A-EYE: A MOBILE PHILIPPINE BANKNOTE IDENTIFIER USING GOOGLE TEACHABLE MACHINE

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In Partial Fulfillment of the Requirements
for the Degree Bachelor of Science in Information Technology

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The Proponents

ABSTRACT

A-EYE is an Android application designed to aid individuals with vision impairments by recognizing and determining the value of banknotes. By leveraging machine learning technology, the app enhances its ability to identify bills and is compatible with Android versions 7.2 and above. It utilizes the smartphone's camera to detect and evaluate banknotes, providing auditory feedback once the processing is complete. The app has garnered favorable responses regarding its user-friendliness, effectiveness, learning capabilities, productivity, and overall satisfaction, highlighting its potential to improve user engagement and meet the anticipated requirements of visually impaired users.

Keywords: Assistive Android Application, Visual Impairment, Google Teachable Machine

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CHAPTER I

INTRODUCTION

1.0 Background of the Study

Visual impairment significantly affects the ability of visually challenged individuals to perceive their surroundings, leading to a diminished quality of life and limitations in daily activities. According to Inquirer, there are 332,150 Filipinos suffering with total vision loss and 2,179,733 Filipinos suffering with bilateral low vision as of 2017. These disabilities present challenges for visually challenged individuals in identifying financial bills, making monetary transactions a complex process. While techniques like the folding trick may assist them in distinguishing money denominations for certain purposes such as transportation, groceries, and food purchases, ensuring accurate change remains difficult due to the similar sizes and textures of banknotes across various categories (Samant et al., 2020).

The uniform size and dimensions of currency banknotes necessitate visual skills for differentiating their denominations. While canes, guide dogs, and human assistance are available as assistive aids for visually impaired individuals (Durodola, Sims, & Uruquhart, 2011), these technologies do not adequately address the challenge of determining banknote denominations. Moreover, the availability of human support cannot be guaranteed at all times, leaving visually challenged individuals susceptible to potential exploitation during monetary transactions, as sighted individuals may take advantage of their condition and receive insufficient funds (HumanMeter, 2017).

Additionally, the Philippines currently lacks mechanisms that specifically assist visually challenged individuals in recognizing banknote denominations, highlighting the necessity of developing a dedicated system to address their monetary transaction difficulties.

This research aims to introduce A-Eye, a mobile Philippine banknote identifier designed to assist visually impaired individuals in determining the denomination of a bill. The proposed device employs advanced technologies to detect Philippine banknotes and instantly pronounce their denominations. By enabling swift and effortless identification and counting of banknotes, A-Eye empowers visually impaired and blind individuals to independently engage in monetary transactions. Furthermore, the device strives to facilitate the distinction of Philippine money denominations, contributing to increased financial autonomy for visually challenged individuals.

1.1 Technology Background

A-EYE is an Android app for those who have vision problems. Its main job is to identify and determine the value of banknotes that have been captured. It was coupled with machine learning to enable its recognition capabilities, which can learn and adapt via data to maximize bill recognition accuracy. This functionality can only be used if the user's Android version is 7.2 or higher.

A-EYE will detect the bill and point in the direction of the note using the phone's camera; tap anywhere on the screen to shoot, and a virtual voice will offer feedback after the bill has been computed. It is a simple-to-use program for those who are blind or visually impaired. The gadget and application can be used without the user having to look at them.

1.2 Objectives of the Study

1.2.1 General Objectives of the Study

This project aims to develop an Android mobile application that allows visually impaired people to recognize and calculate the total value of recognized Philippine banknotes and provide voice feedback using their smartphones.

1.2.2 Specific Objectives of the Study

- To create an application for the visually impaired that can recognize Philippine banknotes.
- To calculate the recognized amount of money with a certain degree of accuracy.
- To provide voice feedback that announces the total amount of banknotes being recognized.

1.3 Significance of the Study

The research was created by the proponents to develop an application for visually impaired people. This research is vital in alleviating the difficulties that visually impaired people encounter when detecting and distinguishing the denomination of a banknote. The research will also help reduce barriers that prohibit visually impaired people from accomplishing activities that lead to undesirable outcomes, such as being fooled and defrauded by sighted people. Furthermore, the suggested method or application can restore these people's faith in their ability to recognize and distinguish Philippine denominations independently.

Furthermore, the study provides ideas that can aid future proponents in developing assistive technologies for people with visual impairments that can solve problems they face in their daily lives, such as object recognition, which allows visually impaired people to recognize

objects around them, and obstacle detection, which alerts visually impaired people to obstacles in their path. Voice recognition and assistance that may make using technology easier; and false money detection, which can assist visually impaired people to distinguish between fake and real currencies and avoid being duped during financial transactions.

1.4 Scope and Limitation

The study's main objective will be to identify Philippine banknotes. The suggested system has a text-to-speech feature that allows the system to speak its findings to visually challenged users. The proponents also include a function allowing the system to determine the amount of money that has been identified. Lastly, the proponents added a flash function allowing users to use the proposed system in dimmed and dark spaces. The suggested solution is designed for visually challenged people who have trouble recognizing banknote denominations during monetary transactions.

The suggested system does not incorporate other characteristics such as fake cash identification or capabilities that recognize various currencies, and accessibility in any different language as the system title indicates.

1.4.1 Visually Impaired

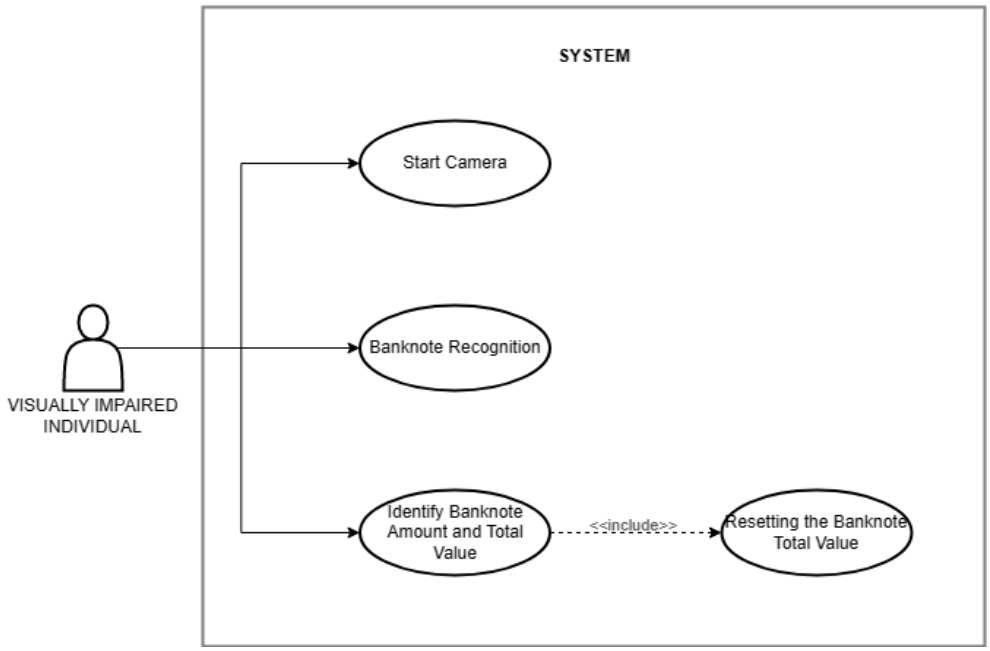


Figure 1.1 *Use Case Diagram for Visually Impaired*

Figure 1.1 is the use case diagram to visualize the interactions between actors (users) and the application. It represents the functionality of an application from a user's perspective.

The use case diagram involves a user who interacts with the system. The user can initiate the recognition of banknotes, allowing the system to capture and process images to determine their denominations. Once the banknotes are recognized, their denominations are accumulated to calculate the total amount. The system can then communicate the results audibly to the user through text-to-speech technology. Additionally, the user has the ability to reset the total amount, clearing the accumulated sum. This diagram provides an overview of

the main functionalities and interactions between the user and the banknote recognition system.

Table 1.1 *Visually Impaired Use Case Description*

Use Case	**Description**
Start Camera	The user initiates the app and accesses the camera functionality of their device.
Banknote Recognition	The app utilizes image processing and recognition algorithms to analyze the camera feed and identify banknotes within the frame.
Identify Banknote Amount and Total Value	Once a banknote is recognized, the app determines its denomination and announces the amount to the user using text-to-speech technology. It also keeps track of the total value of all identified banknotes.
Resetting the banknote total Value	The user has the option to reset the total value of the identified banknotes to zero. This allows them to start a new counting session or clear any previous calculations.

1.5 Definition of Terms

To better understand the study, the following terms were defined operationally.

Android Application. A software application running on the Android platform.

Android Studio. Official Integrated Development Environment (IDE) for Android app development, based on IntelliJ IDEA.

Assistive technology. Any item, piece of equipment, software program, or product system used to increase, maintain or improve the functional capabilities of people with disabilities.

Banknote. A piece of paper money serves as a central bank's promissory note, promising to pay the bearer a certain sum on demand.

Blindness. A loss of vision that cannot be corrected with glasses or contact lenses.

Currency. A system of money, in general, is used in a particular country.

Currency Recognition. It is used to recognize currencies or banknotes.

Machine Learning. The application and development of computer systems capable of learning and adapting without explicit instructions by analyzing and inferring patterns in data using algorithms and statistical models.

Visual impairment. It is a term experts use to describe any vision loss, whether it is someone who cannot see at all or someone who has partial vision loss.

CHAPTER II

A REVIEW OF RELATED LITERATURE AND TECHNOLOGIES

This chapter discusses several literature reviews conducted by other proponents and authors in relation to the proponents' research. It comprises material from the internet, books, and articles that might be useful resources for relevant literature and previously implemented systems. The system's final purpose is met using these associated publications and technology.

2.0 Related Literature

According to World Health Organization article published on October 14, 2021, the number of people with visual impairment rapidly increases due to uncorrected refractive errors and cataracts. Because of this, it is undeniable that the number of people who require assistance in their daily lives is also increasing. As a result, devices and tools are designed for visually impaired people to help them with their daily activities, such as canes and guide dogs.

Also, according to the World Health Organization, assistive devices and technology improve an individual's functionality and independence to promote participation and improve the overall well-being of people with disabilities, including the visually impaired. People with trouble speaking, typing, writing, remembering, pointing, hearing, learning, walking, or seeing might benefit from assistive technology equipment (Assistive Technology Industry Association, n.d.). There are assistive technologies available to help people with impairments overcome their challenges.

In the case of visually impaired individuals, there are assistive technologies available that allow these individuals to perceive their environment. It includes intelligent canes, reading assistance software, speech-to-text software, smart glasses, virtual reality headsets, and innovative home solutions (Shashkina, 2021). With the advancement of technology, a mobile phone can also be considered an assistive device because of the developed apps to assist visually impaired individuals in their daily activities (Everyday Sight, 2021).

Moreover, most mobile phones nowadays have built-in tools, such as VoiceOver and Siri for Apple users and TalkBack and Google Assistant for Android users, that help visually impaired users access their phones independently because of its feature which allow these individuals to explore their phones using voice commands and also because of its feedback that allows visually impaired individuals know what they are clicking (Mukamal, 2020). Hence, utilizing mobile phones to assist is limitless and indispensable, making these individuals feel comfortable performing their day-to-day activities (Community Writer, 2012).

Their day-to-day activities include shopping, buying groceries, and eating in restaurants. These activities include monetary transactions, which are considered challenging jobs for a visually impaired individual to perform. Hence, systems and devices are made to solve this problem of visually impaired people.

Mr. Alvin Sarraga et al. (2020) proposed and developed a system named EyeBill-PH to assist visually impaired people in identifying Philippine Bill. It has a physical setup of acrylic glass. The proponents use Raspberry Pi 4 as its microcontroller, Pi Camera as its capturing device, and audio speakers to communicate the detected bill. The accuracy of the said system is 86.3% due to its low accuracy when identifying 20 pesos and 100 pesos bills.

Proponents from India developed an Android Studio and TensorFlow system that recognizes Indian currency. The said application doesn't require you to log in before the user can use the app, considering the situation of visually impaired individuals. The recognition result will be communicated to the user aloud using the text-to-speech module and operated using voice commands.

Professor Rajesh Babu et al. created a system that provides a method for verifying Indian rupee notes. The ideas of image processing are used to verify monetary notes. The system explains how to extract various properties of Indian rupee notes. The MATLAB program is used to extract the note's characteristics. The criteria for recognizing a genuine note include the serial number, security thread, identification mark, Mahatma Gandhi image, and recall and precision are determined using results obtained from the data set.

In the study of Sigh et al. (2014), they presented an application capable of identifying banknotes using computer vision processes that can be operated on a low-end smartphone. The suggested system employs Indian National Rupees as its working illustration and a visual Bag of Words-based identification mechanism that allows the system to recognize banknotes in a cluttered setting.

Furthermore, according to the proponents' evaluation of the application's performance in various natural environments, the system has 96.7 percent accuracy in recognizing 2584 photos captured using the app.

The study by Liu et al. (2008) proposed a currency recognition system for visually impaired individuals. Their suggested method combines mobile phone cameras' imaging and computation capacity to detect money and produce high-quality photos of the collected

bills in real-time when the phone camera approaches the bill. Furthermore, the system processes ten frames per second and has a false positive rate of about 1/10000.

Noura A. Semary et al. (2015) proposed a system that identifies Egyptian currency in their study. The system employs simple image processing techniques such as thresholding, noise reduction, histogram equalization, and segmentation to extract the ROI and assist the template matching operation. Furthermore, the system was created on the Android platform utilizing MATLAB and the OpenCV library. The technique produced an accuracy of 89 percent using the MATLAB system.

Additionally, a project, “SMARTFLORA Mobile Flower Recognition Application using Machine Learning tools,” conducted by Fatima Khalid, Azfar Husna Abdullah, and Lili Nurliyana Abdullah, uses the same machine learning platform “Teachable machine” as the proponents to develop their application. Their goal is to give ease to people who have difficulty recognizing the types of flowers without using any machine or computer, while the proponent's goal is to give ease to people who are visually impaired in recognizing Philippine currency. At the end of the project, the project SMARTFLORA produces 88 percent accuracy in recognizing flowers, specifically daisies, roses and sunflowers.

Furthermore, currency recognition systems give an easy, reliable and convenient way of recognizing and identifying money to visually impaired individuals in paying and receiving changes in malls, shops, restaurants, or anywhere they are, which also prevent these individuals from experiencing being scammed (Reizin INC., 2020).

According to a visually impaired individual named Mr. Canon from India who encountered being cheated or scammed by some sighted individuals in their everyday lives, it is very

challenging to identify the difference between each banknote due to its different sizes. He also added that with the help of currency identifier applications and devices, they could identify banknotes digitally and conveniently (Canon, 2019).

2.1 Related Technologies

2.1.1 LookTel Money Reader

LookTel Money Reader is an app that enables people with visual impairments and blindness to recognize currency easily, identify denominations in real time and count the bills. The said app can recognize twenty-one currencies, identify their denominations, and does not need an internet connection. Moreover, the app is only available to iOS devices running iOS 4.0 and higher (NantWorks, 2011).

2.2.2 Cash Reader: Bill Identifier

According to VisionLabs (2019), Cash Reader App identifies many world currencies, from Europe to Australia, including Philippine Peso. It reads money denominations aloud, enabling visually impaired individuals to know the denomination of their money. Moreover, the app automatically recognizes the denomination when the phone's camera points in the direction of the note. It works with different light, angles, and focuses. Furthermore, it is optimized for use with iOS VoiceOver and Android TalkBack, giving voice feedback to every tap the user makes. Hence, the user can use the device and the app without looking.

2.2.3 iBill: Talking Money Identifier

iBill is a small, compact, handheld device that quickly identifies US bills. The U.S Currency Reader Program provided it accessible to all qualified U.S citizens who

are visually impaired and blind. Additionally, the device can identify the bill's denomination in a natural voice, the pattern of tones, and vibrations that can be used when the user needs privacy. Also, with the help of vibrations, the device can assist individuals who are deaf and blind (NICOA, 2019).

2.2.4 EyeNote

The U.S. Bureau of Engraving and Printing developed and released the app in 2011 for visually impaired or blind individuals to identify denominations of Federal Reserve notes from Series 1996 to the Present. It is a free mobile device application available on the Apple iOS platform and can be downloaded in the Apple App Store. It uses image recognition technology and a built-in phone camera to recognize bill denominations and supports English and Spanish Languages. The eye note app can also communicate to the user with a pulse pattern and vibration buzzer for pulses (Bureau of Engraving and Printing, 2018).

2.2.5 Tiffy Template

It is a handheld device and pocket-able tool invented by Paul D'Souza to help his friend Tiffany who shared her experience of being cheated due to her condition. Paul developed a grooved plate as small as a credit card and can identify currency notes by folding and placing them to the template. Tiffy Template has a pattern and grooves that help visually impaired and blind individuals identify the Indian bill's denomination through its length and width (Sivaswamy, 2016).

2.2.6. Seeing AI

Seeing AI was developed on July 12, 2017, by Microsoft Corporation. It is an Artificial intelligence application that assists visually impaired and blind

individuals in their daily activities, including money or currency identifiers with high accuracy as the Eye Note. The app is only available on iOS and uses the phone's camera or tablet to identify money denominations. The app can now identify the recently issued currency bills, including Indian currency, and its denominations (Desk, 2018).

2.2.7. IDEAL Currency Identifier

Seeing AI was developed on July 12, 2017, by Microsoft Corporation. It is an Artificial intelligence application that assists visually impaired and blind individuals in their daily activities, including money or currency identifiers with high accuracy as the Eye Note. The app is only available on iOS and uses the phone's camera or tablet to identify money denominations. The app can now identify the recently issued currency bills, including Indian currency, and its denominations (Desk, 2018).

Table 2.1 *Comparison Table of Features of the Seven (7) Existing Applications and the Proposed Application*

APPLICATION	FEATURES							
	Banknote Recognition	**Text-to-Speech**	**Currency Support**	**Accessibility**	**User-Friendly Interface**	**Real-Time Recognition**	**Offline Capabilities**	**Money Calculation**
LookTel Money Reader	✓	✓	✓	✓	✓	✓	✓	
Cash Reader: iBill Identifier	✓	✓	✓	✓	✓	✓	✓	
iBill: Talking Money Identifier	✓	✓	✓	✓	✓	✓	✓	
EyeNote	✓	✓	✓	✓	✓	✓	✓	
Tiffy Template	✓				✓	✓	✓	
Seeing AI	✓	✓	✓					

IDEAL Currency Identifier	✓	✓		✓	✓	✓		
A-EYE	✓	✓		✓	✓	✓	✓	✓

CHAPTER III

METHODOLOGY

This chapter shows the methods used in creating the project program. The specified methods are clearly shown through exploded Gantt Charts from the prototyping development model.

3.0 Feature-Driven Development Process

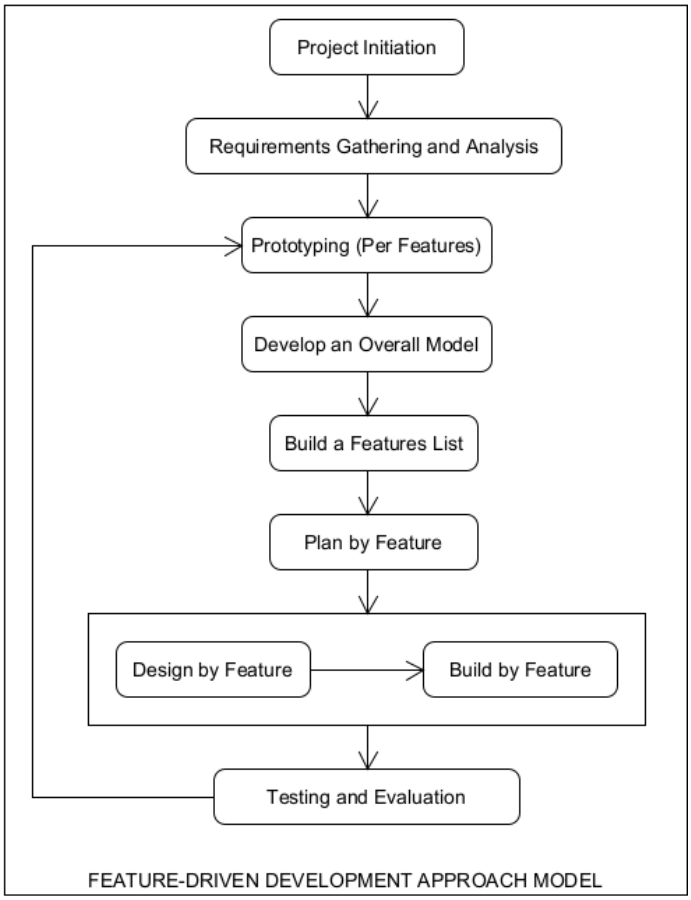


Figure 3.1 *Feature Driven Development Approach*

The overall methodology of the project follows the Feature Driven Development Approach Model in Figure 3.1. First, the project initiation, followed by the requirements gathering and analysis, then prototyping per feature with five sub-phases – (1) Develop an overall

model, (2) Build a features list, (3) plan by feature that is divided into two phase - (1) Designing by feature and (2) Build by feature. These five phases will repeat until the desired system is achieved, and it will be deployed. Lastly, the testing and evaluation.

Table 3.1 *System Application's Methodology Objective, Activities, and Results*

OBJECTIVES	ACTIVITIES	RESULTS
● Create an application for the visually impaired that can recognize Philippine banknotes. ● To calculate the recognized amount of money with a certain degree of precision. ● To provide voice feedback that announces the total amount of banknotes being recognized.	● Project Initiation Phase ● Requirements Gathering and Analysis Phase ● Prototyping per features ● Testing and Evaluation Phase	● A-EYE: A Mobile Philippine Banknote Identifier Using Google Teachable Machine

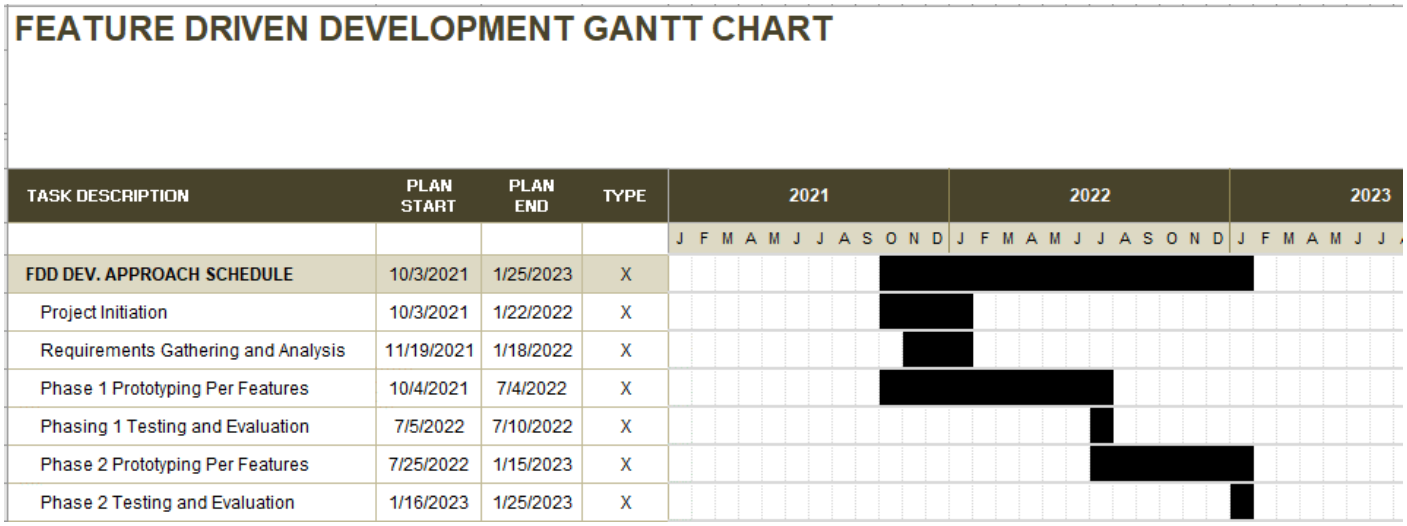


Figure 3.2 *Phases of A-eye System's Development Gantt Chart*

"Feature-Driven Development (FDD) is a client-centric, architecture-centric, and pragmatic software process." (Amber, 2018) Feature-driven development (FDD) is an iterative and incremental software development methodology that prioritizes the timely delivery of software features or functionalities in a structured and organized manner. It places a strong emphasis on tangible results, collaborative teamwork, and efficient communication throughout the development process. FDD aims to break down the software development cycle into manageable units of work, allowing for flexibility and adaptability in responding to changing requirements.

At the core of FDD lies the concept of creating an overall model of the software system. This model serves as a high-level representation of the system's features, processes, and functions. It acts as a guiding framework that provides a shared understanding among team members, enabling effective communication and collaboration. By establishing a

comprehensive model, FDD ensures that everyone involved in the project has a clear vision of the end product and the path to achieving it.

Based on the overall model, the next step in FDD is to develop a prioritized feature list. This list is derived from the model and comprises actionable units of work that need to be implemented. Each feature on the list should be small enough to be completed within a relatively short time frame, typically a couple of weeks. This approach allows for a steady and continuous stream of progress, as the team can deliver features incrementally throughout the development process.

With the feature list in hand, FDD adopts a feature-based planning approach. It divides the development process into a series of short, time-boxed iterations known as "feature sets." Each feature set focuses on delivering a specific set of features. During the planning phase, the team breaks down the features into smaller tasks, estimates the effort required, and assigns them to the appropriate team members based on their expertise and availability. By organizing the work in feature sets, FDD enables a clear roadmap for development and facilitates efficient resource allocation.

Once a feature set is identified, the design phase begins. FDD emphasizes designing by feature, which involves creating the necessary object models and architectural structures required to implement the features effectively. The design process is collaborative and involves discussions among team members to ensure a shared understanding of the system's architecture and design decisions. By designing incrementally and in parallel with development, FDD allows for flexibility and the ability to adapt the design as new insights or requirements emerge.

The building phase is where the actual implementation of the features takes place. In FDD, each feature is developed independently, enabling parallel work and maximizing productivity. The implementation process follows the design specifications created in the previous phase. As each feature is built, it undergoes a series of inspections and unit tests to ensure its quality. Regular progress reporting, code inspections, and automated testing are essential aspects of FDD, enabling the team to identify and address any issues promptly.

Throughout the FDD process, effective communication and collaboration are crucial. Progress is regularly tracked and shared among team members, promoting transparency and ensuring that everyone remains on the same page. FDD encourages a collaborative and cross-functional approach, where team members from different disciplines actively contribute their expertise and insights. This collaborative mindset fosters a sense of ownership and collective responsibility for the success of the project.

FDD is particularly suitable for projects with changing requirements or those that require quick delivery of tangible results. Its iterative nature allows for flexibility and adaptability, enabling the team to respond to changing circumstances and evolving stakeholder needs. By focusing on delivering features in short iterations, FDD provides a transparent and manageable approach to software development. It encourages a structured and disciplined workflow while promoting collaboration, communication, and the timely delivery of working software.

In conclusion, Feature-driven development (FDD) is a software development methodology that prioritizes the timely delivery of software features. By breaking down the development process into manageable units of work, FDD enables flexibility, adaptability, and a focus on tangible result

3.1 Project Initiation

PROJECT INITIATION

TASK DESCRIPTION	PLAN START	PLAN END	TYPE	2021	2022
				J F M A M J J A S O N D	J F M A M J J A S O N D
Project Initiation	10/3/2021	1/25/2022	X		
Background of theStudy	10/3/2021	1/21/2022	X		
Feasibility Study	10/3/2021	1/22/2022	X		
Proposal Document	10/3/2021	1/22/2022	X		
Pitching	1/25/2022	1/25/2022	X		

Figure 3.3 *Project Initiation Phase Gantt chart*

3.1.1 Background of the Study

The proponents listed interesting research topics. Researched each topic to find possible opportunities and problems. The ability to independently recognize and identify banknotes is a crucial aspect of daily life for individuals with visual impairments. Accurately determining the value of banknotes can empower visually impaired individuals to handle financial transactions with confidence, maintain their financial independence, and navigate various aspects of daily living. To address this challenge, the proposed project aims to develop a mobile application specifically designed to assist visually impaired individuals in identifying and recognizing different denominations of banknotes, providing them with a reliable and accessible solution.

3.1.2 Feasibility Study

The proponents studied the feasibility of possible topics and titles. Operational, technical, and economic feasibility are being discussed. In operational feasibility,

the proponents see whether the system will operate when installed and whether the system will be used. In technical feasibility, the proponents see whether it is possible to develop the new system given the current technical resources. The proponents see if the target organization has staff who are technically proficient enough to accomplish the objectives of the system. In economic feasibility, the resources to consider are the proponents' time, the cost of the study of the system, the cost of employees' time for study, and the estimated cost of hardware.

3.1.3 Proposal Documents

The proponents studied the feasibility of possible topics and titles. Operational, technical, and economic feasibility are being discussed. In operational feasibility, the proponents see whether the system will operate when installed and whether the system will be used. In technical feasibility, the proponents see whether it is possible to develop the new system given the current technical resources. The proponents see if the target organization has staff who are technically proficient enough to accomplish the objectives of the system. In economic feasibility, the resources to consider are the proponents' time, the cost of the study of the system, the cost of employees' time for study, and the estimated cost of hardware.

3.1.4 Pitching

The proponents presented their title and the gist of their research to their panelist in a 10-minute presentation. "A pitch is nothing more than a verbal presentation. A presentation of a notion, concept, situation, idea, or story that can be augmented with photographs, casting, suggestions, newspaper articles, clippings, or anything else that will help you in the "selling" of your idea" (SYDFIELD, 2018).

3.2 Requirements Gathering and Analysis

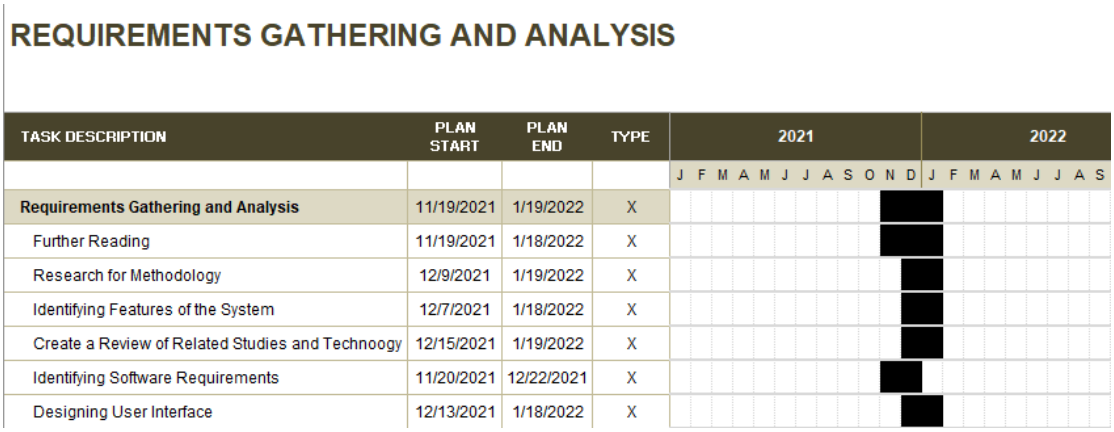


Figure 3.4 *Requirements Gathering and Analysis Phase Gantt chart.*

Figure 3.4 displays the schedule for the phase of requirements gathering and analysis. In the requirements gathering and analysis phase, the proponents engage in extensive research related to the approved title, "A-EYE: A Mobile Philippine Banknote Identifier Using Google Teachable Machine." The initial three activities, which involve further readings, methodology research, and data gathering, constitute the requirements gathering phase. On the other hand, the analysis phase encompasses the identification of features, the creation of a review of relevant literature and technologies, the determination of software and hardware requirements, and the design of the user interface.

3.2.1 Further Readings

In this particular task, the proponents diligently engaged in reading and comprehensively reviewing a wide range of materials such as books, journals, scholarly articles, applications, and software relevant to each aspect of their study. By doing so, they aimed to gain a deep understanding of the subject matter and

ensure that the research study being undertaken would be enriched with a detailed description, a concise summary, and a critical evaluation of the existing literature and related resources.

3.2.2 Research for Methodology

The methods section of a research study outlines the planned actions and rationale behind investigating a specific research problem. It explains the chosen procedures and techniques for identifying, selecting, processing, and analyzing information in order to gain a deeper understanding of the problem at hand. By providing this information, the reader is able to critically assess the overall validity and reliability of the study. In line with this, the proponents of the study surveyed various software development methodologies and carefully selected the most appropriate approach to guide the development of their system.

3.2.3 Identifying Features of the System

After collecting the data, the proponents conducted a thorough analysis. By examining the collected data and conducting extensive research, they were able to identify and determine the key features that their system should possess. To accomplish this, they employed various tools and techniques to analyze and interpret the inputs, processes, outputs, and sequence of events within the system. This analysis enabled them to gain insights into the functioning and structure of the system, facilitating the development of a comprehensive understanding of its components and operations.

3.2.4 Create a Review of Literature and Technologies

The proponents dedicated considerable effort to crafting a comprehensive literature review that encompasses related literature and technologies. In this section, they aimed to provide an overview of the relevant readings they had extensively explored. By doing so, they sought to establish the connection between their research and the broader field of study, demonstrating its relevance and contribution. Furthermore, the literature review involved summarizing and critically evaluating the scholarly readings that directly pertained to their research. This process allowed the proponents to assess the strengths and weaknesses of existing research, identify research gaps, and ultimately support the justification and significance of their own study within the academic discourse.

Through their literature review, the proponents not only showcased their familiarity with the existing body of knowledge but also highlighted their ability to critically analyze and synthesize relevant scholarly works. By presenting a comprehensive summary and critical evaluation of these readings, they demonstrated their rigorous approach to research and positioned their own study as an important contribution to the field

3.2.5 Identifying Software Requirements

During the initial phase of the project, an operational feasibility study was conducted as part of the process of identifying the requirements for the system. This study aimed to assess the practicality and viability of implementing the proposed system. By examining factors such as the organization's resources, budget, and technical capabilities, the proponents evaluated whether the system could be

successfully implemented and operated. This study played a crucial role in determining the feasibility of the system and provided valuable insights for the subsequent phases of the project.

Building upon the identified features of the system, the proponents embarked on extensive research to explore the various methods and approaches available for implementing the system. This research helped them identify the specific software and hardware requirements necessary for the system to function optimally. By thoroughly investigating different technological options and analyzing their compatibility with the identified features, the proponents were able to determine the specific software applications, programming languages, and hardware components that would be required for the successful development and deployment of the system. This process of research and identification of software and hardware requirements laid the foundation for the subsequent stages of the project, ensuring that the system's implementation would align with the project's objectives and feasibility.

3.2.6 Designing User Interface

Designing the user interface posed a multitude of considerations for the proponents, requiring them to carefully evaluate various factors. One crucial aspect was the technical feasibility study conducted during the initial phase of the project. This study provided valuable insights into the system's technical capabilities, limitations, and requirements, enabling the proponents to design an interface that aligned with the system's technical feasibility. By taking into account these technical

considerations, the proponents ensured that the user interface could effectively accommodate the system's functionalities and provide a seamless user experience.

Additionally, conducting a comprehensive literature review on the features of the system was instrumental in shaping the design of the user interface. This review allowed the proponents to identify and understand the essential features that the system needed to offer. By considering these features during the design process, the proponents were able to create an interface that effectively presented and facilitated the use of these features. Furthermore, system branding played a significant role in the user interface design. By aligning the interface design with the system's branding guidelines and objectives, the proponents were able to create a visually cohesive and consistent user experience that reflected the overall branding of the system. This attention to system branding ensured that the user interface conveyed a sense of familiarity and brand identity to the users, enhancing their overall interaction with the system.

3.3 Phase 1 Prototyping

During the first phase of prototyping, the proponents are focused on creating an application specifically designed for individuals with visual impairments. The primary goal is to develop a system capable of accurately recognizing Philippine banknotes in a certain degree of accuracy. This application aims to provide a practical solution for visually impaired individuals to easily identify and assess the value of different banknotes. By incorporating advanced technologies and techniques, the proponents strive to achieve a certain degree of accuracy in the application's functionalities.

Throughout the development process, the proponents adhere to a structured approach that revolves around distinct features. This approach involves a step-by-step progression outlined as follows: first, they develop an overall model for the application. Subsequently, they compile a comprehensive list of features to be incorporated. Following this, they plan the implementation of each feature, design them accordingly, and then proceed to build them. This sequential process, as illustrated in Figure 3.2, ensures a systematic and organized development journey for the application catering to visually impaired users.

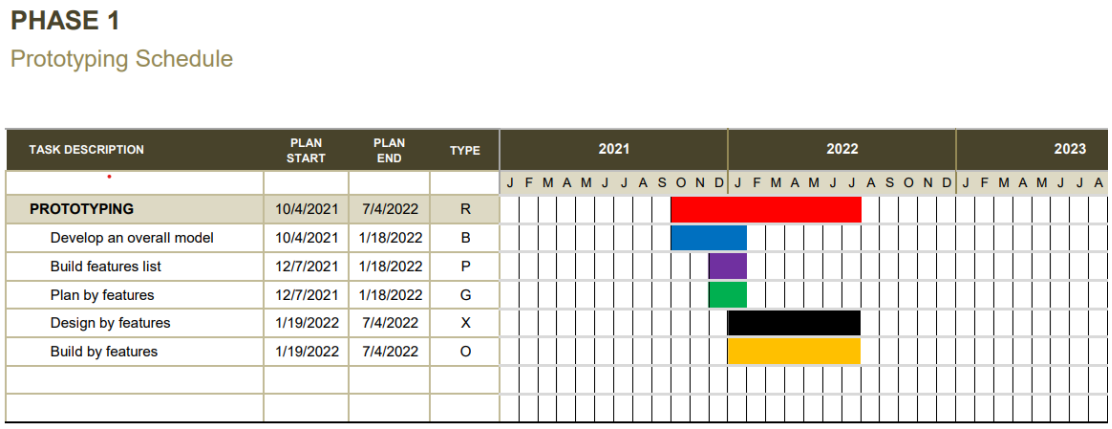


Figure 3.5 *Prototyping Phase Gantt chart*

3.3.1 Build an Overall Model

Building an overall model of a system is a fundamental aspect of system development, providing a holistic view of its structure, components, and interactions. By creating a conceptual representation or blueprint, the system's essential aspects can be captured and analyzed. The overall model serves as a solid foundation for subsequent stages of system development, including design, implementation, and evaluation. It acts as a guiding framework, ensuring that all

stakeholders have a comprehensive understanding of the system and enabling effective decision-making throughout the development process.

The process of building an overall model involves carefully identifying and defining the key elements of the system. This includes determining the system's structure, such as its components, modules, and their relationships, as well as understanding the flow of data or information between them. By creating this conceptual representation, the proponents can gain insights into the system's functionality, dependencies, and potential challenges. The overall model acts as a blueprint that guides the subsequent steps of system development, providing a clear roadmap for design decisions, implementation strategies, and performance evaluation. It lays the groundwork for a successful system development process by ensuring a comprehensive understanding of the system's architecture and facilitating effective collaboration among stakeholders.

3.3.1.1 Feature Model

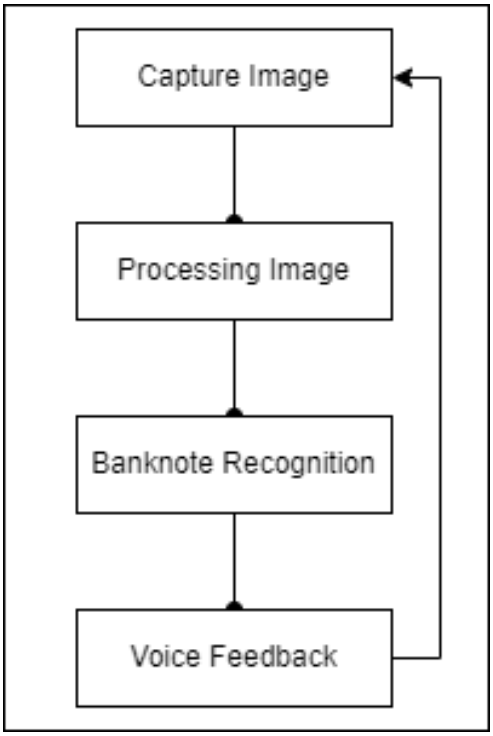


Figure 3.6 *Feature Model*

Figure 3.6 presents a visual depiction of the software product, highlighting its interdependencies and features. The development process begins with the creation of an overall model. In this model, the proponents outline the desired functionalities of the application, which include four sequential processes: image capture, image processing, Philippine banknote recognition, and audio feedback to users.

Firstly, the process of image capture involves the application's ability to acquire visual data through various means, such as using a camera or accessing pre-existing images. This step lays the foundation for subsequent operations by providing the necessary input.

Secondly, the image processing phase entails manipulating the captured image data to enhance its quality, extract relevant information, or perform specific tasks. This process may involve techniques like image filtering, resizing, or feature extraction, depending on the requirements of the application.

The software aims to recognize Philippine banknotes, employing algorithms and models designed to identify and classify different currency denominations accurately. This feature caters specifically to the needs of users who require assistance in distinguishing various Philippine banknotes.

The application provides audio feedback to users, ensuring an inclusive user experience. This feedback can take the form of spoken instructions, descriptions, or alerts, enabling users to receive information and interact with the software through auditory means.

By following these four processes, the proponents strive to create a software product capable of capturing, processing, recognizing Philippine banknotes, and offering audio feedback to enhance usability and accessibility.

3.3.1.2 User Interface Design Model

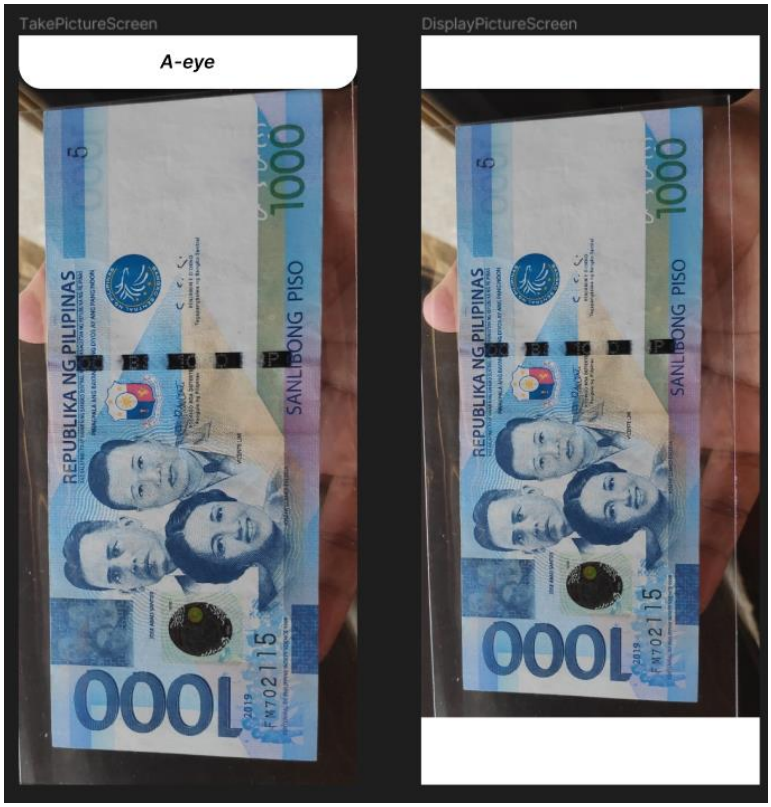


Figure 3.7 *User Interface Model*

Two of the golden rules in designing a user interface are (1) to place users in control of the interface to allow them to learn quickly and gain a fast sense of mastery in using the app. (2) to make it comfortable for the users to interact with the application by removing unnecessary elements that don't help the users. Making the application user interface simple and minimalist would enable users to focus on the essential elements of the user interface while still having an intuitive and useful user experience.

Moreover, the proponents utilize "Figma," a designing tool that aids designers in building anything, including websites and applications, to create the wireframe of the user interface of the system. The proponents

utilize Figma because, aside from being free and easy to understand and use, it also provides prototypes that show how users might interact with the design. It also has a frame for extra functionality and pre-sets of popular devices that the proponents can use to view the prototypes and design on different mobile devices.

Furthermore, the proponents designed the user interface of ‘A-eye’ simply and intuitively for visually impaired users. They did not include any buttons or widgets that require the users to click or tap to start recognizing a banknote. The design would allow users to interact with the system by tapping the screen to recognize and return. After the user taps to recognize banknotes, the system will display the preview on the display screen and deliver the result of recognition through voice feedback along with the total calculation of the identified banknote. Then, the user can tap anywhere on the screen to return to the take picture screen.

3.3.1.3 Application Model

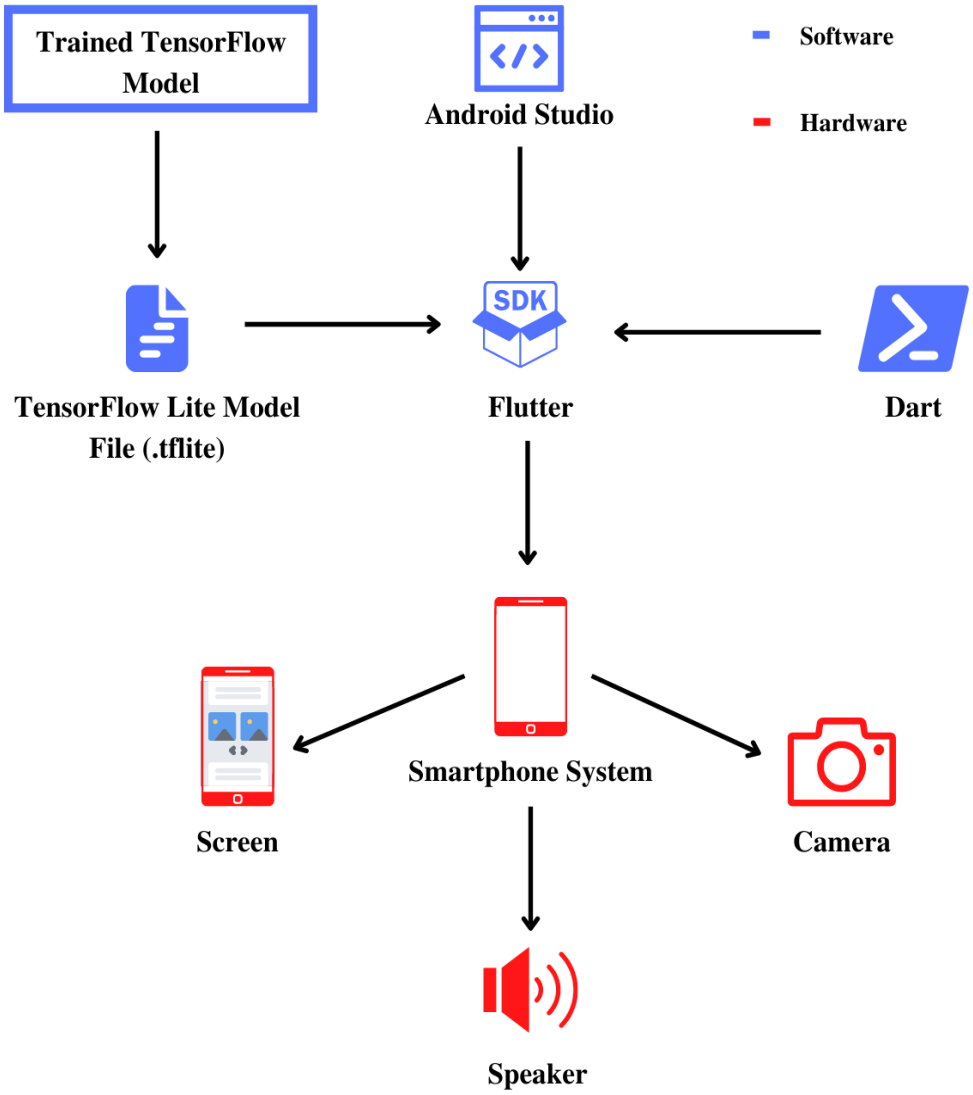


Figure 3.8 *Application Model*

The Figure 3.8 illustrates the key components of the 'A-eye' application, which are responsible for its overall functionality. Application modeling, as depicted graphically, serves as a visual representation of the business and showcases the interconnected foundation elements essential for supporting the application. This approach helps to provide a comprehensive

understanding of how the various components work together to enable the desired functionality of 'A-eye' (Kamen, March 2016).

The development process of the application involves several steps and utilizes various tools and technologies. Firstly, the proponents utilize Android Studio as their development environment, providing them with a comprehensive platform to build the application. Secondly, the proponents employ Flutter as their software development kit (SDK) and Dart as the programming language. This combination enables them to create a robust and efficient application.

The proponents incorporate a TensorFlow model as an asset in the application. This model acts as the core component responsible for analyzing and identifying the banknote value. Once the application is developed, it is installed on smartphones, leveraging the device's camera, speaker, and screen functionalities. This integration allows users to capture images of banknotes using the camera, and the application employs the TensorFlow model to process the images and provide certain accuracy in recognizing Philippine banknotes. Additionally, the application utilizes the speaker and screen to present the results to the user, enhancing the user experience and usability of the app.

3.3.2 Build a Feature List

Table 3.2 *Features List*

FEATURES
Image Recognition
Text-to-Speech
Offline Mode
User-Friendly Interface
Compatibility

The Table 3.2 provided offers a comprehensive list of the features incorporated within the 'A-Eye' system. These features play a crucial role in defining the capabilities and functionalities of the system. By examining Table 3.2, stakeholders can gain a clear understanding of the diverse range of features that have been integrated into the system. Each feature is meticulously outlined and described, allowing for a comprehensive overview of the system's capabilities and offerings.

To delve further into the specifics of each feature, additional information can be found in Table 3.3. This table serves as a complementary resource that provides in-depth explanations and insights into the individual features listed in the main table. By referring to Table 3.3, readers can gain a more detailed understanding of each feature's purpose, functionality, and significance within the broader context of the 'A-eye' system. This

comprehensive reference allows stakeholders to explore and analyze each feature's intricacies, facilitating informed decision-making and a deeper comprehension of the system's capabilities.

The combined utilization of these tables enhances the accessibility and clarity of information regarding the features of the 'A-eye' system. By presenting the feature list in one table and providing detailed explanations in another, stakeholders can navigate through the extensive feature set with ease. This organized and structured approach ensures that individuals interested in the system can effectively comprehend the functionality and significance of each feature, contributing to a comprehensive understanding of the 'A-eye' system as a whole.

3.3.3 Plan by Feature

Table 3.3 *Plan by Features*

APPLICATION DOMAIN	FEATURE
Banknote Recognition	Image recognition that can identify Philippine currencies to aid visually impaired individuals.
Text-to-Speech	The application may offer features like text-to-speech functionality to assist visually impaired users in identifying banknotes.

Offline Mode	The application can function without an internet connection, allowing users to identify banknotes even in areas with limited connectivity.
User-Friendly Interface	The application features an intuitive and easy-to-use interface, making it accessible to users with varying levels of technological proficiency.
Compatibility	The application is compatible with a range of devices, including smartphones, tablets, and other mobile devices as long as it is supported by the required specs of the application.

The Table 3.3 provides a comprehensive overview of the features integrated into the A-eye system. One of the primary application features is Banknote Recognition, which utilizes advanced image recognition technology to identify banknotes by analyzing captured images.

The A-eye system incorporates Accessibility Features, such as text-to-speech functionality or other aids, to cater to the needs of visually impaired users, making it accessible and inclusive.

The system also operates in Offline Mode, allowing users to continue using it even in areas with limited or no internet connectivity. This feature ensures uninterrupted functionality and convenience. The User-Friendly Interface of the A-eye system

enhances the user experience by providing an intuitive and easy-to-navigate interface, accommodating users with varying levels of technological proficiency. Lastly, the system demonstrates Compatibility across a range of devices, including smartphones, tablets, and other mobile devices, ensuring accessibility and flexibility for users across different platforms.

3.3.3.1 Design by Feature

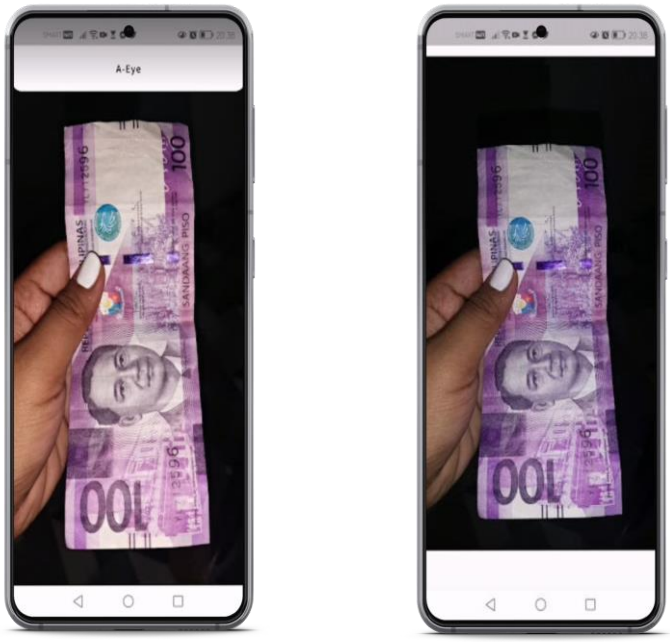


Figure 3.9 *Design by Feature*

Having a particular design principle in mind, the proponents decided to make the user interface of the application ‘A-eye’ simple and intuitive for visually impaired users. The proponents didn't include any buttons on the application to make it more convenient which allows their users to navigate around the app smoothly.

In this UI design, the user can interact with the app just by tapping anywhere on the screen and ‘A-eye’ will automatically recognize the banknote and inform the user of the total computation of the identified banknotes through its voice feedback function. The user can also just tap anywhere on the display or preview screen to return to recognize another banknote.

3.3.3.2 Build by Feature

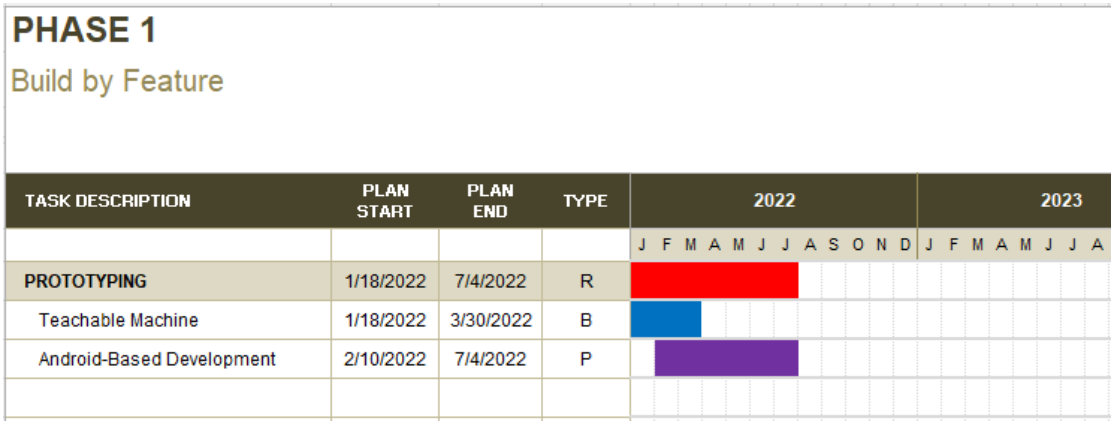


Figure 3.10 *Build by Feature Phase Gantt chart*

Figure 3.10 serves as an illustrative depiction of the essential components required to support the designed feature. This visual representation provides stakeholders with a clear understanding of the foundational elements necessary to facilitate the implementation and functionality of the feature. By referring to the Figure 3.9, individuals can easily identify the key elements that need to be in place for the feature to operate effectively within the overall system architecture.

To realize the designed feature, the proponents engaged in Android-based system design and conducted datasets training utilizing Teachable Machine. This comprehensive approach ensured the development of a robust and

tailored program that aligns with the requirements and objectives of the feature. The Android-based system design encompassed the creation of a user-friendly interface and seamless integration with the Android platform, optimizing the user experience and accessibility. Simultaneously, the Datasets training conducted through Teachable Machine facilitated the training and fine-tuning of the program's algorithms and models, enhancing its accuracy and performance.

By incorporating Android-based system design and leveraging Teachable Machine for Datasets training, the proponents demonstrated a holistic and meticulous approach to building the program. This comprehensive methodology ensures that the feature is not only well-designed but also incorporates state-of-the-art techniques and technologies to enhance its functionality. Through the integration of these essential components, the proponents were able to create a robust and efficient program that effectively supports and brings the designed feature to life.

3.3.3.2.1 Google Teachable Machine

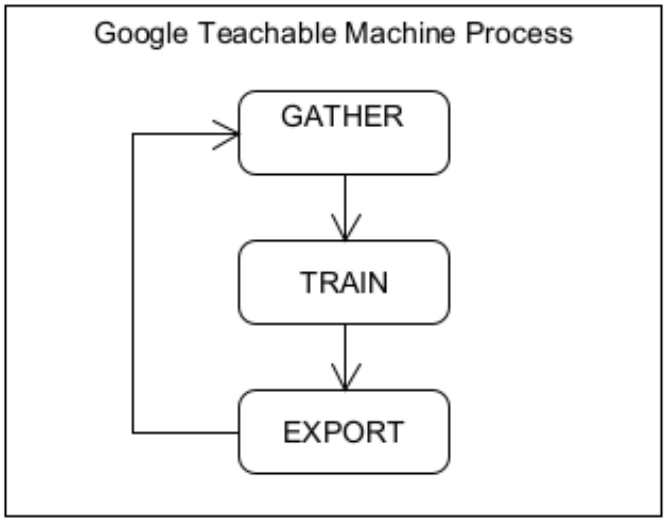


Figure 3.11 *Google Teachable Machine Approach*

Teachable Machine employs a variety of technologies and methodologies to facilitate the training of AI models. One prominent technique it utilizes is transfer learning, which leverages existing models and knowledge to expedite the training process, thereby conserving time and computational resources. Deep learning frameworks, such as TensorFlow, are employed to implement the underlying neural networks and algorithms, providing efficient tools for the training and deployment of AI models. Operating as a web-based tool, Teachable Machine leverages JavaScript, HTML, and CSS to create an accessible and user-friendly interface for tasks such as data collection, model training, and exporting.

Teachable Machine supports a diverse range of data types, encompassing images, sounds, and poses. It employs sophisticated computer vision techniques to analyze and process images, allowing users to train models to recognize and classify visual patterns. Similarly, it utilizes audio processing techniques to analyze and categorize sounds. While the primary training process takes place within Teachable Machine itself, cloud infrastructure may be employed for certain operations, such as accelerated processing and data storage, thereby enhancing the overall efficiency of the training process.

The methodology employed by Teachable Machine consists of three key steps: gathering, training, and exporting. During the gathering phase, users upload or capture data, including images, sounds, or poses, to serve as the foundation for training the AI model. In the training phase, transfer learning techniques are applied to enhance the accuracy and performance of the model using the collected data. Once the training process is complete, users can export the trained model, enabling seamless integration into their applications, websites, or other relevant environments.

An illustrative example of the Teachable Machine's practical application involves a project in which proponents utilized the tool to collect and classify images of Philippine banknotes. Diligently, they compiled 156 images for each of the six distinct classifications.

The training process took place within Teachable Machine, granting the proponents the ability to modify and retrain the model to enhance its accuracy. Following a comprehensive evaluation of the model's performance and user satisfaction, it was exported to Android Studio for further development and rigorous testing. Subsequently, the exported model, alongside the amassed data, was seamlessly integrated into their system, resulting in the creation of a robust and highly effective solution.

In general, Teachable Machine effectively combine these advanced technologies and methodologies, offering a user-friendly and accessible tool that simplifies the training of AI models. It significantly lowers the barrier of entry for users lacking extensive coding knowledge or expertise in machine learning, while ensuring remarkable accuracy and performance in model training.

3.3.3.2.2 Android-Based Development

Figure 3.12 *Android-Based Development Approach*

Figure 3.12 depicts the development schedule of an Android-based system. The primary objective of this phase was to construct a currency identifier specifically designed for the client's use in

identifying Philippine currency. The development process followed a feature-driven approach, wherein each feature underwent a repetitive cycle of tasks. These tasks included building an algorithm tailored to the feature, coding the necessary functionality, conducting thorough testing and evaluation, and making revisions as needed to enhance the system's performance.

The Android-based currency identifier aimed to provide a reliable and efficient solution for accurately recognizing and distinguishing Philippine currency. By adhering to the feature-driven development methodology, the development team ensured that each feature received focused attention and went through a structured process of development, testing, and improvement. This approach allowed for a systematic and iterative refinement of the system's functionalities, enabling the team to create a robust currency identification tool that met the specific requirements of the client.

Throughout the development schedule, continuous evaluation and revision played a crucial role. Feedback from testing and user evaluation informed the necessary adjustments and enhancements to further enhance the performance and accuracy of the currency identifier. By following this iterative process, the development team ensured that the Android-based system underwent continuous improvement, resulting in a final product that effectively addressed

the client's needs and provided a reliable currency identification solution for the Philippine market.

3.3.3.2.2.1 Data Gathering

In the Android application development phase, the proponents gather data from different sources to evaluate and learn about the programs about to be built. “Data gathering enables an individual to answer relevant questions, make predictions, and scrutinize outcomes about future trends and probabilities.” (McLaughlin, 2020)

The advocates used their phones to take 156 images from 20 – 1000 Philippine peso as part of their data collection. The advocates assembled all the images and then uploaded them to Teachable Machine to create models that they could utilize to construct the system.

Gathering, training, and exporting are the three processes that make up the teachable machine. Before training a model, proponents first collect the data or models described above. To meet the objectives of the system, they focus on accuracy epoch during training, and then they consider the exporting technique by which they export the learned model into floating point.

3.3.3.2.2.2 Programming

Figure 3.13 *Programming Development Approach*

Figure 3.13 shows the concept of programming with two phases, namely Writing the Algorithm and Building the Code, which is a systematic approach to software development.

- **Writing Algorithm**

  An algorithm can be described as a set of instructions meticulously designed by programmers to carry out specific tasks. It encompasses a wide range of operations, from simple calculations like multiplication to more intricate processes. Algorithms serve as functions that function as mini-programs, providing a reference for accomplishing desired objectives (TechTerms, 2013). To illustrate the concept, algorithms can be likened to food recipes, as they outline a series of steps to achieve a particular outcome. Therefore, constructing an algorithm marks the initial step in the development of each feature.

During the development process, programmers crafted the algorithm for the system by utilizing a collection of photos trained through a teachable machine. This training process involved feeding the machine a variety of images and allowing it to learn and recognize patterns. Once the photos were incorporated into the machine, programmers proceeded to follow the necessary steps to build the algorithm. The resulting algorithm then served as a guiding set of instructions for the various tasks within the application's system.

The algorithm formed the backbone of the system, enabling it to perform its designated functions. It provided a systematic and logical framework for processing data, making decisions, and executing operations within the application. By implementing the algorithm, the system was capable of accurately identifying and analyzing visual information based on the trained photos. This allowed for the seamless integration of the algorithm into the system's tasks and operations, ensuring optimal performance and functionality.

Overall, an algorithm is a set of instructions devised by programmers to accomplish specific tasks. It resembles a recipe, outlining the steps required to achieve a desired outcome. In the case of the system in question, programmers constructed the algorithm using trained photos and integrated it into the various tasks of the application. The algorithm served as a crucial component, enabling the system to process information and carry out its functions effectively.

- **Building the Code**

  Building code involves the crucial process of transforming algorithms into executable programs. During this phase, proponents utilize programming languages to convert the logical instructions of algorithms into a form that computers can understand and execute. In the case of the project at hand, the proponents utilized the Android Studio development environment and employed Kotlin as the programming language of choice. Kotlin is a statically typed and pragmatic programming language initially designed for the Java Virtual Machine (JVM) and Android platform. It combines elements of object-oriented and functional

programming, placing emphasis on interoperability, safety, clarity, and tooling (Heller, 2020).

The adoption of the Android Studio integrated development environment provided proponents with a robust platform for building the program. Android Studio offers a comprehensive set of tools, libraries, and frameworks specifically designed for Android application development. This development environment streamlines the coding process and provides essential features such as code auto completion, debugging capabilities, and integration with Android-specific APIs.

By utilizing Kotlin as the programming language, proponents were able to take advantage of its modern features and syntax. Kotlin's conciseness, null safety, and interoperability with existing Java code made it an ideal choice for building Android applications. Additionally, Kotlin's focus on readability and expressiveness contributed to the overall efficiency and maintainability of the codebase.

Overall, the process of building code involved the transformation of algorithms into executable programs. The proponents leveraged the Android

Studio development environment and Kotlin programming language to accomplish this task successfully. This combination allowed for efficient and effective development, enabling the creation of a robust and functional program for the Android platform.

3.3.3.2.2.3 Designing User Interface

In the process of designing the user interface, the proponents encountered numerous factors that required careful consideration. Extensive literature review on system features and system branding played pivotal roles in shaping the design of the user interface. The user interface, as defined by Coursera (2021), represents the graphical component of an application, website, or device that facilitates the interaction between the user and the system.

The literature review on system features provided valuable insights into the functionalities and requirements of the application. This review helped identify the key features that the user interface needed to support, ensuring that the design aligned with the intended functionality and purpose of the system. Additionally, the review allowed the proponents to study existing user interface designs in similar domains,

enabling them to gather inspiration and best practices to incorporate into their own design.

System branding also played a significant role in the user interface design process. It involved establishing the visual identity and branding elements of the system, such as the color scheme, typography, and graphical elements. The branding decisions were crucial in creating a cohesive and visually appealing user interface that reflected the system's identity and resonated with the target audience. By considering these factors, the proponents were able to produce a well-designed user interface that effectively facilitated user interaction. The user interface acted as the bridge between the users and the system, providing an intuitive and visually pleasing interface for users to interact with the application. Through their thoughtful approach to the literature review, system features, and branding, the proponents ensured that the user interface design met the needs and expectations of the users, enhancing the overall user experience.

3.4 Testing and Evaluation

Prototyping is a crucial phase in the development process that involves testing and evaluation to ensure the quality and effectiveness of the product. One of the testing methods employed by the proponents in the early stages is known as Quick and Dirty testing. This

approach allows for easy and rapid assessment of the product's usability, design, or specific features that are being considered for integration into an existing product. According to Mehlhorn (2014), Quick & Dirty Usability Test provides a quick and straightforward means of evaluating usability, aiding in the identification of areas for improvement.

To conduct the testing, the proponents followed a controlled procedure. They performed a total of 250 sets of tests for a typical environment. These tests were conducted both during the day and at night, resulting in a total of 500 tests. The proponents personally carried out each test, ensuring consistency and accuracy. To evaluate the outcomes, basic mathematical calculations were employed to determine the average of the findings. Since each parameter had only two possible values, the results were combined and divided by two, providing a representative measure of the test outcomes.

By incorporating testing and evaluation into the prototyping phase, the proponents were able to gather valuable insights into the performance and usability of the application. The Quick and Dirty testing method allowed for efficient assessment, highlighting areas that required further refinement or enhancement. Through the meticulous execution of 250 sets of tests, covering both day and night conditions, the proponents obtained a comprehensive understanding of the application's performance across different scenarios. The subsequent evaluation and calculation of averages ensured a systematic analysis of the test results. This rigorous testing approach enabled the proponents to identify any discrepancies, make necessary improvements, and enhance the overall quality and usability of the application.

3.5 Revision

During the thorough testing and evaluation process, the proponents identified several areas for improvement in the software application. The revision of the application’s system will

be in phase 2 of prototyping per features. These findings include the need to further develop the product by incorporating the following enhancements:

- Integration of a Philippine banknote computation feature to cater specifically to users in the Philippines.
- Implementation of a flash functionality to improve visibility in dimly lit environments.
- Enhancement of the design interface to provide a more intuitive and aesthetically pleasing user experience.
- Incorporation of additional datasets to enhance the accuracy and reliability of the application's results.
- Improvement of audio feedback to assist visually impaired users in better comprehending and navigating the application.

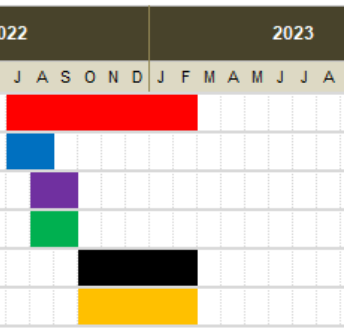
3.6 Phase 2 Prototyping

In this phase, the proponents advance the application's development based on the evaluation of the previous phase. During this evaluation, they identified areas for improvement and identified additional components to enhance the application's system.

PHASE 2

Prototyping Schedule

TASK DESCRIPTION	PLAN START	PLAN END	TYPE
PROTOTYPING	7/25/2022	2/16/2023	R
Develop an overall model	7/25/2022	8/31/2022	B
Build features list	8/18/2022	9/28/2022	P
Plan by features	8/18/2022	9/28/2022	G
Design by features	10/1/2022	2/16/2023	X
Build by features	10/1/2022	2/16/2023	O



These components include integrating Philippine banknote computation, implementing a flash for dimly lit environments, enhancing the design interface, incorporating additional datasets to improve accuracy, and refining audio feedback. To facilitate these activities, the proponents conduct a prototyping per features to implement potential changes that will lead to superior outcome.

Figure 3.14 *Prototyping Gantt chart*

3.6.1 Build an Overall Model

3.6.1.1 Feature Model

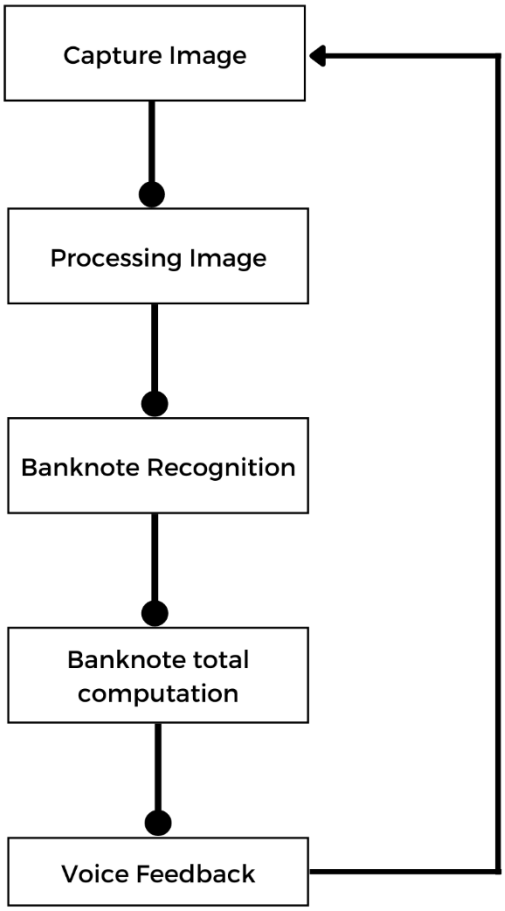


Figure 3.15 *Feature Model*

Figure 3.15 presents an enhanced feature model that builds upon the previous version by excluding the banknote computation aspect. To further augment the application's functionality and assist visually impaired individuals in accurately identifying Philippine banknotes, the proponents introduced an additional component. This new addition incorporates a

unique feature that facilitates the real-time computation of banknotes held by the user.

3.6.1.2 User Interface Design Model

Figure 3.16 *User Interface Design Model*

In phase 1, the user interface model features have a white panel design that spans the upper and lower parts of the screen. However, this design element appears irrelevant and detracts from the overall aesthetic of the application. In response, the proponents have enhanced the design by eliminating the

white panel from the upper portion, which previously displayed the application's name. This modification aligns with the application's functionality, which allows users to interact with the screen through taps anywhere on the interface. In implementing the model, the proponents still used Figma to create the design.

3.6.2 Build a Feature List

Table 3.4 *Features List*

FEATURES
Image Recognition (with Flash)
Banknote computation
Text-to-Speech
Offline Mode
User-Friendly Interface
Compatibility

In Table 3.4, the proponents introduced two new features to enhance the user experience: banknote computation and image recognition with flash functionality. This enhancement stemmed from the proponents' recognition of the challenges users face during monetary transactions. They discovered that users not only struggle with identifying Philippine banknotes but also with calculating the total value of the banknotes they have in hand. Additionally, the proponents included a flash feature in the application to address the need for conducting money transactions at any time, whether during the day or in poorly lit environments.

3.6.3 Plan by Feature

Table 3.5 *Plan by Feature*

APPLICATION DOMAIN	FEATURE
Banknote Recognition (With Flash)	Image recognition with flash functionality that can identify Philippine banknotes in any environment to aid visually impaired users in anytime transactions.
Banknote Total Computation	Image recognition with flash functionality that can identify Philippine banknotes in any environment to aid visually impaired users in anytime transactions.
Text-to-Speech	The application may offer features like text-to-speech functionality or tactile feedback to assist visually impaired users in identifying banknotes.
Offline Mode	The application can function without an internet connection, allowing users to identify banknotes even in areas with limited connectivity.
User-Friendly Interface	The application features an intuitive and easy-to-use interface, making it accessible to users with varying levels of technological proficiency.
Compatibility	The application is compatible with a range of devices running Android 7.2 or higher, including smartphones, tablets, and other mobile devices, as long as it is

	supported by the required specs of the application.

a

3.6.3.1 Design by Feature

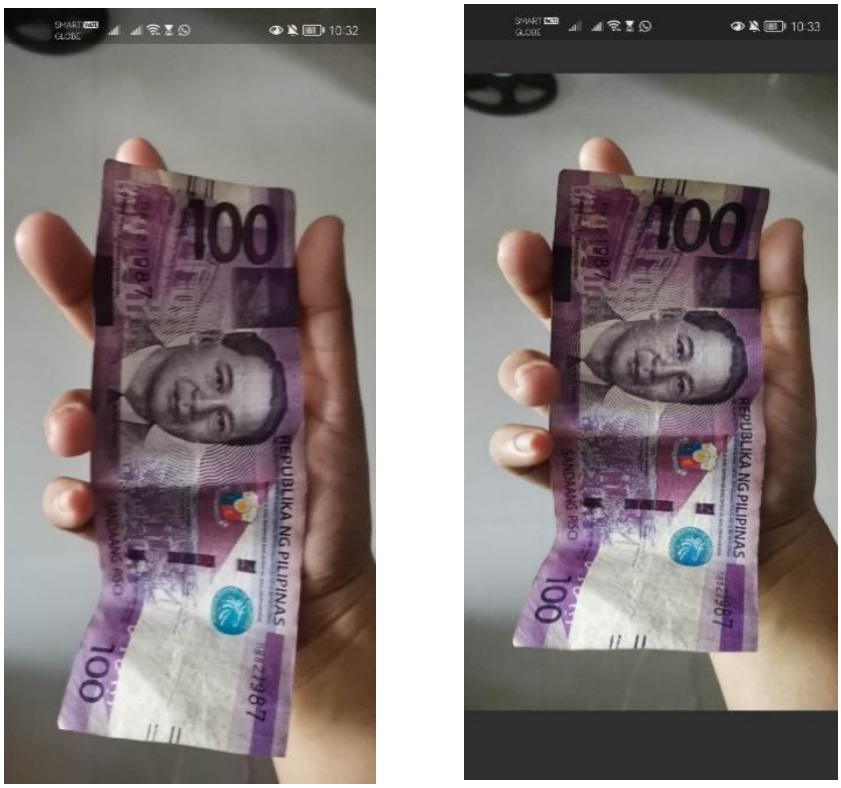


Figure 3.17 *Design by Feature*

Based on the design model implementation, the user interface has been enhanced by removing the two white panels situated at the top and bottom of the screen in the previous phase.

3.6.3.2 Build by Feature

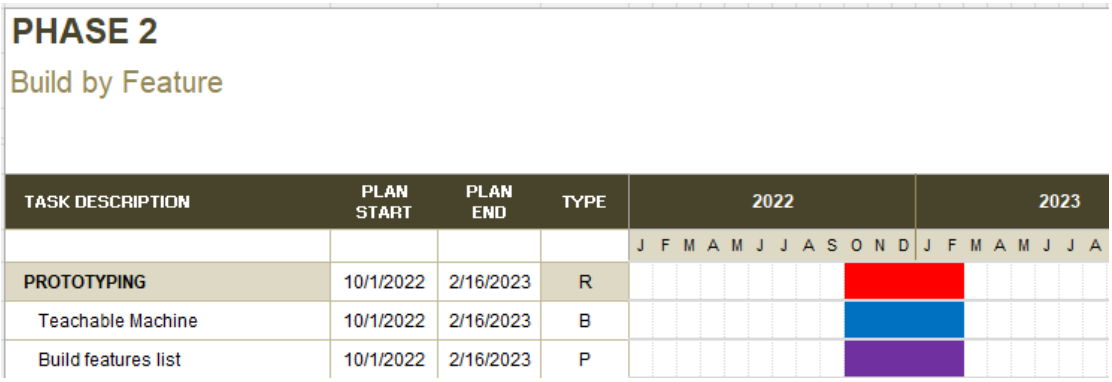


Figure 3.18 *Build by Feature Gantt chart List of Tasks*

3.6.3.2.1 Google Teachable Machine

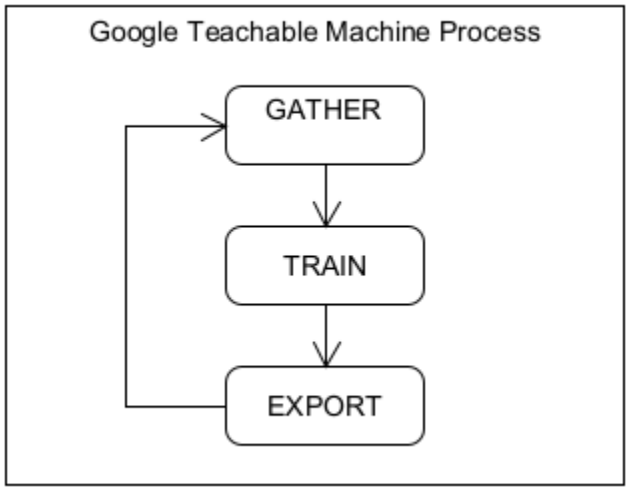


Figure 3.19 *Google Teachable Machine Approach*

During phase one, the proponents collected a total of 156 data sets per class, ranging from 20 to 1000 Pesos. However, upon evaluating the testing results, it became evident that this sample size was insufficient to enhance the application's performance. As a result, the proponents decided to increase the dataset and gathered a total of 486 data sets per class. Additionally, they included a new class

consisting of blurry and gray quality images for training and export in Google Teachable Machine in the same manner with phase 1 prototyping. This expansion of the dataset is expected to significantly improve the application's performance, as believed by the proponents.

3.6.3.2.2 Android-Based Development

Figure 3.20 *Android – Based Development Approach*

3.6.3.2.2.1 Data Gathering

The proponents used their phones to take a total of 486 images from different views of each category of Philippine banknotes including blurry and granny quality of images as part of their data collection. The proponents assembled all the images and then uploaded them to Teachable Machine to create models that they could utilize to construct the system.

3.6.3.2.2.2 Programming

- **Writing an Algorithm**
- **Building the Code**

The proponents conduct a series of enhancements in the code, as they enhance the audio feedback of the system to assist the user. The changes are as follows:

The application will tell the user to double tap the screen to capture an image and to restart the calculation of the application, the app will tell the user to tap the screen and long tap the screen continuously to rest the calculation.

3.7 Testing and Evaluation

During phase 2 testing and evaluation, the proponents employed a comprehensive range of tests, including the Quick and Dirty. This test revealed remarkable performance by the application, particularly in dimly lit environments. The application excelled in recognizing banknotes using the flash feature and displayed an impressive ability to identify banknotes captured in various conditions, such as low-quality or blurry images. Notably, the proponents enhanced the application to provide valuable feedback, ensuring a seamless and enriching experience for visually impaired users.

The successful phase 2 testing and evaluation phase demonstrated the application's robustness and effectiveness in aiding visually impaired individuals. Its performance in recognizing banknotes under challenging circumstances and its thoughtful incorporation of user feedback highlights its potential to significantly improve accessibility and independence for visually impaired individuals.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter presents the system prototype developed in this project, along with the findings and analyses of the implemented technique. It provides an overview of the feature-driven prototype development strategy employed in creating the Android version of the A-EYE: A Mobile Philippine Banknote Identifier Using Google Teachable Machine. Additionally, the chapter includes a discussion on user acceptance and usability testing, highlighting the evaluation and feedback received from users.

The system prototype showcases the tangible outcome of the project, demonstrating the practical implementation of the developed technique. The chapter presents an in-depth analysis of the prototype's functionality, performance, and user experience, providing insights into its strengths and areas for improvement. Furthermore, the user acceptance and usability testing section sheds light on how users interacted with the application, their feedback, and their overall satisfaction. This information is crucial in assessing the effectiveness and user-friendliness of the application, guiding future enhancements and refinements to meet user expectations.

4.0 Project

To effectively manage the activities and tasks involved in developing the A-EYE system application, the proponents utilized Gantt charts. These charts provided a visual representation of the project timeline and helped the team track and organize their progress. The development process commenced with project initiation, followed by requirements gathering and analysis. During this phase, the proponents identified the key features of the

system and proceeded to develop it using a feature-driven prototyping approach. This approach allowed for iterative development and refinement of the system's features, ensuring that they aligned with the identified requirements and met the intended objectives of the application.

4.1 Results of Project Initiation

After completing the tasks in the project initiation phase, the proponents identified several opportunities and established their objectives for the study. During the background study, they assessed the feasibility of the project from various perspectives.

4.1.1 Operational Feasibility

During the project initiation phase, the proponents conducted an assessment of the operational feasibility of the A-EYE application. This involved evaluating the practicality and viability of implementing the application in real-world settings. The proponents carefully considered the potential impact of the application on society and its users, aiming to address relevant problems and provide meaningful solutions. The decision to pursue the A-EYE project was made through a thorough evaluation process, including brainstorming sessions where the proponents explored various problem areas and identified the ones that could be effectively resolved, benefiting the community and its users. This thoughtful approach ensured that the project aligned with the goals and objectives of creating a valuable and practical solution.

4.1.2 Technical Feasibility

The technical feasibility of the A-EYE application was evaluated to ensure its successful implementation. To secure the system's functions in identifying Philippine currency and totaling scanned banknotes, the proponents enforced the use of secure data sets within the system. Additionally, they designed the application to work offline on Android devices, eliminating the requirement for constant internet connectivity. The mechanism used for currency identification was adjusted whenever new banknote features were introduced, ensuring the system's adaptability and accuracy.

4.1.3 Economical Feasibility

The proponents recognized the wide use of information and communication technology (ICT) in various fields, including policing and healthcare. Recent developments in research, surveys, and technological advancements have led to the expansion of technology in these sectors. The demand for ICT tools is rapidly growing, as they have the potential to improve people's lives. Among the most significant devices are smartphones, which offer increasing capabilities, connectivity to the internet and data services, and high portability.

The research community, along with the proponents agencies, has started leveraging the capabilities of smartphones to develop applications and mobile services focused on reducing fraud. These existing benchmarking applications serve as valuable references for the proposed A-EYE system. Smartphones, with their versatility and accessibility, have become powerful instruments for various purposes, including fraud reduction.

In summary, the proponents conducted a comprehensive feasibility assessment during the project initiation phase. They evaluated the operational feasibility, considering that the idea of this project is a product of brainstorming and the willingness of the proponents to help the visually impaired in monetary transactions. The technical feasibility was ensured by implementing secure data sets, offline functionality, and an adaptable mechanism. The economic feasibility was supported by the widespread use of ICT tools, the potential of smartphones as essential devices, and the existing applications dedicated to fraud reduction. These findings provided a solid foundation for further development and implementation of the A-EYE system.

4.2 Results of Requirements Gathering and Analysis

The development of the A-EYE system was greatly facilitated by the existence of similar applications, which played a crucial role in helping the proponents identify the problem at hand. In order to meet the requirements of the system, several features needed to be incorporated, necessitating a comprehensive assessment of the system's needs, scope, and the identification of processes that required modification. Through this evaluation, the programmers were able to successfully introduce the following features into the A-EYE system:

- A-EYE implemented voice feedback functionality to ensure that users were accurately guided throughout the processing application. This feature not only provided real-time directions but also offered feedback upon the completion of each process.

- One significant capability of the A-EYE system is its ability to identify Philippine banknotes. Through the utilization of advanced algorithms and pattern recognition techniques, A-EYE offers an efficient and accurate method for recognizing and distinguishing various denominations of Philippine banknotes.
- The A-EYE system incorporates a useful feature that enables it to calculate the total value of scanned banknotes. This functionality eliminates the need for manual calculations and provides users with a quick and accurate total of the scanned banknote amounts.
- A-EYE incorporates a flash feature designed to improve image quality when capturing subjects under imbalanced lighting conditions. By adjusting the camera settings and utilizing the flash, A-EYE ensures that the captured images are clear and well-illuminated, thus enhancing the overall accuracy of banknote recognition.
- Another noteworthy feature of A-EYE is its ability to identify banknotes even in scenarios where the quality of the captured images is compromised, such as when the banknotes are blurred or in grayscale. This robust capability ensures that the system can still accurately recognize and classify banknotes despite suboptimal image conditions.

To develop the A-EYE system, the creators leveraged a combination of powerful tools and technologies. They utilized Android Studio; a comprehensive integrated development environment (IDE) specifically designed for Android application development. Additionally, they made use of the software development kit (SDK) provided by Android to access a wide range of libraries, APIs, and tools for building feature-rich applications.

Furthermore, the programming language Dart was employed by the creators in the development process. Dart, known for its efficiency and ease of use, provided a solid foundation for implementing the required functionalities and logic within the A-EYE system.

In order to ensure the system's effectiveness, mandatory datasets were obtained and utilized to educate the A-EYE system using teachable machines. These datasets, carefully curated and tailored to the specific needs of the system, played a vital role in training the algorithms and enabling the system to accurately recognize and differentiate banknotes.

The selection of Android Studio, Dart, and the utilization of teachable machines not only offered the necessary programming languages and development materials but also provided a wealth of resources, references, and documentation that significantly aided the creators in building the desired system.

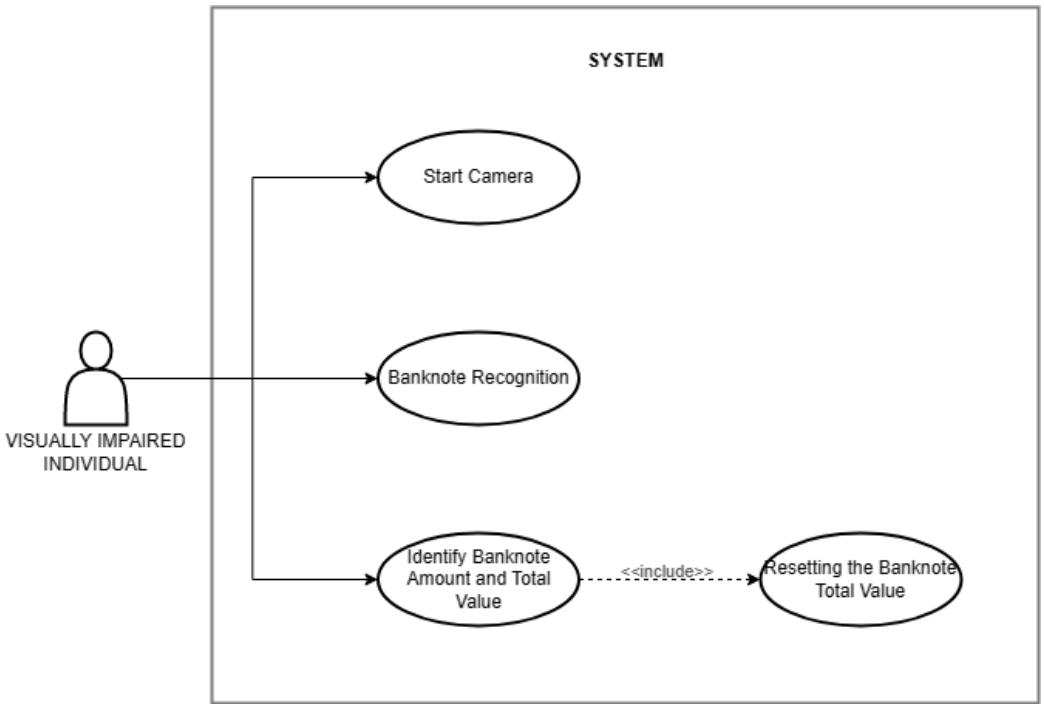


Figure 4.1 *A-EYE Use Case Diagram*

The interaction between visually impaired users and the A-EYE system is illustrated in the use case diagram, as depicted in Figure 4.1. The visually impaired user has the ability to initiate commands within the system. They can start the application and configure the camera settings to capture photographs of banknotes. After capturing the image, the A-EYE system utilizes its trained data sets to identify the banknotes accurately. Once the identification process is complete, the system vocalizes the results to the user, providing them with spoken feedback on the recognized banknotes.

In this interaction, visually impaired users have a direct role in controlling the A-EYE system through their commands. By initiating the application and configuring the camera settings, they enable the system to capture images of banknotes, which serve as input for further processing. The system's ability to dominate the data sets and perform accurate identification allows it to provide valuable spoken results, enhancing the user's understanding of the recognized banknotes.

Overall, the use case diagram illustrates a user-centered approach, empowering visually impaired individuals to independently interact with the A-EYE system, capture banknote images, and receive auditory feedback on the identified banknotes. This interaction design aims to improve the user experience and accessibility for visually impaired users, facilitating their engagement with the system and enabling them to confidently recognize and differentiate banknotes.

4.3 Results of Prototyping

In developing the system of the application, the proponents conduct a 2 set of prototyping phases to ensure that the application's performance is good before deploying to the end-users. The result of the system prototyping is carefully evaluated by the proponents, and this evaluation is guided by the Prototyping Phase Gantt chart. The chart considers various components that are crucial to the prototyping process of the A-EYE system. These components include building an overall model, creating a features list, planning by feature, designing by feature, and building by feature. Each of these phases plays a pivotal role in the creation of the A-EYE prototype, ensuring a systematic and comprehensive approach to its development.

The first component, building an overall model, involves constructing a conceptual representation or blueprint of the A-EYE system. This model captures the fundamental aspects of the system, providing a holistic view of its structure, components, and interactions. It serves as a foundation for subsequent phases of development, enabling stakeholders to analyze and understand the system's functionality.

The next component is creating a features list. This involves identifying and defining the key features and functionalities that the A-EYE system should possess. This list serves as a guide for the prototyping process, ensuring that all essential functionalities are considered and incorporated into the system.

The subsequent phases, planning by feature, designing by feature, and building by feature, follow a systematic and iterative approach. In the planning phase, detailed plans are developed for each feature, outlining the specific requirements, tasks, and timelines. The design phase focuses on creating the detailed design specifications for each feature,

ensuring that the system meets the desired requirements. Finally, in the building phase, the features are implemented, tested, and integrated to create the functional prototype of the A-EYE system.

By following this prototyping approach and considering these key components, the proponents ensure that the development of the A-EYE prototype is conducted in a structured manner. This systematic approach increases the chances of creating a successful prototype that meets the objectives and requirements of the A-EYE system.

proponents.

4.3.1 Results of Phase 1 Prototyping

4.3.1.1 Build an Overall Model

During the initial phase, the proponents construct a comprehensive representation of the software product, emphasizing its interconnections and characteristics. They specify the desired functionalities of the application, which encompass four consecutive procedures: capturing images, processing images, recognizing Philippine banknotes, and providing audio feedback to users. Through these four procedures, the proponents aim to develop a software product that can effectively capture, process, recognize banknotes, and improve usability and accessibility by incorporating audio feedback.

4.3.1.2 Build a Feature List

The proponents compiled a feature list for the 'A-EYE' application by collecting information and conducting planning. The listed features, such as

image recognition, accessibility, offline mode, user-friendly interface, and compatibility, serve as a guide for stakeholders to explore and interact with the application.

4.3.1.3 Plan by Feature

During this phase, the proponents integrate the listed features to create a comprehensive overview of the application's functionality. The main feature of the application is its ability to recognize Philippine banknotes using advanced image recognition technology. Additionally, the application includes accessibility features like text-to-speech functionality, which assists visually impaired users. It also has an offline mode, enabling users to utilize the application without an internet connection. The A-Eye system boasts a user-friendly interface that enhances the overall user experience by providing an intuitive and easy-to-use interface, specifically designed for visually impaired individuals. Moreover, the application is compatible with a variety of devices, requiring a minimum system requirement of android 7.2 and above.

4.3.1.3.1 Design by Feature

The proponents developed an intuitive user interface for the application, specifically designed for visually impaired users. They opted for a button-free layout to enhance convenience and enable seamless navigation within the app. In this user interface, users can interact with the application by tapping the screen, and the app will automatically identify the banknote and provide feedback through

voice prompts. Users can easily recognize multiple banknotes by tapping the screen again.

4.3.1.3.2 Build by Feature

The proponents employed Google's teachable machine to train and export collected datasets. They utilized Android Studio as the development environment and employed Flutter for software development, utilizing Dart as the programming language. In Google's teachable machine, they gathered 156 datasets covering various classes ranging from 20 pesos to 1000 pesos. These datasets were trained using the machine and subsequently exported to Android Studio for application development. The overall software development was carried out using Flutter and Dart. The proponents had confidence that this approach would enable them to achieve the project's objectives.

4.3.1.4 Results of Phase 1 Testing and Evaluation

	No. of test	Classes	Accuracy
	250	20	96%
	250	50	96%
	250	100	97%
	250	200	96%
	250	500	99%
	250	1000	99%
Total			**97.17%**

Figure 4.2 *Evaluation Report of the Phase One (1) Testing*

This Figure 4.2 shows that the performance of the application is excellent, the test is conducted in an open space in a typical environment. The results of this test ranges 96% - 99%, but the application is not performing well in a dimly lit place since the datasets added are not enough to enhance the performance of the application.

Accuracy per class

CLASS	ACCURACY	# SAMPLES
20 pesos	1.00	24
50 pesos	1.00	24
100 pesos	0.96	24
200 pesos	0.96	24
500 pesos	1.00	24
1000 pesos	1.00	24

Figure 4.3 *Phase One (1) Accuracy per class*

The 100-peso bill obtained an accuracy rate of 0.96, indicating that the model correctly identified most instances but may have had a few misclassifications. The 200- and 500-peso bills also achieved an accuracy rate of 0.96, indicating a high level of accuracy in identifying these denominations. Lastly, the 1000-peso bill obtained a perfect accuracy rate of 1.00, further highlighting the model's ability to accurately recognize this denomination.

In conclusion, Figure 4.3 showcases the accuracy rates per class for the model's performance in identifying different Philippine banknote denominations. The results demonstrate a high level of accuracy across the board, with perfect accuracy rates achieved for the 20-, 50-, 500-, and 1000-peso bills. The slightly lower accuracy rate of 0.96 for the 100- and 200-peso bills indicates that the model may have experienced a few misclassifications, but overall, it performed admirably in recognizing these denominations. These results provide valuable insights into the effectiveness of the model and validate its capability to accurately identify and classify Philippine banknotes, which is a critical aspect of the mobile banknote identifier application.

4.3.1.5 Revision

During the initial phase of prototyping for each feature, the proponents chose to adopt the Feature Driven Development approach for initiating and developing the application. After conducting tests and evaluations in this phase, the proponents were dissatisfied with the system's performance. As

a result, they made modifications to the system and adjusted the datasets used in Google's teachable machine.

For the next phase of prototyping, the proponents identified several areas for improvement. These include implementing a flash during image recognition to improve the application's ability to identify banknotes in various environments. Additionally, they believed that incorporating banknote computation would assist users in monetary transactions. Lastly, the proponents added another command in voice feedback to provide users with the option to continue recognizing banknotes and calculating their available funds or to reset the calculation to zero.

4.3.2 Results of Phase 2 Prototyping

4.3.2.1 Build an Overall Model

Following the initial prototyping phase, the proponents made an enhancement to the model by introducing an additional component. This addition aims to improve the functionality of the application and provide assistance to visually impaired individuals in identifying Philippine banknotes. The new component includes a distinct feature that enables the real-time calculation of banknotes held by the user.

4.3.2.2 Build a Feature List

The proponents introduced two new features to enhance the user experience: banknote computation and image recognition with flash functionality. This enhancement stemmed from the proponents' recognition of the challenges users face during monetary transactions. They discovered

that users not only struggle with identifying Philippine banknotes but also with calculating the total value of the banknotes they have in hand. Additionally, the proponents included a flash feature in the application to address the need for conducting money transactions at any time, whether during the day or in poorly lit environments.

4.3.2.3 Plan by Feature

4.3.2.3.1 Design by Feature

Based on the design model implementation, the user interface has been enhanced by removing the two white panels situated at the top and bottom of the screen in the previous phase.

4.3.2.3.2 Build by Feature

The proponents incorporated additional datasets into Google's teachable machine to improve its ability to identify banknotes. The updated datasets consisted of 486 instances per class, and a new class called 'No banknote' was introduced, which included a total of 3402 datasets. Additionally, to enhance the application's usability for visually impaired users, the proponents included a command in the program that provides users with an option after the application generates results.

4.3.2.4 Results of Phase 2 Testing and Evaluation

In this phase, the proponents conduct the same test from the previous phase to ensure a good software product before deploying it to the end users. The results for the quick and dirty testing are following:

	NO. OF TEST	CLASSES	ACCURACY
	250	20	94.40%
	250	50	94%
	250	100	96%
	250	200	95.20%
	250	500	96.40%
	250	1000	94.40%
TOTAL	1500	6	95%

Figure 4.4 *Evaluation results of test in dimly lit place*

Figure 4.4 displays the promising results of the testing phase, indicating a high level of accuracy for the application in dimly lit places. The average accuracy rate achieved during the quick and dirty testing was an impressive 95%. When examining specific Philippine peso denominations, the application demonstrated a 94.40% accuracy rate for the 20-peso bill, 94% for the 50-peso bill, 96% for the 100-peso bill, 95.20% for the 200-peso bill, 96.40% for the 500-peso bill, and 94.40% for the 1000-peso bill. These individual accuracy rates culminated in an overall accuracy rate of exactly 95% for the dimly lit environment.

It is a testament to the application's robust performance and its ability to accurately identify Philippine banknotes even in challenging lighting conditions. With an average accuracy rate of 95% and consistent performance across various denominations, the application proves to be reliable and effective in providing accurate results. These results provide confidence in the application's capability to support visually impaired individuals in recognizing and managing Philippine banknotes during their monetary transactions, particularly in a dimly lit environment.

	NO. OF TEST	CLASSES	ACCURACY
	250	20	96.40%
	250	50	96%
	250	100	94.80%
	250	200	97.20%
	250	500	96%
	250	1000	95.20%
TOTAL	1500	6	95.93%

Figure 4.5 *Evaluation results of tests in a typical environment*

Figure 4.5 illustrates the positive outcomes of the testing phase, indicating a high level of accuracy for the application in a typical environment. The average accuracy rate achieved during the quick and dirty testing was an impressive 95.93%. When examining specific Philippine peso denominations, the application demonstrated a 96.40% accuracy rate for the 20-peso bill, 96% for the 50-peso bill, 94.80% for the 100-peso bill, 97.20% for the 200-peso bill, 96% for the 500-peso bill, and 95.20% for the 1000-peso bill. These individual accuracy rates combined to produce an overall accuracy rate of exactly 95.93% for the typical environment.

	NO. OF TEST	CLASSES	ACCURACY
	500	20	95.40%
	500	50	95%
	500	100	95.40%
	500	200	96.20%
	500	500	96%
	500	1000	94.80%
TOTAL	3000	6	95.50%

Figure 4.6 *Overall evaluation results of test in both dimly lit place and typical environment*

Figure 4.6 presents the combined results of Figure 4.4 and Figure 4.5, which encompass both the dimly lit place and typical environment. The average accuracy rate derived from these two settings is 95.50%. Examining specific Philippine peso denominations, the total accuracy rate for the 20-peso bill is 95.40% in both the dimly lit place and typical environment. For the 50-peso bill, the accuracy rate is 95%, while the 100-peso bill achieves a rate of 95.40%. The 200-peso bill demonstrates a higher accuracy rate of 96.20%, while the 500-peso bill achieves a rate of 96%. Lastly, the 1000-peso bill attains an accuracy rate of 94.80%. Overall, the combined accuracy rate for all denominations is 95.50% in the dimly lit place.

The results presented in Figure 4.6 illustrate the consistent performance of the mobile Philippine banknote identifier application across both dimly lit and typical environments. With an average accuracy rate of 95.50%, the application showcases its reliability and precision in identifying Philippine banknotes, regardless of lighting conditions. The individual accuracy rates for each denomination further validate the application's effectiveness, with rates ranging from 94.80% to 96.20%. These findings underscore the A-EYE system's ability to support visually impaired users in accurately recognizing and managing Philippine banknotes, providing them with greater independence and accessibility during monetary transactions.

Figure 4.4 and Figure 4.5, reveals notable insights into the performance of the mobile Philippine banknote identifier application in different environments. Figure 4.4 highlights the testing results in dimly lit places,

where the application achieved an average accuracy rate of 95%. The accuracy rates for specific Philippine peso denominations ranged from 94% to 96.40%. On the other hand, Figure 4.5 represents testing in a typical environment, where the application achieved a higher average accuracy rate of 95.93%. The accuracy rates for specific denominations in this case ranged from 94.80% to 97.20%.

These results demonstrate the application's overall effectiveness in both dimly lit and typical environments, indicating consistent and reliable performance. The application showcases a strong ability to accurately identify and distinguish Philippine banknotes, thereby assisting visually impaired users during monetary transactions. In both environments, the application delivers accurate results for a wide range of denominations, encompassing the 20-peso, 50-peso, 100-peso, 200-peso, 500-peso, and 1000-peso bills.

The application's performance in dimly lit places, as indicated by Figure 4.4, reflects its ability to handle challenging lighting conditions. With an average accuracy rate of 95%, the application ensures reliable banknote recognition even in environments with limited visibility. This capability is crucial in supporting visually impaired individuals during their daily interactions with Philippine banknotes.

Similarly, the application's performance in a typical environment, as demonstrated in Figure 4.5, further solidifies its effectiveness. The average accuracy rate of 95.50% indicates the application's high level of accuracy

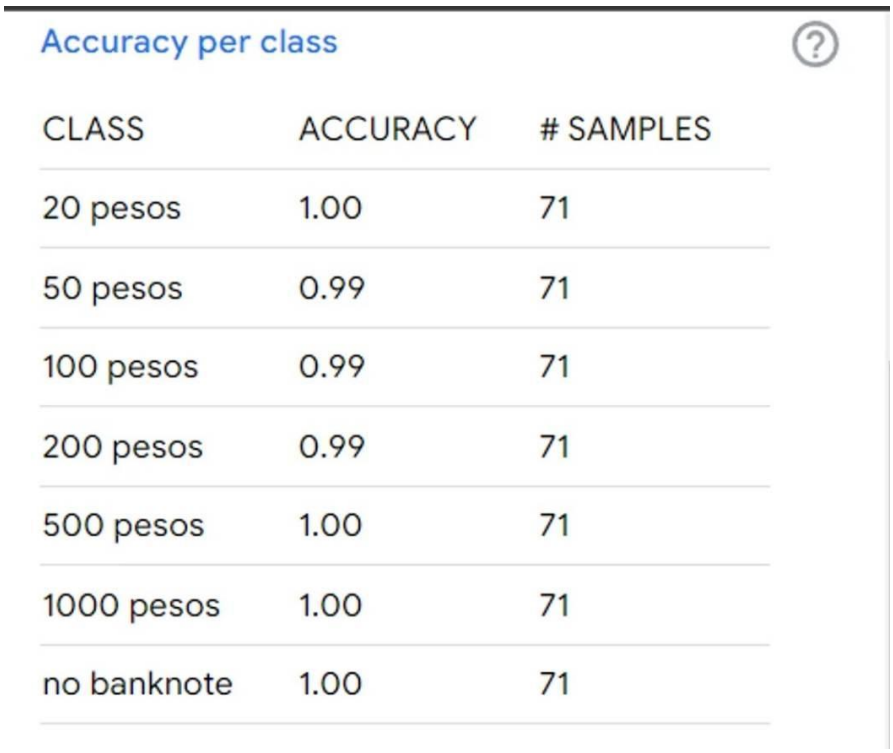
and dependability in normal lighting conditions. This aspect is essential for visually impaired users, ensuring that they can confidently rely on the A-EYE system for accurate banknote identification in their everyday transactions.

In conclusion, it reveals that the mobile Philippine banknote identifier application, utilizing Google Teachable Machine, excels in both dimly lit and typical environments. The application consistently achieves impressive accuracy rates, ranging from 94% to 97.20%, for various denominations of Philippine banknotes. These results provide strong evidence of the application's reliability and effectiveness in assisting visually impaired individuals in recognizing and managing Philippine banknotes during their monetary interactions. The A-EYE system emerges as a valuable tool for enhancing accessibility and inclusivity, enabling visually impaired users to confidently engage in financial transactions with increased independence and efficiency.

In order to ensure the accuracy of the model, it is crucial to evaluate its performance in accurately recognizing each denomination of the money note. The accuracy rates presented below were obtained through the incorporation of multiple classes representing the various Philippine banknote denominations, along with the appropriate epoch values. The inclusion of all denominations, ranging from 20 to 1,000 pesos and no banknote, in this project allowed for a comprehensive assessment of the model's image processing capabilities. The accuracy results for each class

were automatically generated and revealed by the teachable machine, providing valuable insights into the model's ability to accurately identify different Philippine banknotes.

The evaluation of accuracy rates for the model's performance in recognizing Philippine banknotes is essential for assessing its reliability and effectiveness. By incorporating various classes representing different denominations and utilizing the appropriate epoch values, the accuracy rates obtained provide a comprehensive understanding of the model's precision. The inclusion of all denominations from 20 to 1,000 pesos ensures that the model is capable of accurately processing images of the entire range of Philippine banknotes. The automatic generation and revelation of accuracy results by the teachable machine streamline the evaluation process, allowing for efficient analysis of the model's performance across different denominations.



Accuracy per class

CLASS	ACCURACY	# SAMPLES
20 pesos	1.00	71
50 pesos	0.99	71
100 pesos	0.99	71
200 pesos	0.99	71
500 pesos	1.00	71
1000 pesos	1.00	71
no banknote	1.00	71

Figure 4.7 *Phase Two (2) Accuracy per class*

Figure 4.7 provides a detailed breakdown of the accuracy per class, with each class consisting of 71 samples. The accuracy rates achieved for each class highlight the model's performance in accurately identifying Philippine banknotes. In the case of the 20-peso bill, a perfect accuracy rate of 1.00, or 100%, was obtained, indicating that the model successfully recognized all instances of this denomination. Similarly, the 50-peso bill achieved an accuracy rate of 0.99, demonstrating the model's proficiency in identifying this specific denomination. The 100-peso bill obtained an accuracy rate of 0.99, indicating that the model correctly identified most instances but may have had a few misclassifications. The 200 got 0.99 accuracy rate, 500-peso bill achieved an accuracy rate of 1.00-, and 1000-peso bill obtained a 1.00

accuracy rate indicating a high level of accuracy in identifying these denominations. Lastly, the No banknote class obtained a perfect accuracy rate of 1.00, further highlighting the model's ability to accurately recognize this denomination.

In conclusion, the evaluation results presented in Figure 4.7 demonstrate the accuracy of the model in identifying Philippine banknotes across different denominations. The analysis reveals that the model achieved high accuracy rates for each class, reflecting its proficiency in recognizing specific denominations. Notably, the 20-peso bill exhibited a perfect accuracy rate of 1.00, indicating that the model successfully identified all instances of this denomination without any misclassifications. The 50-peso bill achieved an accuracy rate of 0.99, indicating a high level of accuracy in recognizing this denomination. Similarly, the 100-peso bill achieved an accuracy rate of 0.99, with only a few instances potentially being misclassified. The model also demonstrated excellent accuracy rates for the 200-, 500-, and 1000-peso bills, achieving rates of 0.99, 1.00, and 1.00, respectively. These results indicate the model's ability to accurately identify these denominations with a minimal margin of error. Furthermore, the No banknote class achieved a perfect accuracy rate of 1.00, highlighting the model's capability to distinguish instances where no banknote was present. Overall, these findings underscore the effectiveness of the model in accurately recognizing and classifying Philippine banknotes, suggesting

4.4 Results of Final Testing and Evaluation

In the final testing and evaluation phase, the proponents conducted Demographic survey and Usability Testing (PSSUQ) to assess the effectiveness and usability of the A-EYE system. During the Demographic, the respondents were asked about their familiarity and comfort level with using mobile devices or gadgets as well as their willingness to adopt assistive technologies. This information was gathered through purposive sampling, where specific individuals were selected based on their relevant characteristics and experiences. By analyzing the survey responses, the proponents gained insights into the potential user acceptance and adoption of the A-EYE system.

In the Usability Testing evaluation, the proponents transcribed the collected results into a Google Form response format. This allowed them to systematically organize and quantify the feedback provided by the respondents. By calculating the average percentage of the feedback, the proponents obtained a quantitative measure of the system's usability. Usability testing is crucial in assessing the ease of use, efficiency, and overall user satisfaction with the A-EYE system's interface and features.

By conducting both demographic survey and usability testing, the proponents obtained valuable feedback from the target users. This information guided them in refining the A-EYE system to better meet the needs and preferences of the visually impaired individuals. The findings from these evaluations helped the proponents make informed decisions for further improvements, ensuring that the A-EYE system is user-friendly, accessible, and effective in assisting users with banknote identification on mobile devices.

4.4.1 Demographic Survey

The proponents conducted a Demographic Survey as part of the evaluation process for the A-EYE system. This involves gathering feedback and insights from a targeted group of respondents using a structured questionnaire. In this case, the respondents were visually impaired individuals working at Healing Touch located at SM General Santos City, HEAL-OT at Robinsons Mall located at General Santos City, and Gaisano Grand Polomolok in South Cotabato.

The demographic survey consisted of thirteen (13) questions designed to assess the usability, effectiveness, and overall satisfaction of the A-EYE system. The questions covered various aspects of the application, including its interface, functionality, accuracy in identifying banknotes, and accessibility features. The respondents, a total of 25 visually impaired individuals, provided their feedback and responses to the questionnaire.

4.4.1.1 Demographic Profiling Results

Question 1: What is your degree of visual difficulty?

Result:

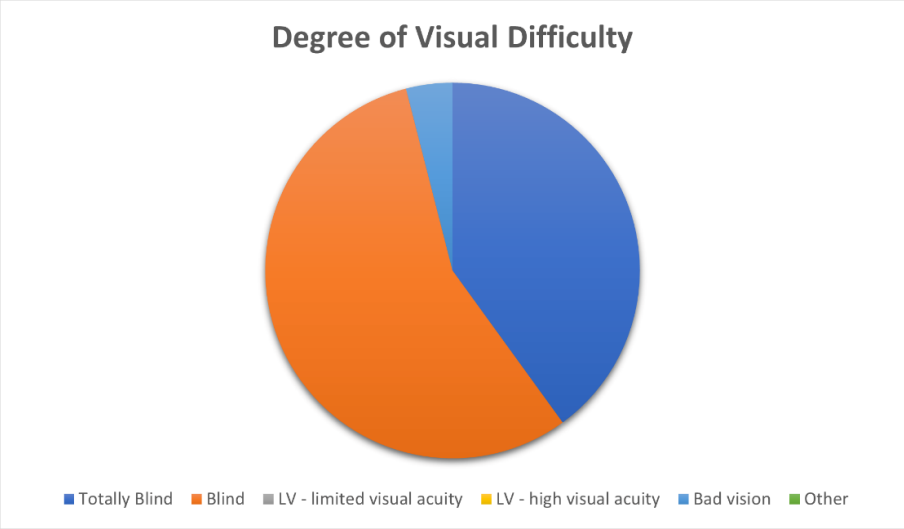


Figure 4.8 *Pie Chart Result of Question 1*

Figure 4.8 shows the result of question number one (1) in the demographic survey, in which the majority of the participants in the survey are blind people who can see lights and shapes.

Table 4.1 *Summary Table of Demographic Profiling from Q2 – Q13*

	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Respondent 1	Between 21-44 years old	Female	Use Public transport	White Cane	Yes - Google Phone	No	N/A	None	No
Respondent 2	Between 21-44 years old	Male	Use Public transport	White Cane	Yes - Google Phone	No	N/A	None	No
Respondent 3	Between 21-44 years old	Male	Use Public transport	White Cane	Other: Keypad	No	N/A	None	No
Respondent 4	Between 21-44 years old	Female	Use Public transport	White Cane	Other: Keypad	No	N/A	None	No
Respondent 5	Between 45-65 years old	Male	Use Public transport	White Cane	Yes - Google Phone	No	N/A	None	No
Respondent 6	Between 45-65 years old	Female	Use Public transport	White Cane	Yes - Google Phone	No	N/A	None	No
Respondent 7	Between 21-44 years old	Female	Use Public transport	White Cane	Yes - Google Phone	Yes	Used Lazarillo, app	Lazarillo	Yes
Respondent 8	Between 45-65 years old	Female	Hatid Sundo	White Cane	Yes - Google Phone	No	N/A	None	Yes
Respondent 9	Between 21-44 years old	Female	Use Public transport	Assisted by a person	Other: Keypad	No	N/A	None	No
Respondent 10	Between 21-44 years old	Female	Use Public transport	White Cane	Yes - Google Phone	Yes	Yes, Lazarillo	Lazarillo	Yes
Respondent 11	Over 65 years old	Male	Use Public transport	White Cane	Yes - Google Phone	No	N/A	None	No
Respondent 12	Between 21-44 years old	Prefer not to say	Use Public transport	White Cane	Yes - Google Phone	No	N/A	None	Yes

Respondent 13	Between 21-44 years old	Female	Use Public transport	White Cane	Yes - Google Phone	No	N/A	None	No
Respondent 14	Between 21-44 years old	Male	Use Public transport	White Cane	Yes - Google Phone	Yes	Lazarillo, accessible app	Lazarillo	No
Respondent 15	Between 21-44 years old	Female	Use Public transport	White Cane	Yes - Google Phone	No	N/A	None	No
Respondent 16	Between 21-44 years old	Female	Use Public transport	Accompanied by a sighted	Yes - Google Phone	No	N/A	None	No
Respondent 17	Between 21-44 years old	Male	Use Public transport	White Cane	Yes - Google Phone	Yes	Lazarillo	Lazarillo	No
Respondent 18	Between 45-65 years old	Male	Use Public transport	White Cane	Other: Keypad	No	N/A	None	No
Respondent 19	Between 21-44 years old	Male	Use Public transport	White Cane	Other: Keypad	Yes	Forgot the name of the	None	No
Respondent 20	Between 45-65 years old	Male	Use Public transport	White Cane	Other: Keypad	No	N/A	None	No
Respondent 21	Between 45-65 years old	Male	Use Public transport	White Cane	Other: Keypad	No	N/A	None	No
Respondent 22	Between 21-44 years old	Male	Use Public transport	White Cane	Yes - Google Phone	Yes	GPS	Lazarillo	Yes
Respondent 23	Between 21-44 years old	Male	Use Public transport	White Cane	Yes - Google Phone	Yes	Lazarillo	Lazarillo	Yes
Respondent 24	Between 21-44 years old	Female	Use Public transport	White Cane	Other: Keypad	No	N/A	None	No
Respondent 25	Between 21-44 years old	Female	Use Public transport	White Cane	Yes - Google Phone	No	N/A	None	No

Table 4.1 provides an overview of the responses obtained from twenty-five (25) participants who took part in the Survey Questionnaire Testing, specifically the Survey of Visual Impaired People and Mobility. The gathered data was systematically organized, categorized, and subjected to quantitative analysis to identify patterns and trends. The respondents in this study represented a diverse community, with ages ranging from 21 to 65 years old. Notably, the age range did not have a significant impact on the survey's main objective, nor did gender. The results revealed that all respondents used mobile devices, with 17 out of 25 utilizing smartphones or Android phones, while the remainder used keypad phones.

In terms of transportation, most of the respondents relied on public transport for their travel needs. Interestingly, some participants reported using a GPS product called Lazarillo. It is an application designed to assist visually impaired individuals with navigation by providing real-time audio cues and directions. This finding highlights the potential familiarity and adoption of digital solutions among visually impaired individuals for mobility-related tasks.

Interpreting the survey results in the context of the A-EYE project, which aims to develop a Mobile Philippine Banknote Identifier Using Google Teachable Machine, the survey questionnaire assessed the mobility of visually impaired individuals in utilizing mobile devices and their willingness to learn and engage with digital applications to enhance their daily lives. The findings indicate that a significant portion of the visually

impaired community already possesses mobile devices and demonstrates a willingness to embrace digital solutions.

In conclusion, the A-EYE system holds great potential to contribute to the visually impaired community by assisting them in their monetary transactions. The survey results suggest that a considerable number of respondents within the community use smartphones or Android phones for communication and travel purposes. This finding underscores the feasibility and relevance of implementing the A-EYE system on these devices, enabling visually impaired individuals to independently identify Philippine banknotes and facilitate smoother financial interactions. By leveraging the existing technology adoption and the community's positive response, the A-EYE system can make a meaningful impact in enhancing the financial independence and inclusion of visually impaired individuals.

4.4.2 Usability Testing

During the Usability testing phase, the twenty-five (25) respondents who previously participated in the Survey Questionnaire Testing were further engaged in the evaluation process using the Post-Study System Usability Questionnaire (PSSUQ). Before answering the PSSUQ survey questions, the respondents were given the opportunity to interact with the application being tested. To ensure a proper testing protocol, the proponents considered the participants' unique circumstances and state.

By allowing the respondents to try the application before answering the PSSUQ survey, the proponents aimed to provide them with first-hand experience and

familiarity with the presented application. This approach helped the respondents form a well-informed opinion about the usability and functionality of the application. The testing protocol employed during this phase ensured that the respondents could provide valuable feedback based on their interaction with the application, leading to a comprehensive evaluation of its usability.

4.4.2.1 Testing Protocol

The vital equipment known as A-eye, created for visually challenged users, can significantly enhance its users' independence and quality of life. Making sure the program is effective and usable for users who are blind is crucial for this reason. A detailed testing protocol must be created and followed to guarantee this.

User testing comes first in the testing methodology. To get feedback on the app's usability and spot any problems that might develop when using it, genuine visually impaired people will be used to test the app. A representative sample of users who are blind or visually handicapped should participate in controlled user testing. It is important to analyze the comments from user testing to find any areas that require improvement and to guide future development.

The Testing Protocol involved the participation of a specific number of respondents, specifically twenty-five (25) individuals. These respondents were carefully selected to ensure a diverse representation of users with varying backgrounds, preferences, and experiences.

In preparation for the testing protocol for A-EYE application, the proponents will follow the following procedures written below to maintain peaceful and balanced testing and survey activities towards the respondents.

1. **Preparation:** During this phase, there are two distinct components: technical preparation and ethical preparation. In the technical preparation, the proponents create an application called A-EYE, which is used for user testing. On the other hand, in the ethical preparation, the proponents compose a letter to communicate with the group of participants.
2. **Research Ethics Protocol:** The proponents prepare letters of permission, which are then distributed to three groups of participants located at various places: HEAL-OT at Robinson Mall in General Santos City, Gaisano Grand in Polomolok, South Cotabato, and Healing Touch at SM General Santos City. Once the letters are disseminated to the groups, the proponents can obtain the necessary permissions to proceed with the test.
3. **Orientation:** After obtaining the necessary consent from the group of participants, the proponents initiate an orientation session for the test participants. During the orientation, the proponents provide an overview of the study conducted by the proponents titled "A-EYE: A Mobile Philippine Banknote Identifier Using Google Teachable Machine" and introduce the application involved in the test, which the participants will interact with during the study. Following the

discussion, the proponents proceed to highlight the benefits for the participants, including the ability to recognize Philippine banknotes, calculate recognized banknotes, and mitigate the risk of fraudulent activities. Lastly, the proponents delve into the impact of the study on the participants themselves and future proponents, as well as the potential implications of the application.

4. **Demonstration:** To commence the demonstration of the application to the participants, the proponents meticulously prepared the application for actual testing. They also ensured the talkback function of the device was set up, allowing the participants to fully explore the application's features.
5. **Actual Testing of Participant:** In this phase, the proponents provide participants with the application in its current state, offering guidance and support throughout the entire testing process.
6. **PSSUQ Usability Test:** Following the completion of the participants' testing process, the proponents administered the PSSUQ usability test to gather their feedback in real-time.
7. **Participant Feedback:** The testing session concluded with a feedback phase, where participants were encouraged to share their thoughts on the application's functionality and suggest areas for improvement in future development.

To sum up, an important part of the development process for the A-eye program created for visually impaired users is the testing routine. User

testing, usability testing, accessibility testing, accuracy testing, performance testing, and user acceptability testing should all be included in the protocol. A representative sample of visually challenged users should be included in the protocol's implementation, which should take place in a controlled setting. To inform future development and identify any areas that require improvement, the testing protocol's outcomes should be analyzed. The proponents may make sure the money identification application is useful, accessible, and usable for users who are blind or visually impaired by putting in place a thorough testing protocol.

4.4.2.2 Results and Evaluation

Table 4.2 *Likert Scale Range*

Level	*Numerical Value*	*Range*	
Strongly Agree	5	4.3	5
Agree	4	3.5	4.2
Neutral	3	2.7	3.4
Disagree	2	1.9	2.6
Strongly Disagree	1	1	1.8

The Likert scale is a commonly used tool in surveys and research studies to measure people's attitudes, opinions, and perceptions. It consists of a series of statements or items to which respondents are asked to indicate their level of agreement or disagreement. The Likert scale range provides a structured framework for respondents to express their views on a continuum from strong agreement to strong disagreement.

At one end of the Likert scale range, we have "Strongly Agree." This category represents a high level of agreement with the statement or item being assessed. Respondents who fall into this category strongly believe in the statement and exhibit a robust conviction towards it. The range for this category extends from 1.3 to 5, indicating the wide spectrum of agreement that can be expressed.

Moving slightly towards the center of the scale, we encounter the "Agree" category, which signifies a moderate level of agreement. Individuals who choose this option generally support the statement but may not hold as strong of a conviction as those in the "Strongly Agree" category. The range for this category spans from 3.5 to 4.2, offering respondents the opportunity to express their agreement within this specific range.

The next category on the Likert scale range is "Neutral," representing a position of neither agreement nor disagreement. Respondents who select this option neither strongly support nor oppose the statement or item in question. The range for the "Neutral" category falls between 2.7 and 3.4, allowing individuals to express their lack of a definitive stance.

On the opposite end of the scale, we encounter the "Disagree" category. Individuals who choose this option express a moderate level of disagreement with the statement or item. While they may recognize some validity in the statement, they ultimately do not support it. The range for this category ranges from 1.9 to 2.6, accommodating different levels of disagreement within this range.

Finally, we have the "Strongly Disagree" category, representing the highest level of disagreement with the statement or item being assessed. Respondents who fall into this category hold a firm conviction against the statement and strongly reject it. The range for this category spans from 1 to 1.8, capturing the range of strong disagreement expressed by respondents.

The Likert scale range provides a flexible and comprehensive framework for capturing the diverse attitudes and opinions of individuals. It allows researchers and survey designers to analyze and interpret the responses, providing valuable insights into the target population's viewpoints and perspectives. By encompassing a range of options, the Likert scale facilitates nuanced and detailed data collection, enabling a more comprehensive understanding of the subject matter under investigation.

Table 4.3 *Question One (1) Result*

Question 1	Numerical Value	Responses	Total
Strongly Agree	5	18	90
Agree	4	6	24
Neutral	3	1	3
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level			4.68

Figure 4.3, In this figure shows the respondents' responses to the question "Overall, I am satisfied with how easy it is to use this system," it can be concluded that the majority of the respondents (18 out of the total) strongly agree with the statement. Additionally, 6 respondents agree with the statement, while only 1 respondent remains neutral. No respondents

disagreed or strongly disagreed with the statement and the sentimental level result of 4.68 suggests that, on average, the respondents have a positive sentiment towards the system's ease of use.

Based on the survey findings, it can be concluded that a significant majority of the respondents expressed a high level of satisfaction with the system's ease of use. The majority agreement in the "strongly agree" category demonstrates that the system is perceived as user-friendly and intuitive. The positive response from the participants suggests that the design and functionality of the system align with their expectations and effectively meet their needs. The relatively small percentage of respondents who remained neutral may indicate a room for improvement in certain areas to further enhance user satisfaction.

Table 4.4 *Question Two (2) Result*

Question 2	Numerical Value	Responses	Total
Strongly Agree	5	14	70
Agree	4	11	44
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level			4.56

Figure 4.4 shows that the majority of respondents expressed a positive sentiment regarding the system's usability. The highest number of responses fell under the category of "Strongly Agree," with 14 participants selecting this option. Additionally, 11 participants chose the "Agree" option. No

participants selected "Neutral," "Disagree," or "Strongly Disagree" options, indicating a lack of negative sentiment towards the system's usability.

The overall sentiment level, calculated as 4.56, suggests that the respondents had a relatively high level of agreement and satisfaction with the system's simplicity. This positive sentiment can be seen from the predominantly positive responses, which align with the sentiment level result.

In conclusion, based on the provided data, it can be inferred that the system was perceived as simple to use by the majority of respondents, and they expressed a generally positive sentiment towards its usability.

Table 4.5 *Question Three (3) Result*

Question 3	Numerical Value	Responses	Total
Strongly Agree	5	15	75
Agree	4	10	40
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.6

Figure 4.5 shows that, based on the responses received from the 25 respondents regarding their ability to complete tasks and scenarios quickly using the system, it can be concluded that a majority of the respondents (60%) strongly agree, while the remaining 40% agree. No respondents expressed neutral, disagree, or strongly disagree sentiments in this regard.

Additionally, the overall sentiment level of the responses, measured on a scale from 1 to 5, is 4.6, indicating a generally positive sentiment towards the system's ability to facilitate quick task completion.

In conclusion, based on the provided data, it can be inferred that the majority of the respondents found the system to be effective in enabling them to complete tasks and scenarios quickly, resulting in a positive sentiment overall.

Table 4.6 *Question four (4) Result*

Question 4	Numerical Value	Responses	Total
Strongly Agree	5	15	75
Agree	4	9	36
Neutral	3	1	3
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.56

Figure 4.6 concluded that the majority of respondents (60%) strongly agreed and the remaining respondents (36%) agreed with feeling comfortable using the system. This indicates a high level of comfort overall. Furthermore, there was only one respondent (4%) who felt neutral, and no participants expressed disagreement or strong disagreement with using the system.

Additionally, the sentiment level result of 4.6 further supports the conclusion that the overall sentiment towards the system's usability was positive. The sentiment level of 4.6 suggests a relatively high positive

sentiment score, indicating that the majority of respondents had a favorable perception of the system's usability.

In conclusion, based on the responses and sentiment level result, it can be inferred that the system was well-received and considered comfortable to use by the majority of the participants.

Question 5	Numerical Value	Responses	Total
Strongly Agree	5	14	70
Agree	4	9	36
Neutral	3	1	3
Disagree	2	1	2
Strongly Disagree	1	0	0
Sentimental Level		25	4.44

Table 4.7 *Question Five (5) Result*

Table 4.7 concluded that the majority of respondents found it easy to learn. This conclusion is based on the fact that 14 respondents strongly agreed and 9 respondents agreed with the statement, indicating a total of 23 out of 25 respondents expressing positive sentiments towards the system's learnability. Additionally, only 1 respondent disagreed and none strongly disagreed, suggesting that the system was generally perceived positively in terms of ease of learning.

Furthermore, considering the sentiment level result of 4.4, it indicates a relatively high average sentiment score, reinforcing the conclusion that the majority of participants had a positive sentiment towards the ease of learning the system.

In summary, based on the responses and sentiment level result, it can be concluded that the system was perceived as easy to learn by the majority of the 25 respondents.

Table 4.8 *Question Six (6) Result*

Question 6	Numerical Value	Responses	Total
Strongly Agree	5	15	75
Agree	4	9	36
Neutral	3	1	3
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.56

Based in Table 4.8, the 25 respondents regarding their belief in becoming productive quickly using the system, it can be concluded that there is a generally positive sentiment towards the system's potential for facilitating quick productivity. The majority of respondents (15 out of 25) strongly agreed with this statement, while 9 respondents agreed with it. Only 1 respondent expressed a neutral sentiment, and there were no strong disagreements or strong disagreements reported.

Additionally, the overall sentiment level calculated from the responses is 4.56, which further indicates a positive sentiment towards the system's ability to enhance productivity quickly.

Table 4.9 *Question Seven (7) Result*

Question 7	Numerical Value	Responses	Total
Strongly Agree	5	18	90
Agree	4	6	24
Neutral	3	1	3
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.68

Table 4.9 concluded that a majority of the respondents strongly agree (1) with the statement that the system provided clear error messages for problem resolution. This is evident from the fact that 18 out of 25 respondents strongly agreed. Additionally, 6 respondents agreed (2), 1 respondent was neutral (3), and no respondents disagreed (4) or strongly disagreed (5) with the statement.

Furthermore, the sentiment level result of 4.68 indicates a relatively high positive sentiment towards the system's error messages, suggesting that the majority of respondents had a favorable perception of the clarity and helpfulness of the error messages provided.

Overall, the data suggests that the system's error messages were perceived positively by the respondents, with a strong majority agreeing that the messages clearly communicated how to address problems.

Table 4.10 *Question Eight (8) Result*

Question 8	Numerical Value	Responses	Total
Strongly Agree	5	12	60
Agree	4	12	48
Neutral	3	1	3
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.44

Based in Table 4.10. majority of the respondents (12 out of 25) strongly agree that they can recover easily and quickly from mistakes made using the system. Additionally, an equal number of respondents (12 out of 25) agree with this statement. Only one respondent expressed a neutral stance, while no respondents disagreed or strongly disagreed with the statement.

Furthermore, the overall sentiment level, calculated as 4.44, suggests a relatively positive sentiment regarding the ease and speed of recovery from mistakes made using the system.

In conclusion, the majority of the respondents expressed agreement or strong agreement that they could recover easily and quickly from mistakes made using the system, indicating a positive sentiment toward the system's error recovery capabilities.

Table 4.11 *Question Nine (9) Result*

Question 9	Numerical Value	Responses	Total
Strongly Agree	5	20	100
Agree	4	5	20
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.8

Table 4.11, it is evident that a significant majority strongly agree (20 responses) and the remaining respondents agree (5 responses) that the information, including online help, on-screen messages, and other documentation, was clear. This indicates a high level of satisfaction with the clarity of the information provided.

Furthermore, the sentiment level result of 4.8 suggests a predominantly positive sentiment regarding the information provided with the system. The high sentiment score further reinforces the conclusion that the respondents found the information to be clear and easily understandable.

Overall, based on the responses and sentiment level, it can be concluded that the majority of respondents were highly satisfied with the clarity of the information provided, indicating that the system effectively delivered clear and comprehensible information through various means such as online help, on-screen messages, and documentation.

Table 4.12 *Question Ten (10) Result*

Question 10	Numerical Value	Responses	Total
Strongly Agree	5	19	95
Agree	4	6	24
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.76

Based in Table 4.12, it is evident that the majority strongly agree (19 responses) and the remaining respondents agree (6 responses). This indicates a high level of satisfaction with the ease of information retrieval. Furthermore, the absence of any neutral, disagree, or strongly disagree responses suggests a consensus among the participants regarding the ease of finding information.

Additionally, the sentiment level result of 4.76 further supports the conclusion of a positive sentiment towards the ease of finding information. This score, on a scale of 1 to 5, indicates a significantly positive sentiment overall.

In summary, the findings from the responses and sentiment analysis demonstrate a strong consensus among the participants, with the vast majority agreeing that it was easy to find the information they needed.

Table 4.13 *Question Eleven (11) Result*

Question 11	Numerical Value	Responses	Total
Strongly Agree	5	18	90
Agree	4	7	28
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.72

Table 4.13, Based on the responses of the 25 respondents to the question "The information was effective in helping me complete the tasks and scenarios," it can be concluded that the majority of respondents strongly agree (18) with this statement, while a smaller number agree (7). No respondents expressed a neutral, disagree, or strongly disagree opinion.

The sentiment level result of 4.72 indicates that, on average, the respondents had a positive sentiment towards the effectiveness of the information in assisting them with their tasks and scenarios.

Table 4.14 *Question Twelve (12) Result*

Question 12	Numerical Value	Responses	Total
Strongly Agree	5	17	85
Agree	4	8	32
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.68

Based in Table 4.14, The majority of respondents, 17 out of 25, strongly agreed that the organization of information on the screens was clear, while

the remaining 8 respondents simply agreed. This indicates a positive sentiment towards the clarity of information layout.

Additionally, the sentiment level result of 4.68 further supports the conclusion of a positive perception regarding the organization of information on the system screens. This sentiment level suggests that the overall sentiment expressed by the respondents was predominantly positive.

In summary, the collected data indicates a strong consensus among the respondents that the organization of information on the system screens was clear, which is further supported by the high sentiment level result.

Table 4.15 *Question Thirteen (13) Result*

Question 13	Numerical Value	Responses	Total
Strongly Agree	5	20	100
Agree	4	5	20
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.8

Table 4.15 concluded that the majority of the respondents had a positive perception of the system's interface. Among the respondents, 20 strongly agreed and 5 agreed that the interface was pleasant, indicating a high level of satisfaction. Additionally, there were no neutral, disagree, or strongly disagree responses.

Furthermore, the sentiment level result of 4.8 further supports the conclusion that the overall sentiment towards the system's interface was highly positive. The sentiment level, which ranges from 1 (negative) to 5

(positive), indicates that the average sentiment expressed by the respondents was close to the highest possible rating.

Therefore, based on the data provided, it can be inferred that the majority of the respondents found the interface of the system to be pleasant, and the overall sentiment towards it was overwhelmingly positive.

Table 4.16 *Question Fourteen (14) Result*

Question 14	Numerical Value	Responses	Total
Strongly Agree	5	17	85
Agree	4	8	32
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.68

Based in Table 4.16, majority of users had a positive experience using the interface of the system. Out of the respondents, 17 strongly agreed and 8 agreed with the statement, indicating a high level of satisfaction. No participants expressed neutral, disagree, or strongly disagree sentiments regarding the interface. The overall sentiment level, calculated as 4.86, further supports the conclusion that the interface was well-liked by the users.

Table 4.17 *Question Fifteen (15) Result*

Question 15	Numerical Value	Responses	Total
Strongly Agree	5	18	90
Agree	4	7	28
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.72

Table 4.17, concluded that the majority of the respondents (72%) strongly agree that the system meets their expectations. Additionally, 28% of the respondents agree with this statement. The absence of any neutral, disagree, or strongly disagree responses suggests a high level of satisfaction among the respondents regarding the system's functions and capabilities. The overall sentiment level of 4.72 further supports the conclusion that the respondents generally hold a positive sentiment towards the system.

Table 4.18 *Question Sixteen (16) Result*

Question 16	Numerical Value	Responses	Total
Strongly Agree	5	20	100
Agree	4	5	20
Neutral	3	0	0
Disagree	2	0	0
Strongly Disagree	1	0	0
Sentimental Level		25	4.8

Based in Table 4.18, majority of the respondents strongly agree (1) with the statement. This is evident from the fact that 20 out of 25 respondents chose the option "Strongly Agree," while the remaining 5 respondents chose

"Agree." There were no responses indicating neutral, disagree, or strongly disagree sentiments.

Furthermore, the overall sentiment level calculated from the responses is 4.8, which is relatively high. This indicates a strong positive sentiment towards the system among the respondents.

Therefore, based on the provided data, it can be concluded that the majority of the respondents are highly satisfied with the system, reflecting a positive sentiment towards it.

4.4.3 Overall Interpretation of All the Results

Overall, the results from the survey indicate a high level of satisfaction and positive feedback from the respondents regarding the system's usability. The majority of respondents expressed agreement or strong agreement in various categories, including satisfaction with ease of use, simplicity, task completion efficiency, comfort level, ease of learning, quick productivity, effectiveness of error messages, ease of recovering from mistakes, clarity of provided information, ease of finding information, effectiveness of information in task completion, clarity of information organization on screens, pleasantness of the interface, preference for using the interface, and fulfilment of expected functions and capabilities.

These findings suggest that the system has successfully met user expectations and provided a user-friendly experience. The positive responses indicate that the design, functionality, and organization of the system align well with user needs and

preferences, contributing to enhanced user satisfaction, engagement, and productivity.

While there are small percentages of respondents who expressed neutral or disagree responses in some categories, it is important to consider the context of their limited exposure to technology or unfamiliarity with digital applications. Overall, most respondents provided positive feedback, indicating the system's effectiveness in accommodating users with varying levels of technological familiarity and delivering a satisfactory user experience.

In conclusion, the survey findings indicate that the system's usability has been well-received, with positive feedback across multiple aspects. The system's ease of use, simplicity, task completion efficiency, comfort level, ease of learning, quick productivity, effectiveness of error messages, ease of recovering from mistakes, clarity of provided information, ease of finding information, effectiveness of information in task completion, clarity of information organization on screens, pleasantness of the interface, preference for using the interface, and fulfilment of expected functions and capabilities have contributed to a positive user experience. These results affirm the system's usability and highlight its potential to enhance user satisfaction, productivity, and engagement.

CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATION

5.0 Summary

The proponents developed the A-Eye, a mobile Philippine banknote identifier, to assist visually impaired individuals in determining the denomination of a banknote. Visual impairment significantly affects the quality of life for visually challenged people, especially in monetary transactions. The Philippines has a large population of visually impaired individuals, with an estimated 12 million people living with vision impairments out of 110 million Filipinos in 2020. Current assistive aids such as canes, guide dogs, and human assistance are unable to assist visually impaired individuals in identifying banknote denominations. Therefore, developing a system like A-Eye is crucial to address this problem.

A-Eye is an Android app that utilizes machine learning to recognize and determine the value of banknotes. It uses the phone's camera to recognize Philippine banknotes and provides audio feedback to the user, allowing them to identify and count banknotes effortlessly. The app is designed to be simple to use, particularly for blind or visually impaired individuals who do not need to look at the device while using it. The app requires an Android version of 7.2 or higher to function.

The significance of this research lies in its potential to alleviate the difficulties visually impaired individuals face when detecting and distinguishing the denomination of a banknote. It can reduce barriers that hinder visually impaired people from completing daily activities and protect them from being deceived during financial transactions. Additionally,

the research provides insights that can aid future development of assistive technologies for visually impaired individuals, such as object recognition, obstacle detection, voice recognition, and false money detection.

The methodology used in this research is Feature-Driven Development (FDD), an iterative and incremental software development methodology. FDD breaks down the development process into manageable units of work, emphasizes tangible results, collaborative teamwork, and efficient communication. It starts with creating an overall model of the software system, followed by developing a prioritized feature list. Each feature is implemented in short iterations called "feature sets," and the design and building phases are conducted incrementally and collaboratively. Throughout the process, effective communication and collaboration among team members are essential.

To ensure the stability of the A-Eye software, quick and dirty testing was conducted, involving real individuals participating in controlled testing sessions. The testing aimed to identify any potential issues or flaws in the software promptly. The results of initial testing in dimly lit places and typical environments showed that the A-Eye app achieved high accuracy rates ranging from 94% to 97.20% for various denominations of Philippine banknotes. These results demonstrate the app's reliability and effectiveness in assisting visually impaired individuals during monetary transactions.

Survey Questionnaire Testing was conducted with visually impaired individuals to gather feedback on the usability, effectiveness, and overall satisfaction of the A-Eye system. The respondents' feedback provided valuable insights for refining and optimizing the system. The survey results showed that a significant portion of visually impaired individuals already use mobile devices and are willing to adopt digital solutions to enhance their daily

lives. This indicates the feasibility and relevance of implementing the A-Eye system on smartphones or Android phones to improve financial independence and inclusion for visually impaired individuals.

Overall, the usability testing of the A-Eye system showed a high level of satisfaction and positive feedback from the respondents. They expressed agreement on various aspects, including ease of use, simplicity, task completion efficiency, comfort level, and effectiveness of error messages. The system received positive feedback for its interface, productivity, information clarity, and overall preference for usage.

In conclusion, the A-Eye system, a mobile Philippine banknote identifier, shows promise in assisting visually impaired individuals in recognizing and managing Philippine banknotes during monetary transactions. The system's accuracy, usability, and positive feedback from users highlight its potential to enhance financial independence and inclusion for visually impaired individuals in the Philippines.

5.1 Conclusion

The development of the A-Eye, a mobile Philippine banknote identifier, represents a significant advancement in assisting visually impaired individuals in determining the denomination of a Philippine banknote. Visual impairment greatly impacts the daily lives of visually challenged people, especially in monetary transactions, and the Philippines, with its large population of visually impaired individuals, stands to benefit greatly from such a solution. Current assistive aids fall short in addressing the specific challenge of identifying banknote denominations, making the development of a system like A-Eye crucial.

The A-Eye is an Android app that utilizes machine learning technology to recognize and determine the value of banknotes. By using the phone's camera and providing audio feedback, the app enables blind or visually impaired individuals to effortlessly identify and count banknotes. The simplicity of its design, along with the fact that users do not need to look at the device while using it, ensures that the app is accessible to individuals with varying levels of visual impairment. The proponents of the application can update the data sets of the application in Google's teachable machine if there is a new release of Philippine banknotes from the Banko Central ng Pilipinas. The requirement of Android version 7.2 or higher ensures compatibility with a wide range of devices.

To gather valuable feedback on usability, effectiveness, and overall satisfaction, survey questionnaire testing was conducted with visually impaired individuals. The respondents' feedback provided insights that helped refine and optimize the A-Eye system. The survey results revealed that a significant portion of visually impaired individuals already use mobile devices and are willing to adopt digital solutions to enhance their daily lives. This indicates the feasibility and relevance of implementing the A-Eye system on smartphones or Android phones, offering the potential to improve financial independence and inclusion for visually impaired individuals.

In general, the results of the usability testing for the A-Eye system indicated a strong satisfaction and positive response from the participants. The app received praise for being easy to use, simple, efficient in completing tasks, comfortable to use, and effective in displaying error messages. Users expressed a preference for its interface, productivity, clarity of information, and overall usability. These findings emphasize the potential of the

A-Eye system to improve the financial independence and inclusion of visually impaired individuals in the Philippines.

The A-Eye system, a mobile banknote identifier in the Philippines, shows great potential in helping visually impaired individuals identify and handle Philippine banknotes during monetary transactions. The system's high accuracy, usability, and positive user feedback indicate that it can greatly improve financial independence and inclusion for visually impaired individuals. By addressing the challenges they face in recognizing banknote denominations, the A-Eye system represents a significant advancement in enhancing their quality of life and promoting inclusivity.

In conclusion, the following objectives are achieved:

- Create a visually impaired user-friendly application that recognizes Philippine banknotes.
- To calculate the total amount of money with precision.
- To provide voice feedback that announces the total amount of banknotes being recognized.

5.2 Recommendation

The A-EYE system, while receiving commendation from users during testing, also garnered valuable feedback and suggestions for improvement. The proponents recognize the importance of incorporating these suggestions into future iterations of the system, with the aim of creating an even more powerful and effective assistive technology. By implementing these recommendations, the system can further advance its goal of enhancing the quality of life within Mindanao State University – General Santos City.

In addition to the system's success in achieving its objectives, the following key recommendations have emerged:

- **Enhance Accuracy and Recognition:** The proponents should focus on refining the accuracy and recognition capabilities of the A-EYE system. This includes improving the detection and identification of banknote denominations through training additional datasets in machine learning, minimizing false positives or negatives, and ensuring reliable performance across different lighting conditions and angles.
- **Expand Accessibility Features:** To cater to a wider range of users, the system should incorporate additional accessibility features. These may include support for multiple languages, adjustable audio feedback settings, compatibility with different smartphone models, Fake money detection, haptic feedback, Transaction History, Coin Identifier, counterfeit detection, and integration with other assistive technologies commonly used by visually impaired individuals.
- **Conduct Comprehensive User Training and Support:** To maximize the system's effectiveness, it is crucial to provide comprehensive training and ongoing support to users. This includes developing detailed user manuals, video tutorials, and conducting workshops or webinars to ensure users are equipped with the necessary knowledge and skills to utilize the system effectively.

By taking these recommendations into account, the proponents can further enhance the A-EYE system, making it more robust, adaptable, and user-centric. With continuous improvement and a strong focus on user feedback, the system will continue to fulfill its objective of improving the quality of life within Mindanao State University – General

Santos City, while also serving as a model for future assistive technologies in the broader context of visual impairment.

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APPENDIX A

RECOMMENDATION FOR ORAL DEFENSE

Mindanao State University – Gen. Santos
COLLEGE OF NATURAL SCIENCES AND MATHEMATICS
IT & PHYSICS DEPARTMENT
Fatima, General Santos City
Philippines

RECOMMENDATION FOR ORAL DEFENSE

In partial fulfillment of the requirements for the degree of **BACHELOR OF SCIENCE IN INFORMATION TECHNOLGY**, *this UNDERGRADUATE Capstone Project entitled:*

A-EYE: A MOBILE PHILIPPINE BANKNOTE IDENTIFIER USING GOOGLE TEACHABLE MACHINE

Has been prepared and submitted by **MARK LLOYD L. TACDOL, SHIE BELLE C. DASALLA, and ROLAND JR. T. TATING**, *and is recommended for ORAL DEFENSE*

DR. LUMER JUDE P. DOCE
Adviser

APPENDIX B

QUESTIONNAIRES

Survey of Visually Impaired People and Mobility

Name: _____ **Date: _____**

The goal of this poll is to gain a feel of how the visually impaired population uses digital technology to get around - i.e., mobility. The opening questions establish a foundation for understanding the user's current status. Then we ask pertinent questions about digital technology and how it is being used by the visually impaired community.

Directions: Choose or write your answer for the following questions below.

1. **What is your degree of visual difficulty? Choose one:**
    a. Totally blind
    b. Blind – can see light and shapes
    c. Low visioned – limited visual acuity
    d. Low visioned – high visual acuity
    e. Bad vision – not legally blind
    f. Other:
2. **What age group best describes you? Choose one:**
    a. Less than 21 years old
    b. Between 21 and 44 years old
    c. Between 45 and 65 years old
    d. Over 65 years old

e. Prefer not to answer

3. **Gender – Are you … (Choose one)**

    a. Male

    b. Female

    c. Other / Prefer not to answer

4. **Distance mobility – how do you travel? Choose all that apply:**

    a. Use door-to-door pick-up service (e.g., Access-a-Ride)

    b. Use public transport

    c. Don't travel

    d. Other:

5. **Use of devices while walking. Choose all that apply:**

    a. White cane

    b. Guide dog

    c. Telescopic device

    d. Other:

6. **Do you have a smartphone? Choose one:**

    a. Yes – An Apple iPhone

    b. Yes – A Google phone

    c. Yes – A Microsoft (Cortana) phone

    d. No

    e. Other:

7. **Do you use your phone to help with getting from one place to another?**

    a. Yes

b. No

8. **If you answer 'Yes' to using a smartphone to aid with walking, tell us what you use and how it helps you get about.**

   _____

9. **Do you use any of the following GPS products to aid with getting about? Choose all that apply:**

   a. Loadstone GPS

   b. LoroDux

   c. Mobile GEO/GEO Mobile

   d. BlindSquare

   e. Trekker/Trekker Breeze

   f. BrailleNote GPS

   g. Other:

   h. None

10. **Does/would social media (BlindSquare, Viz-Wiz, or other crowd-sourcing) help you with getting about? (Choose one)**

    a. Yes

    b. No

11. **Have you been part of a clinical trial for devices or implants to aid with you being able to get about? (If yes, please specify; if not, answer N/A)**

    _____

    _____

12. **Would you be willing to use a crowd navigation system (such as Be My Eyes) which requires you to stream your smartphone video to a person online who guides you for your visual tasks?**
    a. Yes
    b. No
    c. Maybe, but I have safety concerns
    d. Maybe, but I have privacy concerns
13. **Do you use any electronic travel aids that give feedback either through vibration or by talking?**
    a. Yes, and I like using them
    b. Yes, but I do not like/have issues using them
    c. No

Post-Study System Usability Questionnaire

Name: _____ Date: _____

The PSSUQ (Post-Research System Usability Questionnaire) is a 16-item standardized questionnaire that is often used at the end of a study to gauge users' perceived satisfaction with a website, software, system, or product.

Directions: On a scale between Agree, Strongly Agree, Maybe, Disagree, and Strongly Disagree, please rate the following statements:

PSSUQ	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1. Overall, I am satisfied with how easy it is to use this system.					
2. It was simple to use this system.					
3. I was able to complete the tasks and scenarios quickly using this system.					
4. I felt comfortable using this system.					
5. It was easy to learn to use this system.					
6. I believe I could become productive quickly using this system.					
7. The system gave error messages that clearly told me how to fix problems.					

8. Whenever I made a mistake using the system, I could recover easily and quickly.					
9. The information (such as online help, on-screen messages, and other documentation) provided with this system was clear.					
10. It was easy to find the information I needed.					
11. The information was effective in helping me complete the tasks and scenarios.					
12. The organization of information on the system screens was clear.					
13. The interface of this system was pleasant.					
14. I liked using the interface of this system.					
15. This system has all the functions and capabilities I expect it to have.					
16. Overall, I am satisfied with this system.					

Questions 1 to 16: Overall

Questions 1 to 6: System Usefulness (SYSUSE)

Questions 7 to 12: Information Quality (INFOQUAL)

Questions 13 to 16: Interface Quality (INTERQUAL)

APPENDIX C

QUESTIONNAIRES RESULTS

Survey Interview Report

Objective:

The objective of this survey interview includes the following:

- To know the mobility of visually impaired individuals in using mobile devices.
- To know their knowledge about using mobile assistive devices.

Respondent: Narjun Gines

Date of survey: June 7, 2023

Mr. Narjun Gines is an individual who is visually impaired, specifically blind, with the ability to perceive light and shapes. He relies on public transportation for his distance mobility and uses a white cane while walking. Mr. Gines has access to a smartphone and is familiar with using a GPS product called Lazarillo. Furthermore, he expresses a willingness to utilize a crowd navigation system on his mobile phone. Additionally, Mr. Gines actively uses electronic travel aids and finds them beneficial in his daily life.

Usability Testing Narrative

Usability Tester: Josephine Rendon

Date of Testing: June 7, 2023

Location: Healing Touch, SM General Santos City

Josephine Rendon, a visually impaired massage therapist, participated in the PSSUQ survey and expressed strong satisfaction with the usability and effectiveness of the system. In her responses, she indicated that the system was easy to use, allowing her to complete tasks and scenarios quickly. Furthermore, she felt comfortable and confident while using the system, believing that it could make her productive in a short period. The system's ability to provide clear error messages and facilitate easy recovery from mistakes greatly contributed to Josephine's positive experience.

Josephine also praised the clarity and effectiveness of the information provided by the system. She found it easy to locate the information she needed, and it played a significant role in helping her successfully complete tasks and scenarios. Although she agreed that the organization of information on the system screens was clear, it was noteworthy that she expressed a slightly lower level of agreement compared to other aspects. However, overall, Josephine strongly agreed that she liked the system's interface and that it encompassed all the expected functions and capabilities.

Josephine's high level of satisfaction with the system, as reflected in her survey responses, highlights its effectiveness in supporting visually impaired individuals in various professional settings. The system's ease of use, quick task completion, and provision of clear guidance contribute to improving the quality of work and increasing productivity for

visually impaired individuals like Josephine. These findings emphasize the importance of developing and implementing assistive technologies that cater to the specific needs and preferences of visually impaired individuals, enabling them to thrive in their chosen professions and enhance their overall well-being.

Usability Tester: Donato Tano

Date of Testing: May 27, 2023

Location: HEAL-OT Robinsons Mall General Santos City

Donato Tano, a visually impaired massage therapist, participated in the PSSUQ survey and provided overwhelmingly positive feedback on the system's usability and effectiveness. Donato's responses indicate a high level of satisfaction, highlighting the ease and simplicity of using the system. He expressed strong agreement that the system enabled him to complete tasks and scenarios quickly, contributing to his productivity. Donato also felt comfortable while using the system, demonstrating the system's ability to provide a seamless user experience.

According to Donato, the system excelled in providing clear error messages that guided him in resolving problems efficiently. In cases where mistakes were made, he found it relatively easy and quick to recover. The availability of comprehensive and easily accessible information, including online help, on-screen messages, and documentation, further contributed to Donato's positive experience with the system. He praised the system's clear organization of information on the screen, emphasizing its user-friendly design.

Donato's satisfaction with the system's interface indicates that it not only met but exceeded his expectations. The overall positive sentiment conveyed in his survey responses underlines the effectiveness of the system in supporting visually impaired individuals like him in their professional pursuits. The system's ease of use, swift task completion, clear error handling, and intuitive interface provide valuable assistance to Donato, enabling him to excel in his role as a massage therapist. These findings emphasize the importance of developing inclusive technologies that empower visually impaired individuals to thrive in their chosen fields and enhance their overall work experience.

Usability Testing

PSSUQ Overall Results		
Question 1 - 6	System Usefulness	4.566666667
Question 7 - 12	Information Quality	4.68
Question 13 - 16	Interface Quality	4.75
Question 1 - 16	Overall	4.655

Based on the results obtained from the Post-Study System Usability Questionnaire (PSSUQ), it is evident that the system under evaluation has been perceived favorably by the users. The participants rated the system's usefulness with an average score of 4.57 out of 6, indicating that they found the system to be beneficial and valuable in accomplishing their tasks or objectives.

In terms of information quality, the users rated the system highly, with an average score of 4.8 out of 6 for questions 7 to 12. This suggests that the information provided by the system was considered accurate, relevant, and reliable by the users, enhancing their confidence in the system's outputs.

The participants also evaluated the system's interface quality, and the results indicate a positive perception of the interface. With an average score of 4.75 out of 6 for questions 13 to 16, it can be inferred that the users found the system's interface visually appealing, user-friendly, and easy to navigate, contributing to a positive user experience.

Overall, when considering all the questions from 1 to 16, the participants provided an average score of 4.65 out of 6. This indicates a high level of satisfaction and acceptance of the system as a whole. The users found the system to be useful, provided high-quality information, and had an interface that met their expectations.

In conclusion, the PSSUQ results suggest that the system has achieved a positive user perception. The system's usefulness, information quality, interface quality, and overall satisfaction have been rated highly by the participants. These findings highlight the system's effectiveness in meeting user needs, delivering accurate information, and providing a positive user experience.

APPENDIX D

TASK TABLES

In this appendix, the task tables are presented, providing an overview of the individuals responsible for carrying out specific tasks on designated dates.

Table 3.2 *Project Initiation Phase List of Tasks*

Task	Carried out by	Carried out to	Deliverables	Start Date	End Date
Background of the Study				**10/04/2021**	**01/21//2022**
Research About Interesting Topics	Shie Belle, Mark, Roland		Possible Project Topics and Titles	10/04/2021	01/21/2022
Research Related Literatures	Shie Belle		Related Studies Readings	10/04/2021	01/21/2022
Research Related Technologies	Roland		Related Technologies Readings	10/04/2021	01/21/2022
Feasibility Study				**10/04/2021**	**01/21/2022**
Operational Feasibility	Shie Belle, Mark, Roland	Research Topic	Documentation	10/04/2021	01/21/2022
Technical Feasibility	Shie Belle, Mark, Roland	Research Topic	Documentation	10/04/2021	01/21/2022
Economic Feasibility	Shie Belle, Mark, Roland	Research Topic	Documentation	10/04/2021	01/21/2022
Proposal Documents				**10/04/2021**	**01/21/2022**
Analyze Gathered Date	Mark		Data Summaries	10/04/2021	01/21/2022
Create Proposal Documentation and Presentation	Shie Belle, Mark, Roland		Proposal Document and Presentation	10/04/2021	01/21/2022
Pitching				**01/25/2022**	**01/25/2022**
Project Proposal Presentation	Shie Belle, Mark, Roland	Panelist	Proposal Document and Presentation	**01/25/2022**	**01/25/2022**

Table 3.3 *Requirements Gathering Analysis Phase List of Tasks*

Task	Carried out by	Carried out to	Deliverables	Start Date	End Date
Further Reading				Nov. 19, 2021	Jan. 18, 2022
A. Currency Recognition for Visually Impaired People by Srushti Samant et.al B. Currency Recognition on Mobile Phones by Suriya Singh et.al C. Detection of Fake Currency Using Image Processing by Ankush Singh et.al D. EyeBill-Ph: A Machine Vision of Assistive Philippine Bill Recognition Device for Visually Impaired by Alvin Sarraga Alon et.al E. A survey on Assistive Technology for Visually Impaired by Kanak Manjari et.al F. How blind people identify paper money by Tom	Shie Belle, Roland and Mark		Chapter 2 Document	Nov. 19, 2021	Jan. 18, 2022

G. Challenges blind people face when living life by Envision H. Fake Currency Detection using Image Processing by Ms. Monali Patil I. SMARTFLORA Mobile Flower Recognition Application Using Machine Learning Tools by Fatimah Khalid et.al					
Research for Methodology				Dec. 9, 2021	Jan. 19, 2022
Review the development of the existing systems	Shie Belle and Mark		Chapter 3 Document	Dec. 9, 2021	Jan. 19 2022
Studying different kinds of the system development	Shie Belle and Mark		Chapter 3 Documents	Dec. 9, 2021	Jan. 19 2022
Identifying Features of the System				Dec. 7, 2021	Jan. 18, 2022
Identifying the features of the system	Shie Belle, Mark, and Roland		Systems Feature	Dec. 7, 2021	Jan 18, 2022
Compose Use Case Diagram	Shie Belle, Mark, and Roland		Chapter 4 Document	Dec.7, 2021	Jan. 18, 2022

Create a Review of Related Studies and Technologies				Dec. 15, 2021	Jan. 19, 2022
Summarize and Synthesize Researches	Shie Belle, Mark, and Roland		Chapter 2 Document	Dec. 15, 2021	Jan. 19, 2022
Identifying Software Requirements				Nov. 20, 2021	Dec. 22, 2021
Watch YouTube Tutorials	Shie Bell, Mark, and Roland			Nov. 20, 2021	Dec. 22, 2021
Watch Documentaries	Shie Belle, Mark, and Roland			Nov. 20, 2021	Dec. 22, 2021
Designing User Interface				Dec. 13, 2021	Jan. 18, 2022
Prototype the Design	Shie Belle and Roland			Dec. 13, 2021	Jan. 18, 2022
Logo Design	Shie Belle			Dec. 13, 2021	Jan. 18, 2022

Table 3.8 *Testing and Evaluation Phase List of Tasks*

Task	Carried out by	Carried out to	Deliverables

Phase (1) Testing and Evaluation			
Preparation	Shie Belle, Mark, and Roland		Usability Testing
Quick and Dirty Testing	Shie Belle, Mark, and Roland	Developer	Usability Testing
Evaluation			
Evaluate the test results	Mark		Evaluation
Make some Revisions	Shie Belle, Mark, and Roland	A-EYE	System Revision
Phase (2) Testing and Evaluation			
Preparation	Shie Belle, Mark, and Roland		
Quick and Dirty Testing	Shie Belle, Mark, and Roland	Developer	
Evaluation			
Evaluate the test result	Mark		Evaluation
Final Testing			
Preparation	Shie Belle, Mark, and Roland		Test Questionnaires
Survey Questionnaire Testing	Shie Belle, Mark, and Roland	Visually Impaired Employees of HEAL-OT and Healing Touch	Test Questionnaires

Usability Testing	Shie Belle, Mark, and Roland	Visually Impaired Employees of HEAL-OT and Healing Touch	Test Questionnaires
Evaluation and Documentation			
Evaluate Test Results	Mark		Document
Documentation	Mark		Document

APPENDIX E

COMMUNICATION

The appendix provides the permission letters to communicate with the following group of respondents.

Republic of the Philippines
Mindanao State University
General Santos City
College of Natural Sciences and Mathematics

May 27, 2023

Subject: Permission Letter for Testing and Survey of Capstone Research Project

To Whom It May Concern

We, the 4th-year students of BS Information Technology at Mindanao State University - General Santos City, are writing to seek your permission to conduct testing and survey for our Capstone Research project titled "A-EYE: Mobile Philippine Banknote Recognition Application Using Machine Learning tools." Our research project aims to develop a mobile application that utilizes machine learning tools to assist visually impaired individuals in recognizing Philippine banknotes.

The purpose of the testing and survey is to evaluate the functionality, usability, and effectiveness of the "A-EYE" application among visually impaired individuals. We aim to gather valuable insights regarding the application's user experience, accessibility, and overall performance. This feedback will enable us to refine and improve the application's features, accuracy in recognizing banknotes, and overall user satisfaction.

The outcome of the test and survey will provide us with comprehensive data and feedback that we can utilize to enhance the "A-EYE" application. By incorporating the suggestions and insights from visually impaired individuals, we aim to create a more inclusive and accessible digital environment. The research findings will contribute to the advancement of mobile application development for visually impaired individuals and help bridge the gap in financial accessibility.

We would like to assure you that the participation of visually impaired individuals in this testing and survey is entirely voluntary. We will maintain strict confidentiality and ensure the anonymity of all participants. The gathered data will be used solely for research purposes and will be presented in an aggregated and anonymous manner.

To ensure an unbiased and realistic evaluation of the application, we have arranged for the testing and survey sessions to take place at HEAL-OT located at Robinsons Place, J. Jose Catolico Sr. Ave. LungsodngHeneral Santos. This measure is to eliminate any potential bias or external influence that may affect the participants' responses and experiences.

For any inquiries or to confirm participation, we can be reached at the following contact information:

Republic of the Philippines
Mindanao State University
General Santos City
College of Natural Sciences and Mathematics

Shie Belle C. Dasalla
Researcher
Shiebelle.dasalla@msugensan.edu.ph
09397149000

We kindly request your support in disseminating this permission letter to potential participants and providing them with the necessary information about the testing and survey arrangements. Your assistance will be instrumental in the success of our research project and the improvement of the "A-EYE" application for the benefit of visually impaired individuals.

Thank you for your attention to this matter. We sincerely appreciate your consideration and support.

Sincerely,

Mark Lloyd L. Tacdol
Researcher

Shie Belle C. Dasalla
Researcher

Roland Tating Jr.
Researcher

Noted By:

Lymer Jude Doce, DIT
Research Adviser
BS Information Technology Department
Mindanao State University - General Santos City

Republic of the Philippines
Mindanao State University
General Santos City
College of Natural Sciences and Mathematics

June 06, 2023

Subject: Permission Letter for Testing and Survey of Capstone Research Project

To Whom It May Concern

We, the 4th-year students of BS Information Technology at Mindanao State University - General Santos City, are writing to seek your permission to conduct testing and survey for our Capstone Research project titled "A-EYE: Mobile Philippine Banknote Recognition Application Using Machine Learning tools." Our research project aims to develop a mobile application that utilizes machine learning tools to assist visually impaired individuals in recognizing Philippine banknotes.

The purpose of the testing and survey is to evaluate the functionality, usability, and effectiveness of the "A-EYE" application among visually impaired individuals. We aim to gather valuable insights regarding the application's user experience, accessibility, and overall performance. This feedback will enable us to refine and improve the application's features, accuracy in recognizing banknotes, and overall user satisfaction.

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For any inquiries or to confirm participation, we can be reached at the following contact information:

Republic of the Philippines
Mindanao State University
General Santos City
College of Natural Sciences and Mathematics

Shie Belle C. Dasalla
Researcher
Shiebelle.dasalla@msugensan.edu.ph
09397149000

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Thank you for your attention to this matter. We sincerely appreciate your consideration and support.

Sincerely,

Mark Lloyd L. Tacdol
Researcher

Shie Belle C. Dasalla
Researcher

Roland Tating Jr.
Researcher

Noted By:

Lymer Jude Doce, DIT
Research Adviser
BS Information Technology Department
Mindanao State University - General Santos City

Republic of the Philippines
Mindanao State University
General Santos City
College of Natural Sciences and Mathematics

June 07, 2023

Subject: Permission Letter for Testing and Survey of Capstone Research Project

To Whom It May Concern

We, the 4th-year students of BS Information Technology at Mindanao State University - General Santos City, are writing to seek your permission to conduct testing and survey for our Capstone Research project titled "A-EYE: Mobile Philippine Banknote Recognition Application Using Machine Learning tools." Our research project aims to develop a mobile application that utilizes machine learning tools to assist visually impaired individuals in recognizing Philippine banknotes.

The purpose of the testing and survey is to evaluate the functionality, usability, and effectiveness of the "A-EYE" application among visually impaired individuals. We aim to gather valuable insights regarding the application's user experience, accessibility, and overall performance. This feedback will enable us to refine and improve the application's features, accuracy in recognizing banknotes, and overall user satisfaction.

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To ensure an unbiased and realistic evaluation of the application, we have arranged for the testing and survey sessions to take place at HEAL-OTlocated atGaisanoGrand, Polomolok, South Cotabato. This measure is to eliminate any potential bias or external influence that may affect the participants' responses and experiences.

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Republic of the Philippines
Mindanao State University
General Santos City
College of Natural Sciences and Mathematics

Shie Belle C. Dasalla
Researcher
Shiebelle.dasalla@msugensan.edu.ph
09397149000

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Sincerely,

Mark Lloyd L. Tacdol
Researcher

Shie Belle C. Dasalla
Researcher

Roland Tating Jr.
Researcher

Noted By:

Lymer Jude Doce, DIT
Research Adviser
BS Information Technology Department
Mindanao State University - General Santos City

APPENDIX F

USE CASE

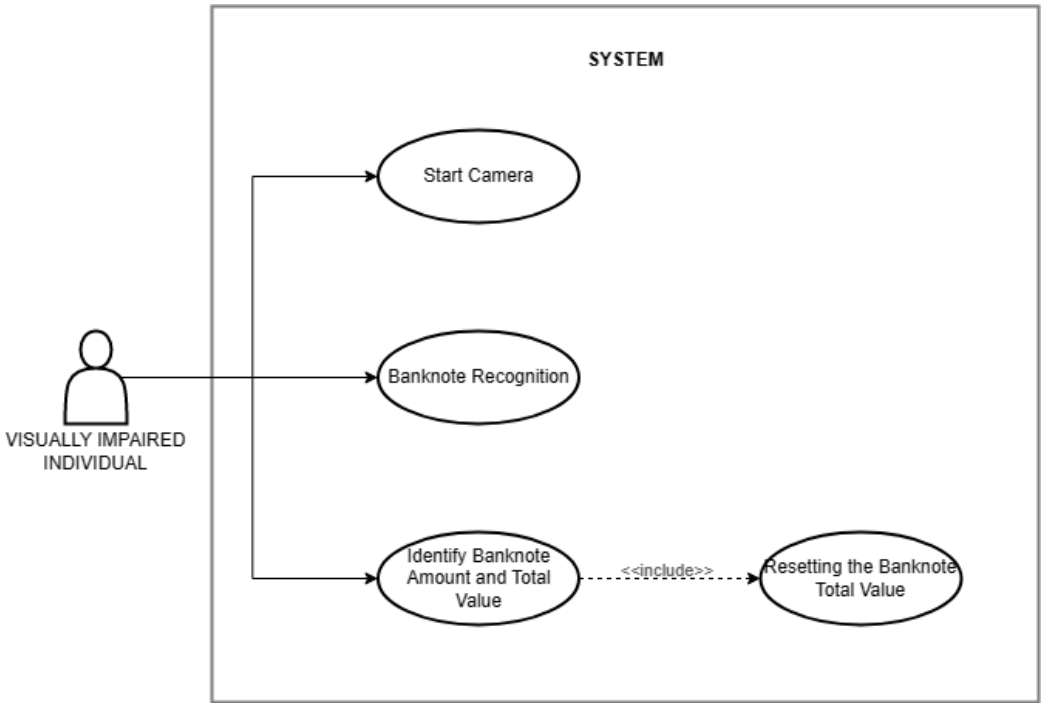


Figure 1.1 *Use Case Diagram of A-EYE: A Mobile Philippine Banknote Identifier Using Google Teachable Machine*

In Figure 1.1, the illustration demonstrates the interaction between visually impaired individuals and the A-EYE application. The visually impaired users initiate the application's camera function to detect Philippine banknotes. The application utilizes image processing to identify the banknote and provides the outcome through voice feedback. Additionally, the application offers command options to the users through voice feedback as well.

APPENDIX G

DIAGRAMS

The Philippine Banknote Recognition Application is represented by a collection of diagrams that present a comprehensive comprehension of its functionality, data flow, and workflow. The Level 0 Diagram provides a broad overview, highlighting the primary functionalities and interactions with external entities. The Data Flow Diagram (DFD) visualizes the movement of data within the application, encompassing its origins, processing stages, and destinations. Meanwhile, the Activity Diagrams portray a detailed sequence of steps and activities, elucidating the actions, decisions, and control flow within specific tasks or processes. Through these diagrams, stakeholders are empowered to gain a holistic understanding of the application's overall functioning, data flow dynamics, and the sequential progression of activities involved.

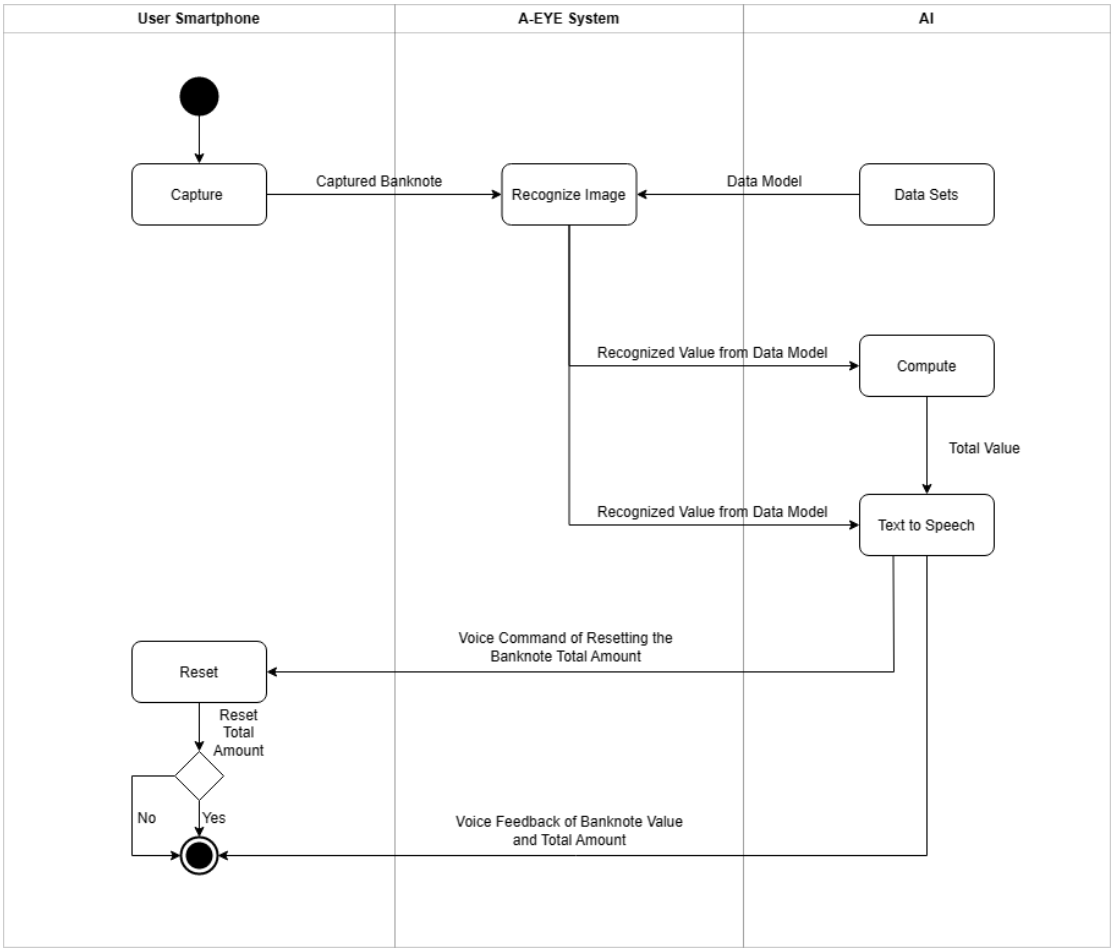


Figure 1.2 *Activity Diagram of A-EYE: A Mobile Philippine Banknote Identifier Using Google Teachable Machine*

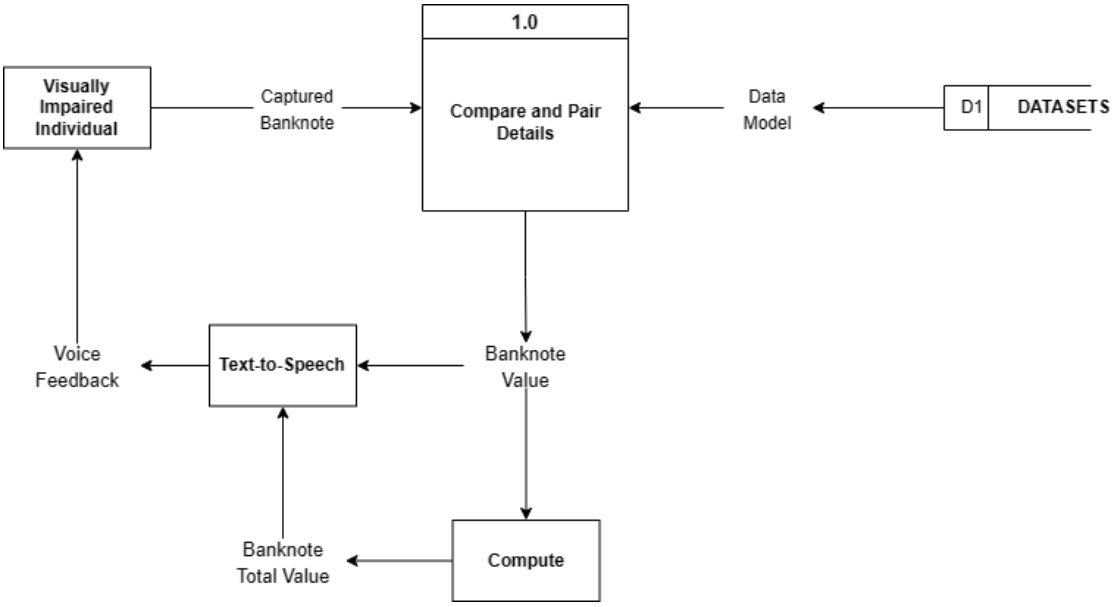


Figure 1.3 *Level 0 Diagram of A-EYE: A Mobile Philippine Banknote Identifier Using Google Teachable Machine*

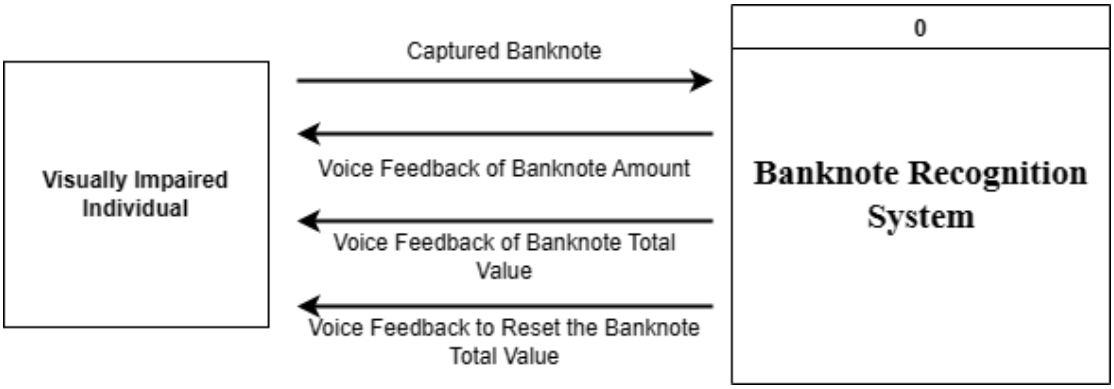


Figure 1.4 *Data Flow Diagram of A-EYE: A Mobile Philippine Banknote Identifier Using Google Teachable Machine*

APPENDIX H
SCREEN SHOTS

APPENDIX I

Capstone Project

A-EYE: User Manual

A Mobile Philippine Banknote Identifier Using Google Teachable Machine

Project Adviser:

Prof. Catherine Niñofranco

Dr. Lumer Jude P. Doce, DIT

Project Team:

Mark Lloyd L. Tacdol

Shie Belle C. Dasalla

Roland Jr. T. Tating

1.0 General Information

1.1 Application Overview

The A-EYE mobile app is a ground-breaking technology developed by a project team led by Mark Lloyd L. Tacdol, Shie Belle C. Dasalla, and Roland Jr. T. Tating, under the guidance of project advisers Prof. Catherine Niñofranco and Dr. Lumer Jude P. Doce. The app aims to assist visually impaired individuals by utilizing image recognition technology powered by Google Teachable Machine. With its array of features, A-EYE provides an innovative solution to help visually impaired users identify Philippine banknotes effortlessly.

One of the key features of the A-EYE app is its image recognition capability. By leveraging advanced machine learning algorithms, the app can accurately identify different denominations of Philippine banknotes in real-time. This functionality is crucial for visually impaired individuals who rely on tactile identification or assistance from others to determine the value of banknotes. With A-EYE, users can gain independence and make quick and informed financial transactions without any external aid.

The app also offers additional features that enhance accessibility and user experience. Real-time updates ensure that users have the most up-to-date information on banknote designs. The app's offline mode ensures accessibility even in areas with limited or no internet connectivity. Furthermore, A-EYE boasts a user-friendly interface, making it intuitive and easy to navigate for visually impaired individuals.

The significance of the A-EYE app lies in its ability to empower visually impaired individuals in their daily financial activities. By providing a reliable and efficient banknote identification system, the app reduces dependence on others and promotes independence.

With A-EYE, users can confidently manage their finances, accurately identify banknotes, and carry out transactions without any barriers. This innovative project demonstrates the potential of technology to create inclusive solutions that improve the quality of life for visually impaired individuals, fostering their autonomy and inclusion in society.

1.2 Authorized Use Permission

Unauthorized copy and use of the code of this project as intended will render it useless and result in criminal and/or civil prosecution.

1.3 Organizational Manual

- **General Information** explains the application's general terms and the purpose for which it is intended. This includes the A-EYE application's major functionalities, deployment, process, responsible organization, application name, and development environment.
- **Getting Started** provides an overview of the application from start to finish exit. It also describes the application functions and processes in general terms in relation to the A-EYE application.

2.0 Getting Started

2.0 General Information

2.1 TalkBack Activation in Smart phones

- **Option 1: Volume key shortcut**

  You can use the volume key shortcut to turn TalkBack on or off.

  1. On the side of your device, find both volume keys.
  2. Press and hold both volume keys for 3 seconds.
  3. To confirm that you want to turn TalkBack on or off, press both volume keys again for 3 seconds.

     a. If you turn on TalkBack when you set up the device, the volume key shortcut is also turned on.

  Tip: To permanently turn off the volume key shortcut, go to Settings Accessibility TalkBack. Then turn TalkBack shortcut to off.

- **Option 2: Google Assistant**

  1. In the Setup wizard or in settings, after you turn on Google Assistant, say “Hey Google.”
  2. Say “Turn off TalkBack” or “Turn on TalkBack.”

- **Option 3: Device Setting**

  1. On your device, open Settings.
  2. Select Accessibility TalkBack.
  3. Turn Use TalkBack on or off.

4. Select Ok.

2. 2 Things to be aware of when TalkBack is on.

1. Tap to select an item, then double-tap to turn on.
2. Use 2 fingers to scroll.
3. When "System navigation" is set to "Gesture navigation," for gestures like home, back, or recent apps, use 2 fingers instead of one.
4. By default, TalkBack speaks password characters to you. To make sure that your phone doesn't speak characters in secure fields, you can change the setting.

2.3 Navigation of A-EYE application

A. Instructions of step-by-step process on how to open the application.

1. With the help of VoiceOver and talkback feature of the smartphone, the user will just swipe left or right to find the application.

Note: Every application that is selected every swiping at the screen will be mentioned through voice feedback.

2. To choose the application, just tap the screen twice and it will open automatically.

B. Instructions of step-by-step process in using the application.

1. Double tap the screen: By tapping the screen twice is an operation to open the application using talkback feature.

2. Once the application is open for the first time, the application will tell users the procedure ‘Welcome to the app. To start recognizing, double tap the screen to capture’. Else, the application will say ‘Start Recognizing’.

3. After double tapping the screen to capture an image the app will initiate and mention ‘Capturing’ and ‘Image captured’ after the application initiates the process. After the initiation process, the application will tell the result and ask the user ‘Do you want to continue recognizing without resetting the total? If yes, double tap the screen. If not, one tap and long-press the screen.’

4. To exit the application, the user can press the back button twice or press home.

APPENDIX J
PHOTO DOCUMENTATION

Final System Testing and Evaluation with Visually Impaired Individuals

Team Members Present: Mark Tacdol, Roland Tating, Shie Belle Dasalla

APPENDIX K
CURRICULUM VITAE

MARK LLOYD L. TACDOL
Bachelor of Science in Information Technology
major in Database

09512486677
tacdolmarklloyd@gmail.com
Sarangani Province

SUMMARY

Seeking a responsible, challenging job to develop my skills, personality, and potential for the benefit of my employer, community, and myself, while aiming for future management advancement.

SKILLS

- Organization and Time Management Solution
- Implementation
- Work Orders
- Project Management Skills
- Negotiation
- Critical Thinking Active Listening
- Communication Skills

EXPERIENCE

- OJT (On-the-Job-Training)
  Location: Brgy. Fatima, Uhaw, General Santos City
  Company Name: Information and Communication Technology, Mindanao State University – General Santos City
  Description:
    - Installing fiber optic cables
    - Computer hardware Inventory
    - Technical Support
    - Installing Internet connectivity inside MSU campus
    - Making office transaction diagrams in Use case
- ETHELIND TUTORIAL CENTER, GENSAN (January 2022 – July 2022)
  Position: Academic Tutor
  Description:

- Demonstrated respect, friendliness and willingness to help wherever needed.
- Carried out day-day-day duties accurately and efficiently.
- Teach students from pre-school to senior high school within their teacher's lesson plans.
- Helps students review lessons and practice lesson activities.

- SixEleven Global Teleservices Inc., General Santos City (January 2021 – October 2021)

  Position: Call Center Agent
  Description:

  - Qualifies foreign costumers for medical benefits.
  - Answering calls to hear costumer concerns and complaints.
  - Resolve issues in regards to costumer accounts.
- (SPES) Special Program for Employment of Students (May 2017)
- (SPES) Special Program for Employment of Students (May 2018)
- (SPES) Special Program for Employment of Students (May 2018)

EDUCATION

PRIMARY EDUCATION
Malandag Central Elementary School
2011 – 2012

SECONDARY EDUCATION
Malandag National High School
2018 – 2019

TERTIARY EDUCATION
Mindanao State University – General Santos City
2022 – 2023

ACHIEVEMENT

- MDCM Secretary General

  Elected as Secretary General at Men's Dormitory Club – Main at MSU – GENSAN SY 2023 – 2023.
- Department V-President

  Elected as Vice President of Junior Information Technology organization of the College of Natural Sciences and Mathematics SY 2021-2022.
- POVAG PIO

  Elected as Public Information Officer of PintaOkir Visual Arts Guild organization of MSU- GenSan Cultural Community SY 2020-2021.
- PSC 7 Regional Champion (Philippine StartUp Challenge)

October 2022 Hosted by Department of Information and Communication Technology.

- PSC 7 top 10 National Innovator (Philippine StarUp Challenge)
  November 2022 Hosted by Department of Information and Communication Technology
- Certificate for Ethical Hacking for Beginners
  July 2022
- Certificate for Certified Information System Security Professional
  July 2022
- Networking Essential
  September 2022 by CISCO
- Audio and Visual Production
  October 2015 by ACLC
- Housekeeping NCII
  January 2017
- Computer Hardware Servicing NCII
  April 2015
- Computer Software Servicing NCII
  April 2015

PERSONAL INFORMATION

Address	Sitio Toning, Malandag Malungon, Sarangani Province, 9503
Date of Birth	April 25, 2001
Gender	Male
Nationality	Filipino
Marital Status	Single

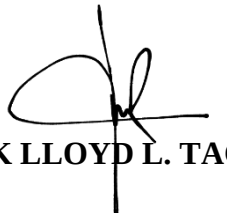
REFERENCE

LAIZA L. LIMPIN, DIT
IT/PHYSICS PROFESSOR
Mindanao State University – General Santos City
09173296768

CHRISTINE JAN BLABAGNO-DELA VEGA, MS
CHAIRPERSON, IT/PHYSICS
Mindanao State University – General Santos City
09469177361

DECLARATION

I hereby declare that all the details furnished here are true to the best of my knowledge and belief.



MARK LLOYD L. TACDOL

SHIE BELLE C. DASALLA
Bachelor of Science in Information Technology

09397149000
belledasalla@gmail.com
Prk. Maghiusa, Poblacion, Polomolok, South Cotabato

SUMMARY

Seeking a responsible and challenging role to enhance my skills, foster personal growth, and contribute to the success of an organization. With a strong commitment to professional development, I aim to leverage my abilities and potential for the benefit of my employer, community, and future management advancement.

SKILLS

- Wireframe Creation
- Network Administration and Configuration
- Network Troubleshooting
- Network Design and Implementation
- Computer Literacy
- Communication and Collaboration

EXPERIENCE

- OJT (On-the-Job-Training)
  Location: Pres. Sergio Osmeña St, General Santos City, Philippines
  Company Name: Local Government Unit – General Santos City
  Description:
  - Installing networks
  - Creating a LAN Plan layout
  - Network Administration

EDUCATION

PRIMARY EDUCATION
Eustacio Barcatan Elementary School
2006-2012

SECONDARY EDUCATION
Christian School of Polomolok
2012-2017
Notre-Dame Siena College of Polomolok
2017-2019

TERTIARY EDUCATION
Mindanao State University – General Santos City
2022 – 2023

ACHIEVEMENTS

- Department Councilor
  Elected as Councilor of Junior Information Technology Society SY 2021-2022 and AY 2022-2023.
- PSC 7 Regional Champion (Philippine StartUp Challenge)
  October 2022 Hosted by Department of Information and Communication Technology.
- PSC 7 top 10 National Innovator (Philippine StarUp Challenge)
  November 2022 Hosted by Department of Information and Communication Technology
- With Honors, Notre Dame - Siena College of Polomolok - Senior High School (2017 – 2019)
- CISCO – Network Defense Digital Badge (2022)
- CISCO – Networking Essentials Certificate (2021)
- CISCO – Introduction to Packet Tracer Certificate (2021)
- Dean's List, Mindanao State University – General Santos (2020-2023)

PERSONAL INFORMATION

Address	Blk. 2, Prk. Maghiusa, Poblacion, Polomolok, South Cotabato
Date of Birth	February 22, 2001
Gender	Female
Nationality	Filipino
Marital Status	Single

REFERENCE

LAIZA L. LIMPIN, DIT
IT/PHYSICS PROFESSOR
Mindanao State University – General Santos City
09173296768

CHRISTINE JAN BLABAGNO-DELA VEGA, MS
CHAIRPERSON, IT/PHYSICS
Mindanao State University – General Santos City
09469177361

DECLARATION

I hereby declare that all the details furnished here are true to the best of my knowledge and belief.

SHIE BELLE C. DASALLA

ROLAND, JR. T. TATING
Bachelor of Science in Information Technology

(639) 08-409-3406
rolandtating@gmail.com
10B Block 4, Fatima
General Santos City, Philippines

SKILLS

- Technical Skill - such as Programming, Graphic Designing, and Microsoft Office Suite.
- Analytical Skill.
- Organizational Skill.
- Creative Skill.
- Interpersonal Skill

EXPERIENCE

Unstuck Coaching, Quezon City — *Social Media Manager*
December 2022 - PRESENT
Responsible for Graphic Designing, Video Editing, Content Creation, Client Engagement in different Social Media Platforms and Proposing Content Strategy.

Bria Homes - GSC, General Santos City — OJT in *Marketing*
JANUARY 2019 - MARCH 2019
Responsible for Customer Service and Strategize Marketing at Bria Homes.

Gaisano - GSC, General Santos City — *Sales Clerk*
MARCH 2017 - APRIL 2017
Responsible for Customer Service in Gaisano's Sports and Pet Stores.

EDUCATION

TERTIARY EDUCATION
Mindanao State University – General Santos City
Bachelor of Science in Information Technology
2022 – 2023

PROJECTS

Video Editor & Graphic Designing
Helping different local and international clients in Video Editing and Graphic Designing according to their needs and wants.

Front End Website Developer
Responsible for creating visually appealing and user-friendly websites that engage and interact with its users.

ACHIEVEMENTS

- Philippine Startup Challenge (PSC) 7 Finalist
- Regional Pitching Competition (Region 12 Champion)
- Cisco Network Defense
- Intel® OpenVINO Online Training

REFERENCE

LAIZA L. LIMPIN, DIT
IT/PHYSICS PROFESSOR
Mindanao State University – General Santos City
09173296768

CHRISTINE JAN BLABAGNO-DELA VEGA, MS
CHAIRPERSON, IT/PHYSICS
Mindanao State University – General Santos City
09469177361

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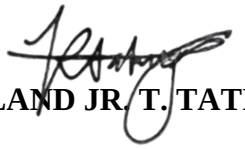
I hereby declare that all the details furnished here are true to the best of my knowledge and belief.



ROLAND JR. T. TATING