in their classes can enhance productivity in academic discussions by utilizing AI as a tool to enrich teaching and learning methods. This insight will inform suggested AI-based activities that can be effectively incorporated into classroom settings.

Participants in this study will gain a deeper understanding and appreciation of recipe ingredient application in help with coming up with dishes particularly kapampangan dishes. This insight will inform suggested recipe that can be effectively incorporated into cooking.

Reimbursements:

The respondents will not receive any amount of money as compensation but will receive a certificate as participant of the study.

Confidentiality:

No names or other identifying information will be used when discussing or reporting data. The investigator will safely keep all files and data collected in a secured Google Drive personally owned and will only be accessible to the researchers. The data collected from Google Forms will not be accessible to anyone other than the researchers. Confidentiality will be maintained to the degree permitted by the technology used. Your participation in this online survey involves risk similar to a person's everyday use of the internet.

Sharing the Results:

The result of the data has a plan for sharing in a paper presentation conference relevant to the ReclnScan application. Then, the data shall be used for publication so that other academic departments, colleges, or institutions may use the data for the improvement of the curriculum delivery.

Right to Refuse:

You have the right to refuse and withdraw from the study. You have also the opportunity to give review on your remarks on questions and erase part or all of the answers or notes.

Whom to Contact:

You may contact anyone from the researchers for some questions and clarifications. For further concerns on the ethical practice of the study, please send an email to umrec@umak.edu.ph

Authorization:

By signing this form, you authorize the use and disclosure of your records, any observations, and findings found during this study for education, publication and/or presentation.

CERTIFICATE OF CONSENT

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked were answered to my satisfaction. I understand that I will be given a copy of this consent form. I consent voluntarily to be a participant in this study.

Printed Name of Participant: _____

Signature of Participant: _____

Date: _____

I have accurately indicated the information sheet to the potential participant to the best of my ability and made sure that the participant understands that the following will be done:

1. Carefully read and agree on the content of the informed consent form

2. Participate in the study conducted by the researchers subject to a voluntary clause

3. Publication of the data in the journal for dissemination may be done

I confirm that the participant was given an opportunity to ask questions about my study, and all the questions asked by the participant have been answered correctly to the best of our ability. I confirm that the individual has not been coerced into giving consent, and the consent has been freely and voluntarily.

A copy of this informed consent form has been given to the participant.

Printed Name of Researcher/s: **Carlos Ivan M. Famisaran**



Signature of Researcher/s: _____

Date: _____

Printed Name of Researcher/s: **James Clark A. Periña**



Signature of Researcher/s: _____

Date: _____

Printed Name of Researcher/s: **Edward M. Salonga**



Signature of Researcher/s: _____

Date: _____

DATA PRIVACY

We value and respect your privacy in accordance with Republic Act No. 10173, also known as the Data Privacy Act of 2012. By participating in this research survey, you consent to the collection, use, and storage of your personal information solely for research purposes.

Rest assured that your data will be kept confidential and securely stored. Only authorized researchers will have access to your responses, and your information will not be shared with third parties without your explicit consent, except as required by law. Any published results will be presented in an anonymized or aggregated format to protect your identity.

If you wish to access, update, or request the deletion of your personal data, or if you have any concerns regarding this notice, please contact the research team.

By proceeding, you confirm that you have read, understood, and agreed to the terms outlined in this privacy notice.

ISO Systems Evaluation Form:

The purpose of this evaluation is to assess various aspects of the product or system according to the ISO 25010 standard. This standard includes both functional and non-functional requirements.

Your response will be based on a scale from 1 to 5, where you will provide a rating that reflects your experience or assessment of the system's performance based on the criteria mentioned in the evaluation.

Instructions:

Read the statements carefully and determine how much you agree with the given statement by selecting one from the following options.

The scale you will use to rate each criterion is a 1-5 Likert scale, with the following meanings:

1 - **Unsatisfied:** ReclnScan or product does not meet the requirement at all, or is extremely poor in performance in this area.

2 - **Somewhat Unsatisfied:** ReclnScan only partially meets the requirement, and the performance is below expectations.

3 - **Neutral:** ReclnScan meets the requirement adequately, but it does not stand out as particularly strong or weak in this area.

4 - **Somewhat Satisfied:** ReclnScan mostly meets the requirement and performs well in this area with minor issues.

5 - **Very Satisfied:** ReclnScan fully meets the requirement and performs exceptionally well in this area.

Converting Evaluation into Statements:

You will be asked to evaluate a specific aspect of the system (such as its functionality, usability, security, etc.). Each question should be answered by

providing a rating based on how well you think the system performs according to the criteria described.

Example of a statement format for an evaluation question:

"The system's user interface is easy to navigate."

Your response will be a rating between 1 and 5 based on your experience.

Demographics:

Name (Optional):

Age:

Gender:

Are you an IT EXPERT? Yes No

I. Functional Suitability - The level to which the ReclnScan web application functions as expected during user registration, login, scanning sessions, and recipe recommendations. This identifies the effectiveness of ReclnScan and helps users meet their goals and needs with the system.
--

A. Functional Appropriateness - refers to the extent to which ReclnScan's features are designed to help users scan ingredients effectively, ensuring that the app meets their needs for this task.

Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
1. ReclnScan helps find recipes using the ingredients you have at home by scanning them with your phone and suggesting personalized dishes.					
2. ReclnScan accurately scans ingredients, ensuring that the detected items are correctly identified and relevant to the recipe, thereby providing reliable recipe					

suggestions.					
3. RecInScan simplifies meal preparation by offering an intuitive and efficient way to identify ingredients and recommend recipes, making cooking easier and more convenient for users.					
B. Functional Completeness - refers to the extent to which RecInScan covers all the essential features that users expect from a food recommendation app, ensuring it meets their needs effectively.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
4. RecInScan enables users to create and customize their profiles by inputting profile information					
5. RecInScan offers users instant food scanning capabilities, allowing them to quickly identify and analyze the ingredients in their meals or products.					
6. RecInScan provides users with an extensive selection of recipe suggestions tailored to the ingredients they have on hand.					
C. Functional Correctness - refers to the extent to which RecInScan provides accurate results and works without errors, making sure it meets user needs effectively					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
7. RecInScan securely stores and displays the user's login and profile					

information, providing a smooth and personalized experience each time they use the app.					
8. RecInScan accurately scans ingredients and works without errors, providing users with reliable recipe recommendations.					
9. RecInScan performs consistently across all its features, ensuring that users can smoothly navigate and use the app without encountering errors.					
Performance Efficiency - The ability of RecInScan to maintain optimal functionality and provide a seamless user experience even under challenging conditions, such as slow internet speeds, high device workload, or limited system resources, ensuring that the app remains responsive and effective in all situations.					
A. Time behaviour - refers to the extent to which RecInScan responds to user requests and processes information, ensuring that everything happens without delays for a smooth experience					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
10. RecInScan delivers consistent performance, allowing users to confidently rely on the app for accurate results and a hassle-free experience every time					
11. RecInScan delivers fast and responsive performance, with pages loading in just a few seconds, ensuring a					

smooth and efficient user experience.					
12. RecInScan can easily recognize a wide range of ingredients used in Pampanga cuisine, helping users accurately identify and understand traditional local ingredients.					
B. Capacity - refers to the extent to which RecInScan handles a growing number of users and requests without slowing down, ensuring that it works smoothly even when many people are using it at the same time.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
13. RecInScan ensures that users can move through their tasks quickly and effortlessly, making the entire process more efficient and enjoyable.					
14. RecInScan can handle multiple ingredient scans and recipe searches simultaneously without slowing down or crashing.					
15. RecInScan remains responsive and functional even when multiple users access it simultaneously for scanning and recipe recommendations.					
C. Resource Utilization - Resource Utilization refers to the extent to which RecInScan uses your device's resources, such as memory and battery, while you're using it, ensuring that it doesn't slow down your device or drain its battery quickly.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
16. RecInScan operates					

seamlessly, even when other applications or websites are open.					
17. RecInScan operates smoothly and efficiently, ensuring that your device's overall performance remains unaffected.					
18. RecInScan efficiently uses your device's resources, such as memory and battery, ensuring it doesn't slow down or drain power during use					
III. Interaction Capability- Refers to the ease and effectiveness with which users interact with RecInScan's features, such as signing up, logging in, scanning ingredients, and viewing recommended recipes, ensuring simplicity and intuitive navigation.					
A. Appropriateness Recognizability - Refers to the ease with which users can determine whether RecInScan meets their needs, such as assisting them in finding recipes or effectively scanning ingredients.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
19. RecInScan offers personalized recipes that help you create delicious dishes with ease, all based on the ingredients scanned.					
20. RecInScan presents information in a simple and easy-to-understand way, making sure users can quickly get the details they need.					
21. RecInScan helps users make informed choices					

with confidence, ensuring they always know exactly what they're working with.					
B. Operability - Refers to the ease and simplicity with which users can utilize RecInScan's features, such as signing up, logging in, scanning ingredients, and viewing recipe recommendations, ensuring a seamless and user-friendly experience.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
22. RecInScan is designed to be simple, making it really easy for users to navigate and use without any hassle.					
23. RecInScan provides easy-to-follow instructions to help users navigate and use the web application.					
24. RecInScan provides helpful guides that show users which pages to visit next, making it easy to explore the app.					
25. RecInScan's layout is straightforward, making it easy to navigate between features like scanning ingredients or browsing recipes.					
C. User Error Protection - Refers to the effectiveness of RecInScan in preventing user mistakes by offering guidance, such as clear instructions, warning messages, or correcting invalid inputs during tasks like scanning ingredients or searching for recipes, ensuring a smoother user experience.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
26. RecInScan uses asterisks (*) to highlight the					

fields you must fill out. This ensures that all necessary information is provided, making the process easier.					
27. RecInScan encourages users to fill in any additional information by offering helpful prompts and reminders.					
28. RecInScan provides clear warnings or alerts when users enter incorrect information, helping them correct mistakes before proceeding.					

Comments and Suggestions

IT EXPERT

Demographics:

Name (Optional):

Age:

Gender:

Are you an IT EXPERT? Yes No

I. Functional Suitability - The level to which the RecInScan web application functions as expected during user registration, login, scanning sessions, and recipe recommendations. This identifies the effectiveness of RecInScan and helps users meet their goals and needs with the system.

A. Functional Appropriateness - refers to the extent to which RecInScan's features are designed to help users scan ingredients effectively, ensuring that the app meets their needs for this task.

Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
1. RecInScan helps find recipes using the ingredients you have at home by scanning them with your phone and suggesting personalized dishes.					
2. RecInScan accurately scans ingredients, ensuring that the detected items are correctly identified and relevant to the recipe, thereby providing reliable recipe suggestions.					
3. RecInScan simplifies meal preparation by offering an intuitive and efficient way to identify ingredients and recommend recipes,					

making cooking easier and more convenient for users.					
4. RecInScan integrates seamlessly with existing databases or ingredient recognition systems, ensuring that the app's backend can scale effectively and maintain high accuracy in ingredient detection and recipe recommendations.					
B. Functional Completeness - refers to the extent to which RecInScan covers all the essential features that users expect from a food recommendation app, ensuring it meets their needs effectively.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
5. RecInScan enables users to create and customize their profiles by inputting profile information					
6. RecInScan offers users instant food scanning capabilities, allowing them to quickly identify and analyze the ingredients in their meals or products.					
7. RecInScan provides users with an extensive selection of recipe suggestions tailored to the ingredients they have on hand.					
8. RecInScan ensures robust data security and privacy measures are in					

place, allowing users to safely store and manage personal information, dietary preferences, and scanned ingredient data without compromising security.					
C. Functional Correctness - refers to the extent to which ReInScan provides accurate results and works without errors, making sure it meets user needs effectively					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
9. ReInScan securely stores and displays the user's login and profile information, providing a smooth and personalized experience each time they use the app.					
10. ReInScan accurately scans ingredients and works without errors, providing users with reliable recipe recommendations.					
11. ReInScan performs consistently across all its features, ensuring that users can smoothly navigate and use the app without encountering errors.					
12. ReInScan employs robust error handling and real-time validation mechanisms, ensuring that ingredient scans and recipe recommendations are accurate, even in					

cases of ambiguous or incomplete ingredient data.					
Performance Efficiency - The ability of RecInScan to maintain optimal functionality and provide a seamless user experience even under challenging conditions, such as slow internet speeds, high device workload, or limited system resources, ensuring that the app remains responsive and effective in all situations.					
A. Time behaviour - refers to the extent to which RecInScan responds to user requests and processes information, ensuring that everything happens without delays for a smooth experience					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
13. . RecInScan delivers consistent performance, allowing users to confidently rely on the app for accurate results and a hassle-free experience every time					
14. RecInScan delivers fast and responsive performance, with pages loading in just a few seconds, ensuring a smooth and efficient user experience.					
15. RecInScan can easily recognize a wide range of ingredients used in Pampanga cuisine, helping users accurately identify and understand traditional local ingredients.					

16. RecInScan optimizes resource utilization, ensuring fast ingredient recognition and recipe recommendations even under high traffic or resource-constrained conditions, maintaining responsiveness without compromising accuracy.					
B. Capacity - refers to the extent to which RecInScan handles a growing number of users and requests without slowing down, ensuring that it works smoothly even when many people are using it at the same time.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
17. RecInScan ensures that users can move through their tasks quickly and effortlessly, making the entire process more efficient and enjoyable.					
18. RecInScan can handle multiple ingredient scans and recipe searches simultaneously without slowing down or crashing.					
19. RecInScan remains responsive and functional even when multiple users access it simultaneously for scanning and recipe recommendations.					
20. RecInScan is built with scalable infrastructure, capable of					

handling a significant increase in user activity and data without compromising performance, ensuring it can support growing user demands over time					
C. Resource Utilization - Resource Utilization refers to the extent to which ReclnScan uses your device's resources, such as memory and battery, while you're using it, ensuring that it doesn't slow down your device or drain its battery quickly.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
21.. ReclnScan operates seamlessly, even when other applications or websites are open.					
22. ReclnScan operates smoothly and efficiently, ensuring that your device's overall performance remains unaffected.					
23. ReclnScan efficiently uses your device's resources, such as memory and battery, ensuring it doesn't slow down or drain power during use					
24. ReclnScan is optimized for minimal resource consumption, utilizing adaptive algorithms that adjust memory and CPU usage based on the device's capabilities, ensuring					

efficient operation across a wide range of hardware.					
III. Interaction Capability- Refers to the ease and effectiveness with which users interact with RecInScan's features, such as signing up, logging in, scanning ingredients, and viewing recommended recipes, ensuring simplicity and intuitive navigation.					
A. Appropriateness Recognizability - Refers to the ease with which users can determine whether RecInScan meets their needs, such as assisting them in finding recipes or effectively scanning ingredients.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
25. RecInScan offers personalized recipes that help you create delicious dishes with ease, all based on the ingredients scanned.					
26. RecInScan presents information in a simple and easy-to-understand way, making sure users can quickly get the details they need.					
27. RecInScan helps users make informed choices with confidence, ensuring they always know exactly what they're working with.					
28. RecInScan utilizes intuitive design and user-friendly interfaces, allowing users to quickly assess whether the app meets their recipe and					

ingredient scanning needs, minimizing the learning curve for new users.					
B. Operability - Refers to the ease and simplicity with which users can utilize RecInScan's features, such as signing up, logging in, scanning ingredients, and viewing recipe recommendations, ensuring a seamless and user-friendly experience.					
Criteria	Unsatisfie d 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
29. RecInScan is designed to be simple, making it really easy for users to navigate and use without any hassle.					
30. RecInScan provides easy-to-follow instructions to help users navigate and use the web application.					
31. RecInScan provides helpful guides that show users which pages to visit next, making it easy to explore the app.					
32. RecInScan's layout is straightforward, making it easy to navigate between features like scanning ingredients or browsing recipes.					
33. RecInScan incorporates accessible UI/UX design principles, ensuring that users with varying levels of technical					

expertise can easily operate the app and access its features without encountering usability barriers.					
C. User Error Protection - Refers to the effectiveness of ReclnScan in preventing user mistakes by offering guidance, such as clear instructions, warning messages, or correcting invalid inputs during tasks like scanning ingredients or searching for recipes, ensuring a smoother user experience.					
Criteria	Unsatisfied 1	Somewhat Unsatisfied 2	Neutral 3	Somewhat Satisfied 4	Very Satisfied 5
34. ReclnScan uses asterisks (*) to highlight the fields you must fill out. This ensures that all necessary information is provided, making the process easier.					
35. ReclnScan encourages users to fill in any additional information by offering helpful prompts and reminders.					
36. ReclnScan provides clear warnings or alerts when users enter incorrect information, helping them correct mistakes before proceeding.					
37. ReclnScan features intelligent error detection and correction mechanisms that proactively identify and					

suggest fixes for common user input mistakes, such as misidentified ingredients or incomplete recipe searches, enhancing overall usability.					
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Comments and Suggestions

APPENDIX D

UNIVERSITY OF MAKATI RESEARCH ETHICS COMMITTEE CERTIFICATE OF APPROVAL



UNIVERSITY OF MAKATI
J.P. Rizal Extension, West Rembo, Makati City

Research Ethics Committee

CERTIFICATE OF APPROVAL

UMREC Code	CCIS-2025-001
Project Title	ReclnScan: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS OF KAPAMPANGAN DISHES UTILIZING YOLOV9 ALGORITHM
Review Category	Expedited review
Principal Investigator/ Researcher	James Clark A. Periña
Co-Investigators/ Co-Researchers	Carlos Ivan M. Famisaran Edward M. Salonga
Department/School	College of Computing and Information Sciences University of Makati
School Address	J.P. Rizal Extension, West Rembo, Taguig City, 1215
Approval Date	24 January 2025
Expiry Date	24 January 2026

This certification is issued by the University of Makati Research Ethics Committee after reviewing the above-named research project. In accordance with the SOPs of an existing policy, the committee finds the submitted paper to be compliant, hence acceptable on ethical grounds. The principal investigator/researcher and co-investigators/researchers have the responsibility to comply with other administrative/regulatory approvals that may be required pertaining to this research project, and to ensure that the above-named research will be carried out according to original protocol approved by this Committee.

The Principal Researcher is directed to notify the Secretary of the Review Ethics Committee of:

- Any significant change to the project and the reason for that change, including an indication of ethical implications (if any);
- Serious adverse effects on participants and the action taken to address those effects;
- A Progress Report on completion of the project (forms to be provided);
- Submission of revisions, specifically cited in the comments and recommendation section of this certificate.

All research projects subject to the University of Makati Research Ethics Committee review must be conducted following the guidelines of the Philippine Health Research Ethics Board (PHREB).


Prof. Mark Philip C. Paderan, MA LIT.
 Chairperson, Research Ethics Committee

Send all correspondence to:
 University of Makati Research Ethics Committee
 University of Makati
 Room 9020, 9th floor HPSB building

APPENDIX E

IT EXPERT DOCUMENTATION

IT EXPERT CERTIFICATION

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I confirm that "**RECINSCAN: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS OF KAPAMPANGAN DISHES UTILIZING YOLOV9 ALGORITHM**" is secure and functions as intended without any significant issues. The software/application adheres to all relevant compliance standards and best practices in software development.

Issued this 30th day of March 2025.

Signed:



JOHN ADRIAN T. MELEGRITO

FREELANCE WEB DEVELOPER

JOHN ADRIAN T. MELEGRITO

Quezon City, NCR, 1116 • 0999-530-8093 • adrn.mlgro@gmail.com • linkedin.com/in/adrnmlgrto • github.com/adrnmlgrto

PROFESSIONAL EXPERIENCE

OPO Networks Corp.

Junior Backend Developer

June 2023 - May 2024

- Developed and maintained core backend services, including payment processing, transaction management, and user management functionalities.
- Designed API endpoints to enable data exchange, ensuring efficient client-server communication.
- Integrated various third-party services, including payment processors, email services, and external tools, to support application functionality.
- Implemented automation scripts and scheduled tasks for auditing processes and background job execution.
- Wrote unit tests to achieve full code coverage, ensuring code reliability and stability.
- Technologies Used: Python, Django, FastAPI, Celery, Stripe, PostgreSQL, Git

OPO Networks Corp.

Software Developer Intern

February 2023 - April 2023

- Assisted in writing and refactoring deprecated code, debugging issues to improve performance, scalability, and maintainability.
- Participated in code reviews, learning and contributing to best practices for clean, scalable code.

SKILLS

- | | | |
|------------|--------------|-------------------|
| • Python | • PostgreSQL | • JSON / XML |
| • Java | • MongoDB | • OOP |
| • Git | • Django | • Scrum |
| • REST API | • FastAPI | • Cloud Computing |

PROJECTS

Readyly Mobile

- Developed a 3D mobile game application for Android using Unity to enhance the English reading comprehension of Grade 3 students in the Philippines.
- Designed and deployed a FastAPI backend to handle requests from the game application for calculating sentence similarity values using a large language model.

EDUCATION

Technological Institute of the Philippines - Quezon City

Bachelor of Science in Computer Science

June 2019 - May 2023

REFERENCES

Will be provided upon request.

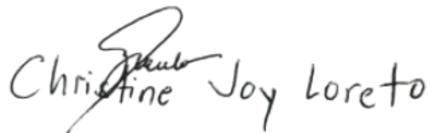
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Issued this 30th day of March 2025.

Signed:



CHRISTINE JOY LORETO
ASSOCIATE APPLICATION SUPPORT
ACCENTURE INC

CHRISTINE JOY LORETO

Quezon City | (+63) 917 822 7607 | christine.j.loreto@gmail.com

Objective

Seeking a career that provides an opportunity to enhance and showcase my skills in Information Technology as well as a Korean Language Speaker.

Personal Skills

- Leadership skills and ability to motivate
- Ability to work independently or as part of a team
- Excellent interpersonal skills
- Ability to adapt and to work under pressure
- Proficient computer literacy
- Eagerness to learn
- Willingness to be trained
- Positive work attitude

Technical Skills

- Web Development (HTML, CSS, JavaScript).
- Experience in Bash, Unix/Linux Shell Scripting and Basic C++ Programming
- Experience in Git, Subversion, JIRA and Jenkins
- Proficient in Microsoft Office (MS Word, Powerpoint, Excel, etc.).
- Familiar with RPA (Automation Anywhere, Accenture Robotics Platform)
- Knowledgeable in Oracle PL/SQL
- Adobe (Photoshop, Flash, Illustrator, XD, Dreamweaver).
- Familiar with Netsuite and Microsoft Dynamic Navision
- Knowledgeable in Korean Language.

Experience

Accenture Inc

Associate Application Support (2017- current)

- ° Develop new features or products for an area of our platform working alongside with Development Team.
- ° Maintain and enhance current features and functionalities and monitor and control the system.
- ° Configure business processes based on defined business requirements.

Performance Advantage System International

- ° Trained to modify POS Systems User Interface Design.
- ° Trained how to support clients in regards with the services that the company offers.
- ° Trained in Microsoft Dynamics NAV implementation.

IT Group Inc.

- ° Trained to modify POS Systems User Interface Design using JavaScript.
- ° Assist on SEO for various handled clients.
- ° Configure webpage designs using Joomla.
- ° Trained in NetSuite ERP implementation.

Education**BS INFORMATION TECHNOLOGY (2015 – 2017)**

Informatics College Eastwood, Quezon City

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Issued this 30th day of March 2025.

Signed:

A handwritten signature in black ink, appearing to read "charles", is placed over a light gray rectangular background.

CHARLES A. FAMISARAN
IT MANAGER
RELIANCE PRODUCER COOPERATIVE

CHARLES A. FAMISARAN

IT Specialist/Network/System Admin

PERSONAL INFORMATION



Full Name	Charles Albios Famisaran
DOB	5th January 1978
Nationality	Filipino
Address	Blk. 69 Lot 50 Begonia St. Zone 7 Rizal Makati City
Phone	+639162359386
Email	charles@famisaran.com

PROFESSIONAL INFORMATION

Over 19 years Experienced as IT Personnel my day-to-day output reflects a high level of motivation, efficiency, and ability to meet any objective. I have a proven ability to perform under a minimum amount of supervision and demonstrate a high degree of initiative and good judgment. Exceptional troubleshooting skills Ability to work well under pressure A strong sense of responsibility and initiative and an ability to complete tasks accurately Work well independently, or in a group setting providing all facets of computer support such as troubleshooting, installations, and maintenance. In-depth knowledge and understanding of numerous software packages and Operating Systems. Skilled in providing Customer and End-User Support. Easily identify and resolve technical issues and concerns.

EDUCATION

BSIT- Electronics <u>Pamantasan ng Makati</u>	Jun 1995 – Apr 2000 Makati City
Seminars Attended:	
Mastering Management Guthrie-Jensen	August 2022 Carmona ,Cavite
CompTIA Network+ Cert.; N10-006. The Total Course <u>Total Seminars / Mike Meyers on Udemy</u>	Sept 2017 Online Course
SCCM (System Center 2012 Configuration Manager <u>Microsoft Philippines</u>	Oct 2013 Makati City
Computer and Electronics Technology <u>Meralco Foundation Inc.</u>	Mar -1998 Pasig City

EXPERIENCE

IT Manager <u>Reliance Producer Cooperative/NST</u>	November 2017 – Present Carmona Cavite
<ul style="list-style-type: none"> • Defines, updates, and implements IT Strategy. • Aligns IT with corporate goals and objectives. • Controls IT performance and budget. • Acquires Software (SW) and Hardware (HW). • Selects, manages and controls IT vendors. • Defines and implements strategic IT process initiatives. • Rationalizes and manages HW/SW portfolio. • Coordinates, consolidates IT processes across the organization • Oversees the IT Dept. to ensure maximum usage of all available support on technical resources & systems for efficient operations or external acquisition, as applicable, 	

including follow-thru on design, installation, implementation, and maintenance thereof in line with company's goals and targets.

- Conducts trainings and seminars related to new computer systems, software and hardware.
- Reviews specifications of IT equipment/peripherals that are approved to be purchased.
- Determines & recommends improvement on current systems to maximize efficiency at all times.
- Conducts periodic systems audit.
- Ensures IT Security and Business Continuity.
- Ensures IT Security Policies and Procedures are in place and updated.
- Ensures that the IS is properly implemented.
- Implements current best practice for IT and IS processes.
- Scans environment and industry for new technology that can bring in tactical and strategic advantage for the company.
- Manages IT team to ensure proper alignment in technical and career growth.
- Partners with other departments to automate and enhance processes through technology

Senior System and Network Admin
Egis Projects Philippines Inc.

August 2015 – November 2017
Pasig City

- Responsible for the system network connectivity of the company.
- Responsible for the upgrading of the system, as necessary.
- Coordinate properly with the systems providers and stakeholders.
- ensure timely and accurate interface of accounts
- Develop a system of back-ups and restorations
- Institute systems options and data maintenance.
- Ensure system run-time on system's hardware and software
- Deployment of Security and Network Policies

Senior IT Support
Mackenzie Sutherland Inc.

June 2014 – May 2015
Pasig City,

- Maintains existing business systems
- Analyzes business processes and recommends solutions to computerize manual operations or improve on existing computer systems
- Provide day to day technical and user support for personal computers/Laptop
- Monitor and Back up File Server Maintenance and upgrading of computer systems or offering recommendations on upgrades needed
- Training staff and orienting them on how to use computer hardware and software systems.
- Skills include deploying, migrating and managing medium to large-scale Servers and desktop environments, designing and implementing system tools and automating operational tasks.
- Computer Telephony Integration, VoIP, Asterisk, Asterisk,Trixbox, FreePBX and VICIdial Predictive Dialer and Enterprise Callcenter Solutions/Dialers.

ITO Desktop Support Specialist
Novenix Corp.

March 2012 – Jan 2014
Makati City

- Provide day to day technical and user support for personal computers/Laptop (PC, Mac), Corporate mobile phones (Blackberry, iPhone), user applications and printers
- Provide timely and consistent support, acknowledging and recording all incidents and requests
- Monitor and escalate requests as required. Monitor ticketing queues and comply with quality guidelines when managing incidents.
- Handle network and desktop setup for new employees/office moves
- User management via Active Directory, Create user Accounts, Email and Grant access to users

- Create standard and custom image for deployment and Physical setting up of computers and software system installation depending on various computer applications and programs.
- Provide the necessary local “hands and eyes” support for 2nd and 3rd level technical support teams to aid with project execution and Incidents, Request and Problem Management.
- Create documentation for users, new releases, and issue logs
- Responsible for maintaining and deploying security patches to the server environment by following standard patching methodology. (Using WSUS)
- Assisting users Corporate Offices and remote locations with technical support of desktop computers, applications, peripherals and related technology including Blackberry devices.
- Assist in the troubleshooting and testing of video conference, IP phones and associated equipment in coordination with Corporate Support resources
- Support includes installation, configuration and testing of computer systems and peripherals within established guidelines
- Configure and setup IP Phones, Blackberry, iPhone's and Wireless Devices
- Monitor and Back up File Server
- Maintenance and upgrading of computer systems or offering recommendations on upgrades needed.

IT Manager
Lyncor, Inc.

Mar 2006 – Feb 2012
Quezon City

- Maintains existing business systems
- Analyzes business processes and recommends solutions to computerize manual operations or improve on existing computer systems
- Documents status of projects concerning design and implementation of systems
- Trains users on how to use existing and new systems
- Recommends new applications for the enhancement of company business processes
- Installs and/or upgrades software packages such as operating systems, networking system utilities, anti-virus utilities and other necessary programs into the servers
- Maintains the integrity, operational efficiency, and security of the company's computer systems such as, Virtual Host, Active Directory, DNS, DHCP, Mail and, Internet Proxy Servers, Anti-Virus Protection, Data Back-up and Recovery, Retail Pro (POS) and Network connections
- Evaluates and reviews hardware and software needs of users and ensures proper resource allocation
- Documents procedures pertaining to network systems, including software and data recovery and restoration procedures
- Conducts periodic workstation audits for copyright compliance and resource usage
- Oversees prioritization of client and user requests for technical assistance
- Performs preventive maintenance on all hardware
- Provides continues improvements in IT Dept.
- Maintains Company Website

Technical Support Engineer I
Crismina Garments Inc.,

June 2000 – March 2006
Makati City

- Performs computer and network hardware troubleshooting and repair Microsoft Office Applications
- Maintains and updates record of reported problems and corresponding solutions
- Installs and/or upgrades software packages such as operating systems, networking, database programs, system utilities, anti-virus utilities and other necessary programs into the servers and individual workstations
- Performs preventive maintenance on all hardware such as computer monitor, CPU, keyboard, mouse, CD-ROM, printer, fax, UPS, power supply, AVR, hub, modem and network connections

- Performs tests on status of online users
- Maintains, updates and evaluates all network resources and status of all network switches
- Promotes awareness and provides support to users

SKILLS & ATTRIBUTES

Computer Software:

- Microsoft Office Applications /Office 365
- Operating Systems / Windows, Linux (Redhat,Ubuntu,CentOS) and Mac (OSX) including Terminal Servers
- Provide Level 3 support for deployed applications (Accpac) in IIS Web Farm and Citrix XenApp 4
- Active Directory Security and Policies
- SCCM and WSUS Administration
- Database management MSSQL Server, Pervasive SQL, Oracle, PostgreSQL and MySQL
- Monitoring software such as MRTG,/PRTG/Cacti/Xangati using SNMP and Netflow
- Mail Systems (MS Exchange, Lotus Domino Server and Client, Mdaemon, Zimbra, Zarafa, Mail Enable, G-Suite and Office365
- Corporate Instant messaging (OpenFire) /Spark XMPP /Hipchat
- Virtual Infrastructures VMWare,HyperV,Xenserver Docker,Azure,Cloud
- Track bugs, tasks, and projects Management MS SharePoint, (Jira, Mantis) Confluence (Wiki)
- HR and Payroll System
- Accounting Software's Eric98 Accpac/Misys, SAP Business One SAP Fico, Odoo and Xtuple
- Mobile Administration (Blackberry (BES) Apple and Android)
- IT Security, Corporate Antivirus
- Internet Proxy ISA and firewall and IDS,Pfsense, Vyatta and Cisco
- Complete Backup System, Data Recovery, Symantec Backup Exec ,Cobian
 - DNS Management
 - Debugging, Development, Testing and Deployments
 - Web Content management such as PLEX and Cpanel, H-Sphere
 - ViciDial/Godial/Asterisk

Hardware

- Computer Hardware Troubleshooting, PC and Mac and Servers
- LAN and WAN design, installation and configuration Structure LAN
- Cisco Switch and Router
- VOIP, PABX System /Cisco Call Manager (Cisco IP Phones)
- Data-center /Racks and Maintenance
- Router/Switch Configuration Cisco ,Huawei, HP , Dell
- Wireless APs Cisco Aironet, Rackus, Ubiquiti
- Tape drive Mammoth 2 (backup),
- Storage Devices such as SCSI, SATA and Raid System Openfiler,Netapps,
- Plotter and Printers
- Lease Lines,DSL,VPN,MPLS,IPLC
- CCTV and Security Door Access
- Electronics Troubleshooting



UNIVERSITY OF MAKATI
J.P. Rizal Extension, West Rembo Makati City

College of Computing and Information Sciences

IT EXPERT CERTIFICATION

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Issued this 7th day of May 2025.

Signed:


JOHN ANDREW A. GALANG
SOFTWARE DEVELOPMENT TEAM LEADER
SCIENTIFIC BIOTECH SPECIALTIES, INC.

MY CONTACT

Phone

+63 949 483 8706

Email

galangjohn38@gmail.com

Address

151-I 18th Ave. East Rembo,
Makati City

LinkedIn

<https://www.linkedin.com/in/john-andrew-galang-b748b9195>

TECHNICAL SKILLS

Programming Technologies

C, C++, C#, JAVA, Visual Basic

Database Technologies

MySQL, SQL Server

QA Technologies

Selenium, Jenkins

TRAININGS ATTENDED

Achieving Effective Leadership in the Workplace

Quality Plus Management
Consulting Co.

Sept. 20, 2023

ISO 19011:2018 Internal Audit

Training on ISO 9001:2015

TUV SUD PSB

Nov. 16, 2021

CHARACTER REFERENCE

Arnold Malaza

Automation Test Engineer - 2
(+63) 908-962-6005

Leonard Charles Dychangco

Technical Test Manager
(+63) 947-329-1054

JOHN ANDREW A. GALANG

PROFESSIONAL EXPERIENCE

Scientific Biotech Specialties, Inc.

June 2021 to Present

Software Development Team Leader

- Responsible for managing subordinates:
 - Creates Gantt chart for the projects.
 - Monitors the pending, ongoing and upcoming projects.
 - Gathers and verifies requirements that was collected by Deployment team.
 - Makes decision if the software update is ready for deployment.
 - Coordinates with Technical Support and Deployment Teams for software concerns and updates.
- Developed and customized software that follows the requirements and processes of the clients:
 - Used C# as programming language and VB.NET for some projects.
 - Used DevExpress as design tool for user interface.
 - Created software that can gather and archive data for hospital transactions, inventories and procurement processes, and laboratory and blood bank transactions.
 - Created middleware to connect machines or other software.
- Created and designed reports using Report Definition Language (RDL).
- Created queries and stored procedures using MySQL to create different reports needed by clients.
- Supported clients when they are encountering errors or bugs in software.
- Deployed the software in client's premises and trained users on how to use the software.

Digital Rooms Inc.

June 2019 to Dec 2019

Software Quality Assurance Intern (Automation Testing)

- Trained to use Keyword-Driven Automation Framework and Modular Automation Framework for testing the company's website.
- Created new keywords for Keyword-Driven Automation Framework using JAVA language.
- Created functions for Modular Automation Framework using JAVA language.
- Learned to used Jenkins and Git.

EDUCATION

Mapua University (Batch 2020)

Bachelor of Science in Computer Science
Specialized in JAVA Programming

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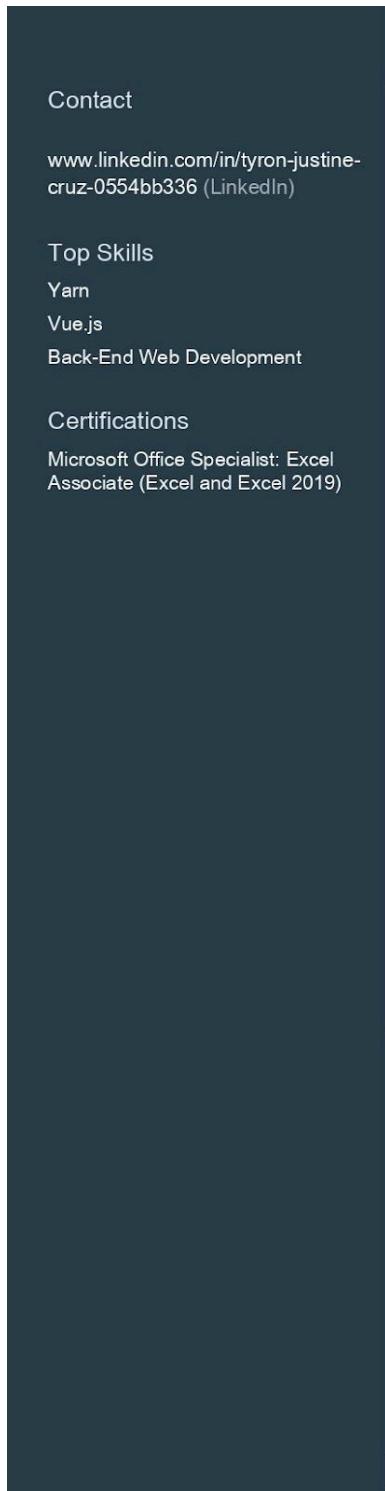
Issued this 30th day of March 2025.

Signed:



Tyron Justine Cruz

TYRON JUSTINE CRUZ
JUNIOR SOFTWARE DEVELOPER
DASHUR AI



Contact

www.linkedin.com/in/tyron-justine-cruz-0554bb336 (LinkedIn)

Top Skills

Yarn
Vue.js
Back-End Web Development

Certifications

Microsoft Office Specialist: Excel
Associate (Excel and Excel 2019)

Tyron Justine Cruz

Junior Software Developer
Quezon City, National Capital Region, Philippines

Summary

Enthusiastic and dedicated individual with a passion for Information Technology. Known for my positive attitude, strong work ethic, and willingness to learn, I bring a fresh perspective and a desire to make a meaningful impact.

Experience

Dashur AI
Junior Software Developer
November 2024 - Present (5 months)

Jollibee
Service Crew
July 2023 - March 2024 (9 months)
Philippines

Education

Systems Plus Computer College - Caloocan City
Information Technology · (2019 - April 2025)

IT EXPERT CERTIFICATION

This document serves as an official confirmation regarding the security and functionality of the application titled "**RECINSCAN: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS OF KAPAMPANGAN DISHES UTILIZING YOLOV9 ALGORITHM**" created by James Clark A. Periña, Edward M. Salonga, Carlos Ivan M. Famisaran. The evaluation has been conducted adhering to industry-standard security practices and in line with the functional requirements specified at the onset of project.

I confirm that "**RECINSCAN: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS OF KAPAMPANGAN DISHES UTILIZING YOLOV9 ALGORITHM**" is secure and functions as intended without any significant issues. The software/application adheres to all relevant compliance standards and best practices in software development.

Issued this 30th day of March 2025.

Signed:



Michael M. Figueroa

MICHAEL M. FIGUEROA
SENIOR PROGRAMMER
FAO OF UNITED NATION

Mr. Michael M. Figueroa**Summary :**

More than 18 years experience in Oracle e-Business Suite , and over 21 years experience in information technology at the highest level.

With nine years experience as a functional and technical Lead in Oracle ERP. Verifiable strength in designing and improving work procedures in providing systems support. Strong in taking a holistic approach to problem solving, able to deal with all levels solution from high level business requirements and objectives.

Involve in two international organizations implementation of Oracle ERP release 12 and 11 (Enterprise Resource Planning) HRMS/Payroll modules, and those are ADB (Asian Development Bank) and FAO of the United Nations.

Extensive Oracle e-Business Suite experience in HRMS, Payroll and Financial modules on a wide range of system platforms. Depth knowledge and experience in providing support large scale application particularly in Oracle ERP modules.

Professional Experience:

FAO of the United Nations, Rome, Italy
HCM Functional and Technical Analyst

Sept 2015 to Nov 2018

- Oracle Human Resource /Oracle Payroll and Financial; version R12 release 12.1.3 and 11i release 11.5.10.2
- Responsibilities
- Liaise with business units in order to identify and confirm business requirements and provide expert advice on the automation of business processes with specialization in HCM.
- Design solutions that meet business needs and ensure that they integrate effectively into the information system environment in use by the Organization. This includes a gap analysis between the set environment and business needs.
- Perform hands-on functional configurations and personalization to meet specified business process needs.
- Monitor the current design of applications to determine issues with current functionality and coordinate the resolution of set issues with the relevant business units.
- Identify items that require technical involvement and act as the bridge between the business units and the technical teams to ensure development of solutions consistent with both business needs and with the overall application environment.
- Develop relevant design documentation and functional specification to be used for system development and assist in the functional verification of developed solutions.

- Provide functional expertise and advice on new functionalities and features looking at trends relevant to FAO systems with specific focus to HCM solutions
 - Environment
- XML Publisher, J-Developer using OAF, Unix, Oracle PL/SQL, AME, Workflow, Report10g/6i, Form10g/6i, Discoverer 10g and SQL Navigator on Oracle 11g. The methodology used is Oracle AIM(Application Implementation Methodology), Unix

Asian Development Bank	0	Mar 2014 to Aug 5
2	1	
Senior Oracle ERP Consultant		

- Oracle Financial
- Responsibilities
- Perform application configuration and setup for CSS (Capital Subscription System).
- Involve in analysis and gathering business requirements for CSS (Capital Subscription System) and Promissory Note system.
- Involve in the development of all pl/sql routines, Workflow processes and approval.

FAO of the United Nations , Bangkok, Thailand	1	Sept 2006-Dec 3
2	0	
Systems Development Specialist		

- Oracle Human Resource /Oracle Payroll and Financial; version R12 release 12.1.3 and 11i release 11.5.10.2
- Responsibilities
- Perform as technical lead for HR module and its extension.
- Perform hands-on functional configurations and personalization to meet specified business process needs.
- Perform as business analyst and involve in gap analysis for major extensions in core HR, iRec.
- Act as solution architect for majority of HR requirements.
- Act as OSDSC focal point for HR post implementation support of r12 upgrade;
- Perform configuration and setup on AME, menu, profile/security profile, responsibilities, and etc.
- Plan and manage the resources and deliverables;
- Lead OSDSC Bangkok team HR development group in Oracle e-Business Suite upgrade from 11i to R12 phase 1 and 2;
- Support the responsible staff member(s) in analyzing functional specifications prior to development by OSDSC(Offshore Systems Development Support Centre) consultants;
- Supervise a big group of developers in Bangkok who develops extensions based on technical specifications; provide assistance in the areas of overall system

design, project background, functional requirements and technical approach and standards;

- Analyze feasibility and determine work effort required for application development;
- Perform the initial test of each extension and ensure the delivery package and installation instructions are complete before passing them back to the responsible Staff Members;
- Mentor and support Staff Members and Developers in both functional and technical aspects of their assignments;
- Communicate progress of the development tasks, indicating any delays or other problems and issues to the responsible staff members in Rome;
- Coordinate and monitor progress of support and development.
- Perform analysis, design and estimates of issues before delegating to Developers;
- Develop critical and complex objects if necessary;
- Setup standard and make sure they are followed by the team;
- Manage and directs the flow of work coming from headquarters;
- Monitor the workload of the team;
- Establish delivery and improvement;
- Act as coordinator for FAS/Atlas applications.
- Environment
- XML Publisher, J-Developer using OAF, Unix, Oracle PL/SQL, AME, Workflow, Report10g/6i, Form10g/6i, Discoverer 10g and SQL Navigator on Oracle 11g. The methodology used is Oracle AIM(Application Implementation Methodology), Unix

FAO of United Nations, Rome, Italy	Oct 2005-Sep 6
2	0

Analyst/Programmer

- Oracle Human Resources /Oracle Payroll version 11i release 11.5.10.2
- Responsibilities
- Involve in HRMS/Payroll Implementation
- Assist responsible staff member(s) with the configuration and design of Oracle HR, Payroll, Advance Benefits(OAB) and Learning Management;
- Assist the responsible project staff member(s) with the preparation of the CRP(Conference Room Piloting);
- Assist team members in performing technical Analysis (e.g. Workflow and conversion reconciliation);
- Handle Technical analysis and solutions for iRecruitment, OLM(Oracle Learning Management), Payroll and Post Management;
- Develop Self-service validation for Personal Action;
- Develop in Self-service personalization in Oracle Learning Management;
- Create workflow business event solution for iRecruitment;
- Handle technical verification and testing for delivered extensions;
- Write technical specification for customization needed to fill the identified gaps in Areas of HR, Payroll, OAB and OLM;
- Perform the setup of Oracle Approval Management (AME) for Oracle Learning Management;
- Write development standards;
- Assist Developers in OSDSC Bangkok Thailand;

- Environment
- XML Publisher, J-Developer using OAF, Unix, Oracle PL/SQL, AME, Workflow, Report10g/6i, Form10g/6i, Discoverer 10g and SQL Navigator on Oracle 10g. The methodology used is Oracle AIM(Application Implementation Methodology), Unix

Asian Development Bank, Manila, Philippines Aug 2004-Oct
2 0 5
Analyst/Programmer

- Oracle Human Resources /Oracle Payroll version 11i
- Responsibilities
- Handle the customization and maintenance of Educational Assistance Module.
- Create Adhoc Reports for OAB;
- Handle the Self-Service maintenance and enhancement;
- Create forms and reports for the HR/Payroll, Oracle Learning Management and Staff Receivable Module;
- Create alerts for Hr/Payroll and Training module;
- Environment
- Unix, PL/SQL8, Reports6i, AME, Workflow, Forms6i, Discoverer 4i and TOAD on Oracle 8i RDBMS. The methodology used is Oracle AIM Oracle AIM(Application Implementation Methodology).

Oracle Singapore, Singapore May 2004-Aug 2004
Senior Technical Consultant

- Oracle Human Resources /Oracle Payroll 11i release 11.5.9
- Responsibilities
- Involve in the implementation and customization of HR/Payroll;
- Customize OTA and iExpense Self-service and workflow customization;
- Develop iExpense self-service benefits amount capping validation against Oracle Benefits;
- Develop HR and Payroll reports using Report 6i;
- Develop expenditure computation against payroll elements;
- Develop OTA(Oracle Training Administration) data conversion routines;
- Environment
- Unix, PL/SQL8, Reports, Forms, Workflow, Discoverer 4i and TOAD on Oracle 8i RDBMS. The methodology used is Oracle AIM Oracle AIM(Application Implementation Methodology),

Asian Development Bank, Manila, Philippines
Analyst/Programmer

Apr 2003-May 2004

- Oracle Human Resources /Oracle Payroll version 11i and OAB
- Responsibilities
 - Handle the customization and maintenance of Educational Assistance Module;
 - Create Adhoc Reports for OAB;
 - Create the ADB Oracle Human Resources/Payroll reports using Report 6i and Oracle Discoverer;
 - Handle Oracle Self-Service maintenance and enhancement;
 - Create forms and reports for the HR/Payroll, Oracle Learning Management and Staff Receivable Module;
 - Create alerts for Hr/Payroll module and Training module;
- Environment
 - Unix, PL/SQL8, Reports6i, Forms6i, Workflow, Discoverer 4i and TOAD on Oracle 8i RDBMS. The methodology used is Oracle AIM (Application Implementation Methodology).

EXXON Mobil, Manila, Philippines
Analyst/Programmer

Nov 2002-April 2003

- Meridium
- Responsibilities
 - Develop backend processing for EXXON existing system using Oracle tools;
 - Involve in data conversion between OMATP and MAFT databases;
 - Create an equipment interface from MERIT database to TABWARE database;

BASF, Manila, Philippines
Analyst/Programmer

Aug 2002- Nov

2 0 0 2

- Avenue and EDW(Enterprise Data Warehouse)
- Responsibilities
 - Create PL/SQL routines and sql scripts for Avenue project;
 - Modify existing transition PI/sql routines for Avenue projects;
 - Act as the lead Oracle resource in the team;
 - Perform Analysis in all objects for EDW reports, this includes creating an ERD;
 - Create the technical and functional specification for the whole build process;
 - Analyze EDW reports that needed to be migrated to SAP reports;
 - Conduct Quality assurance for all delivered Oracle packages and documents;

ORACLE PHILIPPINES, Manila, Philippines
Senior Technical Consultant

Clients under Oracle Philippines

1. *Asian Development Bank* *Nov 2001 - Aug 2002*

- Oracle Human Resources /Oracle Payroll version 11i
- Responsibilities
 - ❑ Involve in HRMS/Payroll implementation;
 - ❑ Develop custom forms, reports and PL/SQL routines;
 - ❑ Create PL/SQL routines to interface Oracle Payroll to AP;
 - ❑ Create PL/SQL routines for Self-Service and Workflow;
 - ❑ Create reports for PMIS interface;
 - ❑ Create the ADB most of complex reports in Oracle Human Resources using Report6i and Oracle Discoverer;
 - ❑ Perform as Discoverer Administrator in development environment;
 - ❑ Create PL/SQL routines for Discoverer reports;
 - ❑ Create the technical specification for the whole build process;
 - ❑ Create and design tables and views for development of reports, forms and alerts;
 - ❑ Create and customize Oracle Alert Distribution form;
 - ❑ Modify the backend processing for mailing list;
 - ❑ Develop database trigger that serve as a filter for insert and update Payroll tables;
 - ❑ Create PL/SQL routines for Organization Hierarchy, this was integrated in Oracle alerts that runs every insert or update in all seeded organization tables;
- Environment
 - ❑ PL/SQL8, Reports6/6i, Forms6i, Workflow, Discoverer 4i and TOAD on Oracle 8i RDBMS. The methodology used is Oracle AIM.

2. *Involve in maintenance and production support for HRMS/Payroll and Financial modules in all major clients of Oracle Philippines.*

Supported Clients:

- Sunlife
- Alaska Philippines
- Lepanto Mining Corporation
- Aboitiz
- Lufthansa Technics Philippines
- Hitachi Computer Products Asia
- China Banking Corporation.

- Oracle Payroll 11.0.3 *July 2000-Oct 2001*
- Responsibilities
 - ❑ Create all Government Internal revenue reports;
 - ❑ Create custom forms and reports for HRMS/Payroll, Financial modules(AP, PO and AR) and Oracle Localized Timekeeping;
 - ❑ Create the technical specification for the whole build process;

- Implement and maintain the localized Oracle Timekeeping;
- Lead the customization of timekeeping reports;
- Conduct training and supervise testing for the Implementation of Oracle Timekeeping;
- Perform Installation and setup for Oracle Timekeeping;
- Create PL/SQL routines for timekeeping to payroll mix batch process;
- Create PL/SQL routines that computes Backpay/Retropay for payroll processing;
- Maintain custom Meal Allowance interface;
- Participate in the tuning of Payroll Process. My role was to convert timekeeping data into summarized form that will improve Payroll performance and its efficiency;
- Maintain Meal Subsidy Module;
- Environment
- Windows NT, Oracle Developer 2000, SQL*PLUS , PL/SQL,SQL Loader, ORACLE 8.x, TOAD

TOSHIBA, Manila, Philippines
Technical Consultant

May 2000 – July 2000

- Oracle Financials and Oracle Manufacturing Project
- Responsibilities
 - Develop Delivery schedule report and the PL/SQL routines needed by the report;
 - Create barcode stickers and barcode tags using Oracle reports;
 - Develop custom forms and reports for (AP,INV,GL);
 - Design and develops custom reports and PL/SQL routines;
- Environment
 - UNIX, Oracle Developer 2000, SQL*PLUS , PL/SQL,SQL Loader, ORACLE 8 x, TOAD

PLDT, Manila, Philippines
2 0 0 0 **October 1999 – May 0**
ORACLE Developer

- Responsibilities
 - Involve in full development and Implementation of the TDAS system;
 - Perform minor DBA jobs for the improvement of system processing;
 - Create control file for uploading raw data to the system using SQL loader;
 - Prepare functional and technical specification;
 - Conduct User acceptance test;
- Environment
 - UNIX, Oracle Developer 2000, SQL*PLUS , PL/SQL,SQL Loader, ORACLE 8 x, TOAD

TESDA, Manila Philippines
ORACLE Developer

April 1999 – October 1999

- Responsibilities
 - Act as the lead Oracle programmer;
 - Responsible for all outgoing programs, check the quality according to clients standard;
 - Perform minor DBA jobs for the improvement of system processing;
 - Prepare Functional and Technical Specification;
 - Conduct User acceptance test;
 - Develop Budget Module and Security Module;
- Environment
 - Windows NT, Oracle Developer 2000, SQL*PLUS , PL/SQL,SQL Loader, ORACLE 7.x, TOAD

Department Of Science And Technology (DOST)
ORACLE Developer

March 1998 – April 1999

- Financial Management Information System(FMIS)
 - FMIS is a government accounting system designed by DBP-DCI for Govt. Agencies based on Commission on Audit (COA) specifications.
- Responsibilities
 - Act as lead programmer;
 - Responsible for all outgoing programs, check the quality according to standard;
 - Perform minor DBA jobs for the improvement of system processing;
 - Conduct User training and system Demos in selected DOST agency;
 - Conduct User acceptance test;
 - Develop Cash Module, Budget Module and Security Module;
 - Perform installation and setup of FMIS in DOST head office;
- Environment
 - SOLARIS, Oracle Developer 2000, SQL*PLUS , PL/SQL,SQL Loader,
 - ORACLE 7.x

National Economic Development Authority(NEDA)
ORACLE Developer

December 1997 – March 1998

- Financial Management Information System (FMIS)
 - FMIS is a government accounting system designed by DBP-DCI for Govt. Agencies, based on Commission on Audit (COA) specifications.
- Responsibilities
 - Involve in the development of Cash Module and Budget Module this includes the form, reports and PL/SQL routines.

- Environment

- Windows NT, Oracle Developer 2000, SQL*PLUS , PL/SQL,SQL Loader,
ORACLE 7.x

DBP Data Center Inc.
ORACLE Developer

July 9, 1997 – December 1997

- PAYROLL System
- In house Payroll System for DBP Data Center Inc

- Responsibilities

- Involve the development of reports and forms for in-house payroll system.

- Environment
- Windows NT, Oracle Developer 2000, SQL*PLUS , PL/SQL,SQL Loader,
ORACLE 7.x

Education:

Polytechnic University of the Philippines
Bachelor of Computer and Data Processing Management 1993-1997

Professional Awards:

Award of Excellence – Jul 2002, given by Direk Williams – Executive Vice-President of Oracle Asia Pacific

SPECIALIZED TRAINING:

J-Developer and OAF(Internal Training) J2EE, Introduction to CMMI Stage Representation , Project Management, Risk Management, Oracle Developer 2000,SQL*plus, PL/SQL, Java, Java Script, HTML and Program Logic, Formulation, Foxpro for Windows. Oracle Discoverer 4i Admin/Desktop Edition

OPERATING SYSTEM:

Windows 3.x/95/98/2000/NT/XP, UNIX (IBM AIX 4.1),SOLARIS

DATABASES:

ORACLE 7.X/8.X/8i,9.x/10g

LANGUAGES

J-Developer, Oracle Report, Forms, SQL*PLUS , PL/SQL,SQL Loader HTML, JAVA/JAVA Script, Oracle Discoverer 4i Admin/Desktop Edition, Foxpro for Windows/DOS ,BORLAND C/C++, Pascal

SOFTWARE:

MS Offices, TOAD , SQL Navigator, SQL Developer

HARDWARE:

Dell, Microcomputer Environment (IBM PC Compatibles, Pentium Series), COMPAQ and SUNS, HP machines

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Issued this 28th day of April 2025.

Signed:



KENJIRO CORNELIUS LAMBERT M. YOSHIY
FREELANCE GAME DESIGNER
IRIDESCENT RENDER



KENJIRO CORNELIUS LAMBERT M. YOSHIY

Game Programmer

ABOUT ME

I am a passionate, highly motivated, organized, and detail-oriented game developer. I explore, dissect, learn from, and implement different game systems. I am flexible in working with different people and can take leadership roles. Collaboration, innovation, and integration are my motto for becoming an effective game developer.

WORK EXPERIENCE

January 2023 - Present

Freelance Game Programmer

Iridescent Render

- Developed core features on multiple projects using Unity
- Integrated in-house assets on various projects using Unity
- Developed a Virtual Reality game using Unity and XR Toolkit

April 2024 - September 2024

Game Developer Intern

HPL Gamedesign Corporation

- Helped developed a casual mobile game using Unity
- Helped developed a mobile strategy game using Unity
- Implemented frameworks for data management to improve scene-to-scene data flow
- Designed a game for a mobile simulation game

RESEARCH WORK

October 2024

Our college capstone project, **Gamification of Fast Food**

Service Crew, was nominated for the 2024 CIIT Inabel Awards for Best Interactive Media Project, Best Use of Emerging Technologies, and Outstanding Competitive Achievement.

ACHIEVEMENTS

July 2024

- Our game "**Fast Food Service Crew VR**" was presented in the Indie Game Stars at the 2024 Philippine GameDev Expo.

October 2023 - January 2024

- Our game "**Unfaltering**" (*formerly Hubris*) advanced in the semi-finals for Game Jam + 2023/2024.

January 2023 - August 2023

- Our game "**Neurons**" got featured in ConQuest 2023 and at the Genshin Impact University Roadshow at CIIT.

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Issued this 28th day of April 2025.

Signed:



MARC JASPER SABADO
FREELANCE GAME DEVELOPER



MARC JASPER SABADO

GAME DEVELOPER

- 0918-318-4087
- sabadomarcjasper@gmail.com
- 123, K-3d, Kamuning, QC
- <https://c.ram.itch.io/>

SKILLS

- Unity 2D/3D/VR
- Unreal Engine
- C#/C++ Programming
- Source Control
- Level Designing
- Figma UI/UX
- 3D Modelling
- Design Thinking
- Team-Player
- Problem-Solving

EDUCATION

HIGHSCHOOL

Muir Woods
2014-2019

BS ENTERTAINMENT AND MULTIMEDIA COMPUTING

CIIT College of Arts and Technology
2020 - 2024

PROFILE

I am a Game Developer with at least two years of experience conceptualizing and executing video games. Strong collaborator and highly adaptable. A great team player with excellent time management and an eye for detail.

ACHIEVEMENT/EXPERIENCE

GAME DEVELOPER INTERN

Finished HPL Game Development Internship
April 2024 - September 2024

GAMIFICATION OF FAST FOOD SEVICE CREW

Presented in PGDX 2024 and in CIIT E-sports Summit,
Capstone 1 and 2 Best Thesis, CIIT Inabel Award Winner
July 2024

NEURONS

ConQuest 2023 and CIIT Genshin Impact University Roadshow
January 2023 - August 2023

UNFALTERING(FORMERLY HUBRIS)

Semi-Finalist for Game Jam + 2023/2024
October 2023 - January 2024

WORKSHOPS

CIIT Rise Up: Production Management (Nov. 2020)

CIIT Rise Up: Game Dev and Source Control (Nov. 2020)

CIIT Syntax - Build Better Code Sessions (March 2021)

CIIT Festival of Learning, Project Management (Sept. 2022)

PORTFOLIO: [HTTPS://IRIDESCENTRENDER.COM/](https://iridescentrender.com/)

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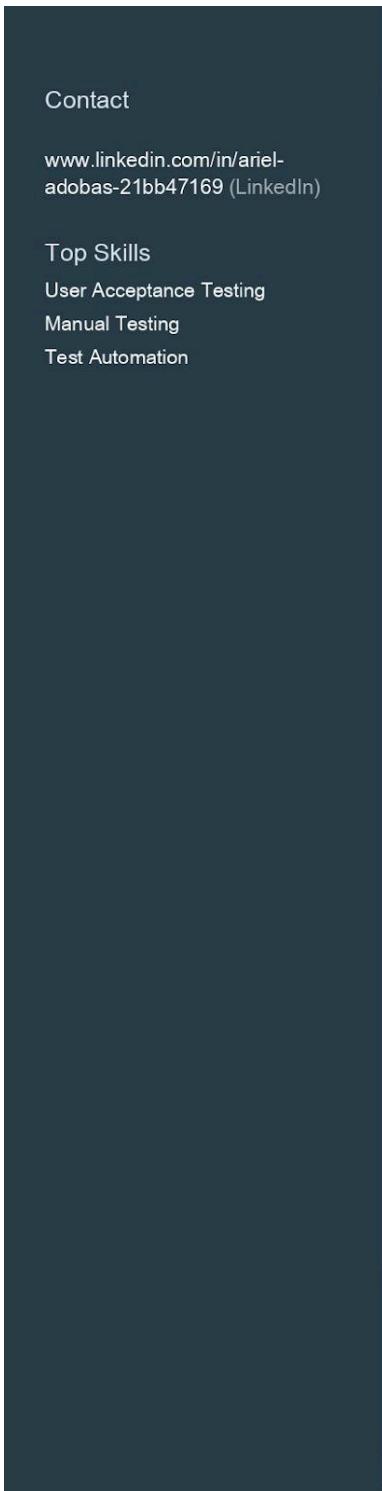
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Issued this 28th day of April 2025.

Signed:

ARIEL B. ADOBAS

ARIEL B. ADOBAS
SOFTWARE QUALITY ASSURANCE TESTER
iRELY LLC



Contact

www.linkedin.com/in/ariel-adobas-21bb47169 (LinkedIn)

Top Skills

User Acceptance Testing
Manual Testing
Test Automation

Ariel Adobas

Software Quality Assurance Specialist at iRely LLC
Metro Manila, National Capital Region, Philippines

Summary

Experienced Quality Assurance Specialist with a demonstrated history of working in the information technology and services industry. Skilled in Web Testing, Manual Testing, Test Automation, Quality Assurance, and User Acceptance Testing. Strong quality assurance professional with a Bachelor's degree in Science of Information Technology and Service Management focused in Information Technology from University of Makati.

Experience

iRely LLC
Software Quality Assurance Tester
March 2021 - Present (4 years 3 months)

Red Core Solutions
3 years 4 months
Software Quality Assurance Tester
March 2018 - February 2021 (3 years)

Intern Software Quality Assurance Tester
November 2017 - February 2018 (4 months)

Education

University of Makati
Bachelor's degree in Science of Information Technology and Service Management , Information Technology · (2014 - 2018)

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Issued this 6th day of May 2025.

Signed:



NOVEM JAN YDZEL SAYMAN
BACKEND DEVELOPER
LABRADOR: INFORMATION TRANSPARENCY

CITY OF MAKATI
novemjanyzdel@gmail.com-09064328442

Novem Jan Ydzel Sayman,

Backend Developer

A back-end developer who uses the Spring Boot framework and has an experience in implementing deep learning algorithms and is an enthusiast of dynamic programming, and system architectures.

Employment History Backend Developer (Java) at Labrador :
Information Transparency, Pasig City
September , 2024

- Used Java frameworks like Spring and Hibernate to build a strong, fast application.
- Improved the speed of our web services by using optimization methods.
- Upgraded the framework and simplified complex methods to make them easier to read and maintain.

Education Bachelor of Science in Computer Science, City of Makati
2020 - 2024

- Graduated with Honors

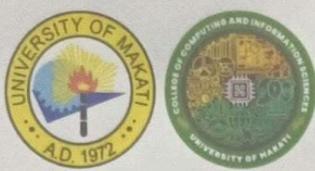
Links <https://www.linkedin.com/in/novem-sayman/>

Skills Java, Spring Boot, PostgreSQL, & Git

APPENDIX F

GRAMMARIAN ACCEPTANCE AND CERTIFICATE

	UNIVERSITY OF MAKATI J.P. Rizal Extension, West Rembo, Makati City COLLEGE OF COMPUTING AND INFORMATION SCIENCES LANGUAGE EDITOR ACCEPTANCE FORM																	
<p>This formally signifies my acceptance of the request to serve as the adviser of:</p>																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Class</td> <td style="width: 80%;">IV-BCSAD</td> </tr> <tr> <td>Group Name</td> <td>FLOOR GANG</td> </tr> <tr> <td>Program</td> <td>Bachelor of Science in Computer Science Major in Application Development</td> </tr> </table>			Class	IV-BCSAD	Group Name	FLOOR GANG	Program	Bachelor of Science in Computer Science Major in Application Development										
Class	IV-BCSAD																	
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<p>Proponents:</p>																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Names (Surname First)</th> <th style="width: 20%;">Student Number</th> <th style="width: 20%;">Contact Number</th> <th style="width: 30%;">Signature</th> </tr> </thead> <tbody> <tr> <td>Famisaran, Carlos Ivan</td> <td>K11936222</td> <td>09666974510</td> <td></td> </tr> <tr> <td>Periña, James Clark</td> <td>A12137283</td> <td>09551251784</td> <td></td> </tr> <tr> <td>Salonga, Edward</td> <td>K11941622</td> <td>09761507363</td> <td></td> </tr> </tbody> </table>			Names (Surname First)	Student Number	Contact Number	Signature	Famisaran, Carlos Ivan	K11936222	09666974510		Periña, James Clark	A12137283	09551251784		Salonga, Edward	K11941622	09761507363	
Names (Surname First)	Student Number	Contact Number	Signature															
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Periña, James Clark	A12137283	09551251784																
Salonga, Edward	K11941622	09761507363																
<p>For the Research Project entitled:</p> <p style="text-align: center;">"RECINSCAN: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS OF KAPAMPANGAN DISHES UTILIZING YOLOV9 ALGORITHM"</p>																		
<p>As the Language Editor, I hereby agree to guide and monitor the development of my students' research paper until their successful defense, after which I will be responsible for the final grammar and language checks.</p>																		
<p>CONFORME:</p>																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Adviser</td> <td style="width: 25%;">Anne France I. Dellova, LPT, MAEd</td> <td style="width: 25%;">Adviser's Signature</td> <td style="width: 25%;"></td> </tr> <tr> <td>Contact No.</td> <td>09772383092</td> <td>Email Address</td> <td>annefrance.dellova@uma.k.edu.ph</td> </tr> </table>			Adviser	Anne France I. Dellova, LPT, MAEd	Adviser's Signature		Contact No.	09772383092	Email Address	annefrance.dellova@uma.k.edu.ph								
Adviser	Anne France I. Dellova, LPT, MAEd	Adviser's Signature																
Contact No.	09772383092	Email Address	annefrance.dellova@uma.k.edu.ph															
<p>NOTED BY:</p>																		
ASST. PROF MARY ELLAINE R. CERVANTES <i>Course Adviser</i>		ASST. PROF. ALI A. NAIM <i>Chair, IS and ITE Allied Programs</i>																



UNIVERSITY OF MAKATI
J.P. Rizal Extension, West Rembo Makati City

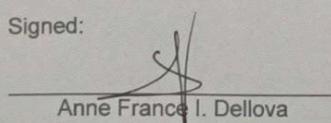
College of Computing and Information Sciences

GRAMMARIAN CERTIFICATION

This is to certify that the undersigned has carefully reviewed and proofread the Thesis titled "**RECINSCAN: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS OF KAPAMPANGAN DISHES UTILIZING YOLOV9 ALGORITHM**" created by James Clark A. Periña, Edward M. Salonga and Carlos Ivan M. Famisaran to ensure that it adheres to the set of structural rules that control how sentences, phrases, and words are put together in the English language. Also, all corrections and recommendations made have been done and/or incorporated in the final manuscript.

Issued this 6th day of May 2025.

Signed:



Anne France I. Dellova

Grammarien / English Editor

APPENDIX G

TURNITIN CERTIFICATE



UNIVERSITY OF MAKATI
J.P. Rizal Extension, West Rembo, Makati City

Center for University Research

CERTIFICATE OF ORIGINALITY CHECK WITH TURNITIN

This is to certify that the undergraduate thesis of **James Clark A. Períña, Edward M. Salonga & Carlos Ivan M. Famisaran** from the College of Computing and Information Sciences entitled "**RECINSCAN: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS OF KAPAMPANGAN DISHES UTILIZING YOLOV9 ALGORITHM**" was subjected to an originality check using Turnitin, yielding a **5%** similarity index.



Issued this 23rd day of May, 2025.

Prepared by:


JAYSON R. VILLAFLOR, MBA
General Research Services Officer

Noted by:


FLORANTE E. DELOS SANTOS, RGC
CUR Director

UGT-179-2425-03

APPENDIX H
USER MANUAL



MARCH 2024
VERSION 2.1

RecInScan

MANUAL

Getting Started with RecInScan

The information and features provided by RecInScan are intended for general informational purposes only and are designed to enhance your cooking experience. While the application strives for accuracy in detecting ingredients and providing recipe recommendations, it is not guaranteed to be error-free.



Carlos Ivan Famisaran

James Clark Periña

Edward Salonga

Authors

About this Manual

- This user manual provides an overview of RecInScan's features and functions to help users maximize its capabilities.
- Please read this manual before using the application to ensure proper usage and a seamless experience. The content may vary depending on the version of RecInScan, operating system, or device specifications.
- Descriptions in this manual are based on the default settings of Windows 11. Some features and services may differ depending on your system configuration.
- Images and screenshots included are for reference purposes and may not exactly match the final product. Features, functionality, and design are subject to change without prior notice.

Overview

OVERVIEW OF THE APPLICATION

Welcome, at magandang pagdating! **RecInScan** is a web application designed to scan for ingredients, and provides kapampangan recipe recommendations based on the input. Utilizing the YOLOv9 Object Detection Algorithm, it offers healthy and delicious kapampangan meals that is catered to home cooks and chefs alike. You may also use RecInScan on your phone in a web browser, so you can use it at your convenience!

Key Features

The **RecInScan** application is catered to home cooks and chefs, to give them healthy kapampangan dishes to be cooked with available ingredients. The application is also designed so these available ingredients are not put to waste.

KEY FEATURES

- YOLOv9 Algorithm - Uses YOLOv9 Algorithm to detect ingredients.
- Scanning of Ingredients - Scans for ingredients using the camera.
- Ingredient detection - Detects ingredients based on your image.
- Recipe Recommendations - Recommends recipes to users based on their ingredients.
- User-friendly Interface - The application is designed to have a user-friendly interface for clarity.

System Requirements

RecInScan requires the following system requirements:

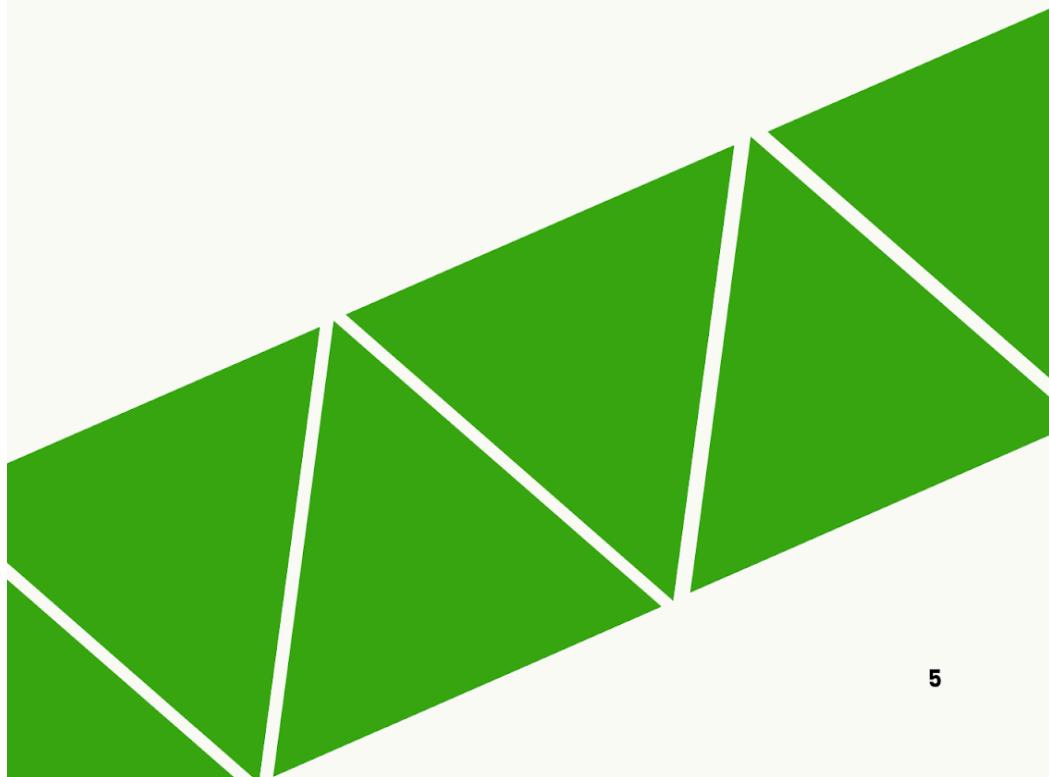
- At least 1920 x 1080 minimum screen resolution (for scanning)
- At least 1 GHz Dual-core processor
- 2 GB RAM
- 8GB internal storage
- Camera: At least 1080p resolution or Higher

Intended Users

RecInScan is designed to cater to a diverse range of users who are passionate about cooking and discovering new kapampangan recipes, such as:

Home cooks, who may want to use available ingredients in their household to cook and minimize waste of food

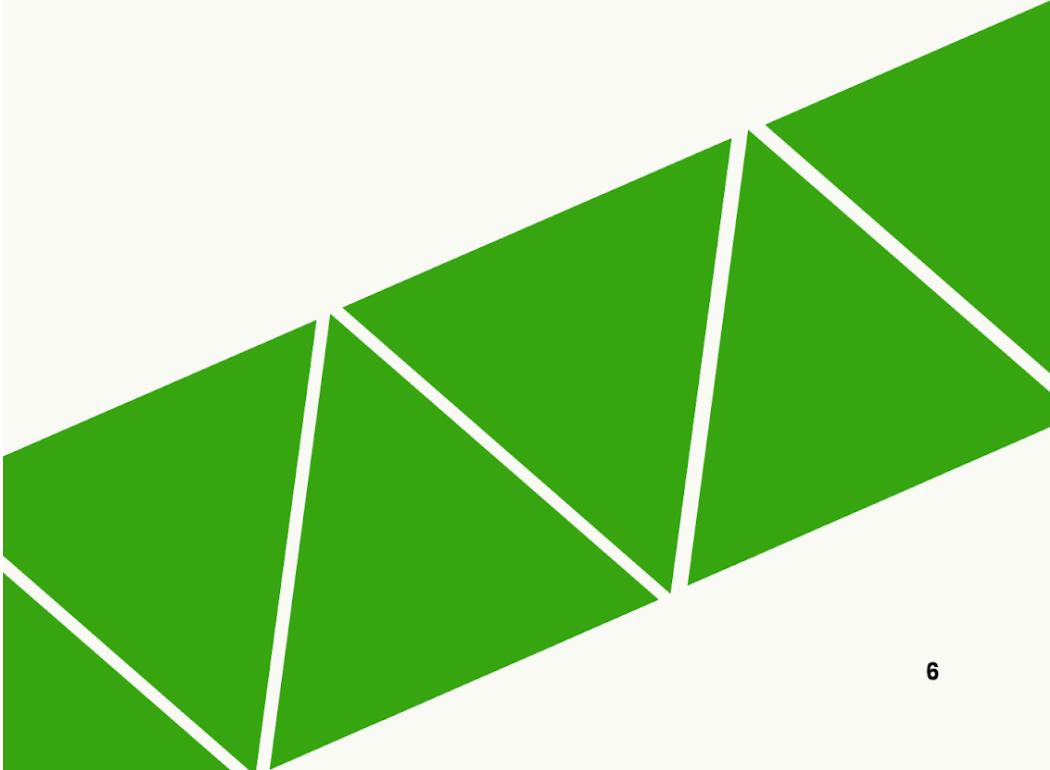
Chefs, who may want to discover kapampangan dishes to add to their culinary expertise.



Getting Started

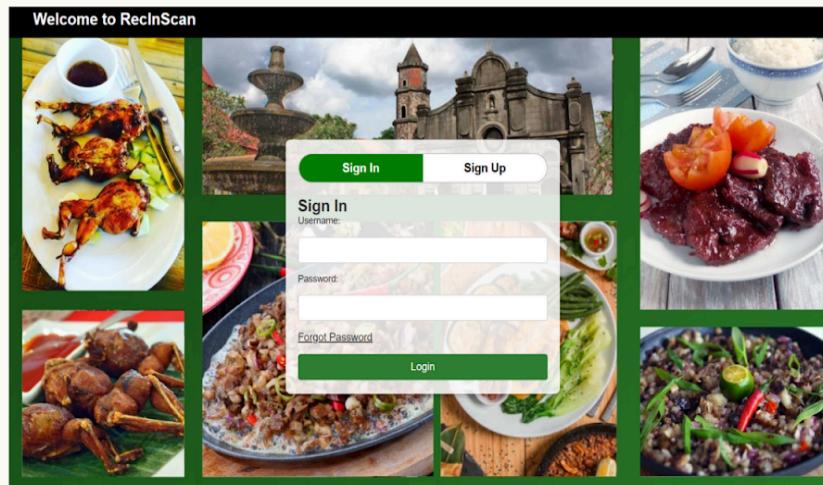
To access RecInScan, please go into the link below:

<https://recinscan.site>



Features (PC, MOBILE)

SIGN IN AND SIGN UP PAGE



Welcome to RecInScan! The first page you will encounter when you open the page is the Log In and Sign up page, where you can log in an account or sign up.

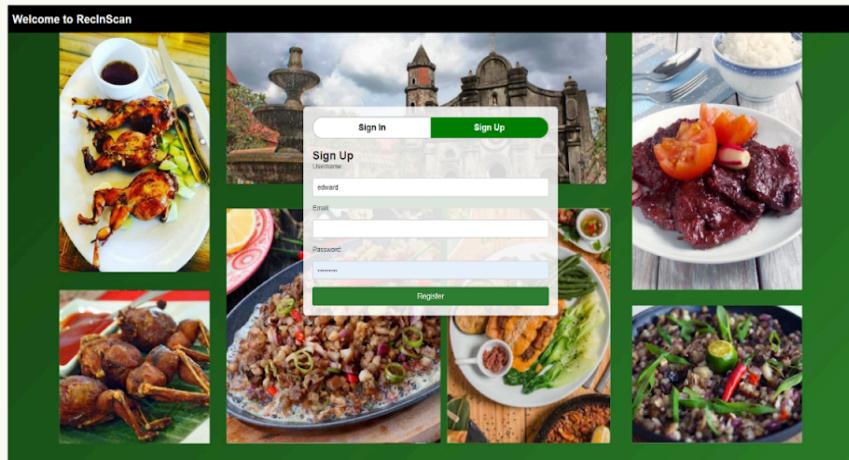
The default tab you will land on is on the “Sign in” page, where you can log in using your credentials.

When you click on the “Sign up” button, you are directed to the Sign Up tab, where you can create an account to use for the application.

You are required to create an account so the system will remember your preferences.

Features

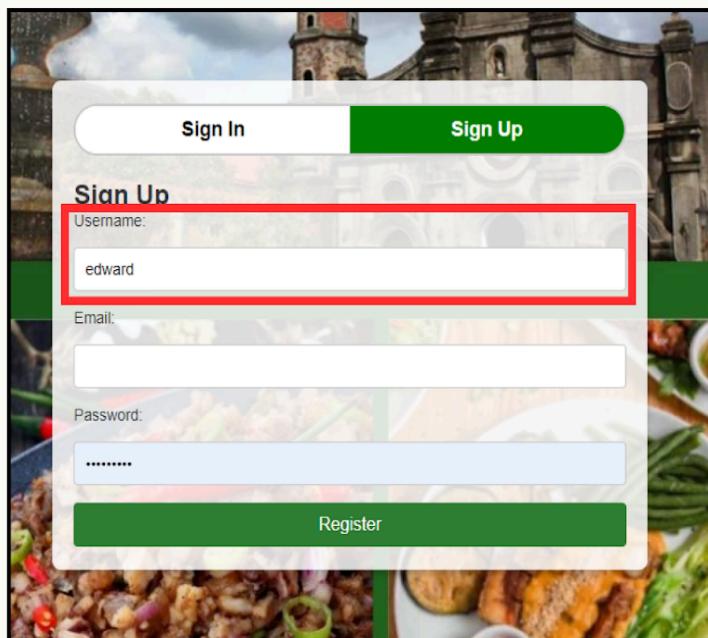
SIGN IN AND SIGN UP PAGE



When you click on the “Sign up” button, you are directed to the Sign Up page, where you can create an account to use for the application. You are required to create an account so the system will remember your preferences.

Features (PC, MOBILE)

SIGN IN AND SIGN UP PAGE

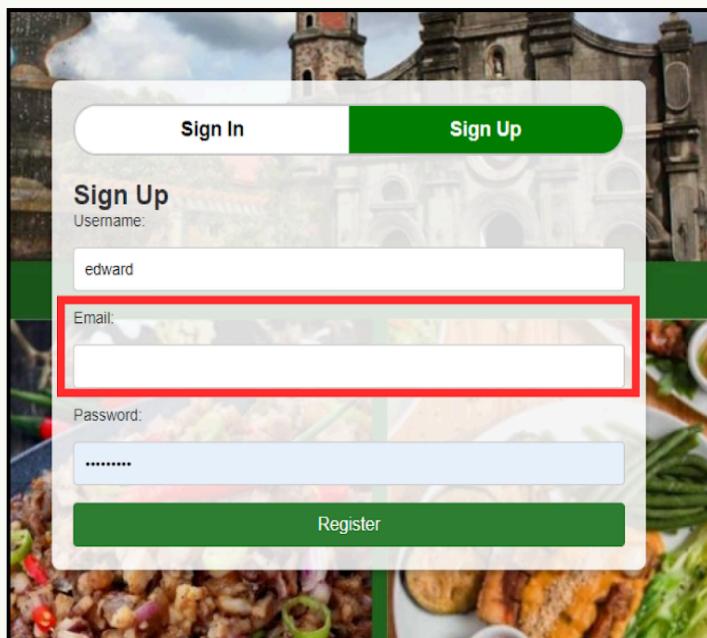


Steps in creating an account:

Step 1: Type your username.

Features (PC, MOBILE)

SIGN IN AND SIGN UP PAGE

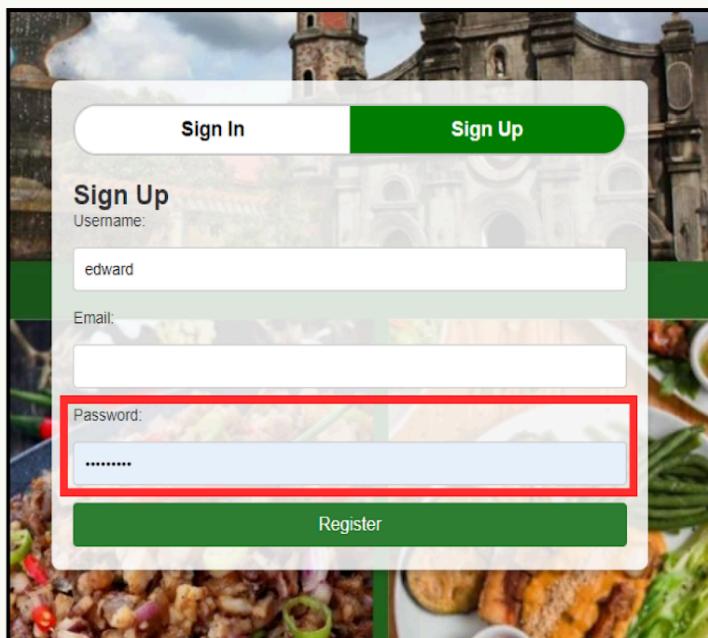


Steps in creating an account:

Step 2: Type in your E-mail address.

Features (PC, MOBILE)

SIGN IN AND SIGN UP PAGE

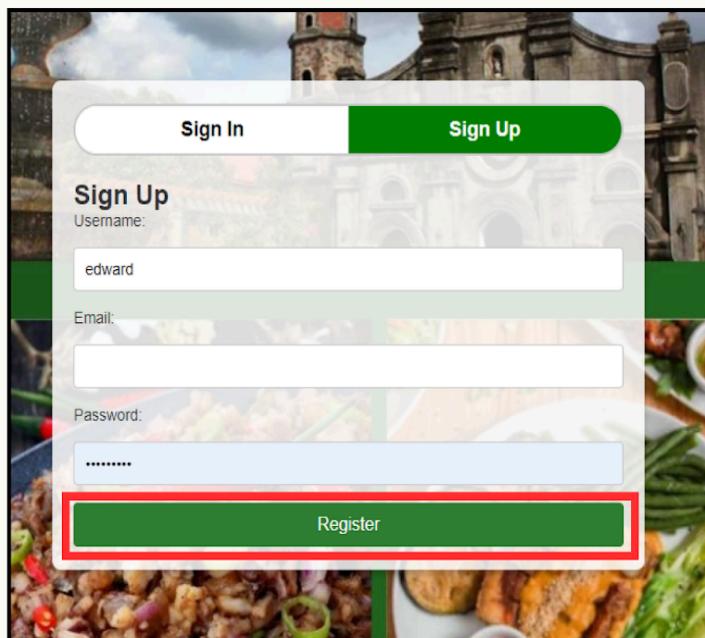


Steps in creating an account:

Step 3: Type in your E-mail address.

Features (PC, MOBILE)

SIGN IN AND SIGN UP PAGE

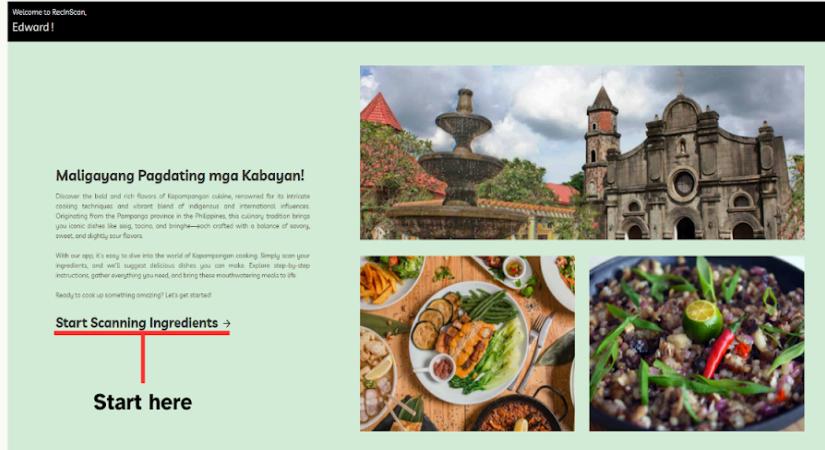


Steps in creating an account:

Step 4: Click on the “Register” Button.

Features (PC)

INDEX PAGE (PC)

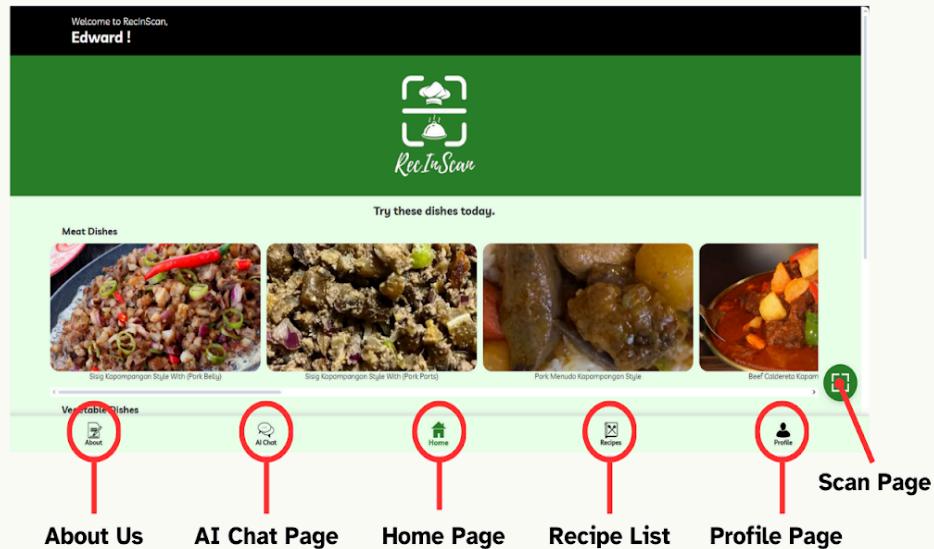


After successfully logging in, you will be greeted by the index page, showing the ins and outs of the application. The index page is designed so that users cater to their hunger and prepare themselves for cooking recipes.

To access the main features of the application, click on the “Start Scanning Ingredients link.

Features (PC)

HOME PAGE (PC)

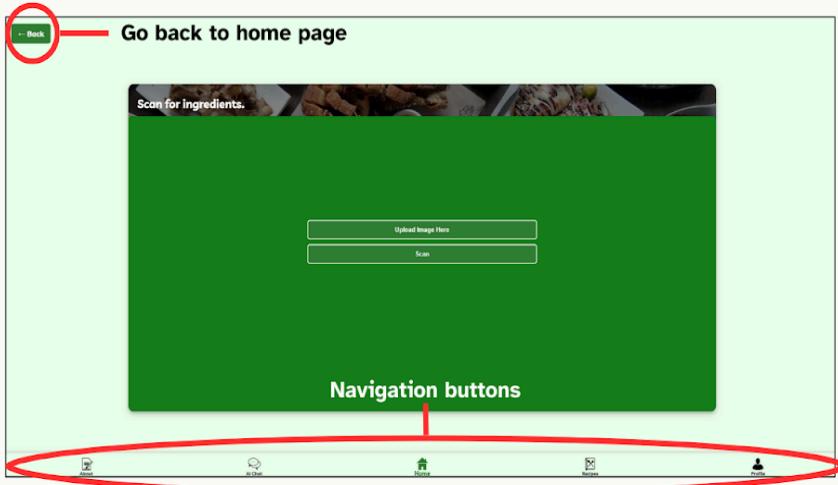


After clicking on the “Start Scanning Ingredients” button, you can now access the main home page of the application. From here, you can look for different kinds of recipes, and the page will recommend you dishes that you could try for that day. To access other pages, you may click on the links at the bottom of the page, which will redirect you to other parts of the system.

From here, you can also access the scanning page, which is the scan button located at the bottom right of the screen.

Features (PC)

INGREDIENT SCANNER (PC)



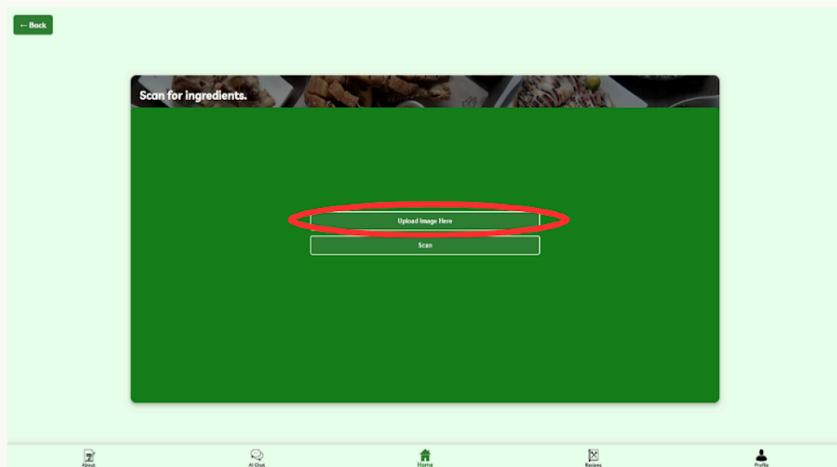
When you click on the scan button on the bottom right, you are given access to the scanner page. You may go back to the home page by clicking on the “Back” button.

Error messages appear depending on if the application detects an error:

- No ingredients detected
- No file selected
- Invalid image type

Features (PC)

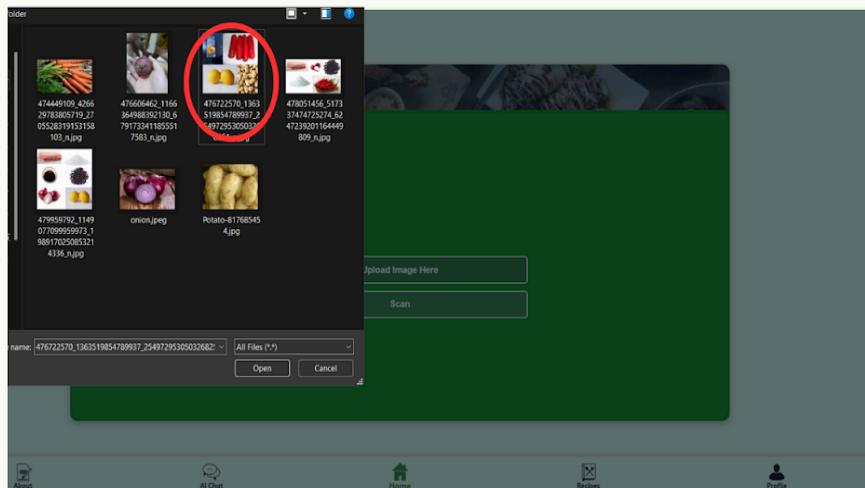
STEPS IN SCANNING AN INGREDIENT FOR DETECTION



Step 1: Click on “Upload Image Here”.

Features (PC)

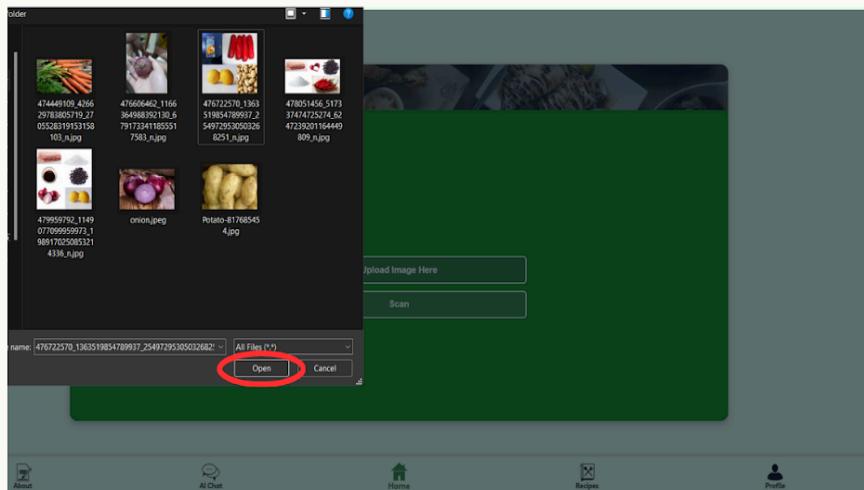
STEPS IN SCANNING AN INGREDIENT FOR DETECTION



Step 2: Your file picker should appear. Select the ingredient image that you want to scan.

Features (PC)

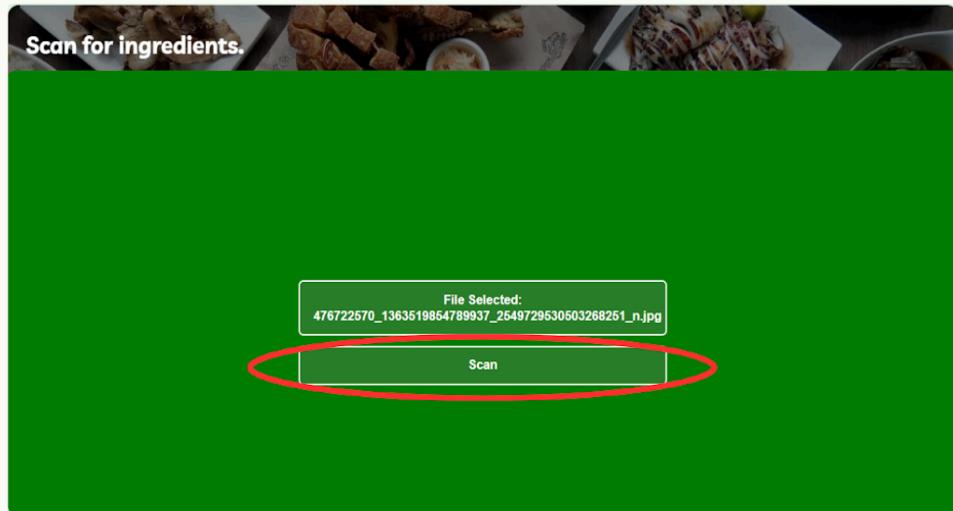
STEPS IN SCANNING AN INGREDIENT FOR DETECTION



Step 3: Click on “Open”.

Features (PC)

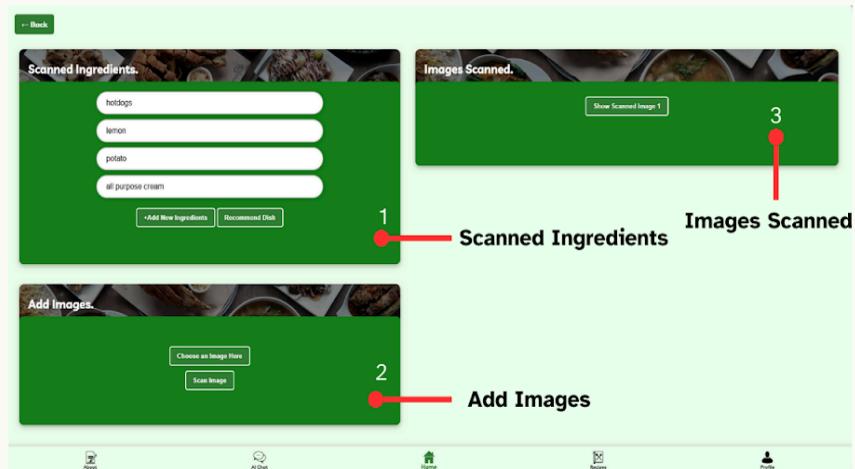
STEPS IN SCANNING AN INGREDIENT FOR DETECTION



Step 4: The image will be appended to the site. Click on “Scan” to continue. The image will then be processed by the model.

Features (PC)

DETECTED INGREDIENTS PAGE (PC)

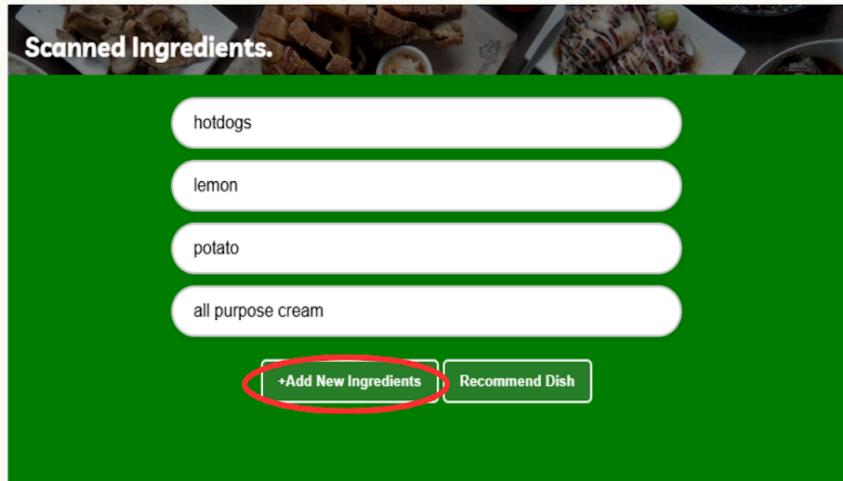


This page will appear after you have selected and scanned an image containing ingredients for the application. You have three main items in this page:

1. **Scanned Ingredients**
2. **Add Images**
3. **Images Scanned**

Features (PC)

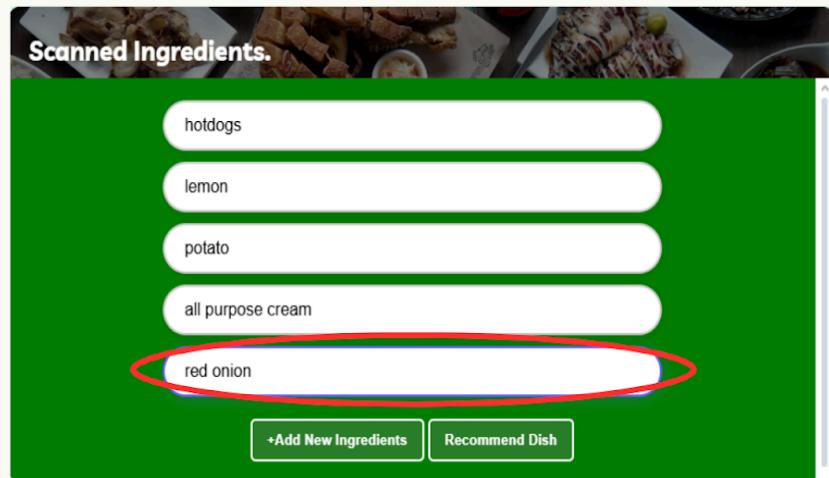
STEPS TO MANUALLY ADD INGREDIENTS



Step 1: In the Scanned Ingredients card, Click on
“+Add New Ingredients”

Features (PC)

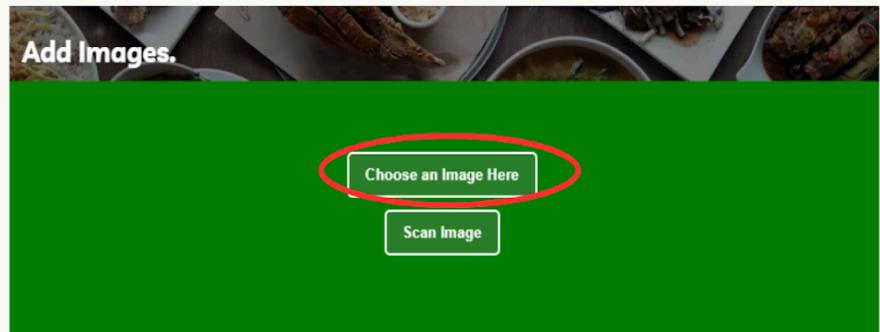
STEPS TO MANUALLY ADD INGREDIENTS



Step 2: Type the name of the ingredient you want to add.

Features (PC)

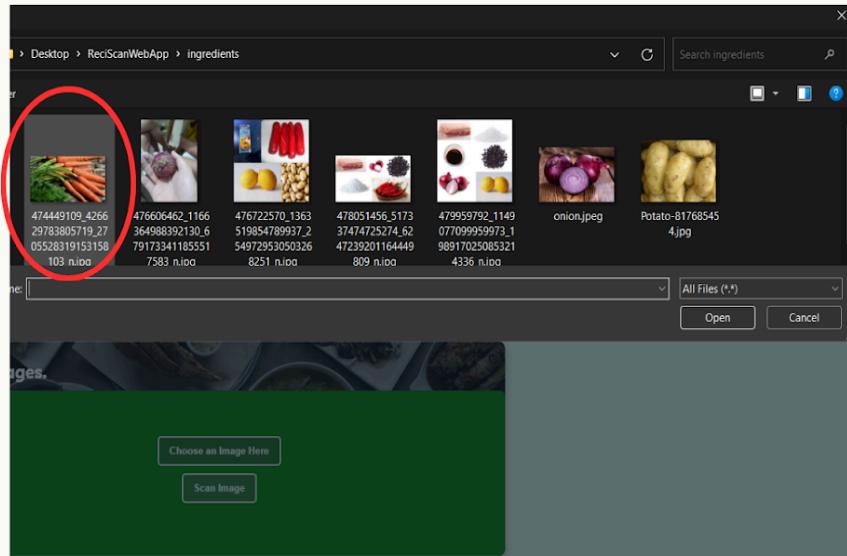
STEPS TO ADD ANOTHER IMAGE FOR DETECTION:



Step 1: In the Add Images card, click on “Choose an Image Here”

Features (PC)

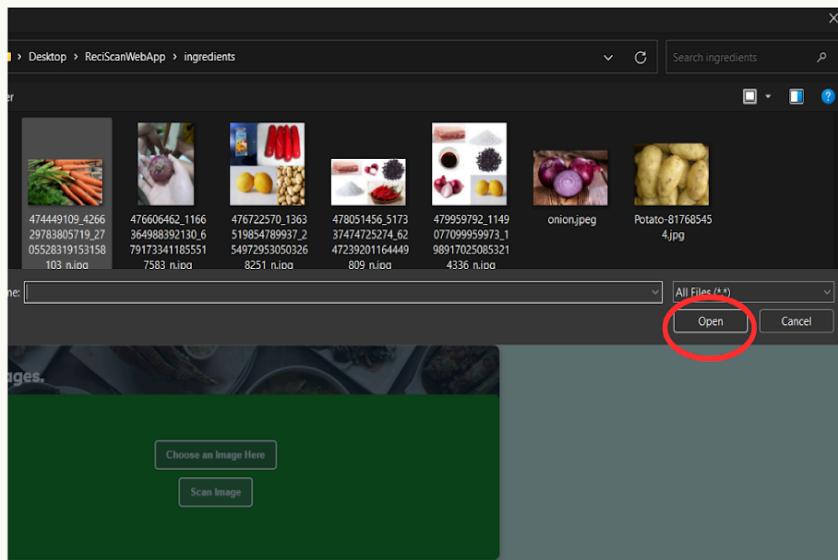
STEPS TO ADD ANOTHER IMAGE FOR DETECTION:



Step 2: Your file picker should appear. Select the ingredient image that you want to scan.

Features (PC)

STEPS TO ADD ANOTHER IMAGE FOR DETECTION:



Step 3: Click Open.

Features (PC)

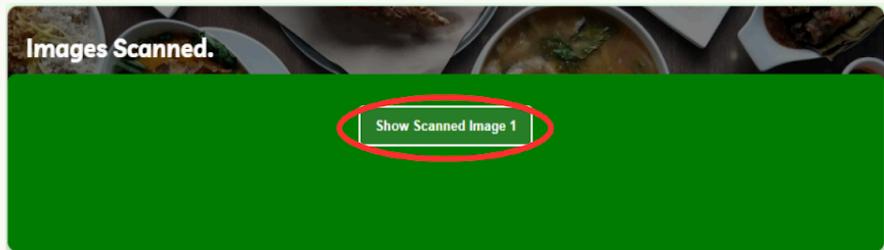
STEPS TO ADD ANOTHER IMAGE FOR DETECTION:



Step 4: Click on Scan Image. The image will be appended and scanned by the model.

Features (PC)

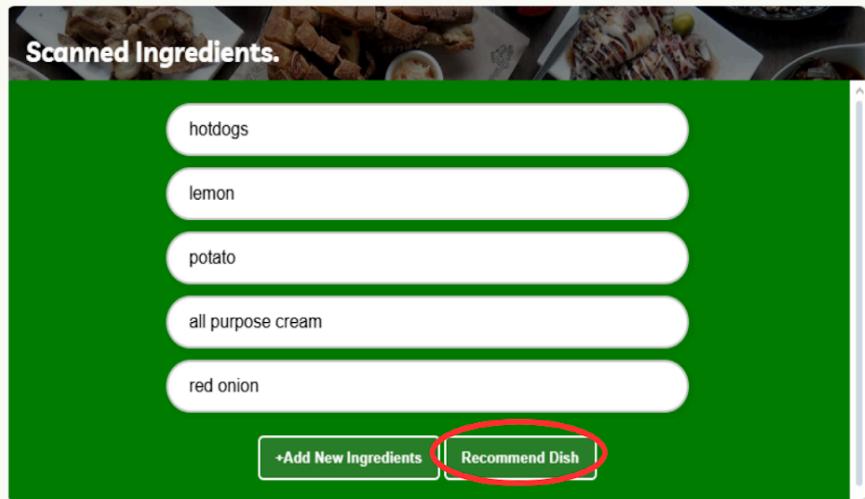
STEPS TO CHECK THE SCANNED IMAGE



Step 1: In the “Images Scanned” card, click on Show scanned image. The image you have scanned should appear.

Features (PC)

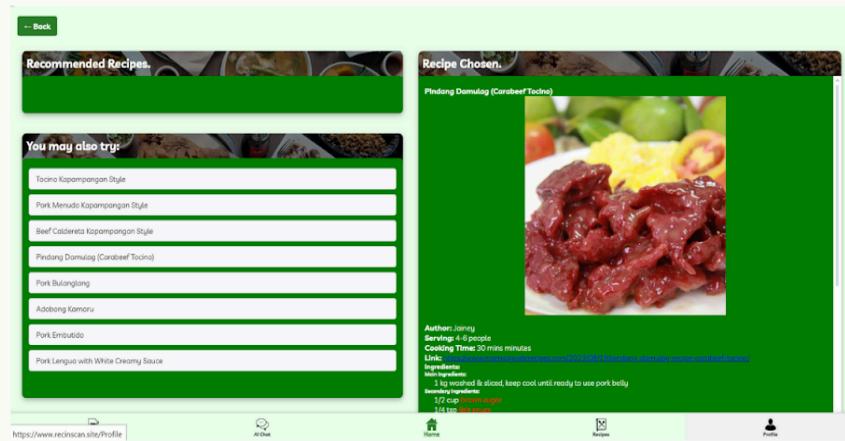
STEPS TO RECOMMEND DISH



Step 1: In the Scanned Ingredients card, click on "Recommend Dish". The recommendation system will recommend you dishes that are suited to your ingredients.

Features (PC)

RECOMMENDATION PAGE (PC)



In the recommendation page, you will be shown various dishes based on the ingredients detected in the detect page. The best dish recommended to you will be shown at the topmost.

The recipe page on the right will show you various information about the recipe, including:

Features (PC)

RECOMMENDATION PAGE (PC)

Recipe Chosen:



1 → **Author:** JaneY
 2 → **Serving:** 4-6 people
 3 → **Cooking Time:** 30 mins minutes
 4 → **Link:** <https://www.momsguidedrecipes.com/2023/08/19/pindong-damulog-recipe-carabao-beef-tacno/>
Ingredients:
 Main Ingredients:
 1 kg washed & sliced, keep cool until ready to use pork belly
 Secondary Ingredients:
 1/2 cup brown sugar
 1/4 tsp fish sauce
 3 Tbsp garlic
 1/2 cup glutinous rice
 2 tbsp Tusino curing powder
 Common Ingredients:
 1/2 tsp black pepper
 1 tsp salt
Procedure:
 Step 1: You should clean and dry all of your bowls and utensils. You might want to wear gloves.
 Step 2: Combine the curing powder, glutinous rice flour, pepper, salt, sugar, and garlic in a bowl.
 Step 3: Add the carabao meat and massage all the ingredients to the meat for 5 minutes, or until everything is well combined.
 Step 4: For three days, leave the plastic at room temperature. The interior will begin to bubble, as you can see. You should smell vinegar and not decaying foul odor. By the third day, a lot of air will start to build up inside the plastic bag.
 Step 5: Note: The fermented carabao meat should not turn green and the bag of meat should smell fermented and not like vinegar.
 How to Cook Step 1: In a pan, boil a little bit of water, and add the carabao.
 Step 2: Just add about 1/4 cup water or depending on the amount of meat. Avoid putting in too much water so it does not dilute the flavor.
 Step 3: Bring it to a boil and let it cook until all the water gets dry or evaporates for about 5 minutes.
 Step 4: Once the pan is dry, add some oil and continue to fry the meat until it caramelized or cooked through.
 Step 5: Serve it with fried rice, egg, sliced cucumber, tomatoes, and spiced vinegar dipping. Serve and enjoy!
[Try This Dish](#)

1. **Author** - This is the author of the recipe.
2. **Serving** - This will show the amount of servings the recipe provides.
3. **Cooking Time** - This is an approximation of the time it will take to cook the recipe.
4. **Link** - The original source will be shown in this link, crediting the original.
5. **Ingredients** - This will show the list of ingredients that the recipe requires, and is filtered based on the ingredients you have and the ingredients you do not have. It will flash green if you have it, while red if you do not have it.
6. **Procedure** - This will show how to cook the recipe in a step-by-step format. **30**

Features (PC)

RECOMMENDATION PAGE (PC)

Recipe Chosen.



Author: Jaineu
Serving: 4-6 people
Cooking Time: 30 mins minutes
Link: <https://www.momosguiderecipes.com/2021/08/19/nindang-q-nimulap-recipe-carabao-beef-tacino/>

Ingredients:

Main Ingredients:
 1 kg washed & sliced, keep cool until ready to use pork belly

Secondary Ingredients:
 1/2 cup brown sugar
 1/4 tsp fish sauce
 3 Tbsp garlic
 1/2 cup glutinous rice
 2 tbsp Tusino curing powder

Common Ingredients:
 1/2 tsp black pepper
 1 tsp salt

Procedure:

Step 1: You should clean and dry all of your bowls and utensils. You might want to wear gloves.
 Step 2: Combine the curing powder, glutinous rice flour, pepper, salt, sugar, and garlic in a bowl.
 Step 3: Add the carabao meat and massage all the ingredients to the meat for 5 minutes, or until everything is well combined.
 Step 4: For three days, leave the plastic at room temperature. The interior will begin to bubble, as you can see. You should smell Vinegar and not decaying foul odor. By the third day, a lot of air will start to build up inside the plastic bag.
 Step 5: Note: The fermented carabao meat should not turn green and the bag of meat should smell fermented and not rotten.
 How to Cook: Step 1: In a pan, boil a little bit of water, and add the carabao.
 Step 2: Just add about 1/4 cup water or depending on the amount of meat. Avoid putting in too much water so it doesn't lose its flavor.
 Step 3: Bring it to a boil and let it cook until all the water gets dry or evaporates for about 5 minutes.
 Step 4: Once the pan is dry, add some oil and continue to fry the meat until it caramelized or cooked through.
 Step 5: Serve it with fried rice, egg, sliced cucumber, tomatoes, and spiced vinegar dippings. Serve and enjoy!

Try This Dish

When you have finally selected and decided on a dish, you may click on “**Try this dish**” on the bottom of the card to set it on your profile history.

Features (PC)

PROFILE PAGE (PC)

The screenshot displays the Profile Page interface. At the top, there's a green header bar with the title "Profile" and a sub-instruction: "Learn about your dish history and set your preferences here." Below the header, a user profile section shows a placeholder icon and the name "Edward". A "Log Out" button is located in the top right corner.

The main content area is divided into two main sections:

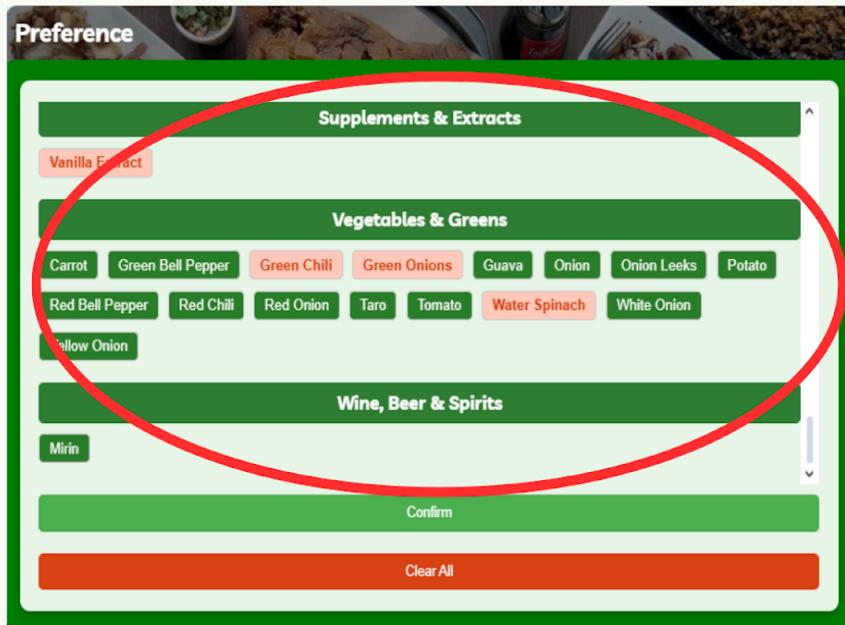
- Preference:** This section contains a grid of items categorized under "Baking", "Beverages", "Canned Food", and "Cheeses". Each category has several items listed, such as "All Purpose Flour", "Baking Powder", "Bread Crumbs", "Cake Flour", "Cornstarch", "Flour", "Rice Flour", "Vanilla", "Vanilla Extract", "Calamansi Juice", "Lemon Juice", "Pineapple Juice", "Water", "Corn Kernel", "Tomato Paste", "Tomato Sauce", etc.
- Dish History:** This section lists four dishes with their preparation dates and ingredients:
 - Sisig Kapampangan Style With (Pork Belly)** (2025-02-24) - Ingredients: pork belly, calamansi, lemon, salt, soy sauce
 - Tocino Kapampangan Style** (2025-02-18) - Ingredients: pork belly, black pepper, salt
 - Pork Menudo Kapampangan Style** (2025-02-16) - Ingredients: pork belly, black pepper, salt
 - Sisig Kapampangan Style With (Pork Belly)**

At the bottom of the page, there are navigation links: "About", "AI Chat", "Home", "Recipe", and "Profile".

In the Profile Page, you may set your preferences, in the case that you have allergic reactions to the dishes, log out of the system or view your dish history.

Features (PC)

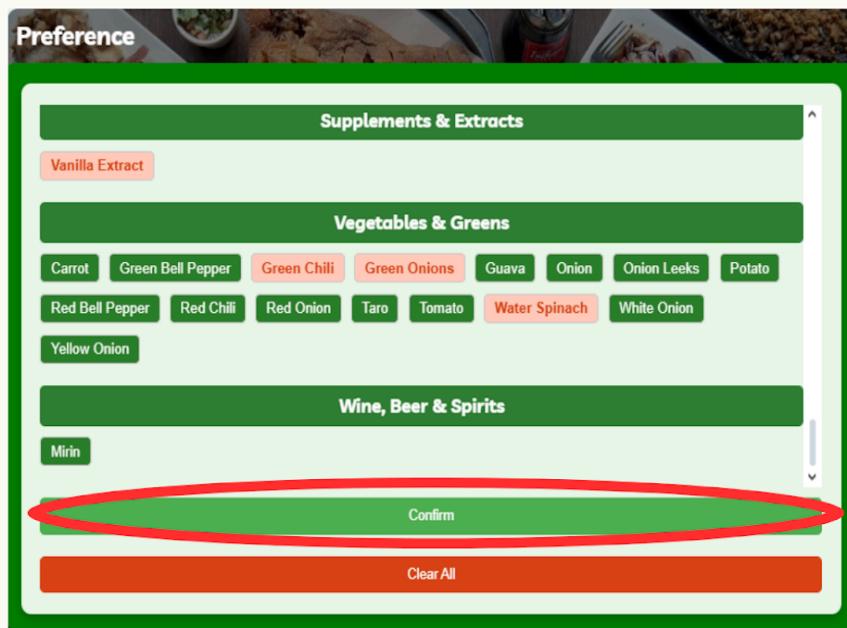
STEPS IN SETTING PREFERENCES



Step 1: On the left of the screen, click the ingredients that you want to exclude from your searches.

Features (PC)

STEPS IN SETTING PREFERENCES



Step 2: Click on the “Confirm” Button. The system will now detect if the ingredients you detect has the options, and will exclude the dish from your preferences.

Features (PC)

RECIPE LIST (PC)

The screenshot shows a user interface for a recipe database. At the top, a black header bar contains the word "Recipes" in white. Below it, a sub-header reads "Here are the finest Kapampangan recipes you should try!" In the main content area, there are six cards arranged in two columns of three. Each card features a small thumbnail image of the dish, the name of the recipe, and a brief description.

Image	Recipe Name	Description
	Sisig Kapampangan Style With (Pork Belly)	A sizzling Kapampangan dish made from pork parts, usually served with calamansi and chili.
	Sisig Kapampangan Style With (Pork Parts)	A sizzling Kapampangan dish made from pork parts, usually served with calamansi and chili.
	Tocino Kapampangan Style	A sweet cured pork dish, popular as a breakfast staple in the Philippines.
	Pork Menudo Kapampangan Style	A tomato-based pork stew with liver, potatoes, and vegetables.
	Beef Caldereta Kapampangan Style	A rich, spicy beef stew with liver spread and vegetables.
	Bringhe	Kapampangan-style paella made with glutinous rice, coconut milk, and turmeric.
	Morcon	A beer roulade stuffed with eggs, sausages, and pickles.
	Pindang Damulag (Carabeef Tocino)	A sweet cured pork dish, popular as a breakfast staple in the Philippines.

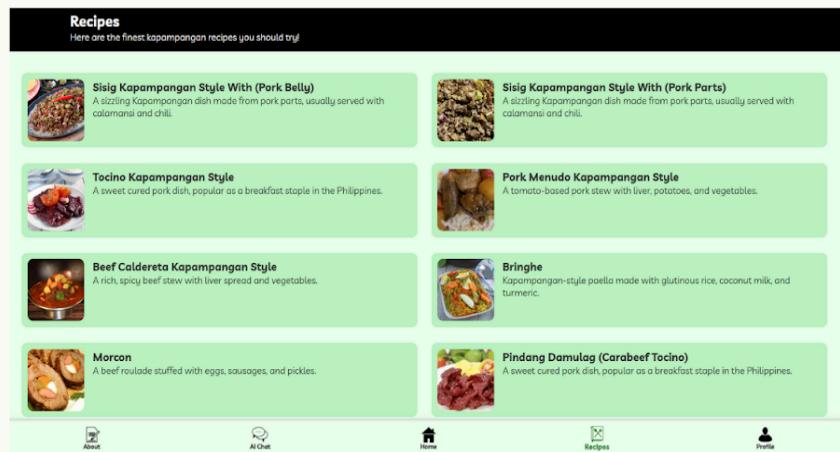
At the bottom of the page, there is a navigation bar with icons for "About", "AI Chat", "Home", "Recipes", and "Profile".

In this page, the user will be shown the list of recipes that the database offers. It works similarly to the recommendation page.

The user may see information such as author, servings, cooking time, ingredients, and procedure. The user may access the original links of these recipes, by clicking on the respective recipe's link.

Features (PC)

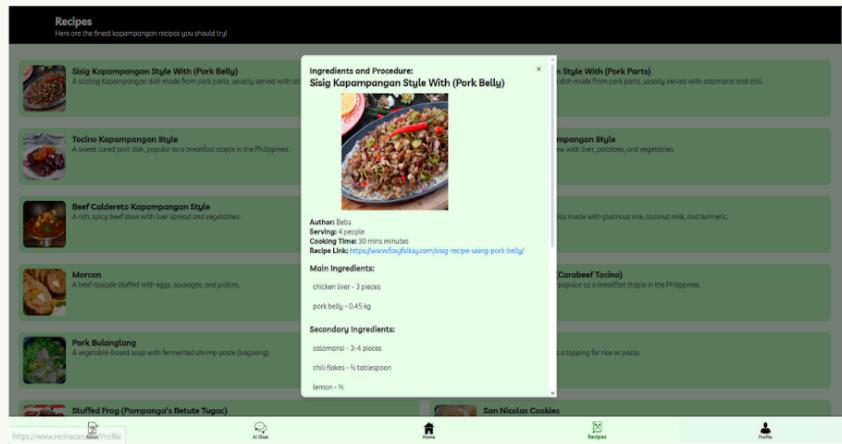
STEPS IN VIEWING A RECIPE



Step 1: Click on any recipe you would like to view.

Features (PC)

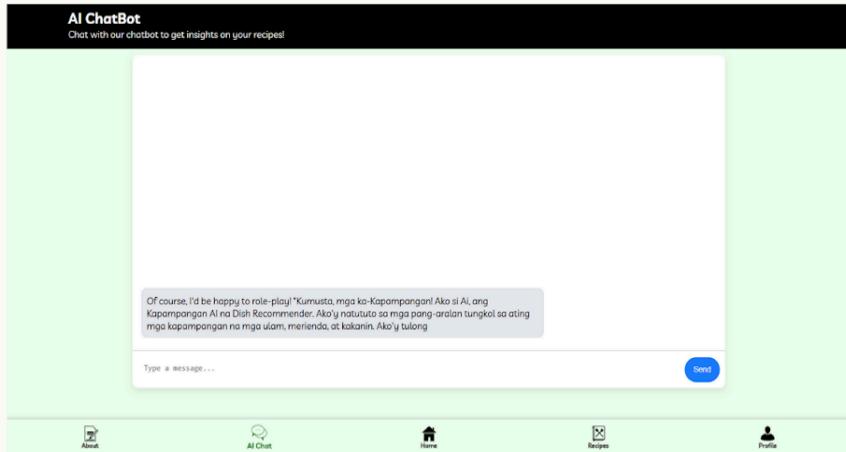
STEPS IN VIEWING A RECIPE



Step 2: The recipe you have chosen will appear in the middle of the page, showing its contents.

Features (PC)

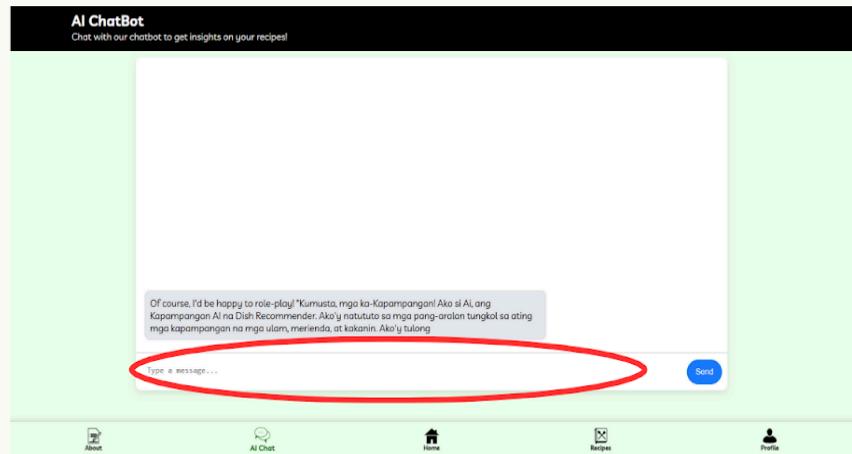
AI CHAT PAGE (PC)



The AI Chat page allows you to interact with an AI-powered chatbot that provides recommendations on Kapampangan dishes. You can type messages in the chatbox, and the AI will respond with relevant dish suggestions based on the conversation. The interface includes navigation buttons for easy access to other sections like Home, Recipes, About, and Profile.

Features (PC)

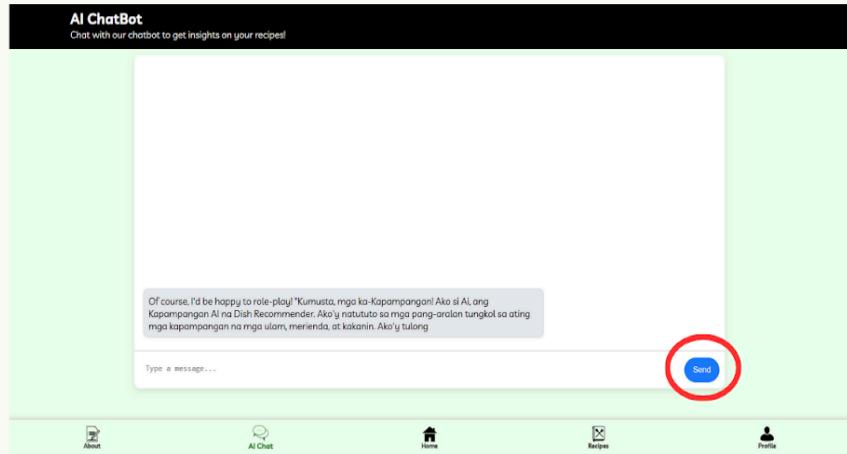
STEPS ON SENDING A MESSAGE ON THE AI CHATBOT



Step 1. Type a message on the chatbox.

Features (PC)

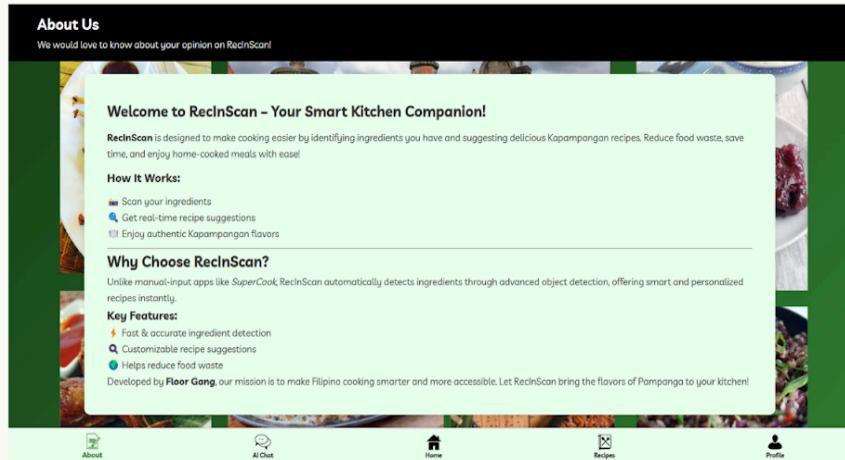
STEPS ON SENDING A MESSAGE ON THE AI CHATBOT



Step 2. Click on “Send.” The AI Chatbot will respond with an appropriate message to you based on your prompt.

Features (PC)

ABOUT PAGE (PC)



The About Us page introduces RecInScan as a smart kitchen companion that detects ingredients and suggests Kapampangan recipes. It highlights key features such as real-time ingredient scanning, customizable recipe suggestions, and food waste reduction. The page also emphasizes RecInScan's advantage over manual-input apps by using advanced object detection for instant recommendations.

Features (Mobile)

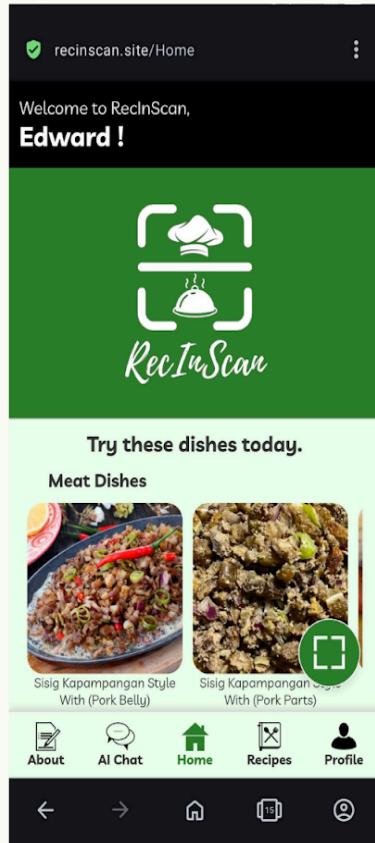
INDEX PAGE (MOBILE)



In the mobile version, the Index Page serves as the main entry point for users upon launching RecInScan. Similarly to the PC version, it offers a personalized welcome message, greeting users by name for a more engaging experience. The page introduces users to Kapampangan cuisine.

Features (Mobile)

HOME PAGE (MOBILE)

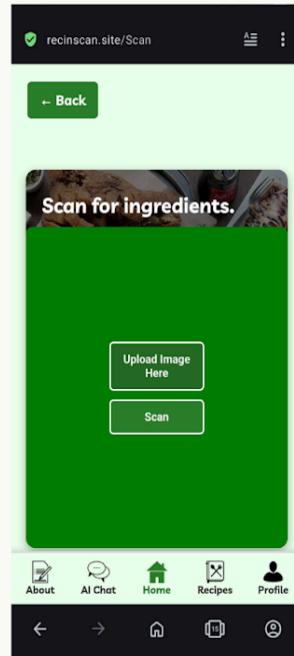


The home page of RecInScan is displayed in a mobile format. This is where you will land after you have successfully signed in the application.

To begin, click on the “Start Scanning Ingredients” link, so that you may start using RecInScan Mobile.

Features (Mobile)

INGREDIENT SCANNER (MOBILE)



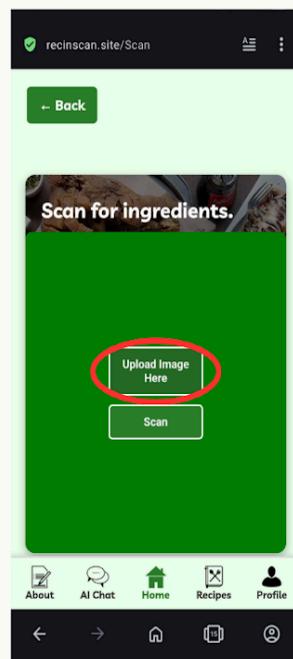
In the mobile version, the same process follows, except that the user may choose to use the camera to scan for ingredients instead of manually adding the ingredients through a file.

To scan using your camera in your phone:

1. Click on “Upload Image here”. A popup will appear on your screen to choose from your album or on your phone camera.
2. If you choose the camera, snap a photo of your ingredients.
3. Check if the photo is correct, then click on the checkmark to append.
4. Click on “Scan” to scan the image you have chosen.

Features (Mobile)

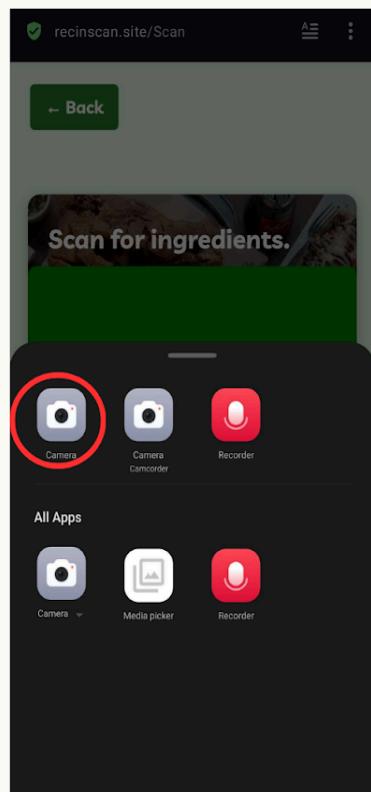
STEPS IN USING CAMERA FOR INGREDIENT DETECTION



Step 1: Click on “Upload Image here”. A popup will appear on your screen to choose from your album or on your phone camera.

Features (Mobile)

STEPS IN USING CAMERA FOR INGREDIENT DETECTION



Step 2: Choose the camera app on your mobile phone.

Features (Mobile)

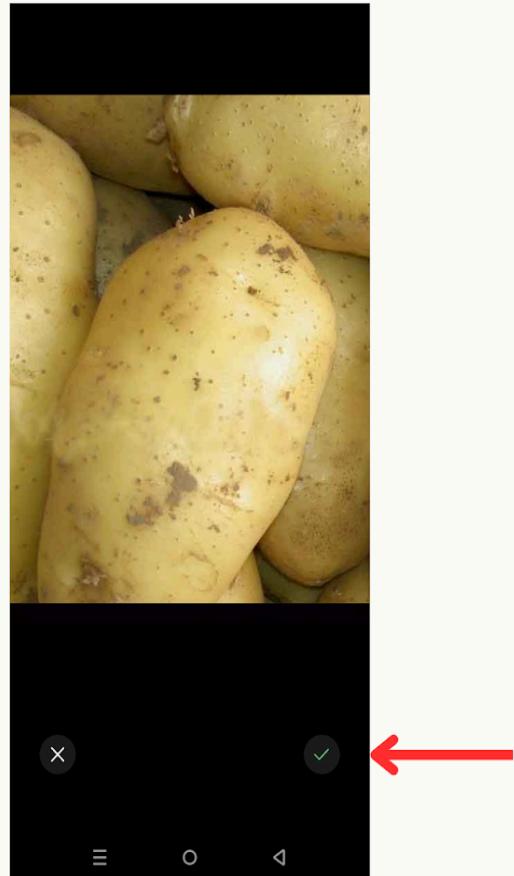
STEPS IN USING CAMERA FOR INGREDIENT DETECTION



Step 3: Snap a photo.

Features (Mobile)

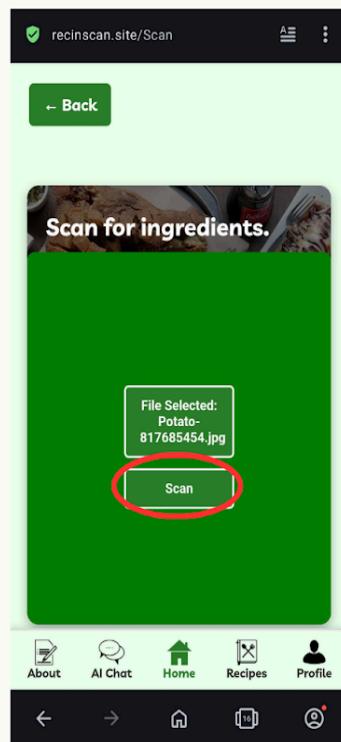
STEPS IN USING CAMERA FOR INGREDIENT DETECTION



Step 4: Check if the photo you have taken is correct, then click on the checkmark to continue.

Features (Mobile)

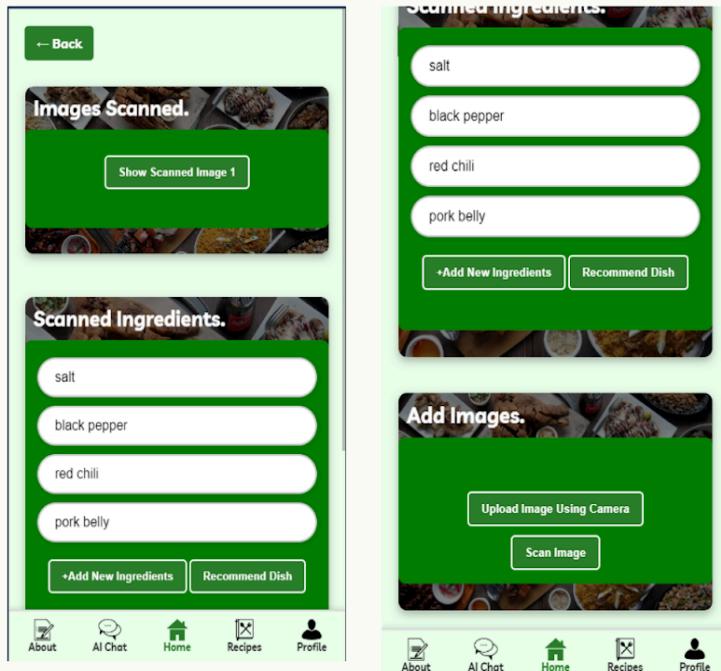
STEPS IN USING CAMERA FOR INGREDIENT DETECTION



Step 5: Click on “Scan” to scan the image you have chosen.

Features (Mobile)

DETECTED INGREDIENTS PAGE (MOBILE)

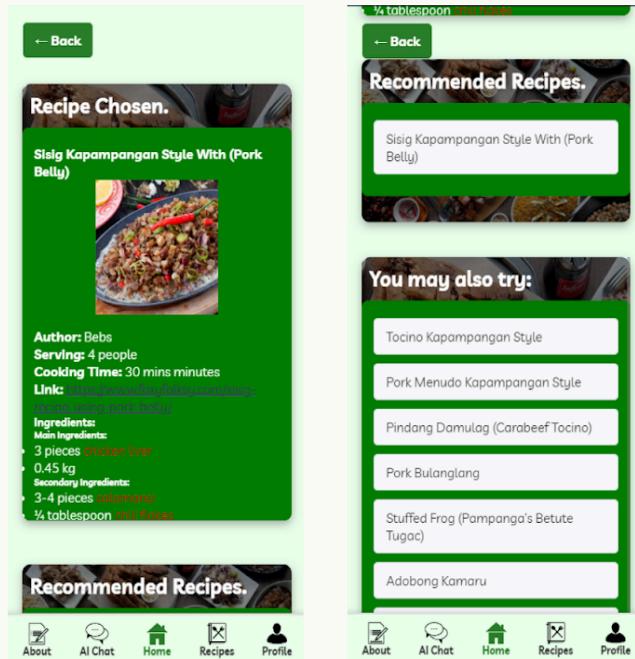


In the mobile version, the Detect page is displayed in a mobile format, from top to bottom. It contains the same cards, **Images scanned**, **Scanned Ingredients** and **Add Images**.

NOTE: To see steps on each card, please refer to the page “**DETECTED INGREDIENTS PAGE (PC)**”

Features (Mobile)

RECOMMENDATION PAGE (MOBILE)



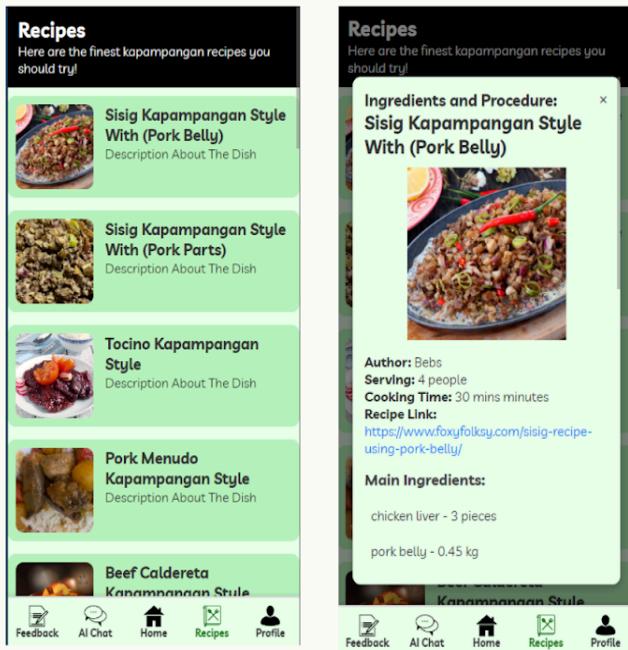
The recommendation page in mobile will show various dishes based on the ingredients detected in the detect page in a mobile format. It contains the details of the recipes.

NOTE: To see the details of each classification, please refer to the page “RECOMMENDATION PAGE (PC)”

When you have selected a dish, you may click on “**Try this dish**” on the right to set it on your profile history.

Features (Mobile)

RECIPE LIST (MOBILE)



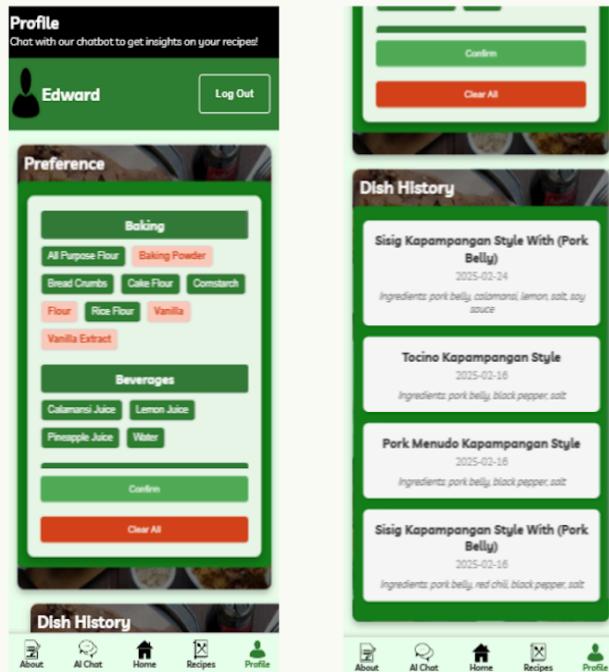
You will be shown the list of recipes that the database offers. It works similarly to the recommendation page.

The user may see information such as author, servings, cooking time, ingredients, and procedure. The user may access the original links of these recipes, by clicking on the respective recipe's link.

NOTE: To view a dish, refer to “STEPS IN VIEWING A RECIPE”.

Features (Mobile)

PROFILE PAGE (MOBILE)

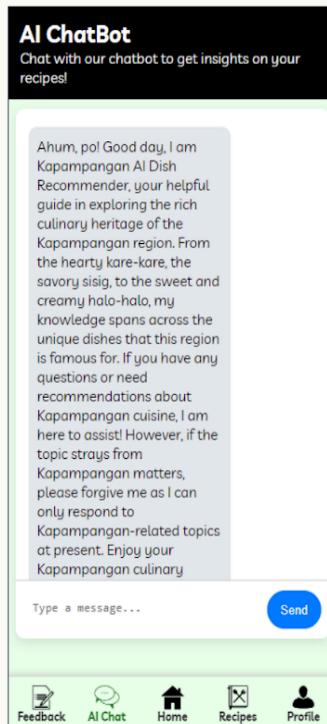


In the Profile page, you may set your preferences; in the case that you have allergic reactions to the dishes, log out of the system or view your dish history.

Note: To set preferences, refer to the page “STEPS IN SETTING PREFERENCES”.

Features (Mobile)

AI CHAT PAGE (MOBILE)



The AI Chat page allows you to interact with an AI-powered chatbot that provides recommendations on Kapampangan dishes. You can type messages in the chatbox, and the AI will respond with relevant dish suggestions based on the conversation.

NOTE: To see steps, refer to “STEPS IN SENDING A MESSAGE TO THE AI CHATBOT” page.

Features (Mobile)

ABOUT US PAGE (MOBILE)

The screenshot shows the 'About Us' page of the RecInScan mobile application. At the top, there is a dark header bar with the text 'About Us' and a subtext 'We would love to know about your opinion on RecInScan!'. Below this is a light green main content area. The first section is titled 'Welcome to RecInScan – Your Smart Kitchen Companion!' It describes the app's purpose: 'RecInScan is designed to make cooking easier by identifying ingredients you have and suggesting delicious Kapampangan recipes. Reduce food waste, save time, and enjoy home-cooked meals with ease!' The next section, 'How It Works:', lists three features: 'Scan your ingredients', 'Get real-time recipe suggestions', and 'Enjoy authentic Kapampangan flavors'. A third section, 'Why Choose RecInScan?', compares it to manual-input apps like SuperCook, stating that RecInScan uses advanced object detection for faster and more personalized results. The final section, 'Key Features:', highlights three: 'Fast & accurate ingredient detection', 'Customizable recipe suggestions', and 'Helps reduce food waste'. A note at the bottom credits 'Floor Gang' for developing the app, mentioning its mission to make Filipino cooking smarter and more accessible. At the very bottom is a navigation bar with icons for 'About' (selected), 'AI Chat', 'Home', 'Recipes', and 'Profile'.

The About Us page introduces RecInScan as a smart kitchen companion that detects ingredients and suggests Kapampangan recipes. It highlights key features such as real-time ingredient scanning, customizable recipe suggestions, and food waste reduction.

Troubleshooting and FAQ

Q: Why can't the scanner detect the ingredient I have in the image I have given?

A: The application has an approximate 80% to 95% chance of detecting the ingredient you have in your image. Here are some are several factors affecting the detection:

1. **Camera lighting** - Check if the lighting is enough, and try again.
2. **Camera angle** - Check if the angle can show the ingredient in full, and try again.
3. **Camera saturation** - The model may not detect if the image is not saturated enough.
4. **Camera blurriness** - Adjust the camera for blurriness, and try again.



5. **Ingredient not in the database** - The ingredient you have chosen may not be in the ingredient list.

Troubleshooting and FAQ

Q: The recipe I wanted isn't shown. Where is it?

A: The application will be updated with more dishes as time goes on.

Note that the application is only limited to kapampangan dishes.

Q: Can the application detect multiple ingredients?

A: The application may detect up to 2-3 ingredients at a time. We are working on a way to detect more ingredients.

Q: What happens to the images after scanning?

A: We prioritize user privacy. The images will be deleted after the prompted scan. Additionally, the content outside of ingredients is filtered.

Q: The pages won't load/I cannot access the website.

A: There are several factors as to why this may occur:

1. Your internet connection is currently unavailable.
2. The server may be down. If so, contact the authors. Contact information may be found at the last page of the User Manual.
3. The model may be processing the image you are scanning for currently. It takes a long time. Please be patient.
4. The link <https://recinscan.site> may be incorrect. Please check the spelling.

Contact Information

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**TEAM FLOOR GANG***RecInScan*

APPENDIX I

CURRICULUM VITAE



PERIÑA, JAMES CLARK A.

Blk 262 L1 Sta. Maria St., Pembo, Taguig City | +639551251784 |

jamesclarkperina@gmail.com | [LinkedIn](#)

A dedicated Computer Science undergraduate with hands-on experience in backend development and test case automation, gained through internship and academic projects. Strong communicator and quick learner, eager to contribute to the IT industry and grow professionally in this field. Looking to leverage backend and test automation to drive results and develop in a dynamic work environment.

EDUCATIONAL BACKGROUND

University of Makati	J.P. Rizal, Makati City
<i>Bachelor of Science in Computer Science</i>	<i>Aug. 2021 – June 2025 (Expected)</i>
Benigno "Ninoy" Aquino High School	Aguho St. Comembo, Taguig City
<i>Senior High School - S T E M</i>	<i>Sept. 2019 – June 2021</i>
Benigno "Ninoy" Aquino High School	Aguho St. Comembo, Taguig City
<i>TVL - Programming</i>	<i>June 2016 – June 2019</i>

PROFESSIONAL EXPERIENCES

Scientific Biotech Specialties, Inc.	Makati, Philippines
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*QA Intern**February 2025 – Present*

- Test Case Automation
- "Monitors and ensures the software product adheres to quality standards, performing thorough testing and validation to guarantee readiness for deployment."
- Assisted in testing, identifying defects, and collaborating with developers to ensure the software met quality standards, resulting in improved stability and timely releases.
- Strong attention to detail, effective communication, problem-solving, teamwork, and time management.

ACHIEVEMENTS & RECOGNITION

- Role | Achievement Name | Organization 20XX
Short description of the achievement (*optional*)
- Lead Developer | **2nd Place, Hackathon...** | University of Makati 2022
"Led a team of four in designing and pitching the solution."
◊ Include 4-5 soft skills relevant to all the achievements above

VOLUNTEER WORK & PERSONAL PROJECTS

-
- Project Manager and Documentation Specialist | **RecInScan| Recipe Ingredient Scanner with Object Detection Algorithm using YOLOv9** | University of Makati 2025
Defined the project scope and deliverables to ensure clarity of objectives among the team
Led the development of a Ingredient Scanner web application implementing YOLOv9

-
- Utilized the python and mysql to develop the web app system, using ultralytics to train the model.

 - Project Manager and Lead Developer | **ReliTrack| Rice and Incentives Tracking System** | University of Makati
 - Oversaw the project development of a company incentives and record management system, achieving an average score of 4.5 out of 5 for the user acceptance survey
 - Developed the backend and database of the program.
 - Overseer the coding development of the program.
 - Implemented Agile methodologies to allow for quick and iterative progress2024

 - Sole Developer | **Queen Victoria| Discord bot modeled toward helping Elsword players** | Personal Project
 - Created the discord bot using python with discordpy module
 - Goal of the application was to help new player of Elsword with character skills

CERTIFICATION

-
- Certificate of Completion for Java Programming, Great Learning, 08 October 2024.
 - Certificate of Completion for Introduction to Cybersecurity- Cisco Skills For All, 25 October 2024
 - Career Essentials in Software Development by Microsoft and LinkedIn - LinkedIn, Learning, 14 December 2024
 - Programming Foundations: Fundamentals - LinkedIn, Learning, 14 December 2024
 - Introduction to Career Skills in Software Development - LinkedIn, Learning, 14 December 2024
 - Programming Foundations: Beyond the Fundamentals - LinkedIn, Learning, 14 December 2024

SKILLS

-
- *Language:* Java, C#, C, C++
 - *Microsoft Office Suite:* Excel, Word,
Powerpoint
 - *Domain Knowledge/Technical Skills:* Software
Development, Quality Assurance, Database
Management, Web Development, Testing Frameworks
 - *Interests:* Python, Game Development, AI



Salonga, Edward M.

Makati City | 09761507363 | edwardsalonga.programmer@gmail.com | [LinkedIn](#)

A dedicated BACHELOR OF SCIENCE IN COMPUTER SCIENCE APPLICATION DEVELOPMENT TRACK graduate with hands-on experience in Web Development Python Java programming and many more gained through my internship in CodeBold Philippines Inc and from my past projects in University of Makati. Strong communicator and quick learner, eager to contribute to the programming industry and grow professionally in this field. Looking to leverage my skills in programming to drive results and develop in a dynamic work environment.

EDUCATIONAL BACKGROND

University of Makati	J.P. Rizal, Makati city
<i>Bachelor of Science in Computer Science</i>	<i>June 2021 – June 2025 (Expected)</i>
University of Makati	J.P. Rizal, Makati city
<i>Elective Computer Programming</i>	<i>June 2019 – June 2021</i>
San Isidro National High School	Borneo, Makati City
	<i>June 2009 – June 2019</i>

ACHIEVEMENTS & RECOGNITION

- Dean's Lister | University of Makati 2021

Graduated with Dean's Lister

- Participant | **Champion, Infotech Olympics** | University of Makati 2024

"Led a team of 2 in .Net C# Programming Category."

PAST PROJECTS

- Lead Programmer / Developer of the Project | **DEVELOPMENT OF SMART KITCHEN COMPANION: INGREDIENTS SCANNER FOR RECIPE RECOMMENDATIONS UTILIZING OBJECT DETECTION ALGORITHM USING YOLOV9** | University of Makati 2024 - 2025
- Lead Programmer / Developer of the Project | **DEVELOPMENT OF D&G Pacific Website** | D&G and Course Project 2023 - 2024

CERTIFICATION

- Career Essentials in Software Development by Microsoft and Linked In 2024
- DevOps Professional Certificate by PagerDuty and Linked In
- Introduction to CSS 2020
- Installing and Configuring Computer Systems
- Setting Up Computer Networks
- Web Development using HTML5 and CSS3

SKILLS

- *Language:* Python, Flask, C# & C++, Java,
HTML&CSS, JavaScript's, PHP, MySQL



Famisaran, Carlos Ivan M.

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famisarancarlosivan@gmail.com | <https://www.linkedin.com/in/arclevi/>

A dedicated BACHELOR OF SCIENCE IN COMPUTER SCIENCE APPLICATION DEVELOPMENT TRACK graduate with hands-on experience in UI/UX Design, Front-end programming, Java, C# and Python, gained through 8box Solutions, RecInScan, and other past projects in the University of Makati. Strong communicator and quick learner, eager to contribute to computer science and grow professionally in this field. Looking to leverage designing and creating UI components and UX best practices to drive results and develop in a dynamic work environment.

EDUCATIONAL BACKGROUND

University of Makati

Bachelor of Science in Computer Science

J.P. Rizal, Makati City

Aug. 2021 – June 2025 (Expected)

University of Makati

Electronics Products and Services

J.P. Rizal, Makati City

Sept. 2019 – June 2021

Benigno "Ninoy" Aquino High School

TVL - Programming

Aguho St. Comembo, Taguig City

June 2016 – June 2019

PROFESSIONAL EXPERIENCES

8Box Solutions

Pasig City, Philippines

UI/UX Designer, Intern

February 2025 – Present

- Designed UI/UX components and pages using Figma.
- Applied typography, color, and layout principles.

- Collaborated with designers and developers.
 - **Interned as a UI/UX Designer, creating Figma-based designs, applying design principles, and collaboration.**
- ◊ UI Design, UX Design, User Research, Wireframing and prototyping

ACHIEVEMENTS & RECOGNITION

- **Dean's Lister | University of Makati** 2022-2023,2024-2025
Five-time Dean's Lister
- **Participant | 1st Runner Up, Infotech Olympics 2022 Quiz Bee | University of Makati** 2022
Achieved 1st Runner Up position in the Quiz bee.

VOLUNTEER WORK & PERSONAL PROJECTS

-
- UI/UX Designer / Model Trainer | **ReclnScan** | University of Makati 2024- 2025
Designed UI/UX components, trained AI model using CUDA and Ultralytics
 - UI/UX Designer | **ReliTrack** | University of Makati 2023-2025
Designed UI/UX components and encoded them into HTML, CSS and Javascript.
 - Full-stack developer | **FlyCo Airline Ticketing System** | University of Makati 2022
Designed, encoded, and programmed the entirety of Flyco using Java.
 - Music Composer | **ExSeed** | Iridescent Render 2023 - Present
Composing the soundtrack, focusing on immersive audio to enhance user experience.
 - Audio Engineer / Game Tester | **Hubris** | Iridescent Render 2023
Testing and refining audio assets for the game Hubris.

Composed the soundtrack, designed the SFX, and tested the game “Hubris” during Game Jam Plus Manila 23/24 with the theme “No Plant, no Planet”.

- Volunteer | **Community Service** | University of Makati 2021

Contributed to barangay community service.

CERTIFICATION

-
- Career Essentials in Software Development | Microsoft and LinkedIn 2024
 - Java Programming | Great Learning Academy 2024
 - Introduction to Cybersecurity | Cisco 2024
 - Google Colab Python | Great Learning Academy 2023

SKILLS

-
- | | |
|---|--|
| <ul style="list-style-type: none"> ● <i>Language:</i> Java, C#, Python, HTML, CSS, PHP, JavaScript ● <i>UIUX Design:</i> Figma, Canva ● <i>Analytics:</i> Power BI | <ul style="list-style-type: none"> ● <i>Microsoft Office Suite:</i> Excel, Word, PowerPoint ● AI: Image Generation Prompting ● <i>Interests:</i> Game Development |
|---|--|