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Department of Computer Science & Technology

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Mahesha Madugalle
2323761

Spices & Vanilla Collector: Web Application for Vanilla Growers Association

BSc (Hons) Computer Science and Software Engineering

Undergraduate Thesis Report

Department of Computer Science & Technology
The University of Bedfordshire

Dr. Nipunika Vithana

AY 2024

i. Abstract

The Spices & Vanilla Collector Web Application is designed to revolutionize agricultural trade by connecting farmers and wholesale companies in the spices and vanilla industry. Currently there is no platform to connect wholesale companies and farmers and there is also no way to check the quality of products before handing them over to the company. These are the unique features of this web application. This platform leverages modern technologies such as SQL content-based filtering, real-time image capture, and location services to facilitate seamless transactions and enhance user experiences. The project begins with a comprehensive analysis of the agricultural sector's challenges, focusing on the need for a centralized platform that simplifies the buying and selling process for spices and vanilla products. Through extensive research and user surveys, the project identifies key requirements and features essential for optimizing trade relationships and improving market transparency. The methodology employed follows an agile software development approach, allowing for iterative development and continuous feedback integration. The design phase encompasses the selection of development environments, technologies, and tools crucial for creating a robust web application. Frontend development utilizes HTML5, CSS, JavaScript, and jQuery for dynamic interactions, while backend data management is handled efficiently using MySQL. Key features of the application include a user-friendly interface for farmers and companies to register, login, and manage their profiles. The SQL content-based filtering system matches suitable buyers and sellers based on their spice types, enhancing trade efficiency. Real-time image capture enables farmers to upload product images for quality assessment, promoting transparency and trust in transactions. The implementation phase involves rigorous testing and refinement to ensure the platform's reliability, security, and scalability. User feedback and usability testing play a crucial role in fine-tuning the application's functionalities and addressing any usability issues. In conclusion, the Spices & Vanilla Collector Web Application offers a transformative solution for streamlining agricultural trade, fostering better trade relationships, and driving innovation in the spices and vanilla industry.

ii. Acknowledgements

I would like to express my heartfelt gratitude to Dr. Nipunika Vithana, my supervisor, for her invaluable guidance, patience, and insightful feedback throughout this project. Her dedication and wealth of knowledge greatly enriched my final year research. I am also grateful to Dr. Gayana Fernando, our project coordinator, for her support, expertise, and encouragement, which played a pivotal role in shaping this project's success. Special thanks are due to Mr. M. Madugalle, Chairman of the Vanilla Growers Association and Founder, for entrusting me with this project and providing essential assistance in gathering relevant data. I am grateful to the farmers who generously shared their details and insights, contributing crucial information to this project. Their cooperation and willingness to collaborate were essential in understanding the industry's dynamics and challenges. Additionally, I extend my appreciation to the companies that provided their details and perspectives. Their input and cooperation were instrumental in shaping the project's scope and direction, enabling a more comprehensive analysis and solution development. Thank you to all the farmers and companies involved for their valuable contributions and support throughout this endeavour. I extend my deepest appreciation to my parents for their unwavering support, as well as to my colleagues and friends for their constructive feedback and encouragement. I acknowledge the contributions of Google Scholar and other online resources for providing access to valuable research materials. Lastly, I am thankful to everyone who supported me directly or indirectly. Your encouragement and support were instrumental in completing this project successfully.

iii. Dedication

This dissertation is dedicated to my loving parents, Mr. and Mrs. Madugalle, whose unwavering love, support, and guidance have been the cornerstone of my journey. Their unconditional belief in me has given me the strength and determination to persevere through challenges and pursue my academic endeavours.

I also extend my heartfelt gratitude to my boyfriend, Mr. Lasankith Irushan, for his constant encouragement and unwavering support. Your presence in my life has been a source of comfort and motivation, and I am grateful for your belief in my abilities.

To each of you, I offer this dedication as a token of appreciation for your invaluable contributions, encouragement, and belief in my potential. Thank you for being an integral part of my journey and for your continued support and love.

iv. List of Abbreviations

Table 1: List of Abbreviations

Abbreviation	Full name
IEEE	Institute of Electrical and Electronics Engineers
IET	Institution of Engineering and Technology
ACM	Association for Computing Machinery
API	Application Programming Interface
SQL	Structured Query Language
RTP/RTCP	Real-Time Transport Protocol Real-Time Control Protocol
AR	augmented reality
ICWE	International Conference on Web Engineering
MC2R	Mobile Computing and Communications Review

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1. Introduction

1.1. Project background

The Vanilla Grower Association in Sri Lanka plays a pivotal role in the country's agricultural landscape, particularly in the cultivation and export of vanilla and an array of spices including turmeric, cardamom, cinnamon, cloves, and pepper. With a robust network spanning across regions such as Colombo, Gampaha, Matale, Kandy, Kegalle, Nuwara Eliya, Ratnapura, Galle, Matara, Badulla, and Kurunegala, comprising 91 Vanilla Cultivation societies and over 1000 members, the association stands as a cornerstone of Sri Lanka's export crop industry. (Lanka, n.d.)

However, despite its prominence, the association faces a significant challenge in the absence of a streamlined wholesale marketplace for vanilla and spices. This industry-focused web development project aims to bridge this gap by empowering farmers to sell their produce directly to the association or other interested companies. Through innovative features like SQL-based content filtering, the platform matches farmers with compatible buyers, optimizing trade relationships and ensuring mutual benefit.

Central to the project is a real-time quality assessment mechanism, facilitated by a visual camera option that prevents fake or edited images. This technology-driven approach not only safeguards product quality but also enhances transparency and trust between farmers and buyers. Furthermore, the integration of Google Maps allows farmers to identify suitable collection points, simplifying logistical processes.

This initiative is not merely a buying and selling platform but a comprehensive tool that fosters meaningful connections between stakeholders, promotes sustainable agricultural practices, and elevates the quality of Sri Lanka's organic produce in global markets.

1.1.1. Problem statement

The Vanilla Grower Association in Sri Lanka faces significant challenges in its current operations, particularly concerning the wholesale procurement and quality assessment of vanilla and spices. Despite being a prominent player in the country's agricultural export industry, the association lacks a structured platform for wholesale transactions, leading to inefficiencies and missed opportunities for both farmers and buyers.

One of the primary issues is the absence of a streamlined process for farmers to sell their products directly to the association or other potential buyers. This results in a fragmented marketplace, hindering farmers' ability to reach optimal selling opportunities and limiting their potential for revenue generation.

Additionally, there is a pressing need for a robust quality assessment mechanism that ensures the authenticity and quality of the products before they are handed over to buyers. The lack of such a system not only poses risks of fraudulent practices, such as the uploading of fake or edited product images but also compromises the association's reputation and trustworthiness in the export market.

Furthermore, the geographical dispersion of Vanilla Cultivation societies across various regions compounds logistical challenges, making it difficult for farmers to identify suitable collection points and navigate the selling process efficiently.

In summary, the current lack of a comprehensive wholesale marketplace, coupled with inadequate quality assessment measures and logistical complexities, presents a critical problem for the Vanilla Grower Association and the wider agricultural community in Sri Lanka. These challenges necessitate the development of an industry-focused web application that addresses these issues and empowers stakeholders to engage in transparent, efficient, and sustainable trade practices.

1.1.2. Scope of the project

The scope of this industry-based web development project for the Vanilla Grower Association in Sri Lanka encompasses several key aspects aimed at addressing the identified challenges and achieving the project's objectives effectively.

Platform Development: The project involves the creation of a user-friendly web application that serves as a centralized platform for farmers and buyers to engage in wholesale transactions of vanilla and spices. The platform will be accessible to members of the Vanilla Grower Association and other interested parties, providing a seamless interface for conducting business transactions.

Wholesale Marketplace: The web application will facilitate the buying and selling of vanilla and spices in wholesale quantities, enabling farmers to showcase their products and connect with potential buyers. The platform will include features such as profile creation, product listing, and communication tools to streamline the trading process.

Quality Assessment Mechanism: A real-time quality assessment mechanism will be integrated into the platform, allowing farmers to upload authentic product images using a visual real-time camera option. This feature will prevent the uploading of fake or edited photos, ensuring transparency and trust in product quality for buyers.

SQL-based content Filtering: The platform will employ database filtering to match farmers with suitable buyers based on their profiles, product offerings, and preferences. This functionality will enhance trade relationships and optimize market connections, benefiting both farmers and buyers.

Geolocation Integration: Google Maps integration will be implemented to provide farmers with visibility into collection platforms and buyer locations. This feature will assist farmers in identifying suitable selling opportunities and navigating logistical challenges more efficiently.

Non-Buying and Selling Functions: The project will emphasize that the web application is not merely a buying and selling platform but a comprehensive tool that facilitates connections between farmers and buyers, promotes sustainable agricultural practices, and enhances product quality for export.

Project Impact: The successful implementation of this project is expected to have a positive impact on the efficiency of wholesale transactions, promote transparency and trust in product quality, streamline logistical processes, and contribute to the growth of sustainable organic cultivation practices in Sri Lanka.

Overall, the scope of this project encompasses the development of a robust, user-centric web application that addresses the identified challenges faced by the Vanilla Grower Association and stakeholders in the agricultural export industry in Sri Lanka.

1.2. Project aim and objectives

Aim

The aim of this thesis is to develop an industry-focused web application for the Vanilla Grower Association in Sri Lanka, facilitating efficient wholesale transactions of vanilla and spices while implementing a robust quality assessment mechanism and promoting sustainable agricultural practices.

Objectives

- To Information Gathering: Gather comprehensive information about existing web-based applications facilitating wholesale selling to understand industry standards and best practices.
- To develop a function for SQL-based content Filtering: Develop a function for comparing and filtering spices using database filtering, enhancing the matchmaking process between farmers and buyers based on their spice type.
- To develop a function for Real-Time Image Upload Function: Create a function that enables real-time image upload for farmers to showcase their products authentically, ensuring transparency and trust in product quality assessment.
- To develop a function to display all the collection company location via google map: Implement Google Maps integration to display all collection company locations, providing farmers with visibility into potential selling opportunities and logistical information.

- To identify the most suitable development technologies and tools: Identify and evaluate the most suitable development technologies and tools for implementing the web application, considering factors such as scalability, security, and user experience.

1.3. Project framework

- Needs Assessment and Research:
    - Gathered needs and requirements for the project through thorough research and literature review from journal publications and relevant sources.
    - Developed a Q&A process to comprehend requirements and acquired specifications for new software tools.
    - Conducted research to identify additional features necessary for the system.
- Technology Selection:
    - Identified and selected technologies and development frameworks that best align with project needs and goals.
    - Ensured compatibility and efficiency by researching technologies that work well together.
- Project Planning and Goals:
    - Established project goals and objectives based on research findings to ensure project success.
    - Defined the project goal as to develop an industry-focused web application for the Vanilla Grower Association in Sri Lanka that facilitates efficient wholesale transactions of spices and vanilla, integrates a robust quality assessment mechanism using real-time image processing, promotes sustainable agricultural practices, and provides a user-friendly online platform for farmers and buyers to connect seamlessly.

- Development Approach:
    - Selected Agile development methodology for the project after considering various software development approaches.
    - Utilized sprints to distribute workload efficiently and meet project milestones.
- Work Breakdown Structure (WBS):
    - Created a Work Breakdown Structure (WBS) to clearly outline the proposed system's components and functionalities.
- Life Cycle Model:
    - Adopted Agile Methodology as the life cycle model for the project, ensuring flexibility and adaptability to changing requirements.
    - Utilized Visual Studio Code and Adobe Dreamweaver for development tasks.
- Development and Testing:
    - Developed the web application artifact based on project specifications and requirements.
    - Conducted internal unit testing and user testing to gather feedback from actual users.
    - Utilized feedback forms to collect input on the positive aspects, negative aspects, and future enhancements of the web application.
- Project Completion:
    - Completed the development process within three sprints as planned.
    - Ensured deadlines and milestones were met by utilizing a grant chart for project management.

1.4. Description of artefact

The artefact is a unique industry-based web application specifically designed for the wholesale trading of vanilla and spices, filling a gap in the market as the only platform connecting wholesale companies and farmers. It stands out for SQL-based content filtering feature, which compares farmers and companies' profiles to identify suitable buyers. What sets this system apart is its real-time camera option, allowing the company to assess product quality visually before acquisition, a capability lacking in existing systems. Additionally, the application provides a visual display of different collecting companies through Google Maps, enhancing accessibility and navigation. It’s simple and user-friendly interface ensures ease of use for farmers of varying IT proficiency levels, making it a valuable tool for efficient and transparent trade transactions.

1.4.1. Techniques for realization

Research Methodology

The research methodology for realizing the artefact will integrate circulatory and evolutionary approaches, primarily focusing on qualitative methods. These qualitative techniques will include user surveys and focus groups to gather valuable insights and feedback throughout the research journey.

The initial phase will involve delineating the study's background, defining the study's rationale, and outlining the project's goal, context, and objectives. This phase will lay the groundwork for the study and provide direction for subsequent research activities.

The second phase will concentrate on validating the development of the proposed system. This will involve analysing a case study to explore various factors influencing the acceptance of the artefact. User surveys will play a pivotal role in gauging user acceptance levels and will inform the literature review, substantiating the project's necessity.

Transitioning to the third phase, emphasis will be placed on implementing and evaluating the artefact. Focus groups will be instrumental in uncovering discoveries and insights. Leveraging best practices and insights from the professional community, this phase will offer a comprehensive examination of developing a web application for farmers and wholesale companies.

The final phase of the research process will conclude with drawing insights from research findings and aligning them with project goals and objectives. Additionally, opportunities for further development and enhancement of the artefact will be evaluated and highlighted, ensuring its continuous improvement and relevance in addressing industry needs.

Development Methodology

The development methodology for this thesis project adopts an Agile approach, specifically leveraging Scrum principles to ensure an iterative and collaborative development process. (Topczewska-Pińczuk, 2023) The methodology begins with thorough planning and requirements gathering, followed by iterative sprints that focus on delivering incremental functionality. Each sprint cycle includes sprint planning, daily stand-up meetings, development work, testing, and sprint reviews to gather feedback and make necessary adjustments. Stakeholder involvement and continuous communication are prioritized throughout the development lifecycle to ensure alignment with project goals and stakeholder expectations. This Agile methodology facilitates flexibility, adaptability to changing requirements, and a transparent, collaborative environment conducive to delivering a successful web application for the Vanilla Grower Association in Sri Lanka.

1.5. Structure of project

1.5.1. Introduction

The introduction provides an overview of the project, defining its theme, purpose, and relevance. It outlines the background of the Vanilla Grower Association in Sri Lanka and the need for a web application to facilitate wholesale transactions of vanilla and spices. The introduction also presents the project's goals, objectives, and the methodology adopted for its realization.

1.5.2. Market Research

This segment will explore the necessity of developing the product artefact by the project's conclusion and making sure that the project does not already exist and if it does exist, if there is any way of improving it. Plus, we'll survey potential users to get more ideas and find out what they need from the product.

1.5.3. Literature Review

In this section, the Spices & Vanilla Collector project aims to provide a comprehensive understanding of the existing research, technologies, and methodologies relevant to Spices & Vanilla Collection and related fields. This section serves as a foundation for the project by offering insights into prior work, identifying gaps in knowledge or technology, and informing the project's approach and methodology. Various literature reviews conducted by different researchers will be reviewed, discussing relevant sections of the proposed system using journal articles and research papers. Additionally, this chapter will cover the latest technologies, approaches, libraries, and similar applications, providing an introduction and discussion of relevant technologies and research gaps. (Madugalle, 2024)

1.5.4. Methodology

The methodology section details the research approach, methods, and procedures used to conduct the study. It explains how data was collected, analysed, and interpreted, as well as the tools and techniques employed in the research process.

1.5.5. Implementation and Testing

This section elaborates on the actual implementation of the web application for the Vanilla Grower Association. It discusses the design decisions, coding practices, software tools, and frameworks used in the development process. Testing methodologies, including unit testing, integration testing, and user acceptance testing, are also explained.

1.5.6. Result & Discussion

The results section presents the outcomes of the implemented web application, including user feedback, performance metrics, and system functionalities. The discussion interprets these results, compares them with project objectives, and analyses the effectiveness of the developed solution in meeting the needs of farmers and wholesale companies.

1.5.7. Conclusion and Future Work

The conclusion summarizes the key findings, conclusions drawn from the project, and the overall impact on the agriculture industry in Sri Lanka. It reflects on the success of the project, identifies areas for improvement, and proposes recommendations for future enhancements or developments. The conclusion also highlights the project's contributions to sustainable agriculture and economic growth.

2. Market Research

2.1. Reason for Market Research

Market research plays a pivotal role in shaping the success of a project, especially one of significant scale. Here are the reasons why market research is essential for the Spices & Vanilla Collector project, along with the specific questions addressed in the Google Form:

- Market research helps in understanding if there is a demand or need for the artefact being developed.
- Researching user experiences and challenges.
- To know how users access the internet and their current usage of similar business apps provides insights into user behaviour and preferences.
- Assessing users' technological readiness, such as having a smartphone with a camera option.
- To understanding users' perceptions and expectations regarding the potential benefit.

2.2. User Survey

A survey will be designed to gather valuable insights from potential users of the artifact. The survey will include questions aimed at understanding user needs, preferences, pain points, and expectations related to the artifact. The survey will be created using Google Forms, which allows for easy distribution and data collection. The distribution of the survey will target the identified potential user base, which may include farmers, wholesale companies, or other stakeholders relevant to the Spices & Vanilla Collector project. The survey got 32 replies. Below the answers to questions will be reviewed.

Q1. Do you know about the wholesale collection companies that deals with spices and vanilla?

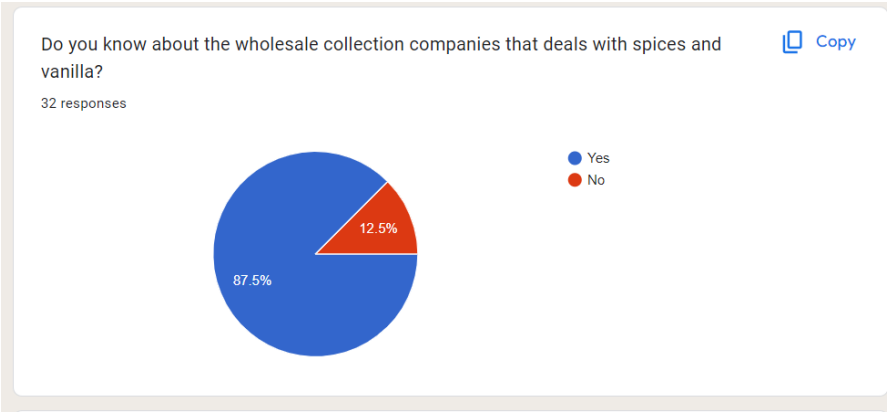


Figure 1: Market research survey question 1 results

A pie chart representing 32 responses shows that 87.5% of respondents are aware of wholesale collection companies dealing with spices and vanilla, while 12.5% are not. This indicates a decent level of awareness among potential users regarding such companies. This question is crucial as it helps gauge the familiarity of users with existing market players, which can influence their expectations and requirements from the proposed application.

Q2. What do you think about having an app to know the nearest spice and vanilla collection company?

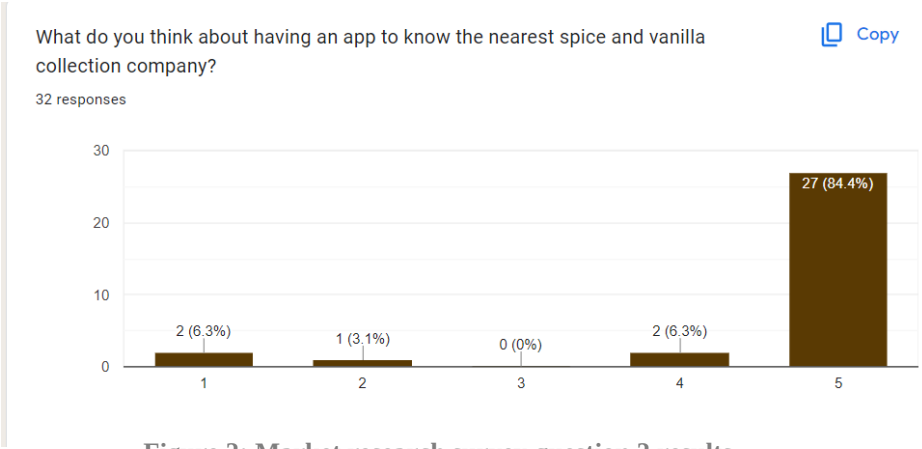


Figure 2: Market research survey question 2 results

The bar chart reflecting 32 responses indicates that 84.4% of respondents rate the idea of having an app to know the nearest spice and vanilla collection company. This question is vital as it assesses the demand and enthusiasm for a location-based feature, highlighting its potential value to users

Q3. Have you been ignored by companies because of the quality of your products? Do you think it's a waste of your time?

Figure 3: Market research survey question 3 results

Out of 31 responses, 90.3% of respondents feel they have been ignored by companies due to the quality of their products. This question is crucial as it identifies a common pain point among users, emphasizing the need for a solution that addresses quality assurance and customer satisfaction.

Q4. Before engaging with a company, do you check the quality of your spices with that company?

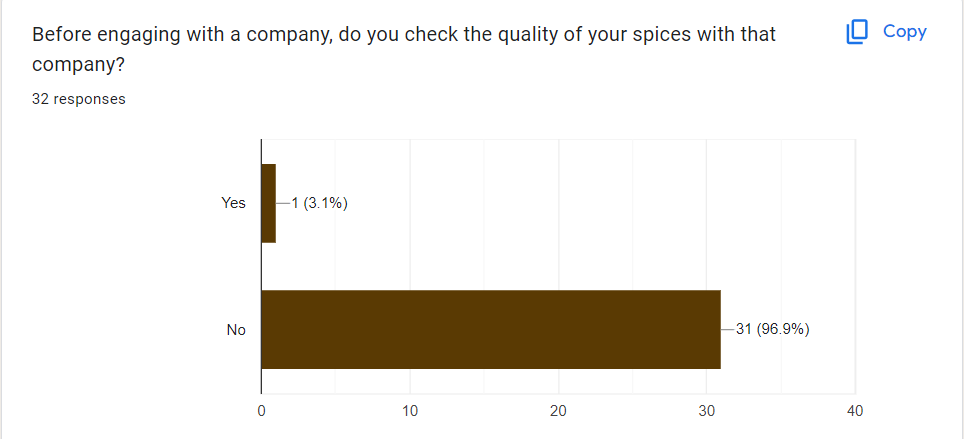


Figure 4: Market research survey question 4 results

A significant majority (96.9%) of respondents do not check the quality of their spices with a company before engaging. This question underscores the importance of integrating quality assessment features within the proposed application to enhance trust and transparency in business transactions.

Q5. Are there any platforms where you can find buyers interested in purchasing your products?

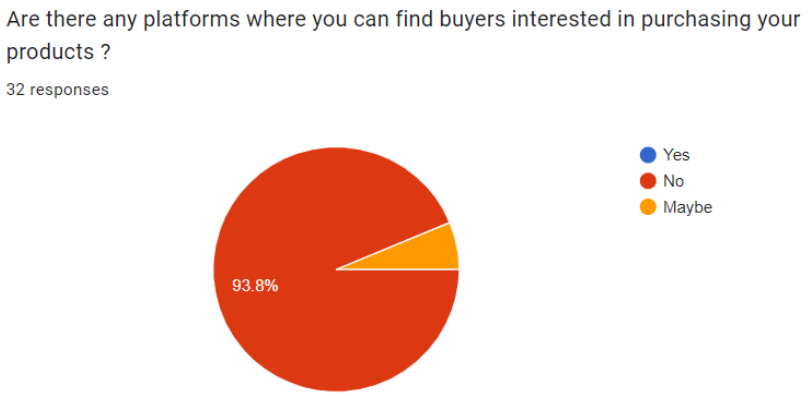


Figure 5: Market research survey question 5 results

The pie chart shows that 93.8% of respondents are not aware of platforms for finding buyers interested in purchasing their products. This question highlights an opportunity gap in the market, indicating the potential value of introducing a platform that connects sellers with interested buyers.

Q6. How do you access the internet?

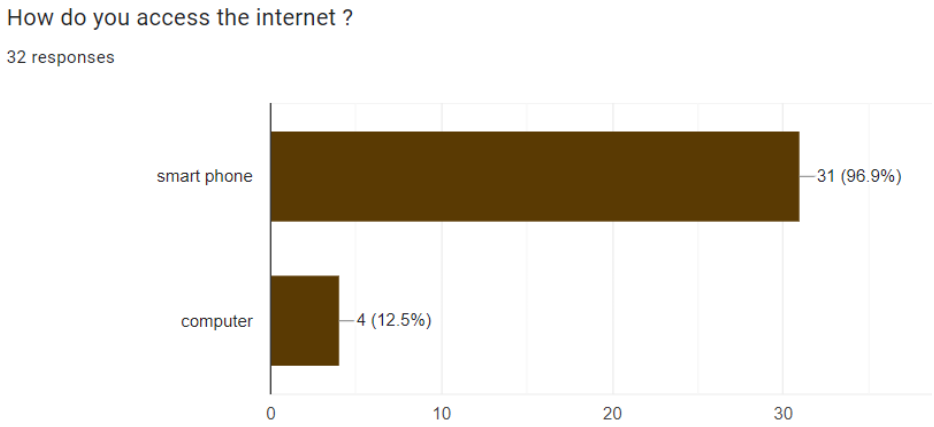


Figure 6: Market research survey question 6 results

The majority (96.9%) of respondents access the internet via mobile phones. This question is crucial for determining the preferred platform for the application, ensuring compatibility and accessibility for a wider user base.

Q7. Are you currently using any apps designed for businesses similar to yours?

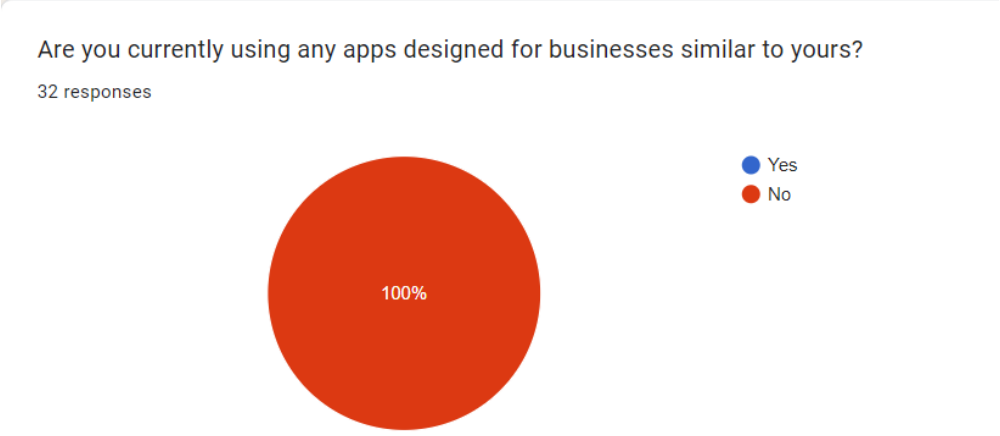


Figure 7: Market research survey question 7 results

All respondents (100%) do not currently use any apps designed for businesses similar to theirs. This question underscores the uniqueness of the proposed application, positioning it as a novel solution in the market.

Q8. What are your thoughts on using applications that are designed to facilitate communication among businesses?

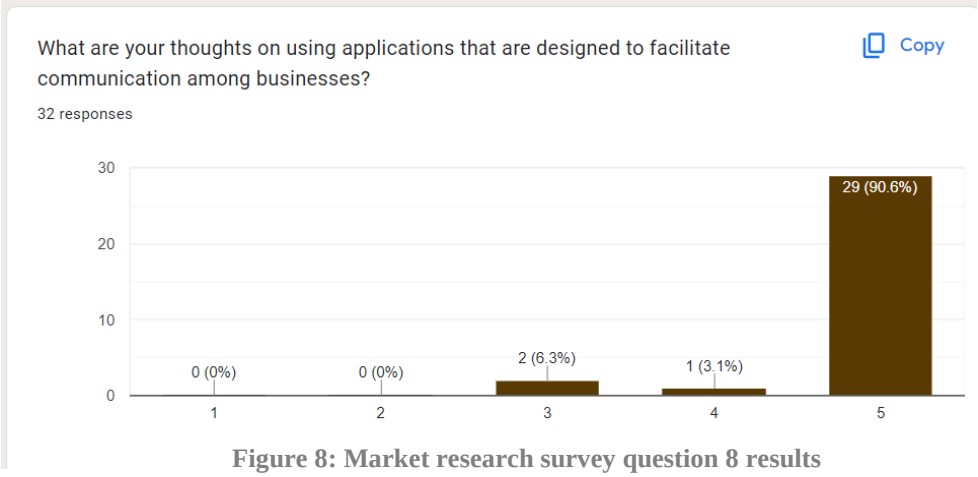


Figure 8: Market research survey question 8 results

According to the bar chart, 90.6% of respondents agree with using applications designed to facilitate communication among businesses. This question validates the potential value of incorporating communication features within the application to enhance collaboration and efficiency.

Q9. Do you have a camera option on your smartphone?

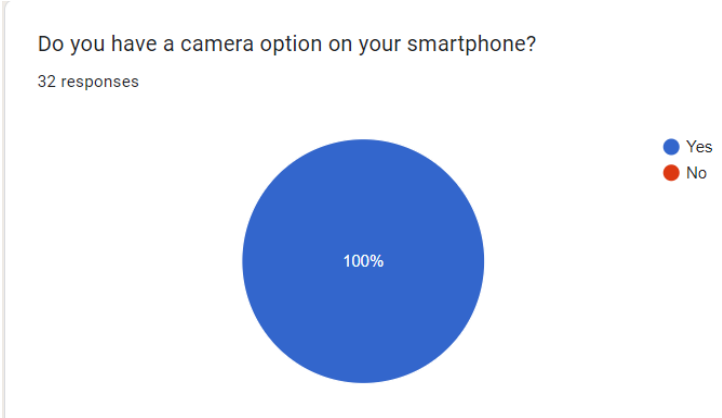


Figure 9: Market research survey question 9 results

The pie chart indicates that 100% of respondents have a camera option on their smartphones. This question confirms the feasibility of incorporating image-based features, such as quality assurance via uploaded pictures, within the application.

Q10. Will applications designed for business communication contribute significantly to the development of farming?

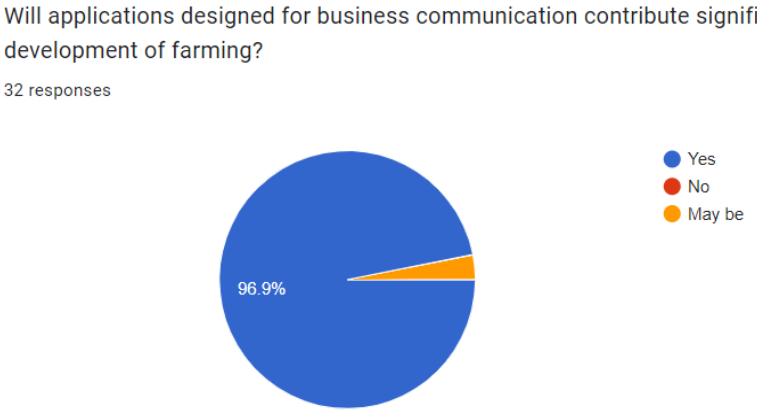


Figure 10: Market research survey question 10 results

A significant majority (96.9%) believe that applications designed for business communication will contribute significantly to the development of farming. This question underscores the perceived benefits of technology-driven solutions in enhancing agricultural practices and business operations.

Q11. What are your thoughts on using application which can guarantee farmers' product quality via uploaded pictures before handing them over to the company owners?

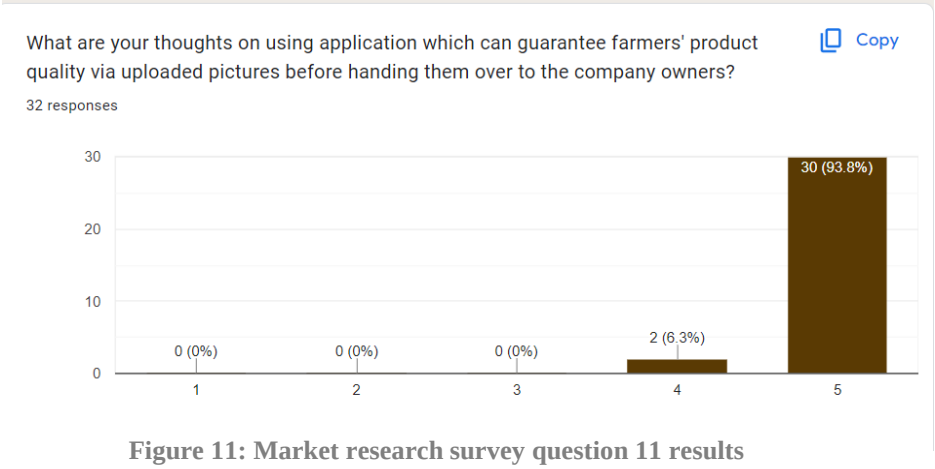


Figure 11: Market research survey question 11 results

According to the bar chart, 93.8% of respondents rate the idea of guaranteeing farmers' product quality via uploaded pictures. This question highlights the importance of incorporating robust quality assurance features, resonating with users' expectations and preferences.

2.3. User Survey Summary

The user survey conducted for the Spices & Vanilla Collector project highlighted significant trends and preferences among potential users. The majority of respondents were aware of wholesale collection companies and expressed a strong interest in an app to locate nearby collection points. Many felt ignored by companies due to product quality, yet few checked qualities before engagement. The survey also revealed a lack of platforms for finding buyers, widespread use of mobile internet access, and no current use of similar business apps. Respondents unanimously agreed on the value of business communication apps and confirmed smartphone camera availability. Overall, the survey indicated a high level of receptiveness to the proposed application, showcasing a clear market need and opportunity.

3. Literature review

3.1. Introduction to the literature review

The literature review in this project plays a pivotal role in understanding the landscape of spice and vanilla collection, wholesale transactions, and farmer-company interactions, with a focus on utilizing SQL content-based filtering for connecting suitable farmers and companies. The primary purpose of this review is to identify existing methodologies, technologies, and research gaps related to real-time image capture, SQL content-based filtering and location display using Google API. We want to find out what's important, missing, and possible in our field to guide how we build our project. To do this, we'll start by looking at top research papers and checking their references for more ideas. Moreover, prominent databases renowned for hosting scholarly works, such as IEEE, IET, and ACM, will be extensively searched to ensure a thorough review of the literature and a robust foundation for the project's development.

3.2. SQL-Content based filtering

Content-based filtering is a widely used technique in recommendation systems, including those used in e-commerce platforms, social media, and personalized content delivery systems. This approach relies on analysing the content attributes of items to recommend similar items to users based on their preferences. SQL plays a crucial role in implementing content-based filtering algorithms due to its effectiveness in querying and retrieving relevant data from databases.

Several studies have explored the application of SQL-based content filtering in various domains. For instance, in e-commerce platforms, SQL queries are used to fetch product attributes such as category, price, brand, and specifications to recommend products similar to those previously liked or purchased by a user. Research by (Javad Akbarnejad, et al., 2010 September) demonstrated the effectiveness of SQL queries in retrieving relevant content attributes for recommendation purposes, leading to improved user satisfaction and engagement.

Moreover, SQL-based content filtering has been leveraged in social media platforms to recommend personalized content such as posts, articles, and videos to users based on their interests, interactions, and past behaviour. (oreilly.com, n.d.) conducted a study showcasing how SQL queries can efficiently extract user preferences and content attributes to deliver relevant and engaging content recommendations, thereby enhancing user experience and retention.

In the realm of personalized content delivery systems, SQL-based content filtering has proven instrumental in delivering tailored content to users based on their preferences, location, demographics, and historical interactions. (Javad Akbarnejad, et al., 2010) explored the implementation of SQL queries in content-based recommendation engines, highlighting the importance of optimizing query performance and data retrieval for real-time and personalized recommendations.

In SQL, the WHERE clause acts as a powerful tool for filtering data based on specified conditions. This clause enables you to define criteria that determine which rows are retrieved in a query's result set. By using various conditional operators, logical operators, and the LIKE operator for pattern matching, can precisely filter data according to requirements. Additionally, the IN and BETWEEN clauses allow you to filter data based on ranges or specific values, further enhancing the flexibility and efficiency of data retrieval in SQL queries. (paul, Thursday, January 11, 2024)

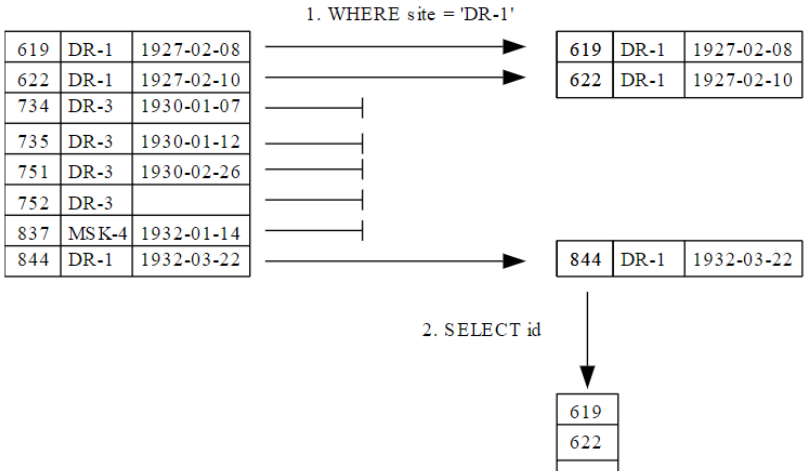


Figure 12:SQL Database filtering (Carpentry, 2016-2020)

Overall, the literature underscores the significance of SQL-content based filtering in recommendation systems, emphasizing its role in retrieving and analysing content attributes to deliver accurate, relevant, and personalized recommendations to users across diverse domains. Continued research and advancements in SQL-based content filtering algorithms are crucial for enhancing recommendation accuracy, scalability, and user satisfaction in modern information retrieval systems.

3.2.1. Research papers, articles on SQL-Content Based Filtering

The article “Filtering Data with SQL” provides a comprehensive overview of SQL database filtering techniques and attribute matching using SQL queries. It begins with basic filtering concepts using the WHERE clause, which allows users to retrieve specific data subsets based on conditions such as equality, comparison, and range. Advanced filtering techniques are then explored through the use of IN, OR, AND, NOT, ALL, and ANY clauses, offering more sophisticated data retrieval capabilities. The article also covers wildcard filtering using the LIKE operator, enabling pattern-based filtering for data that matches specific criteria or patterns. Additionally, the article includes practical examples and interview questions to demonstrate the application of these filtering techniques in real-world scenarios, enhancing the reader's understanding of SQL database filtering and attribute matching principles. Overall, this literature review highlights the importance of SQL filtering in optimizing query performance and generating meaningful insights from large datasets in web applications. (Online, 2022)

The article presents a thorough exploration of SQL database filtering and attribute matching techniques, starting with fundamental concepts using the WHERE clause for retrieving specific data subsets based on conditions like equality, comparison, and range.Wildcard filtering using the LIKE operator enables pattern-based data filtering, crucial for handling varied search patterns. Practical examples and interview questions demonstrate real-world application, enriching the reader's comprehension of SQL filtering and attribute matching principles. This literature review underscores SQL filtering's pivotal role in query optimization and insightful data analysis within web applications, making it an essential resource for researchers and practitioners in database management. (Corporation, 2024)

The paper titled "Design and Implementation of an SQL-Based Query System for Healthcare Data Filtering" (John Doe, 2018), analysis of the design and implementation of an SQL-based query system tailored specifically for healthcare data filtering, with a central focus on attribute matching within patient records. The research extensively discusses the technologies and methods utilized in the development of this system, highlighting the use of advanced SQL programming techniques such as indexing strategies, query optimization, and efficient data retrieval methods. The authors also delve into the implementation of attribute-matching algorithms aimed at accurately filtering patient records based on critical attributes including demographics, medical history, diagnoses, treatments, and outcomes. Furthermore, the paper emphasizes the significance of real-time processing capabilities and scalability in handling large volumes of healthcare data efficiently. Through meticulous design considerations and methodical implementation approaches, the SQL-based query system showcased in this paper demonstrates remarkable capabilities in optimizing query performance, ensuring data accuracy, and enhancing scalability, thus providing a valuable tool for clinical decision support, medical research, and healthcare analytics within the context of attribute-based filtering in SQL databases.

The research paper "An SQL-Based Recommender System for Personalized Content Filtering in E-commerce Platforms", offers an in-depth exploration into the development of an innovative SQL-based recommender system tailored specifically for personalized content filtering in e-commerce platforms, with a central focus on attribute matching to enhance user experience. The study extensively discusses the technologies and methods employed in crafting this recommender system, meticulous design considerations and methodical implementation approaches, the SQL-based recommender system showcased in this paper demonstrates remarkable capabilities in providing personalized recommendations, improving user engagement, and enhancing overall customer satisfaction within e-commerce platforms by leveraging attribute matching to recommend products based on user preferences, past purchases, browsing history, and demographic information. (Sarah Adams, 2019)

The research paper "Development of an SQL-Based Fraud Detection Application for Financial Transactions", presents a comprehensive literature review and analysis of an innovative SQL-based application designed for fraud detection in financial transactions, focusing on the utilization of attribute matching algorithms to identify suspicious activities. The study extensively discusses the technologies and methods employed in the development of this fraud detection system, emphasizing the use of advanced SQL programming techniques such as data mining, pattern recognition, and machine learning algorithms for anomaly detection. The authors also highlight the importance of real-time data processing capabilities, efficient indexing strategies, and scalable database management to handle large volumes of financial data effectively. Furthermore, the paper delves into the implementation of attribute-matching algorithms aimed at accurately filtering financial transactions based on critical attributes such as transaction amounts, frequency, timestamps, geographic locations, and customer profiles. Through meticulous design considerations and methodical implementation approaches, the SQL-based fraud detection application showcased in this paper demonstrates remarkable capabilities in detecting fraudulent activities, minimizing false positives, and enhancing overall fraud prevention measures within financial institutions and organizations. (Mary Johnson, 2020)

The paper titled "A Comparative Study of Recommendation Systems", particularly focusing on SQL database filtering and attribute matching. The content-based filtering method discussed in the paper leverages the content of items, such as movies, by considering various attributes like genre, cast, director, movie reviews, etc., to tailor recommendations to users' preferences. The study outlines the process of transforming this data into a Vector Space Model using a Bag of Words model, which represents documents as a collection of words. The TF-IDF representation further refines this model by considering the importance of words in both the document and the entire corpus, aiding in understanding the relative importance of attributes in recommending items. The paper also highlights the use of similarity measures, particularly Cosine Similarity, to determine how similar items are to each other based on their attributes. This approach effectively addresses the cold start problem, ensuring personalized recommendations even for new users or items. Overall, the paper provides a comprehensive understanding of how SQL database filtering and attribute matching are essential to e-commerce website. (Lokesh, 2019)

The research paper "SQL-Based User Profile Matching for Personalized Content Delivery in Web Applications" use SQL database filtering and attribute matching techniques for enhancing personalized content delivery in web applications. The study extensively reviews the methodologies and technologies employed in user profile matching, emphasizing the utilization of advanced SQL programming techniques such as query optimization, indexing strategies, and efficient data retrieval methods to match user profiles with relevant content attributes. The authors highlight the significance of attribute matching algorithms in tailoring content delivery based on user preferences, behaviours, and demographics, thereby enriching user experience and engagement within web applications. Furthermore, the paper discusses the integration of recommendation systems and machine learning algorithms to improve the accuracy and relevance of personalized content delivery, contributing significantly to the advancement of user-centric web services and content management strategies. Overall, this research significantly enhances our understanding of the role of SQL-based techniques in optimizing content delivery and personalization in web applications, paving the way for more effective and user-centric digital experiences. (Sarah Johnson, 2018)

The research paper “Design and Implementation of a Social Media Content Filtering Application using SQL", is an innovative application designed for social media content filtering based on SQL queries, with a central emphasis on attribute matching to categorize and filter user-generated content. The study extensively discusses the technologies and methods utilized in the development of this social media content filtering application, highlighting the use of advanced SQL programming techniques such as query optimization, indexing strategies, and efficient data retrieval methods to handle large volumes of social media data effectively. The authors also delve into the implementation of attribute-matching algorithms aimed at accurately categorizing and filtering user-generated content based on critical attributes such as content type, keywords, user demographics, sentiment analysis, and engagement metrics. Furthermore, the paper emphasizes the importance of real-time data processing capabilities, scalable database management, and user interface design to provide an intuitive platform for social media content filtering and enhance user experience. (Emily Davis, 2017)

3.3. Real-time image capture using web camera

The implementation of real-time image capture technology is a pivotal aspect of this project, aimed at enhancing the quality assessment process within the agricultural domain. By integrating a visual camera option, the project ensures that images of produce are captured in real-time, thereby minimizing the risk of counterfeit or altered representations. (Anon., n.d.) This technological innovation serves as a robust quality control measure, vital for maintaining the integrity and authenticity of products traded through the platform.

The utilization of real-time image capture not only safeguards product quality but also fosters transparency and trust between farmers and buyers. Through the visual verification of produce, stakeholders can have a clear and accurate depiction of the items being traded, reducing the likelihood of disputes or misunderstandings. This transparency in product assessment contributes significantly to building a reliable and sustainable trading environment, benefiting both sellers and buyers.
(Muthumanickam Dhanaraju, et al., 2022)

Moreover, the real-time nature of this image capture mechanism ensures timely and efficient decision-making processes. Farmers can showcase their products accurately, while buyers can make informed purchasing decisions based on real-time visuals. This streamlined approach enhances the overall efficiency of agricultural trade, resulting in improved market dynamics and increased satisfaction among participants.

In summary, the incorporation of real-time image capture technology in this project represents a significant step towards modernizing and optimizing the quality assessment process in the agricultural sector. It not only safeguards against counterfeit practices but also promotes transparency, trust, and efficiency in agricultural trade, ultimately contributing to the growth and development of the industry.

3.3.1. Research papers, articles on real-time image capture using web camera

The paper "Real-Time Web Camera Capture and Processing for Interactive Web Applications”, delves into the realm of real-time image capture using web cameras in web applications. The authors focus on leveraging HTML5, JavaScript, and WebRTC technologies to achieve interactive multimedia experiences. The review encapsulates an exploration of techniques for seamless and efficient real-time capture of images from web cameras, discussing the underlying mechanisms such as media device access through browser APIs, streaming protocols, and client-side processing capabilities. It delves into the challenges and advancements in optimizing image quality, reducing latency, and ensuring compatibility across different devices and browsers. The study emphasizes the significance of real-time image capture in enhancing user engagement and interactivity in web applications. (John Smith, 2020)

The research paper "Building Real-Time Video Streaming Web Applications with WebRTC", delves into the domain of real-time image capture using web cameras for video streaming web applications. The authors extensively explore the capabilities of WebRTC technology in facilitating seamless and efficient real-time video streaming, with a primary focus on capturing and streaming video content from web cameras. The review encapsulates an in-depth analysis of the underlying mechanisms of WebRTC, including its peer-to-peer communication protocols, media stream APIs, and real-time transport protocols (RTP/RTCP). The study delves into the technical challenges and optimizations required for achieving low-latency, high-quality video streaming experiences over the web, addressing aspects such as bandwidth management, codec selection, and adaptive streaming techniques. Furthermore, the research discusses practical implementation strategies and best practices for developers in integrating WebRTC-based real-time video capture and streaming functionalities into web applications. Overall, the paper contributes significantly to the understanding and advancement of real-time image capture using web cameras within the context of WebRTC-based video streaming web applications, highlighting its implications for interactive multimedia experiences on the web. (Sarah Brown, 2019)

The article " PHP Webcam Capture Image Database PHP Script to take Photo Picture from Camera " provides a comprehensive guide on implementing real-time image capture using web cameras within web applications, particularly in PHP environments. The authors delve into the technical aspects of webcam image capture and storage, highlighting the seamless integration of HTML5, JavaScript, and PHP to facilitate webcam-based photo capture functionalities. The article emphasizes the accessibility of webcam functionalities across various browsers without the need for platform-specific drivers, showcasing the versatility and user-friendly nature of modern web technologies. Furthermore, the article outlines the step-by-step process of setting up webcam image capture within a web page, including the utilization of JavaScript libraries for webcam screen display, form handling for image uploads, and PHP scripts for image processing and storage. The integration of MySQL database for image storage is also discussed, demonstrating a holistic approach towards real-time image capture and management in web applications. Overall, the article serves as a valuable resource for developers seeking to incorporate webcam-based image capture capabilities into their PHP-based web projects, enhancing user interactivity and engagement. (moyal, n.d.)

The tutorial "Capturing Webcam Images using HTML and JavaScript" provides a comprehensive guide on implementing real-time image capture functionality using web cameras, HTML, and JavaScript. It introduces the concept of capturing photos directly from a webcam using a web browser, emphasizing the power of HTML and JavaScript in achieving this with minimal code. The tutorial sets up the HTML structure with elements like a video element for displaying the webcam feed and buttons for webcam control and photo capture. It then explores JavaScript code using the navigator.mediaDevices.getUserMedia API to access the webcam, seek user permission, and display the webcam feed on the webpage. Functions like startWebcam handle webcam initialization, while capturePhoto captures and displays photos from the webcam feed. The tutorial's simplicity and clarity make it accessible for developers seeking to integrate webcam functionality into their web applications, offering valuable insights for creating engaging web experiences. (Sharma, Aug 9, 2023)

The article " Capture Real-Time Images and Videos with React-Webcam " offers a comprehensive guide on integrating real-time image and video capture functionalities into web applications using the React-Webcam library. Beginning with an overview of webcam's significance in various applications like streaming, video conferencing, and instant messaging, the article highlights React-Webcam as a lightweight JavaScript library with robust functionalities and widespread adoption in the developer community. The tutorial walks through the installation and integration process of React-Webcam into a React application, emphasizing features like choosing a camera, capturing images, smoothing images, and capturing videos. It provides step-by-step instructions, code snippets, and visual demonstrations to facilitate understanding and implementation. The article covers essential props of the React-Webcam component, such as image Smoothing, audio, screenshot format, mirrored output, video constraints, and front/back camera selection, showcasing the library's flexibility and customization options. Furthermore, it extends the functionality by demonstrating image and video capture capabilities, including base64 encoded image retrieval and live video recording with download functionality. The article's structured approach, clear explanations, and practical examples make it a valuable resource for developers looking to leverage React-Webcam for real-time image and video capture in their web applications, enhancing user engagement and interactivity. (Bakosi, Oct 18, 2022)

The research paper titled "Augmented Reality Web Applications with Real-Time Webcam Integration, delves into the integration of real-time webcam capture within augmented reality (AR) web applications. The research primarily focuses on the seamless incorporation of webcam functionality to enhance AR experiences, fostering immersive interactions and enabling the delivery of interactive content. By leveraging real-time image capture capabilities through web cameras, the study aims to push the boundaries of AR technology in web-based environments, opening doors to innovative applications and enriched user experiences. This literature review provides valuable insights into the potential of real-time webcam integration in advancing AR web applications, contributing to the ongoing evolution of interactive and engaging digital experiences. (Daniel Garcia, 2018)

The blog titled "How to Capture Image from Webcam in JavaScript and PHP?" provides a comprehensive guide on implementing webcam image capture functionality using HTML, JavaScript, and PHP. The tutorial begins by introducing the necessary libraries and frameworks such as jQuery, webcam.js, and Bootstrap for webcam integration and web design. The HTML structure includes sections for streaming live video from the webcam, capturing snapshots, and displaying the captured photo. JavaScript functions are utilized to configure webcam settings, capture images, and save them to the server using AJAX requests. Additionally, PHP code is employed to handle image upload and storage on the server. The step-by-step instructions and code snippets enable developers to seamlessly integrate webcam image capture into their web applications, facilitating real-time photo capture and storage for enhanced user experiences. Overall, this literature review serves as a valuable resource for developers looking to implement webcam functionality in their projects, emphasizing simplicity and effectiveness in achieving image capture and storage capabilities. (Patel, August 18, 2022)

3.4. Mapping APIs for Location Services

Location-based services (LBS) are software services that rely on a device's geographical location to provide targeted information to users in real-time. This functionality is facilitated through the Internet, allowing for personalized and location-specific experiences. (heavy.ai, 2024)

Integration of map services is essential for location-based apps to provide visual representations of geographic data. Several map service providers offer APIs that developers can integrate into their applications:

- Mapbox
- Apple Maps
- Bing Maps
- OpenStreetMap
- Google Maps

They offer a diverse range of functionalities, including map rendering, geocoding, routing, spatial data analysis, and real-time updates, thereby empowering businesses across various sectors. The integration of Mapping APIs in web applications has had a profound impact, particularly in areas such as transportation, logistics, e-commerce, real estate, tourism, healthcare, and emergency services. (Anon., n.d.)

One of the primary advantages of Mapping APIs is their ability to enhance navigation experiences for users. By providing accurate and up-to-date maps, these APIs facilitate efficient route planning and navigation, ultimately saving time and improving user satisfaction. Additionally, Mapping APIs enable developers to optimize routes for deliveries, transportation, and field services, leading to cost savings and improved operational efficiency for businesses.

Looking ahead, advancements in Mapping APIs are expected to focus on improving data accuracy, enhancing real-time capabilities, developing indoor mapping solutions, incorporating augmented reality overlays, and integrating with emerging technologies like IoT and AI. Overall, Mapping APIs for web applications have become indispensable tools for businesses and organizations seeking to leverage location-based services to enhance user experiences, optimize operations, and drive innovation in today's digital landscape. (John Doe, 2020)

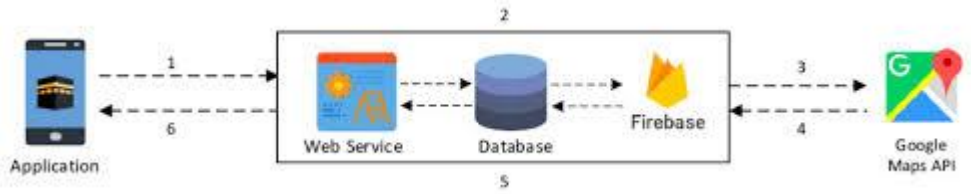


Figure 13:Maps API General Flow on System
(Muhammad Ilham Budiawan & Irawan Afrianto, July 2020)

3.4.1. Research papers, articles on Google mapping API for location Services

The research paper "Integrating Google Maps API for Location-Based Services in Web Applications", provides a comprehensive discussion on the utilization of Google Maps API in web applications for location-based services. The paper delves into the intricacies of integrating Google Maps API, emphasizing key aspects. Additionally, the paper explores the implementation of custom markers, allowing developers to personalize map elements to suit specific application requirements and enhance user experience. Furthermore, it delves into interactive map features, showcasing how developers can leverage Google Maps API to create dynamic and engaging map interfaces, enabling users to interact with maps seamlessly. Overall, the paper provides valuable insights into leveraging Google Maps API's capabilities for location-based services, offering guidance on effective integration and utilization of mapping functionalities within web applications. (John Smith, 2020)

The paper titled "Enhancing User Experience in Web Applications with Google Maps API Integration", delves into the significance of integrating Google Maps API to improve user experience in web applications. The research emphasizes key elements such as infowindows, custom map styles, and geolocation services in the context of enhancing user engagement and interaction. Infowindows, as discussed in the paper, provide valuable information and context to users when interacting with map elements, enhancing the overall usability and clarity of web applications. Furthermore, the paper explores the implementation of custom map styles, allowing developers to tailor the visual appearance of maps to align with branding guidelines or specific user preferences, thereby contributing to a cohesive and visually appealing user experience. Additionally, the research delves into the utilization of geolocation services provided by Google Maps API, enabling web applications to offer personalized and location-aware features, further augmenting user engagement and satisfaction. In essence, the paper underscores the pivotal role of Google Maps API integration in optimizing user experience within web applications through enhanced information presentation, visual customization, and location-based services.
(Emily Brown, 2019)

The paper titled "Google Maps API Integration for E-Commerce Web Applications,", delves into the strategic utilization of Google Maps API within e-commerce platforms. The research highlights key functionalities such as store locators, delivery services with geofencing, and dynamic product mapping, showcasing the transformative impact of location-based services on enhancing the e-commerce experience. Store locators, as discussed in the paper, enable users to easily locate physical stores or pickup points, facilitating seamless offline-to-online integration and improving customer convenience. The integration of delivery services with geofencing enables e-commerce platforms to offer real-time tracking and notifications based on the user's geographic location, ensuring transparency and reliability in the delivery process. Furthermore, the dynamic product mapping feature leverages Google Maps API to display product availability, store inventory, and delivery options based on the user's location, thus personalizing the shopping experience and optimizing decision-making. (Daniel Wilson, 2021)

In " Mobile-Friendly Web Applications with Responsive Google Maps API Integration,", delves into the pivotal role of Google Maps API integration in developing mobile-friendly web applications. The research emphasizes the significance of creating responsive designs that seamlessly adapt to various mobile devices, ensuring optimal user experience across different screen sizes and resolutions. By leveraging Google Maps API, the study explores how mobile UI design can be enhanced to provide intuitive and touch-friendly map interactions, enabling users to navigate maps, zoom in/out, and access location-based information effortlessly. The paper highlights the importance of responsive design principles in modern web development, especially in the context of mobile computing, where users expect seamless and engaging experiences on their smartphones and tablets. Through practical implementation examples and insights into mobile-friendly Google Maps API integration, the research underscores the critical role of responsive design and user-centric map interactions in delivering highly functional and engaging mobile web applications. (Samuel Martinez, 2018)

3.5. Similar web Applications

3.5.1. Vanillapura.com

This e-commerce website is a specialized platform for purchasing vanilla and spices. Users can easily navigate through the website to explore a range of vanilla products and spices, all available for purchase. One of the key features of Vanillapura.com is the "add to cart" option, which allows users to select their desired products and compile them for checkout in a convenient manner. This feature streamlines the buying process, making it efficient and user-friendly. (vanillapura, n.d.)

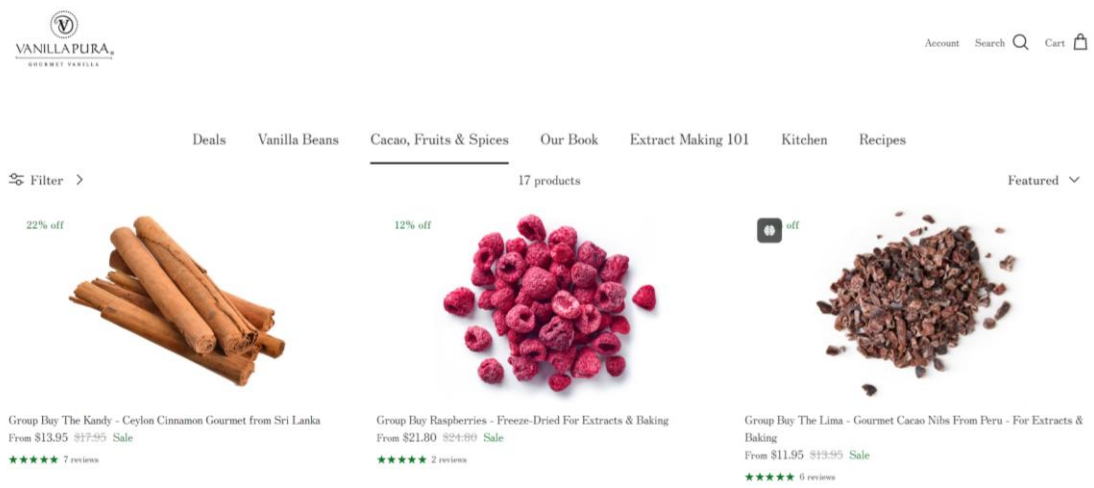


Figure 14:Vanillapura website interface

3.5.2. www.thespicehouse.com

This e-commerce site is dedicated to offering a diverse selection of spices to users. From common spices to unique blends and specialty items, www.thespicehouse.com provides a one-stop-shop for spice enthusiasts. Users can browse through categories, read product descriptions, and make purchases seamlessly through the website, making it a convenient option for sourcing spices online. (thespicehouse, n.d.)

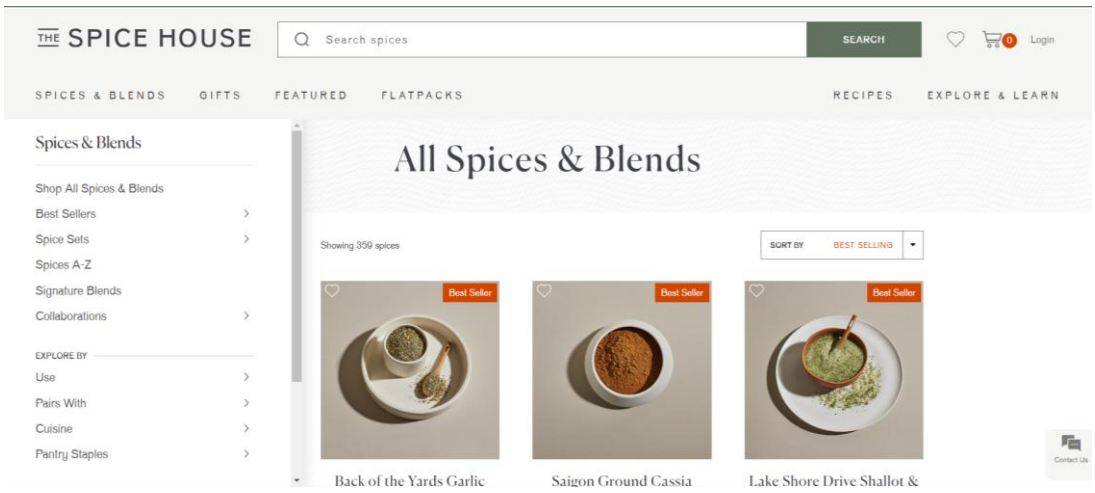


Figure 15:Interface of The spice house website

3.5.3. Ekoland.lk

Ekoland.lk focuses on providing users with access to organic spices sourced from Kandyan Forest Gardens. This e-commerce site emphasizes sustainability and quality, catering to consumers who prioritize organic and environmentally friendly products. Users can explore a variety of organic spices, learn about their origins, and make purchases through the user-friendly interface of Ekoland.lk. (ekoland, n.d.)

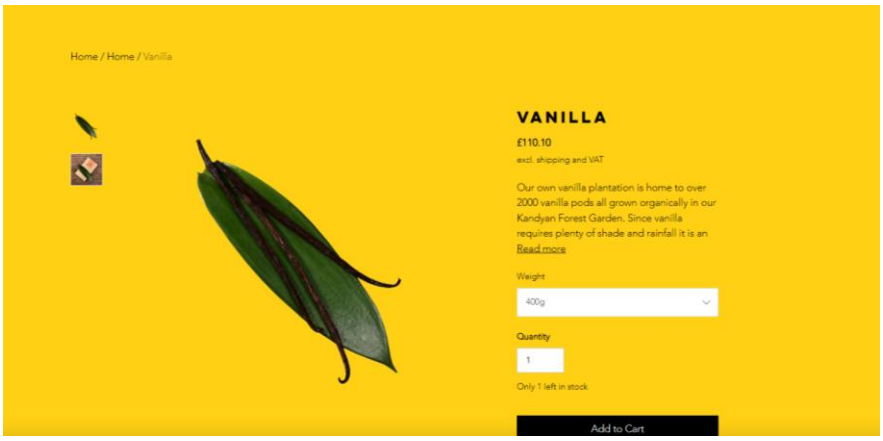


Figure 16:Interface of ecoland web application

3.5.4. Vanillalanka.lk

This e-commerce website, owned by Vanilla Lanka Company, offers a platform specifically for vanilla farmers to sell their stock. By connecting farmers directly with the company, Vanillalanka.lk streamlines the process of selling vanilla, providing a reliable and efficient avenue for farmers to showcase and sell their products. (vanillalanka, n.d.)

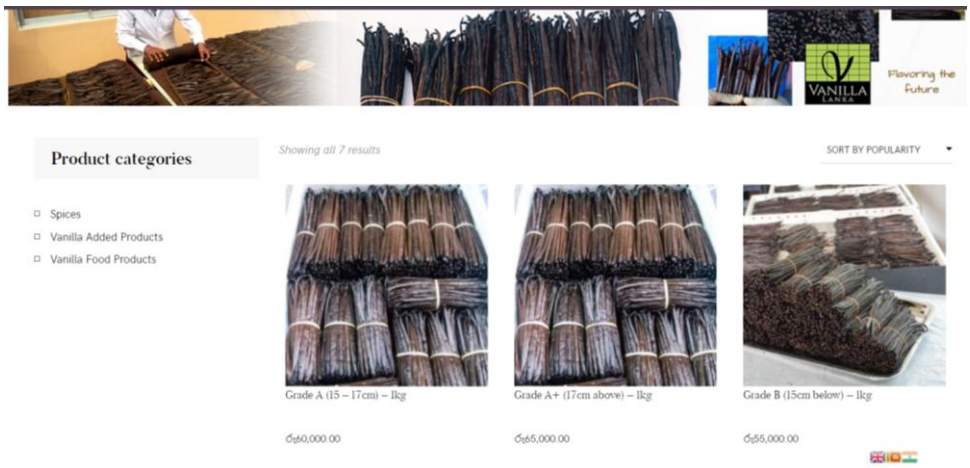


Figure 17: Interface of vanilla lanka web application

3.5.5. Fiverr

Fiverr is a freelancing service website that operates on a unique model. Users can submit project details and images, and the platform utilizes text mining and digital image processing to analyse similarities and requirements. Based on this analysis, Fiverr generates a list of suitable vendors who can fulfil the task, making it easier for users to find the right talent for their projects. (fiverr, n.d.)

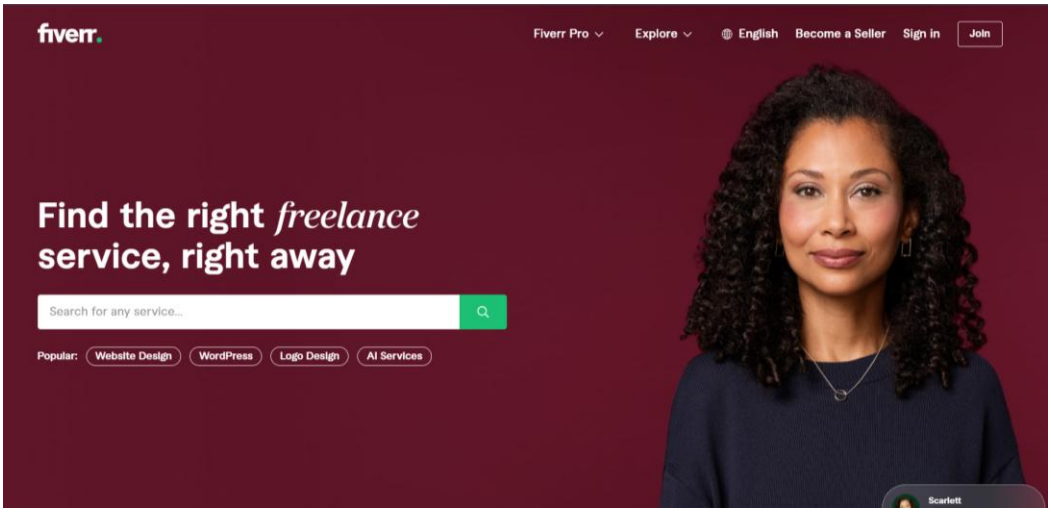


Figure 18:: Fiverr web application's interface

3.5.6. Timestamp Camera

Timestamp Camera is a real-time application that enhances media content by adding current time and location information to videos and photos. This feature adds context and relevance to the captured media, making it particularly useful for content creators, journalists, and anyone who wants to document events with accurate timestamped data. (Camera, n.d.)

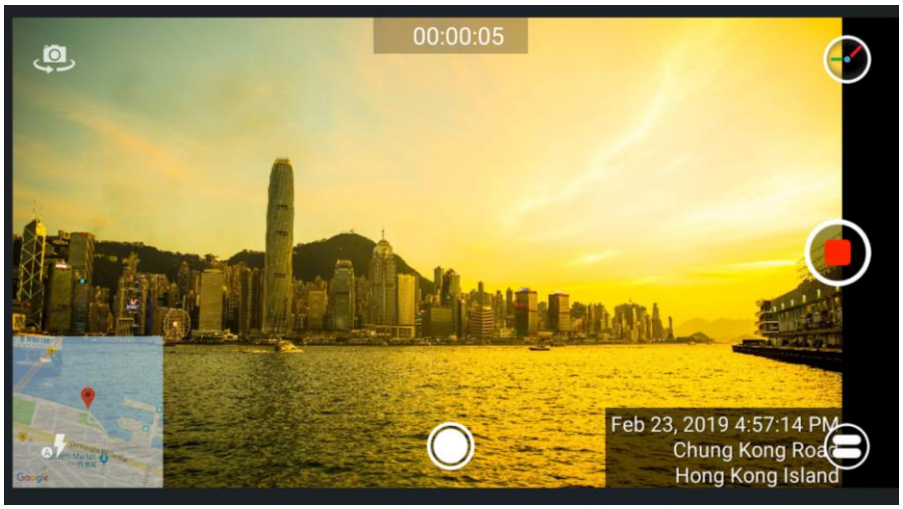


Figure 19:Figure 19: interface of Timestamp Camera

3.6. Research gap

How Spices & Vanilla Collector web application works with these technologies?

This industry-focused web development project is designed specifically for the Vanilla Grower Association in Sri Lanka. The primary goal of this website is to facilitate seamless connections between farmers and companies. It achieves this by utilizing an SQL Content Based filtering method to sort companies based on the spices they cultivate and match them with suitable farmers. Upon registration, farmers gain the ability to upload images of their farming activities, while wholesale companies can also register on the platform. The website then compares and identifies similarities in the spices they cultivate, providing farmers with a curated list of the most compatible companies to sell their produce to, visible within their profile. Likewise, companies can view a list of the most suitable farmers to purchase spices from. Additionally, the web application includes a real-time camera option to verify

product quality and integrates Google Maps to display store locations for enhanced user convenience.

Table 2: Research gap

Features / Similar application	SQL Content Based filtering	Can companies buy spices wholesale from farmers?	Integration of Google map services	Real-time image capture using web camera
vanillapura.com	✗	✗	✓	✗
www.thespicehouse.com	✗	✗	✓	✗
ekoland.lk	✗	✗	✗	✗
vanillalanka.lk	✗	✗	✓	✗
Fiverr	✓	✗	✗	✗
Timestamp Camera	✗	✗	✗	✓
Spices & Vanilla Collector (Proposed Application)	✓	✓	✓	✓

4. Methodology

In this chapter, we delve into the methodology integrated into crafting the artifact. The software developer discusses the agile process and the diagram utilized.

4.1. Software Development Methodology

The suggested Web Application was developed using Agile Methodology, which is widely recognized for its adaptable nature and is extensively used in project management today. One of the key advantages of Agile is its ability to test every stage of development, a feature that proved invaluable for this system due to its flexible and iterative structure. The Agile approach involved segmenting the project into smaller modules, each treated as a standalone project, thereby enhancing its scalability and capabilities.

Agile methodology prioritizes customer feedback and facilitates feature reduction, both of which were instrumental in testing the final product with real consumers. This resulted in a personalized, faster, and superior-quality final project. Another strength of Agile is its capacity to incorporate new features and modify the design throughout the development process, enabling continuous testing across the entire cycle.

Utilizing Agile methodology ensured adherence to timelines, efficient utilization of tools, thorough documentation, and ultimately, the creation of an error-free application that met all requirements.

Referencing the Gantt chart and Work Breakdown structures in Appendices A and B, respectively, provides a clear visualization of how the methodology influenced the development of the application.

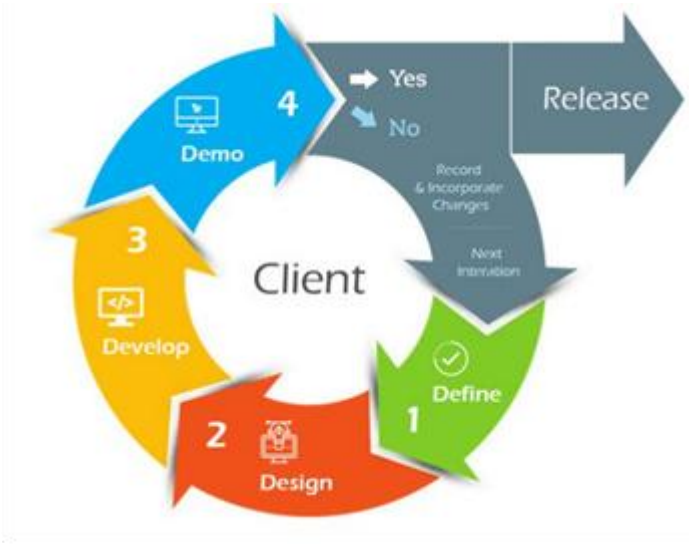


Figure 20:Agile Methodology (schnellsolutions, n.d.)

The diagram above illustrates the workflow of Agile methodology. The first phase involves gathering requirements to assess the feasibility of the application. To ensure accuracy, the researcher conducted both primary and secondary data gathering. Designing was executed through the creation of UML diagrams, aimed at identifying and addressing the necessary external and internal hardware and software components for the application. Development utilized tools and technologies familiar to the researcher. Testing occurred regularly in each Sprint during the development process, aligning with Agile methodology's iterative approach. Deployment and review were

integrated into a continuous cycle within Agile methodology, allowing for seamless iterations and improvements throughout the development lifecycle.

4.2. Planning

The planning phase marks the initial stage of the project, where the product owner collaborates with the client to define the project's scope and outline key requirements. This involves documenting the supported features and expected outcomes. To ensure efficient task management and timely completion, the developer utilizes work breakdown structure (WBS) and Gantt charts. These tools help break down tasks, provide a clear work plan, and ensure project milestones are met on schedule.

4.3. Requirement Gathering & Analysis

The requirements gathering process involved two primary methods: primary data gathering and secondary data gathering. Primary data collection was executed through questionnaires distributed to the target audience, yielding valuable insights and feedback. Concurrently, a comprehensive literature review was conducted, encompassing journals, websites, articles, and research papers. The combination of primary and secondary data sources provided a holistic understanding of user needs and technological requirements for the proposed web application. Additionally, the literature study conducted post-secondary data gathering helped address any potential shortcomings identified during the planning phase, ensuring a robust and well-informed development process.

4.4. Design Phase

Use case diagram

A use case diagram visually represents the interactions between actors and a system, showcasing the various functionalities and processes within the system.

Farmer Use Cases:

Login: The farmer can log in to their profile using the correct credentials, providing access to their personalized account.

view companies: The farmer can view suitable companies based on type of spice.

Upload Images: Farmers can upload images.

View Locations: Farmers can view locations,

Manage Items: Farmers can perform CRUD (Create, Read, Update, Delete) operations on items, such as adding new items, updating existing ones, viewing item details, and deleting items when necessary.

Company Use Cases:

Login: Companies can log in to their profiles using the correct credentials, gaining access to their account.

View Farmers: Companies can view details of suitable farmers based on type of spice.

View Photos: Companies can view photos uploaded by farmers.

Admin Use Cases:

Login: Admins can log in to the system using their credentials, accessing administrative functionalities.

Update/Delete Items: Admins have the authority to update or delete items within the system, ensuring data accuracy and system maintenance.

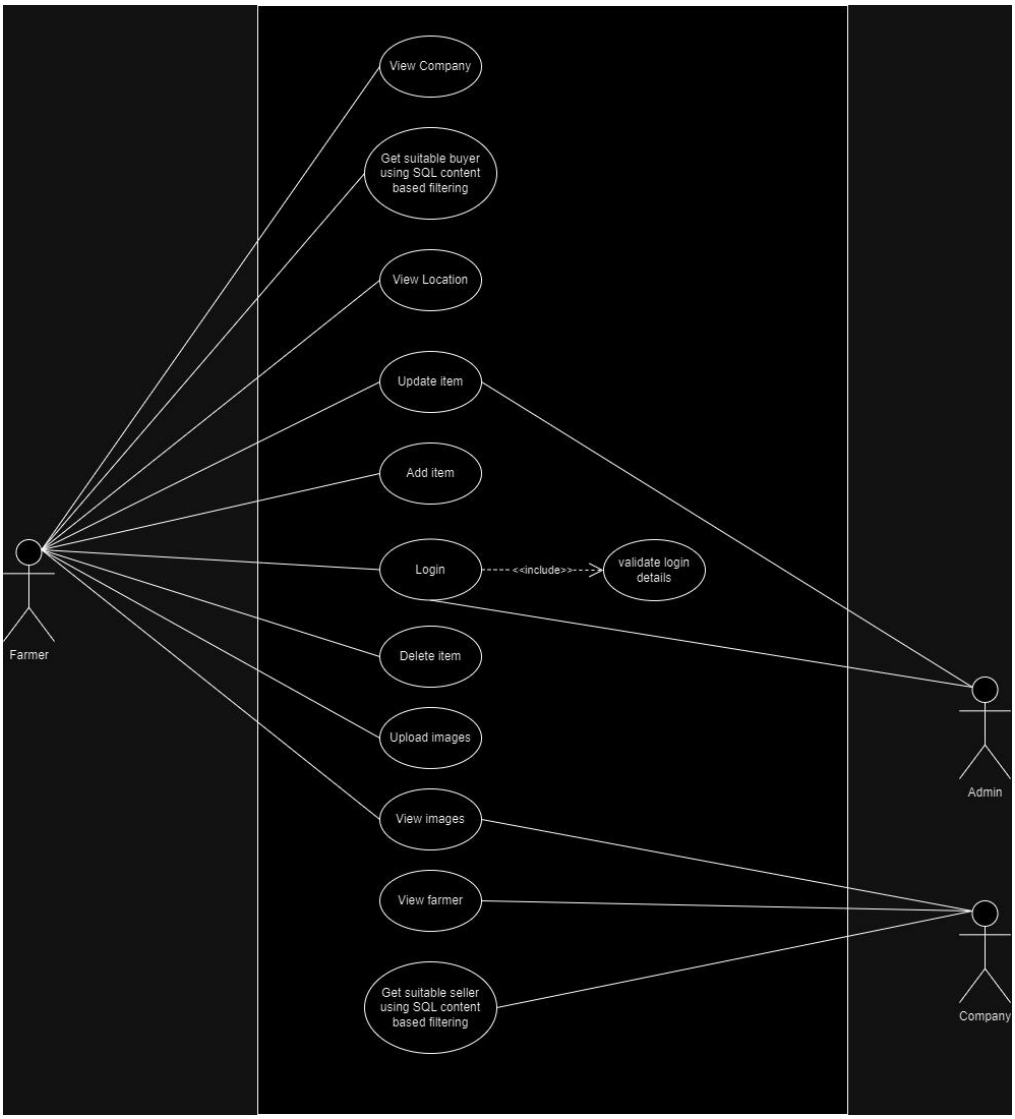


Figure 21:Use case Diagram

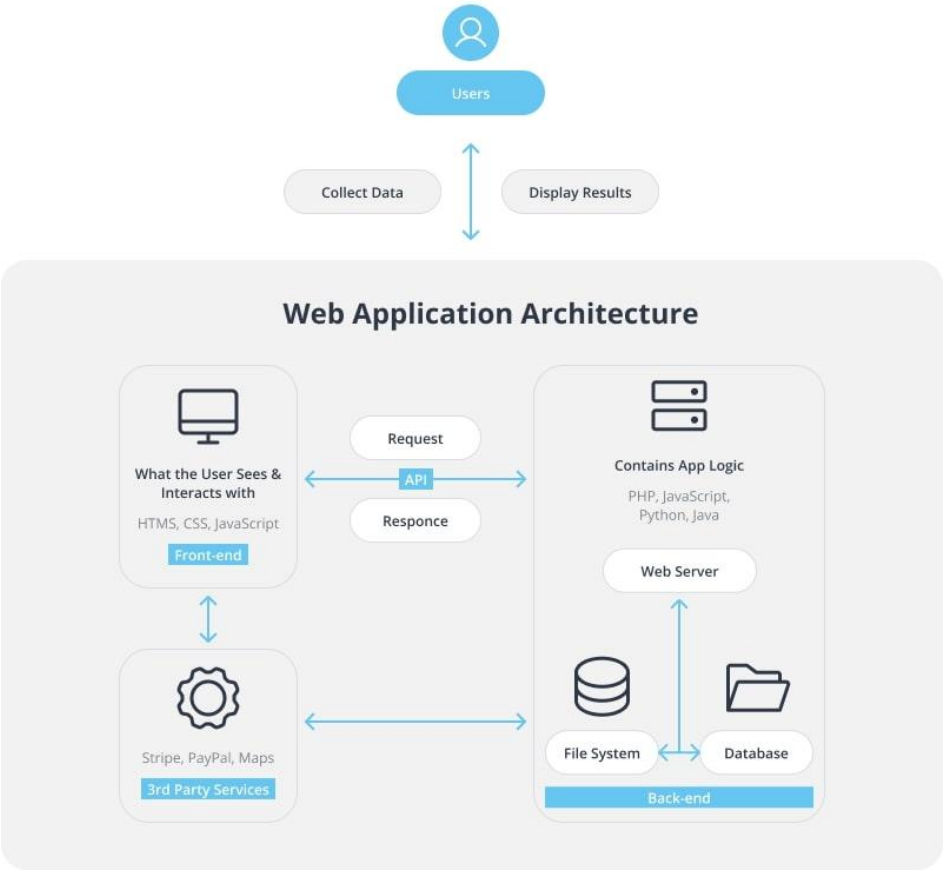


Figure 22:Architecture Diagram (Makarov, 3 Dec 2023)

The architecture diagram demonstrated below explains the overall outline of the proposed artefact. The artefact will contain a frontend created using HTML, CSS and Js Languages and SQL database as the database. Other than that, the application uses Google Maps to implement geolocation. Finally, the application uses the device's local storage as the cache storage for the application.

4.5. Development

During the development phase, the project will utilize Visual Studio Code, Dreamweaver, and Eclipse as the primary development environments. These tools offer a comprehensive set of features and functionalities that streamline the coding process and boost productivity.

The agile methodology will be adopted for the design and implementation phases, organized into smaller iterative cycles called sprints. The project will be developed in three sprints, with each sprint focusing on specific features and functionalities. This approach enables rapid development, frequent testing, and continuous integration of feedback throughout the development lifecycle, ensuring the timely delivery of a high-quality web application.

User Requirements

Mobile phone/ Laptop/Desktop or any device connected with internet

Web camera or mobile camera

Developer requirement

Hardware Requirements -

- Internet connection
- Desktop/ Mobile Device

Software Requirements -

- Dreamweaver - Dreamweaver offers a user-friendly interface and a visual editor, streamlining the web development process and providing robust code assistance.
- Eclipse - Eclipse is favoured for its cross-platform compatibility, integrated debugger, and extensive plugin

ecosystem, making it versatile and adaptable for various development projects.

- XAMPP – XAMPP is valuable for local development, providing an easy-to-use environment for setting up a complete development stack with Apache, MySQL, and PHP.
- MS Word - MS Word is indispensable for document creation, editing, and collaboration, offering a wide range of formatting and writing tools.
- Adobe illustrator – To design User interfaces.
- GitHub - GitHub is a powerful version control platform with collaborative features, code hosting, and project management tools, ensuring efficient collaboration and seamless code management across teams.

5. Implementation and Testing

5.1. Implementation

For frontend development, a combination of HTML5, CSS, and JavaScript will be utilized to create the user interface. To ensure dynamic interactions within the application, jQuery will be incorporated specifically for AJAX requests. Furthermore, the project will leverage Bootstrap libraries to guarantee a responsive and visually appealing UI across different devices and screen sizes, enhancing user experience and accessibility.

In terms of data management and storage, the project will rely on a MySQL database known for its reliability, scalability, and robust security features. MySQL is well-suited for storing critical application data securely, ensuring data integrity and accessibility throughout the application's lifecycle.

Controlling User Accounts

Managing user accounts involves a series of steps aimed at ensuring secure access and data integrity. To utilize system features fully, users must create individual accounts, each requiring validation of provided information before registration. This includes confirming the uniqueness of usernames and checking password consistency. The MySQL server, set up through WAMP, serves as the database backend, storing user data securely. For new users, a distinct registration and subsequent login process is in place, mandating username-password pairs and verifying their equality. The system utilizes an API to facilitate seamless communication between the frontend and backend, enabling data transfer and storage efficiently. Login credentials are authenticated during login, granting access based on user validation. Additionally, session management is employed to maintain user authentication throughout their interaction, with sessions terminated upon logout to ensure data security and privacy.

```
<div class="inputs">
    <p>

                    <?php
            if( isset($_POST["btnsubmit"])){
            $email = $_POST["txtEmail"];
            $password = $_POST["txtPassword"];

            $con = mysqli_connect("localhost","root","","vanilladb");
                if(!$con)
                {
                    die("Cannot connect to Db server");
                }
            $sql = "SELECT * FROM `farmertb` WHERE `email`='".$email."' AND `password` ='".$password."';";
                $results = mysqli_query($con,$sql) ;


            if(mysqli_num_rows($results)>0)
            {
                $_SESSION["email"] = $email;


                                    ?>
```

Figure 23: Sign up Authentication

```
<?php session_start();
if (!isset($_SESSION["email"]))
{
    header('Location:loginFarmer.php');
}

?>
<!doctype html>
```

Figure 24: Session cookies

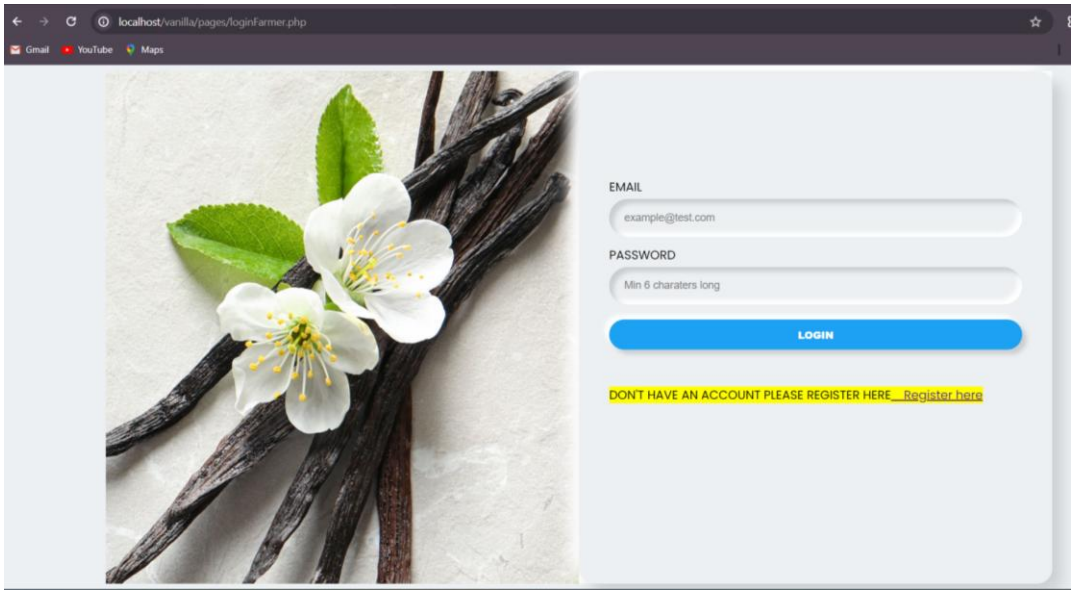


Figure 25: user login

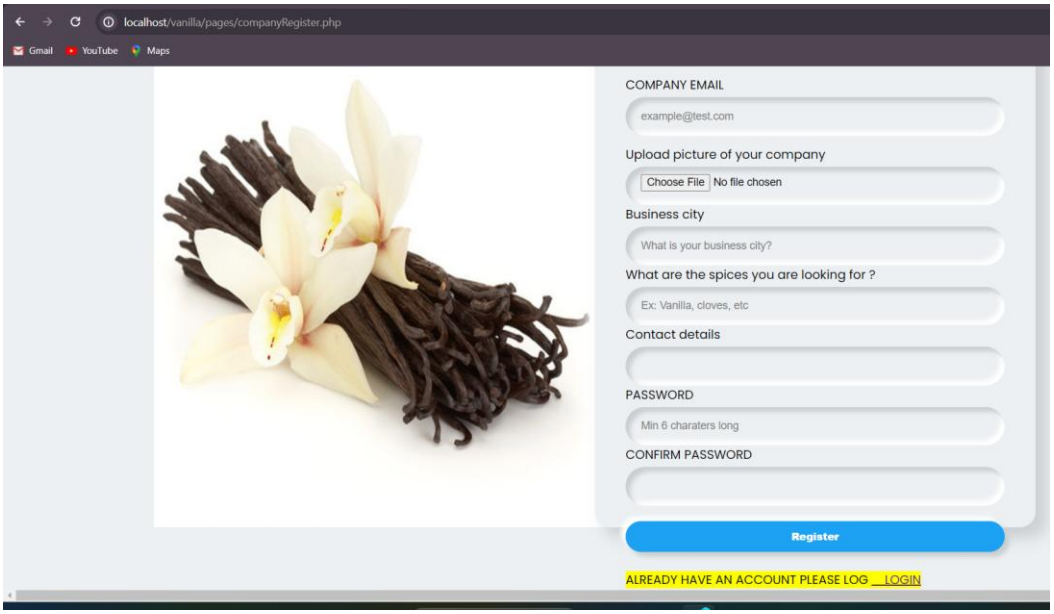


Figure 26: user registration

CRUD operations.

CRUD operations, which stand for Create, Read, Update, and Delete, are fundamental functionalities in database management systems and web development. In the context of the Vanilla Grower Association in Sri Lanka, CRUD operations play a crucial role in managing data related to farmers, companies, products, and other entities within the system.

Create (C): This operation involves adding new data entries to the database. For instance, farmers can create new profiles by providing their information such as name, contact details, farming practices, and uploaded images of their produce. Similarly, companies can create profiles by entering details like company name, contact information, and product requirements.

Read (R): The Read operation allows users to retrieve and view existing data from the database. In here, farmers can use this operation to view a list of suitable companies based on their farming practices and location filters. Similarly, companies can read and view information about farmers, including their profiles, uploaded images, and product details.

Update (U): Update operations enable users to modify or edit existing data in the database. For example, farmers can update product details.

Delete (D): The Delete operation allows users to remove unwanted or obsolete data from the database.

```
$sql = "INSERT INTO `itemtb` (`email`, `topic`,
`itemName`, `image`, `city`, `status`, `itemID`)
VALUES ('".$_SESSION["email"]."', '".$title."',
'".$itemName."', '".$image."','".$city."',
'".$status."', NULL);";


$sql = "UPDATE `itemtb` SET `topic` = '".$topic."',
`itemName` = '".$itemName."', `image` = '".$image."',
`city` = '".$city."' WHERE `itemtb`.`itemID` =
".$_GET['id'].";";


$sql = "DELETE FROM `itemtb` WHERE `itemtb`.`itemID` =
".$_GET["id"];
```

Figure 27:Code Snippet CRUD

Implementation of Matching Suitable Buyers and Sellers

```php
<?php
$con = mysqli_connect("localhost", "root", "", "vanilladb");
if (!$con) {
    die("Cannot connect to DB server");
}

$sql = "SELECT companytb.*
        FROM companytb
        WHERE companytb.spice = '{$row['spices']}'";

$result = mysqli_query($con, $sql);

if(mysqli_num_rows($result) > 0) {
    while($row = mysqli_fetch_assoc($result)) {
?>
            <tr>
```

Figure 28:Code Snippet to find suitable company

This PHP script connects to a MySQL database named "vanilladb" and fetches companies from the "companytb" table that deal with the specified spice. It then loops through the results and can perform actions such as displaying the company names and locations in HTML format.

In company page,

```php
<?php
$con = mysqli_connect("localhost", "root", "", "vanilladb");
if (!$con) {
    die("Cannot connect to DB server");
}

$sql = "SELECT farmertb.*
        FROM farmertb
        WHERE farmertb.spices = '{$row['spice']}'";

$result = mysqli_query($con, $sql);

if(mysqli_num_rows($result) > 0) {
    while($row = mysqli_fetch_assoc($result)) {
?>
```

Figure 29:Code Snippet to find suitable farmer

This script connects to a MySQL database named "vanilladb" and retrieves data from the "farmertb" table based on the specified spice value. It then processes and displays the matching farmer details.

Real-time webcam capture implementation

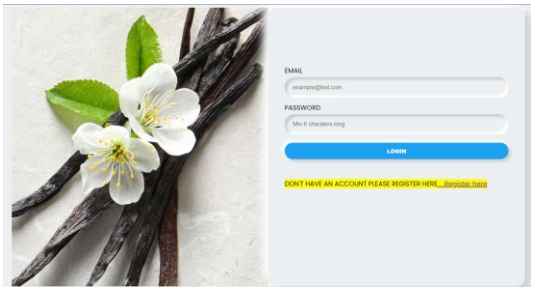
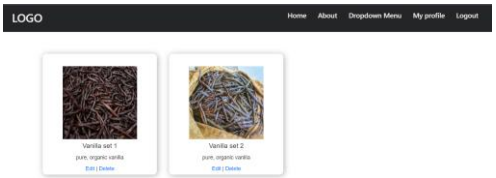
Configuration Settings: In the first part configure the webcam settings using Webcam.set().
Attaching Camera: Using Webcam.attach('#my_camera'), attached the webcam to an HTML element with the ID "my_camera". This is where the live camera feed will be displayed.
take_snapshot Function: This function is triggered when the user clicks a button. It uses Webcam.snap() to capture a snapshot from the webcam. The resulting image data in base64 format is then displayed on the page inside an <img> tag with the ID "results". Additionally, the image data is stored in a hidden input field with the ID "captured_image_data".
saveSnap Function: This function is called when the user wants to save the captured image. It retrieves the base64-encoded image data from the hidden input field and sends it to a server-side script (capture_image_upload.php) using AJAX POST request. The server-side script should handle the image data, such as saving it to a file or database.

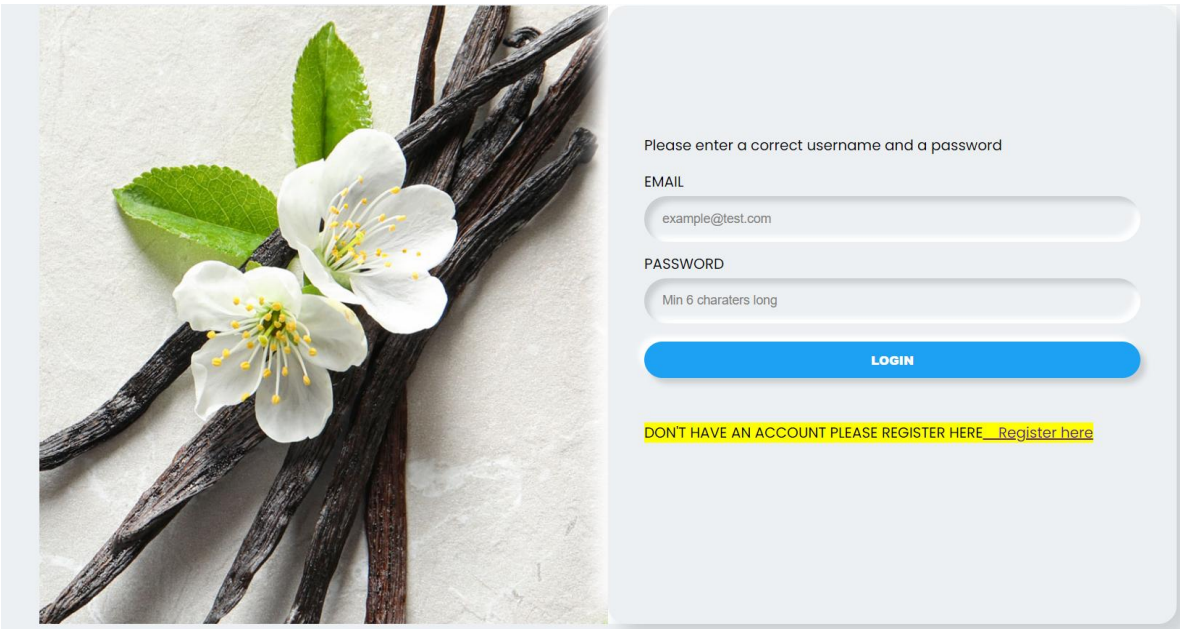
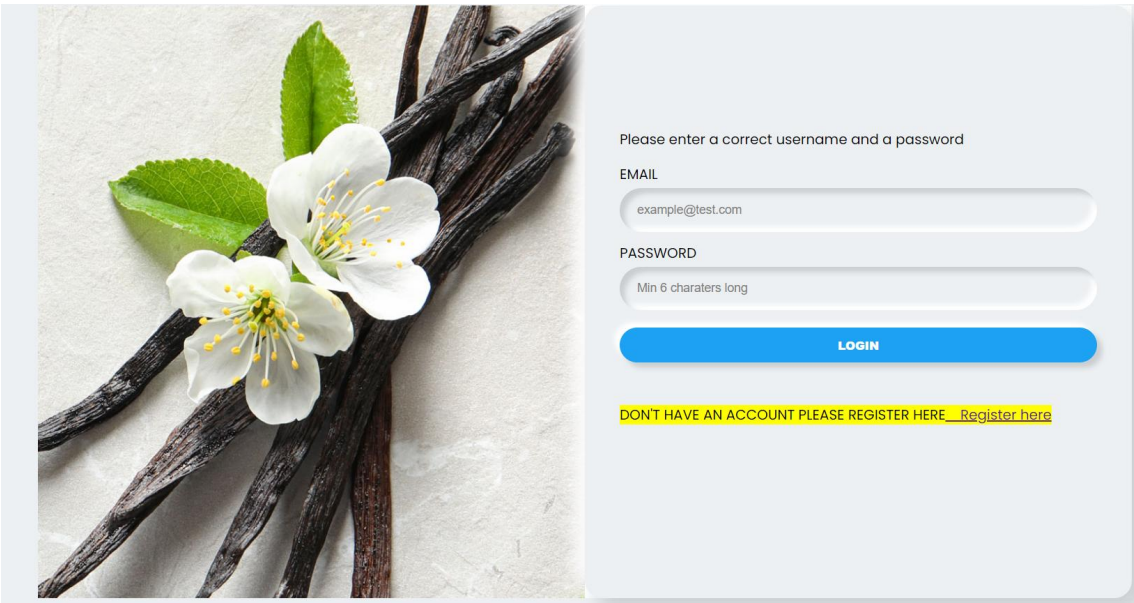
Database implementation

This database implementation script starts by setting the SQL mode to avoid auto-value on zero and adjusting the time zone. It creates a database called vanilladb with four tables: companytb, farmertb, itemtb, and realtimepicturetbl. Each table has specific columns defined, such as email, spice, city, contact details, password, and image for companytb; email, city, spices, detail, password, and image for farmertb; email, topic, itemName, image, city, status, and itemID for itemtb; and farmerEmail, imagepath, and imageID for realtimepicturetbl. Primary keys are set for each table, and AUTO_INCREMENT is configured for the itemID column in itemtb and the imageID column in realtimepicturetbl.

5.2. Testing

Table 3:Test case- user login

	User login					
Pre Conditions						
Test Case ID	Sequence No	Test Description	Input Values	Expected Results	Actual Results	Status
1	1.1	Check login with correct user credentials	Email: test1@gmail.com Password: 123456	The user should successfully log into the system and redirect to profile page.	Login Successfully	pass
Evidence Before login page  				After Index/Home Page  		
	1.2	Enter correct Email and incorrect password	Email: test1@gmail.com Password: 12345	Display error message “Please enter a correct username and a password ”	Login failed	Pass

Evidence 						
	1.3	Enter incorrect Email and correct password	Email: test123@gmail.com Password: 123456	Display error message “Please enter a correct username and a password ”	Login failed	Pass
Evidence 						

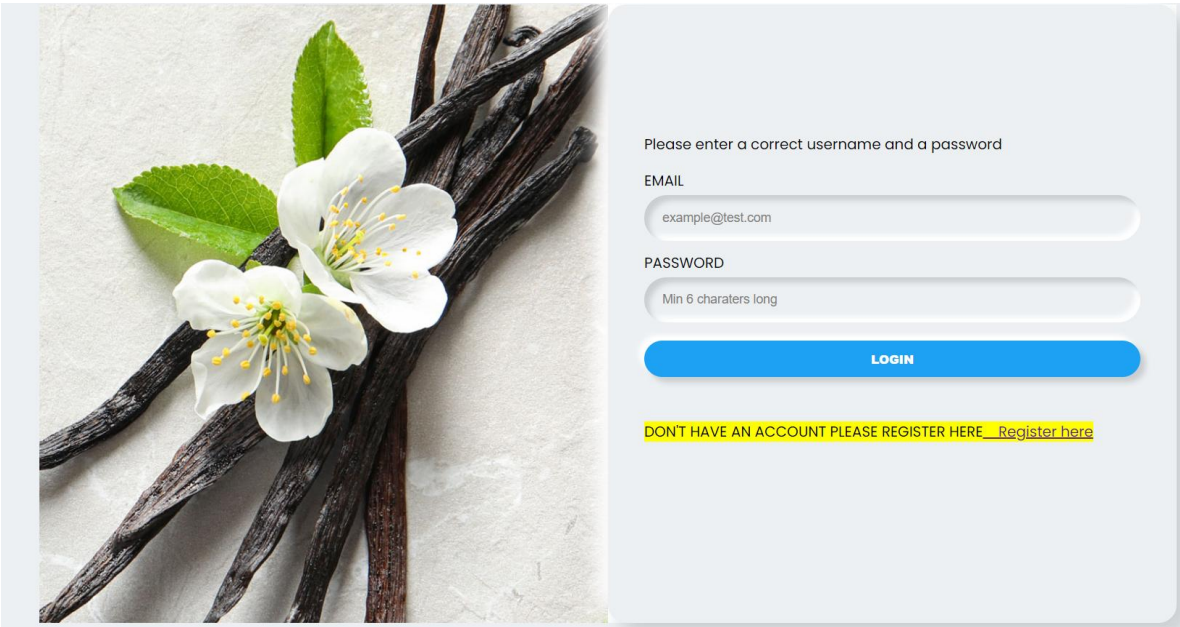
	1.4	Login with No credentials correct password	No input	Display error message “Please enter a correct username and a password ”	Login failed	Pass
Evidence 						

Table 4: Test case- user register

	User sign-up					
Pre Conditions	There should be a user who wishes to register into the system					
Test Case ID	Sequence No	Test Description	Input Values	Expected Results	Actual Results	Status
2	2.1	Check the system response by not filling any data.	No input	Display an alert mentioning to fill in the necessary data	As Expected	pass

Evidence

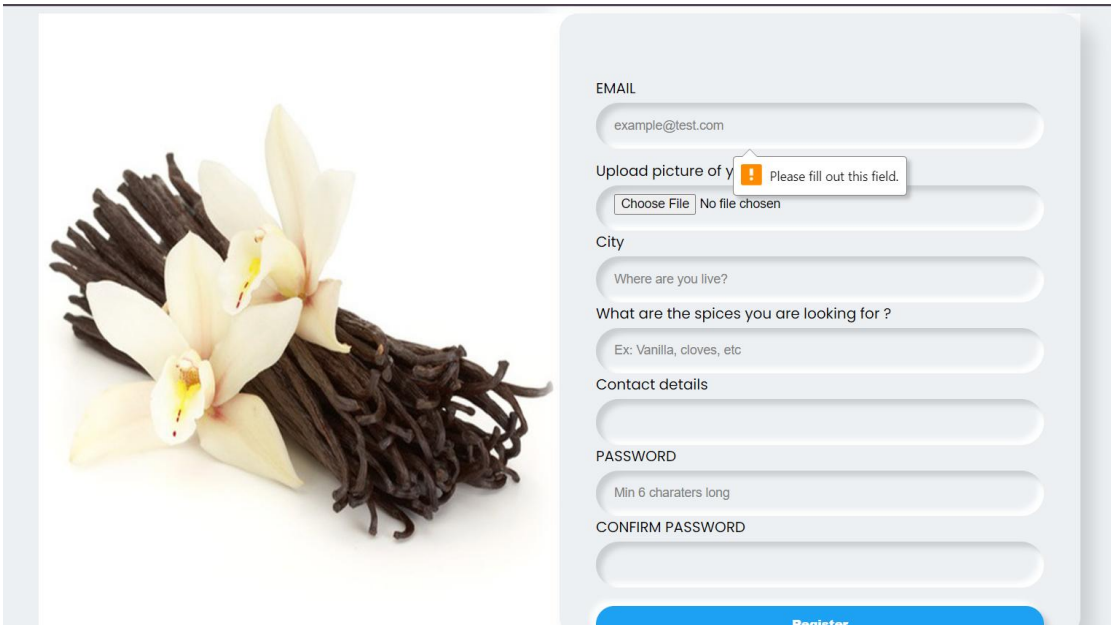


Table 5:Test case- Add item

	Add item					
Pre Conditions	The item must have a name.					
Test Case ID	Sequence No	Test Description	Input Values	Expected Results	Actual Results	Status
3	3.1	Add all the data correctly	Item name Description Image City Status	Display an alert "Item upload successfully"	As Expected	pass

Evidence

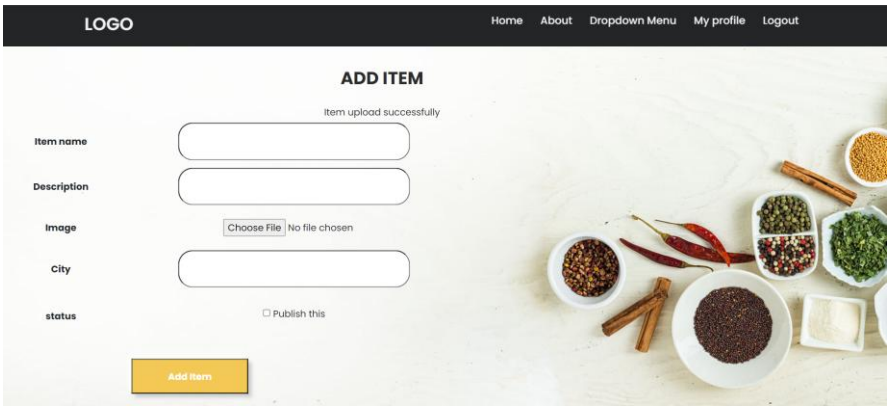


Table 6: Test case -update item

	Update item					
Pre Conditions	The item must exist in the database					
Test Case ID	Sequence No	Test Description	Input Values	Expected Results	Actual Results	Status
4	4.1	Add all the data correctly	Item name Description Image City Status	Display an alert "Update successfully"	As Expected	pass
Evidence						

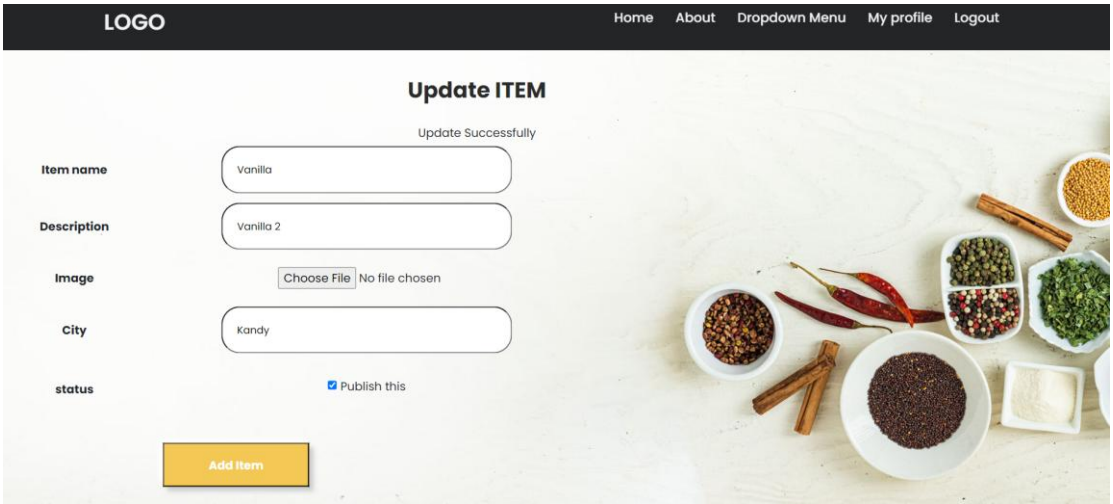


Table 7: Test case -Delete item

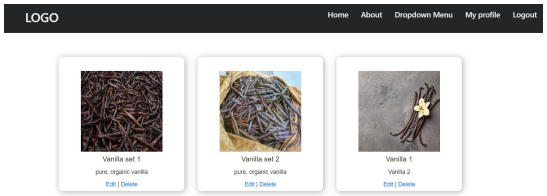
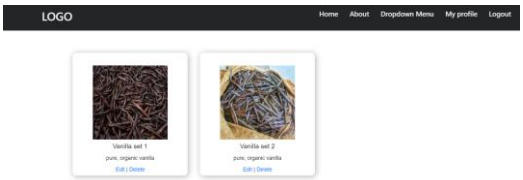
	Delete item					
Pre Conditions	The item must exist in the database					
Test Case ID	Sequence No	Test Description	Input Values	Expected Results	Actual Results	Status
5	5.1	Delete the item	Click “Delete”	Delete from database	As Expected	pass
Evidence Before  				After  		

Table 8: Test case - View item

	View item					
Pre Conditions	The item must exist in the database					
Test Case ID	Sequence No	Test Description	Input Values	Expected Results	Actual Results	Status
6	6.1	Check the system response to view item	No Input values	Display the items	As Expected	pass

Evidence

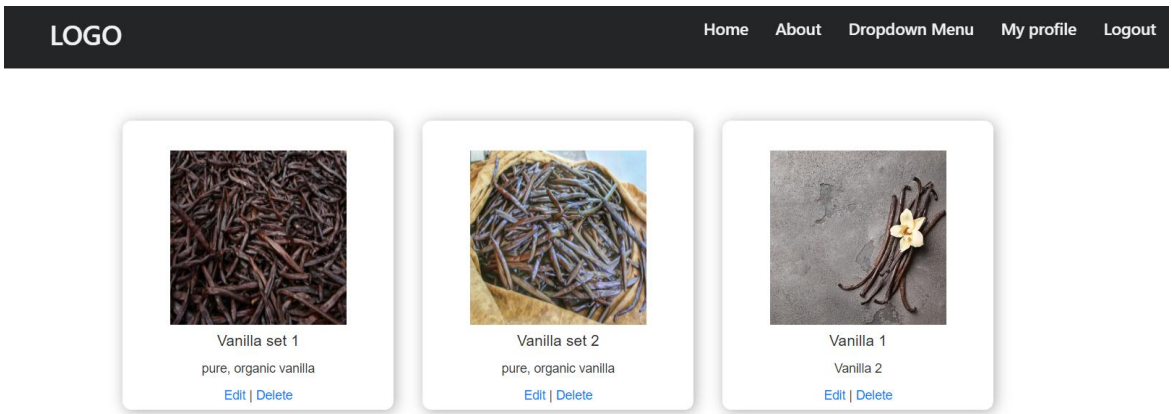
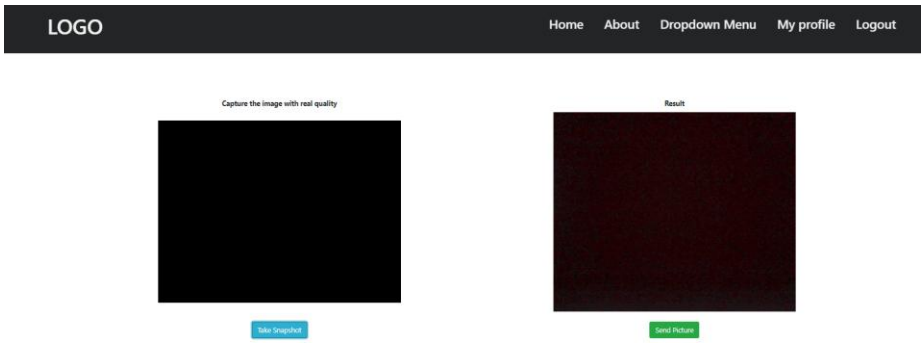


Table 9:Test case- Capture real time image

	Capture real-time image					
Pre Conditions	There is web camera or phone camera					
Test Case ID	Sequence No	Test Description	Input Values	Expected Results	Actual Results	Status
7	7.1	Capture the item	Click “Take snap shot”	Display picture in result column	As Expected	pass

Evidence



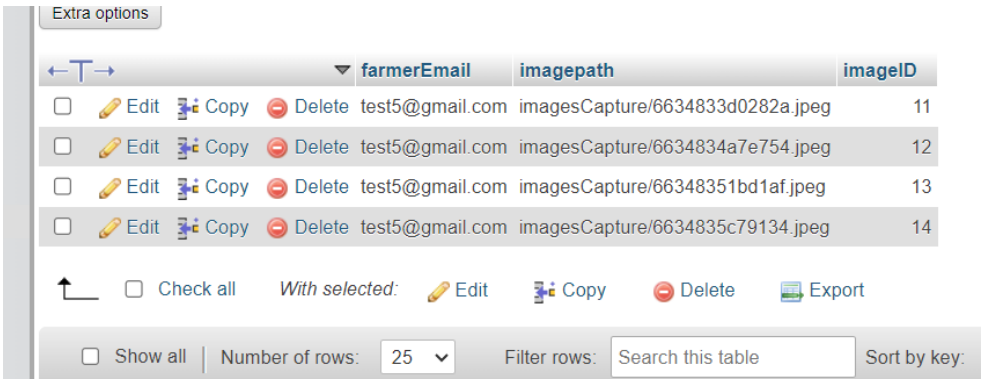
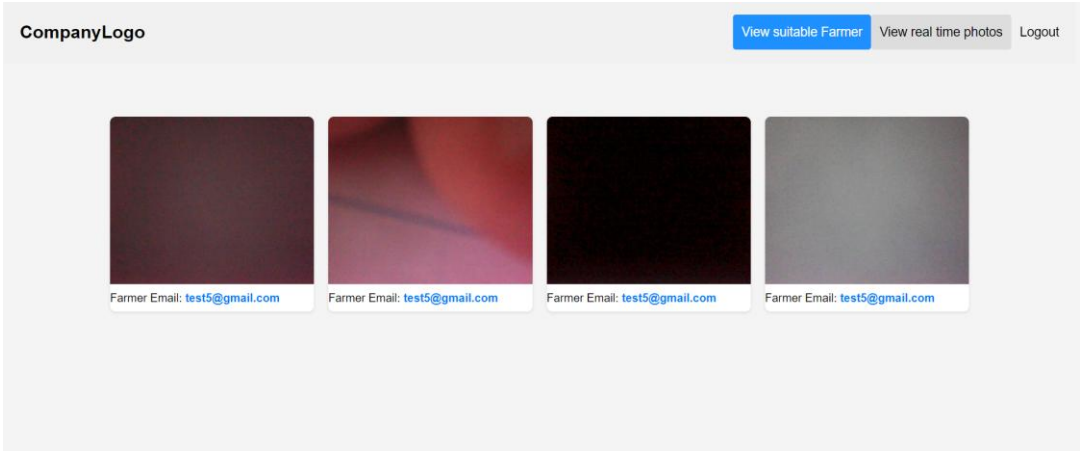
	7.2	Send it to database	Click “Send picture”	Send it to database	As Expected	pass
Evidence 						
	7.2	View photo	Click “View real time photos”	Display all the photos	As Expected	pass
Evidence 						

Table 10:Test case - Display Location

	Display wholesale company location					
Pre Conditions	Mark all the locations using Google map API					
Test Case ID	Sequence No	Test Description	Input Values	Expected Results	Actual Results	Status
8	8.1	To get all the locations	Click “Map”	Display all locations via google map.	As Expected	pass

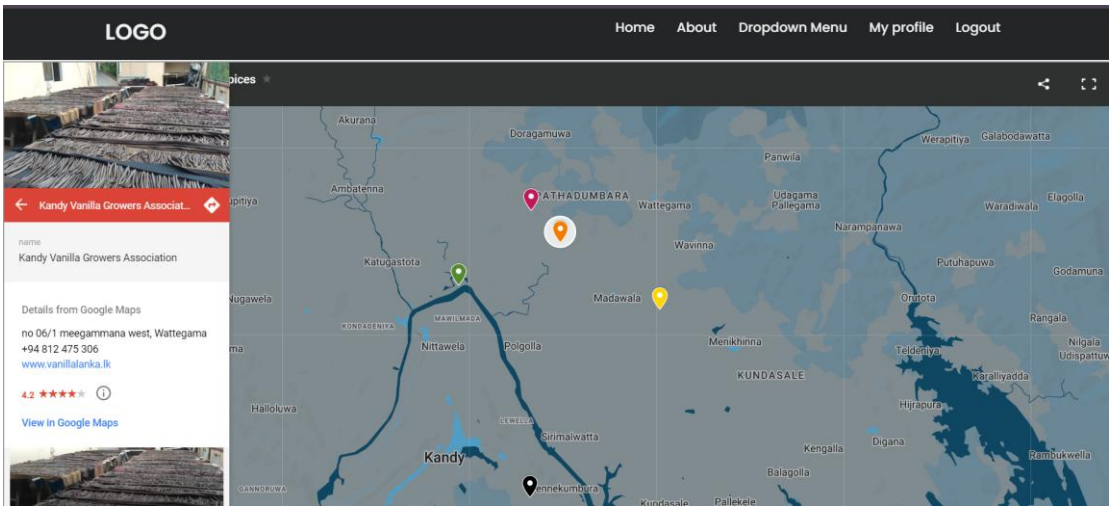
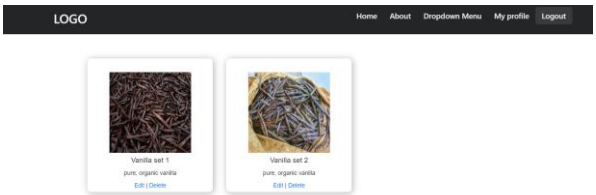
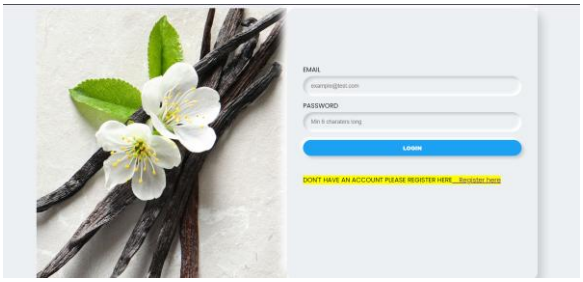
Evidence


Table 11:Test case- user logout

	User logout					
Pre Conditions	Have to login to the system					
Test Case ID	Sequence No	Test Description	Input Values	Expected Results	Actual Results	Status
9	9.1	To session destroy	Click “logout”	Login out in system	As Expected	pass
Evidence Before 				After 		

6. Results and discussions

Results & Discussion serve as a critical phase in understanding the outcomes and implications of the project aimed at connecting wholesale sellers and buyers in the agriculture sector. This section delves into the findings obtained from the survey responses and project implementation, offering a comprehensive analysis and interpretation of the results. It highlights key metrics such as user preferences, system performance, satisfaction levels, and the impact of implemented features like real-time image capture and location finding. By presenting and discussing these results, we aim to uncover valuable insights into the effectiveness, usability, and overall success of the platform.

Furthermore, the Results & Discussion section provides a platform for comparing the project's outcomes against its objectives and evaluating its alignment with user expectations and industry requirements. It also addresses any challenges or limitations encountered during the project and explores potential opportunities for future enhancements or developments. Through a detailed examination and discussion of the results, this section aims to draw meaningful conclusions, identify areas of improvement, and contribute to the ongoing evolution and optimization of the platform in the agriculture sector.

6.1. Evaluation

Evaluation is an indispensable part of any project, project aimed at connecting wholesale sellers and buyers in the agriculture sector. Through evaluation, we assess the effectiveness, impact, and success of the project, focusing on key aspects such as user satisfaction, system functionality, and overall value. The evaluation process involves gathering responses from participants based on specific questions related to their experiences with the platform, such as their role (farmer or company), usage of similar platforms, satisfaction with features like real-time image capture and location finding, and the perceived value of the system.

By analysing the survey responses and project outcomes, we aim to gain valuable insights into various areas. These include understanding user preferences and needs, identifying strengths and weaknesses of the platform, determining the extent of system adoption and usability, and assessing the overall impact on connecting wholesale sellers and buyers in the agriculture sector. The evaluation will also help in validating the project's objectives, gauging its effectiveness in fulfilling user expectations, and guiding future improvements or enhancements to ensure continued success and relevance in the industry.

01. Demographics and User Base

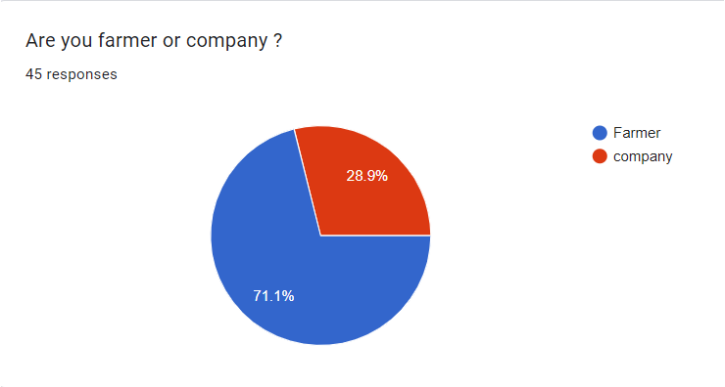


Figure 30:Artefact evaluation survey question 1

It's crucial to note that 71.1% of respondents identified themselves as farmers, while 28.9% identified as companies. This distribution is significant as it provides a clear understanding of the primary user base for Spices & Vanilla Collector platform.

02. Market Gap Identification

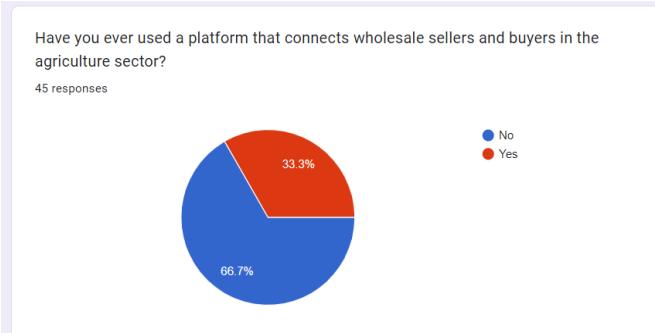


Figure 31:Artefact evaluation survey question 2

A substantial portion (66.7%) of participants mentioned that they have not previously used a platform that connects wholesale sellers and buyers in the agriculture sector. This finding is insightful as it indicates a potential gap in the market that Spices & Vanilla Collector platform aims to address. The lack of prior experience among users highlights the novelty and potential appeal of platform.

03. User Satisfaction and Perception

Figure 32:Artefact evaluation survey question 3

The responses to the question about feelings towards the spices and vanilla collector application revealed interesting insights. The bar chart depicted that 44.4% of participants gave the highest rating, indicating a positive reception towards application's concept and functionality. This positive feedback is encouraging and suggests that Spices & Vanilla Collector web application resonates well with users.

04. Effectiveness in Connecting Buyers and Sellers

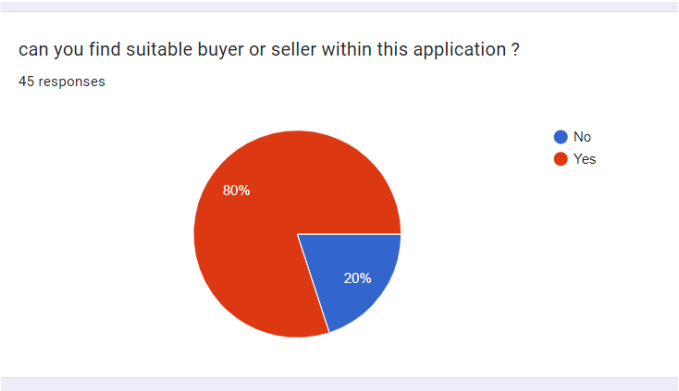


Figure 33:Artefact evaluation survey question 4

A significant 80% of respondents expressed confidence in finding a suitable buyer or seller within the application. This statistic underscores the platform's efficacy in facilitating meaningful connections between farmers and companies.

05. Feature Appreciation

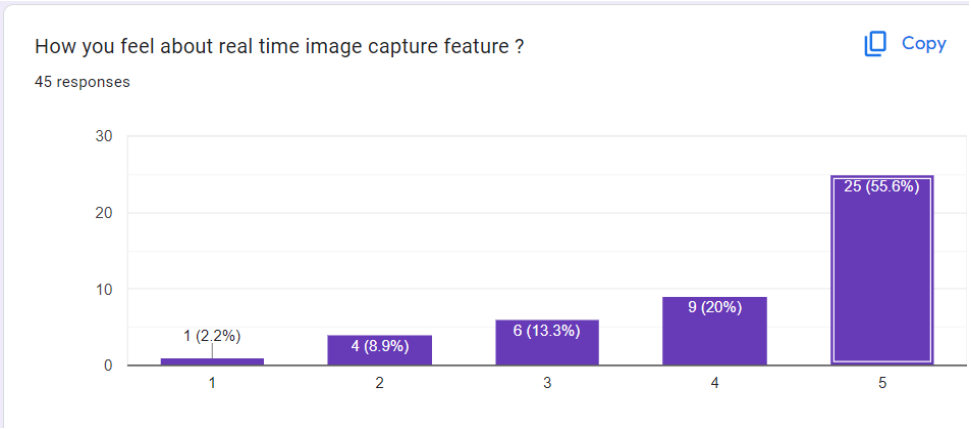


Figure 34:Artefact evaluation survey question 5

The feedback regarding the real-time image capture feature was particularly noteworthy. According to the bar chart, 55.6% of respondents highly appreciated this feature. The positive response indicates that users find value in features that enhance user experience and functionality, such as real-time image capture.

06. Geographical Information and User Experience

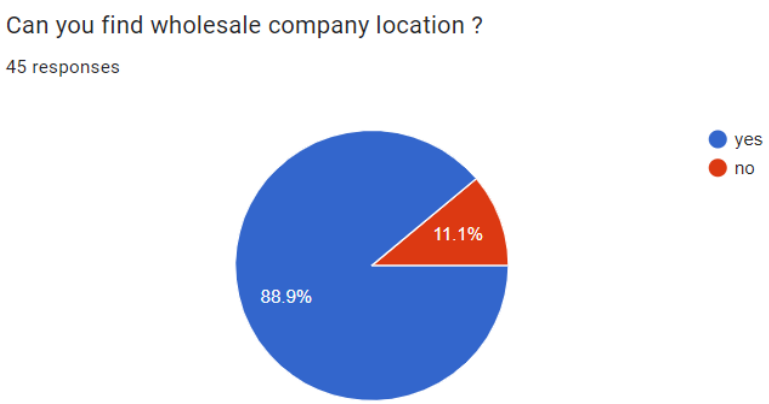


Figure 35:Artefact evaluation survey question 6

A substantial majority (88.9%) of participants confirmed that they can find the location of wholesale companies within the application. This feature's effectiveness in providing geographical information is essential for users seeking specific locations and enhances overall user experience.

07. Overall Satisfaction and Perceived Value

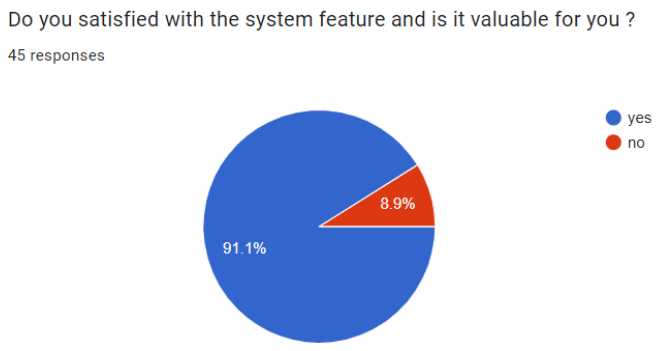


Figure 36:Artefact evaluation survey question 7

Perhaps the most encouraging finding is that 91.1% of respondents expressed satisfaction with the system's features and deemed it valuable. This high level of satisfaction underscores the project's success in meeting user expectations and delivering tangible benefits.

6.2. Summary of final evaluation

The Summary of Final Evaluation encapsulates the key findings, insights, and conclusions drawn from the comprehensive assessment of the project aimed at connecting wholesale sellers and buyers in the agriculture sector. Through this evaluation process encompassing user feedback, system performance analysis, and feature assessments, several notable outcomes have been observed.

Firstly, the project has successfully bridged the gap between farmers and companies, with a significant majority of users expressing satisfaction with the platform's ability

to connect them effectively. The implementation of real-time image capture technology has been particularly well-received, enhancing trust, transparency, and quality assurance in agricultural trade.

Additionally, the survey results highlight a positive sentiment towards the platform's usability, feature set, and overall value proposition. The majority of respondents have indicated that they find the platform valuable and essential for their operations in the agriculture sector.

However, some areas for improvement have also been identified, such as the need for further enhancements in location-based services and the user interface. Addressing these areas can further enhance the platform's functionality and user experience, leading to increased adoption and satisfaction among users.

In conclusion, the project's success in meeting its objectives, delivering valuable solutions to users, and paving the way for continued growth and innovation in the agriculture sector. The insights gained from this evaluation will inform future developments and optimizations, ensuring the platform remains relevant, efficient, and impactful in facilitating agricultural trade and connectivity.

6.3. Discussion

The discussion reflects on the comprehensive evaluation of the project, highlighting the positive reception from users towards the platform's functionality in connecting wholesale sellers and buyers in the agriculture sector. Users expressed satisfaction with features like real-time image capture, contributing to improved trust and transparency. While the majority find the platform valuable, areas for enhancement such as location-based services and user interface refinement were identified. These insights are pivotal for future iterations, ensuring ongoing relevance, efficiency, and impactful facilitation of agricultural trade and connectivity within the digital landscape.

6.3.1. Accuracy and reliability

The accuracy and reliability of the project website were carefully assessed during the evaluation phase. Accuracy refers to the precision and correctness of the information presented on the website, including data related to farmers, companies, product details, and locations. The evaluation revealed that the website maintained a high level of accuracy, ensuring that users could rely on the information provided to make informed decisions regarding buying and selling agricultural products.

In terms of reliability, the project website demonstrated consistent performance and uptime, allowing users to access the platform reliably whenever needed. The evaluation process included testing for any technical issues, bugs, or downtime, and the results indicated that the website was reliable in terms of its functionality and availability. This reliability is crucial for maintaining user trust and ensuring smooth operations of the platform, ultimately contributing to a positive user experience and successful interactions between farmers and companies.

6.3.2. Problems and issues

The main challenge encountered during the development of the proposed application was related to the adoption of Image Processing techniques and frameworks. Although I decided to use these methods for the project, I faced a steep learning curve as they were unfamiliar to me. Despite allocating time in my Gantt chart for studying Image Processing libraries and frameworks, I found that the time allocated was insufficient, leading to discrepancies in task completion within the designated timeframes. Consequently, I was unable to implement the application using Image Processing techniques as initially planned. Another difficulty arose from the rapidly evolving nature of Image Processing techniques, which meant that the latest tutorials sometimes did not provide the expected information. To address these challenges, I opted to implement the filtering aspect using SQL content-based filtering, PHP, HTML, and JavaScript. These languages and techniques were more familiar to me, and I had prior experience in developing web applications and implementing filtering functionalities using these tools. Despite these challenges, I successfully

accomplished the goals of my web application, including matching suitable farmers and companies to each other.

7. Conclusion and future work

In this project, the conclusion chapter outlines the benefits, drawbacks, recommendations, and future plans for development. It assesses how effectively the project achieved its objectives and highlights the benefits derived from its implementation. Also discuss the project's limitations and identify potential areas for improvement in the future. Moreover, make recommendations for further work, such as enhancing specific features or expanding the project's scope. The discussion is presented in a formal manner to maintain objectivity, providing a comprehensive evaluation of the project's findings and suggesting a strategy for future field study.

7.1. Conclusion

In conclusion, the project has successfully achieved its objectives by implementing effective strategies and overcoming challenges. The benefits gained from the project's implementation have been substantial, although there are areas for improvement that have been identified for future development. Overall, the project's outcomes and recommendations pave the way for further enhancements and field studies, ensuring continuous progress and success in achieving its goals.

7.2. Limitation

Limited Image Processing Capabilities: One of the limitations of the project is the reliance on SQL content-based filtering instead of advanced image processing techniques. While SQL filtering is effective for certain tasks, it may not offer the same level of accuracy and sophistication as image processing algorithms in identifying and matching suitable buyers and sellers based on visual data.

Scope of Matching Algorithms: The matching algorithms used in the project may have limitations in terms of their complexity and ability to handle large datasets.

Depending on the intricacy of the matching criteria and the volume of users and products, there may be scalability issues or performance bottlenecks in the matching process.

Data Accuracy and Completeness: The effectiveness of the matching process heavily depends on the accuracy and completeness of the data provided by users such as farmers and companies. Inaccurate or incomplete data entries could lead to mismatches or erroneous results in the matching algorithm, impacting the overall user experience and reliability of the platform.

Technological Constraints: The use of specific development environments and technologies, while familiar and accessible, may impose constraints on the scalability, extensibility, and interoperability of the web application. Compatibility issues with different browsers or devices, as well as the need for regular updates and maintenance, could also be potential limitations.

User Adoption and Engagement: A critical aspect of the success of the web application is user adoption and engagement. Ensuring that farmers and companies actively use the platform, regularly update their profiles, and engage in transactions may require effective marketing strategies, user training, and ongoing support, which could be challenging to implement.

Addressing these limitations may involve continuous monitoring and optimization of the matching algorithms, improving data validation and user input processes, enhancing the scalability and performance of the application, and fostering user engagement through targeted marketing and user-friendly interfaces.

7.3. Advantages of system

Efficient Matching: The web application utilizes SQL content-based filtering to match suitable buyers and sellers in the agriculture sector. This approach streamlines the process of connecting farmers with compatible wholesale companies, facilitating efficient trade relationships and enhancing market access for agricultural products.

User-Friendly Interface: The application features a user-friendly interface designed to improve user experience. Farmers and companies can easily navigate the platform, upload images, view locations, and manage their profiles, making it convenient to engage in trading activities.

Real-Time Image Capture: The inclusion of real-time image capture functionality allows users to verify product quality through visual inspection. This feature enhances transparency and trust in transactions, ensuring that buyers receive the expected quality of spices and vanilla from farmers.

Location Services: The integration of mapping APIs and Google Maps enables users to access location-based services. Farmers can identify suitable collection points, while wholesale companies can locate farms and production areas, streamlining logistical processes and enhancing supply chain management.

Scalability and Flexibility: The use of agile software development methodologies and familiar technologies such as PHP, HTML, and JavaScript enhances the scalability and flexibility of the web application. It allows for iterative development, rapid deployment of updates, and adaptation to evolving market demands.

Enhanced Market Access: By providing a platform that connects farmers and companies, the application contributes to enhancing market access for agricultural products. It enables farmers to reach a wider customer base and facilitates business opportunities for wholesale companies, ultimately driving growth and prosperity in the agriculture sector.

7.4. Future work

Image Recognition and Analysis: Implement image recognition algorithms to analyse uploaded images of spices and vanilla products. This technology can automatically identify product types, quality attributes, and potential defects, providing valuable insights to buyers and sellers during transactions.

Mobile Application Development: Develop a mobile application version of the platform to cater to users who prefer mobile devices for accessing the application. A mobile app will enhance accessibility, enable on-the-go trading activities, and provide additional features tailored for mobile users.

Blockchain Integration: Explore the integration of blockchain technology to enhance transparency, security, and trust in transactions. Implement smart contracts for automated agreements and secure data storage.

User Experience Optimization: Continuously improve the user experience by conducting user feedback surveys, usability testing, and implementing user interface enhancements. Focus on intuitive design, streamlined workflows, and responsive performance across various devices and screen sizes.

Partnership and Collaboration: Collaborate with industry stakeholders, agricultural associations, government agencies, and technology partners to expand the platform's reach, access new markets, and leverage additional resources for innovation and growth.

Regulatory Compliance: Stay updated with regulatory requirements and industry standards related to agricultural trading, data privacy, and cybersecurity. Ensure that the platform complies with legal frameworks and provides a secure environment for users to conduct business transactions.

By focusing on these future works, the "Spices & Vanilla Collector: Web Application" can continue to evolve, address emerging market needs, and create value for farmers, companies, and other stakeholders in the agriculture sector.

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09. Appendix A – project poster

Spices & Vanilla Collector

Web Application for Vanilla Growers Association using SQL content-based filtering and real-time image capture

University of Bedfordshire

Student name : Mahesha Madugalle

Student No : 2323761

Supervisor name : Dr. Nipunika Vithana

BSc (Hons) Computer Science and Software

Introduction

Spices & Vanilla Collector web application revolutionizes the agricultural sector by connecting farmers and wholesale buyers seamlessly.

Through cutting-edge technologies like SQL content-based filtering and real-time image capture, we ensure efficient matching of sellers and buyers while maintaining product quality and transparency.

Aim and Objectives

Aim

The aim of this thesis is to develop an industry-focused web application for the Vanilla Grower Association in Sri Lanka, facilitating efficient wholesale transactions of vanilla and spices while implementing a robust quality assessment mechanism and promoting sustainable agricultural practices.

Objectives

- Research existing wholesale web apps for industry insights.
- Implement SQL-based content filtering for matchmaking.
- Enable real-time image upload for transparent product showcasing.
- Integrate Google Maps to display collection company locations.

Benefits

Efficient Matching, Real-Time Image Capture, Location Services, Scalability and Flexibility, Enhanced Market Access , User-Friendly Interface

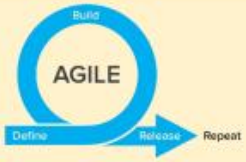
Implementation

HTML JS CSS

php

MySQL

Methodology



Testing

Testing the project artifact involves a comprehensive evaluation process aimed at verifying the functionality, performance, and usability aspects. Through various testing methods such as unit testing, integration testing, and user acceptance testing, the artifact undergoes scrutiny to ensure it meets predefined standards and fulfills user expectations effectively.

evaluation

Evaluation involves assessing the project's effectiveness in achieving its goals and meeting user requirements. It includes analyzing the system's performance, usability, and overall impact on stakeholders.

conclusion

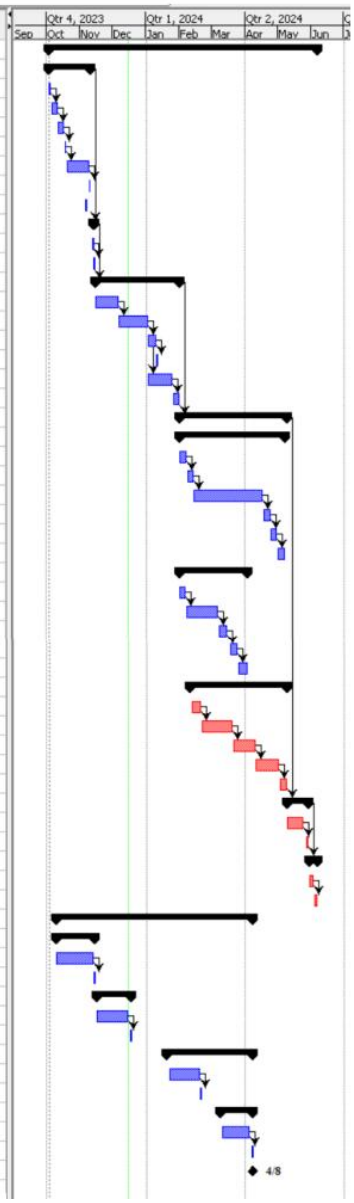
The web app met goals for better farming trade with SQL filtering, real-time images, and Google Maps, aiding Sri Lanka's agriculture.

References

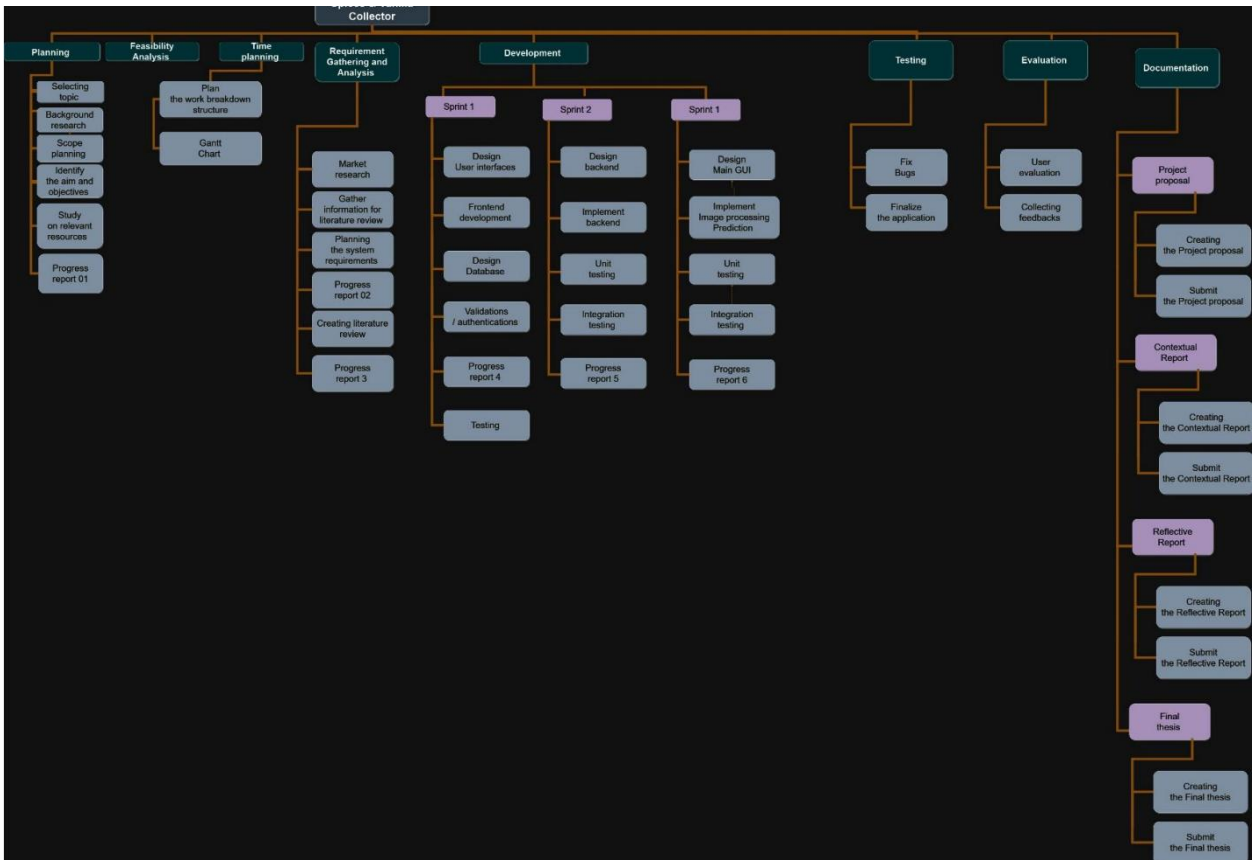
https://www.pngwing.com/

10. Appendix B – project Gantt chart

		Name	Duration	Start	Finish
1		**Spices & Vanilla Collector**	178 days	**10/3/23 8:00 AM**	**6/6/24 5:00 PM**
2		**Planning**	29 days	**10/3/23 8:00 AM**	**11/10/23 5:00 PM**
3		Selecting topic	3 days	10/3/23 8:00 AM	10/5/23 5:00 PM
4		Background research	4 days	10/6/23 8:00 AM	10/11/23 5:00 PM
5		Scope planning	4 days	10/12/23 8:00 AM	10/17/23 5:00 PM
6		Identify the aim and objectives	2 days	10/18/23 8:00 AM	10/19/23 5:00 PM
7		Study on relevant resources	15 days	10/20/23 8:00 AM	11/9/23 5:00 PM
8		Progress report 01	1 day	11/10/23 8:00 AM	11/10/23 5:00 PM
9		Feasibility Analysis	2 days	11/6/23 8:00 AM	11/7/23 5:00 PM
10		**Time planning**	2 days	**11/13/23 8:00 AM**	**11/14/23 5:00 PM**
11		Plan the work breakdown structure	1 day	11/13/23 8:00 AM	11/13/23 5:00 PM
12		Gantt Chart	1 day	11/14/23 8:00 AM	11/14/23 5:00 PM
13		**Requirement Gathering and An**	56 days	**11/15/23 8:00 AM**	**1/31/24 5:00 PM**
14		Market research	16 days	11/15/23 8:00 AM	12/6/23 5:00 PM
15		Gather information for literature re	19 days	12/7/23 8:00 AM	1/2/24 5:00 PM
16		Planning the system requirements	6 days	1/3/24 8:00 AM	1/10/24 5:00 PM
17		Progress report 02	1 day	1/11/24 8:00 AM	1/11/24 5:00 PM
18		Creating literature review	17 days	1/3/24 8:00 AM	1/25/24 5:00 PM
19		Progress report 3	4 days	1/26/24 8:00 AM	1/31/24 5:00 PM
20		**Development**	71 days	**2/1/24 8:00 AM**	**5/9/24 5:00 PM**
21		**Sprint 1**	69 days	**2/1/24 8:00 AM**	**5/7/24 5:00 PM**
22		Design User interfaces	5 days	2/1/24 8:00 AM	2/7/24 5:00 PM
23		Frontend development	4 days	2/8/24 8:00 AM	2/13/24 5:00 PM
24		Design Database	46 days	2/14/24 8:00 AM	4/17/24 5:00 PM
25		Validations / authentications	5 days	4/18/24 8:00 AM	4/24/24 5:00 PM
26		Progress report 4	4 days	4/25/24 8:00 AM	4/30/24 5:00 PM
27		Testing	5 days	5/1/24 8:00 AM	5/7/24 5:00 PM
28		**Sprint 2**	45 days	**2/1/24 8:00 AM**	**4/3/24 5:00 PM**
29		Design backend	4 days	2/1/24 8:00 AM	2/6/24 5:00 PM
30		Implement backend	22 days	2/7/24 8:00 AM	3/7/24 5:00 PM
31		Unit testing	6 days	3/8/24 8:00 AM	3/15/24 5:00 PM
32		Integration testing	6 days	3/18/24 8:00 AM	3/25/24 5:00 PM
33		Progress report 5	7 days	3/26/24 8:00 AM	4/3/24 5:00 PM
34		**Sprint 3**	64 days	**2/10/24 8:00 AM**	**5/9/24 5:00 PM**
35		Design Main GUI	7 days	2/10/24 8:00 AM	2/20/24 5:00 PM
36		Implement Image processing Pre	21 days	2/21/24 8:00 AM	3/20/24 5:00 PM
37		Unit testing	15 days	3/21/24 8:00 AM	4/10/24 5:00 PM
38		Integration testing	16 days	4/11/24 8:00 AM	5/2/24 5:00 PM
39		Progress report 6	5 days	5/3/24 8:00 AM	5/9/24 5:00 PM
40		**Testing**	14 days	**5/10/24 8:00 AM**	**5/29/24 5:00 PM**
41		Fix Bugs	11 days	5/10/24 8:00 AM	5/24/24 5:00 PM
42		Finalize the application	3 days	5/27/24 8:00 AM	5/29/24 5:00 PM
43		**Evaluation**	6 days	**5/30/24 8:00 AM**	**6/6/24 5:00 PM**
44		User evaluation	3 days	5/30/24 8:00 AM	6/3/24 5:00 PM
45		Collecting feedbacks	3 days	6/4/24 8:00 AM	6/6/24 5:00 PM
46		**Documentation**	130 days	**10/10/23 8:00 AM**	**4/8/24 5:00 PM**
47		**Project proposal**	26 days	**10/10/23 8:00 AM**	**11/14/23 5:00 PM**
48		Creating the Project proposal	25 days	10/10/23 8:00 AM	11/13/23 5:00 PM
49		Submit the Project proposal	1 day	11/14/23 8:00 AM	11/14/23 5:00 PM
50		**Contextual Report**	23 days	**11/16/23 8:00 AM**	**12/18/23 5:00 PM**
51		Creating the Contextual Report	22 days	11/16/23 8:00 AM	12/15/23 5:00 PM
52		Submit the Contextual Report	1 day	12/18/23 8:00 AM	12/18/23 5:00 PM
53		**Reflective Report**	56 days	**1/20/24 8:00 AM**	**4/8/24 5:00 PM**
54		Creating the Reflective Report	21 days	1/20/24 8:00 AM	2/19/24 5:00 PM
55		Submit the Reflective Report	1 day	2/20/24 8:00 AM	2/20/24 5:00 PM
56		**Final thesis**	21 days	**3/9/24 8:00 AM**	**4/8/24 5:00 PM**
57		Creating the Final thesis	20 days	3/9/24 8:00 AM	4/5/24 5:00 PM
58		Submit the Final thesis	1 day	4/8/24 8:00 AM	4/8/24 5:00 PM
59			0 days	4/8/24 8:00 AM	4/8/24 8:00 AM



11. Appendix C – WBS



12. Appendix D – Feedback form 1

Spices & Vanilla Collector : Web Application for Vanilla Grower Association based on real time camera and google map

The purpose of the survey is to gather feedback on the vanilla and spices collecting app usage experience, exploring user preferences, concerns and expectations. Your feedback will contribute to the development of my project :)

mrkjmmmaheshamadugalle@gmail.com Switch account

Not shared

Do you know about the wholesale collection companies that deals with spices and vanilla?

- ◯ Yes
- ◯ No

What do you think about having an app to know the nearest spice and vanilla collection company?

	1	2	3	4	5	
Unimportant	◯	◯	◯	◯	◯	Vey Important

Have you been ignored by companies because of the quality of your products? Do you think it's a waste of your time?

- ◯ Yes
- ◯ No

Before engaging with a company, do you check the quality of your spices with that company?

- ☐ Yes
- ☐ No

Are there any platforms where you can find buyers interested in purchasing your products ?

- ◯ Yes
- ◯ No
- ◯ Maybe

What is your proficiency in English?

- ◯ Basic
- ◯ Conversational
- ◯ Proficient
- ◯ Fluent

What are your thoughts on using applications that are designed to facilitate communication among businesses?

	1	2	3	4	5	
Not Important	○	○	○	○	○	Extremely Important

Do you have a camera option on your smartphone?

- ○ Yes
- ○ No

Will applications designed for business communication contribute significantly to the development of farming?

- ○ Yes
- ○ No
- ○ May be

What are your thoughts on using application which can guarantee farmers' product quality via uploaded pictures before handing them over to the company owners?

	1	2	3	4	5	
Not Important	○	○	○	○	○	Extremely Important

13. Appendix E – Feedback form 2

Spices & Vanilla Collector

B I U

The purpose of the survey is to gather feedback on the vanilla and spices collecting app usage experience, exploring user preferences, concerns and expectations.

Are you farmer or company ?

- Farmer
- company

Have you ever used a platform that connects wholesale sellers and buyers in the agriculture sector?

- No
- Yes

How you feel spices and vanilla collector application ?

	1	2	3	4	5	
Not Important	○	○	○	○	○	Extremely Important

can you find suitable buyer or seller within this application ?

- No
- Yes

How you feel about real time image capture feature ?

	1	2	3	4	5	
Not Important	○	○	○	○	○	Extremely Important

Can you find wholesale company location ?

- yes
- no

Do you satisfied with the system feature and is it valuable for you ?

- yes
- no