PORTABLE LANGUAGE TRANSLATOR DEVICE FOR CEBUANO AND TAGALOG SPEAKERS

An Undergraduate Proposal

Presented to the Faculty of the College of Engineering

University of Rizal System

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In Partial

Fulfillment of the Requirements

for the Degree of Bachelor of Science in

Computer Engineering

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DEDICATION

We
want to
dedicate this
research study
to our family for
their unwavering
support while
writing our
thesis

JOSH

JARIUS

JHES

KHEIL

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Chapter 1

THE PROBLEM AND ITS BACKGROUND

This chapter includes the introduction, background, theoretical and conceptual framework, objective, assumption, scope and limitations, significance of the study, and definition of terms used.

Introduction

Language is a medium that people use in order to express themselves, allowing people to socialize and pass information from one person to another. According to Britannica, a language is a structured system comprising conventional spoken, manual (signed), or written symbols. Through this system, human beings, as members of a social group and contributors to its culture, articulate themselves. The role of language encompasses communication, manifestation of identity, engagement in play, imaginative expression, and release of emotions.

Language also distinguishes what social group we belong to, since there are thousands of different languages across the world. As stated by Ethnologue, there are 7,164 languages that are in use today and languages change as we learn more. They are used by communities in the fast-changing world. Unfortunately, about 40% of languages are at risk, with fewer than 1,000 speakers. On the

positive side, only 23 languages are spoken by more than half of the world's population.

The Philippines, for instance, as one of the countries located in south-east Asia is known to have rich and diverse indigenous languages, where majority of people use different languages depending on what region they are currently in at the moment. In the Philippines, over 150 languages are spoken, underscoring its immense cultural diversity. The official languages are Filipino, a standardized form of Tagalog, and English. Filipino serves as the lingua franca, facilitating communication among the country's various ethnolinguistic groups. The significant number of regional languages, with Tagalog and Cebuano being notably widespread, reflects the linguistic richness of the Philippines (WorldAtlas, 2018).

It is common knowledge that Tagalog and Cebuano are the most spoken languages in the Philippines. As stated by Britanica, Tagalog, the largest cultural-linguistic group in the Philippines, is prevalent in Manila and surrounding provinces, both to the north and south. As an Austronesian language, it shares roots with other Philippine languages. Spoken by around 19,550,000 Filipinos, Tagalog serves as the basis for the national language, Filipino, and is taught in all schools. Britanica also explained that Cebuano constitutes the second-largest indigenous language in the Philippines, following Tagalog, with an estimated population of around 18.5 million in the early years of the 21st century. They are collectively categorized as part of the Visayan (Bisayan) peoples, alongside Hiligaynon and Waray-Waray, showcasing the linguistic diversity within the

archipelago. It just shows that having an interpreter will be beneficial for the local travelers.

Although tourists can just hire interpreters, interpreters can be costly and comfortable for people. According to Talent, interpreters in the Philippines earn an average annual salary of ₱630,000 or ₱252 per hour. Starting positions typically offer ₱420,000 per year, while experienced individuals can make up to ₱840,000 annually. That is why having a translator device may be better and more convenient to most tourists.

Background of the Study

With the Philippines' diverse languages, technology that translates languages is becoming useful, helping people who speak different languages understand each other better. For example, Adlaon and Marcos (2018) used neural networks to translate Cebuano to Tagalog. This shows that machine learning can break the language barriers between these two languages. Additionally, Aquino et al. (2019) made huge progress by creating automated transcription systems for Tagalog, Cebuano, and Hiligaynon speech, which performs equally to human translators but with reduced cost.

However, translating Cebuano and Tagalog is not an easy task. Unexpected challenges might arise when working on such a project. This can be seen in the work of Villanueva et al. (2019), where they tried to make a mobile translation system but found it hard due to the languages' differences. The variety

of tones of various speakers might also affect the accuracy of speech-to-text technology when translating one language to another. Danao et. al. (2017) showed in their work that recognizing different Tagalog accents is a very important factor when creating translation devices. This is to make sure that everyone, no matter their accent, can use the technology well. Also, aside from focusing on the accuracy of translation, ensuring that the device is user-friendly is also an important matter. The study of Tripathi et al. (2021) shows this when they made a device for translating speech and sign language, wherein they emphasized how important it is to design tech that's also easy to use and understand.

Other than the device's user-friendliness and translation accuracy, it's also important to think about ethics and culture when creating a language translation device. For instance, the speech-enabled language translator device of Shadiev, Sun, and Huang (2018) did a great job as they also aimed to help people understand each other better across cultures. This shows the need for technologies that do not only translate words but also respect cultural differences and ethical concerns.

These translation devices are rapidly improving over time, with dedicated researchers working hard to introduce innovations in this field. Renovalles, et. al. (2021) made huge contributions in the development of such devices by testing text-to-speech systems for Filipinos using advanced methods like deep learning. This is a strong effort to make speech sound more natural in local languages. A machine translation system created by Villanueva et. al. (2019), was helpful not

only with tourism but also with everyday conversations between Filipino and Cebuano speakers.

Different approaches in these translation devices also exist, with the same purpose of connecting people together regardless of what language they use. Zhou et. al. (2020) made a breakthrough with a new device that turns sign language into spoken words. This kind of innovation can change the way we think about translating different kinds of communication. Also, understanding how to choose which language to speak can be made possible using technology (Dresibach & Demeterio. 2020).

The advancement of language translation technologies in the Philippines is marked by notable achievements and challenges. Studies like Adlaon and Marcos (2018) and Aquino et al. (2019) have highlighted the effectiveness of machine learning in breaking down linguistic barriers through neural network-based translations and automated transcription systems, achieving human-like performance at reduced costs. However, challenges such as linguistic discrepancies, the need for accent recognition to enhance inclusivity (Danao et al., 2017), and the importance of user-friendliness and ethical considerations in design (Tripathi et al., 2021; Shadiev, Sun, and Huang, 2018) remain significant. Innovations continue to emerge, such as text-to-speech systems (Renovalles et al., 2021), devices aiding in tourism and everyday conversations (Villanueva et al., 2019), and groundbreaking tools for translating sign language into spoken words Zhou et al., 2020), (all aiming to connect people across different languages while respecting cultural nuances.

All these literatures and studies provide a solid foundation for creating a Cebuano-Tagalog translation device, helping the researchers understand how to preserve language, respect culture, and include technology for everyone. The goal of the researchers' study is to use this existing information to further improve language translation technology and bring different Filipino communities closer together.

Theoretical Framework

This research is fundamentally guided by two theoretical perspectives: Communication Theory and the Technology Acceptance Model (TAM), which together form the foundation of the researchers' approach to overcome language barriers between Tagalog and Cebuano speakers through technological innovation.

Communication Theory forms the backbone of understanding the translation process. It emphasizes the importance of effective communication as a medium for information exchange, cultural understanding, and social integration. In the context of this study, Communication Theory shows how complex it is to translate Tagalog and Cebuano, highlighting the need for a device that can accurately capture and convey not just the literal meanings of words, but also the underlying context in language.

The TAM helps in understanding how people might view and use the proposed translation device. It suggests that the two main factors, perceived

usefulness, and perceived ease of use, determine whether people will adopt the technology. For the translation device, TAM highlights the importance of making a tool that's not only good at bridging language gaps but also easy for people with different levels of tech skills to use. By following TAM principles in developing the device, the goal is to ensure it meets users' practical needs and expectations, making it more likely to be accepted and used in everyday life.

Communication Theory and TAM provide a solid theoretical basis for this study. They help explore how technology can improve communication between different language speakers and offer guidance on designing and adopting such technologies. This framework focuses on making a portable translation device that deals with the real-world issues of language barriers in the Philippines, considering factors like accuracy, innovation, and user-friendliness.

Conceptual Model

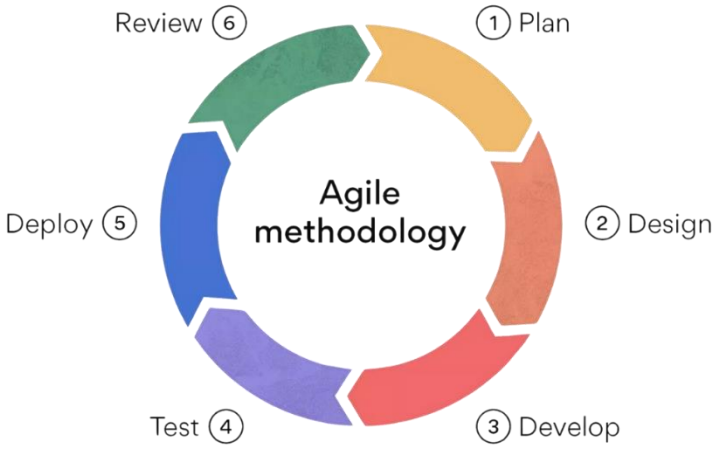

Figure 1:
Conceptual Model on the Portable Language Translator Device for Cebuano and Tagalog Speakers

Conceptual Framework

In this study, the researchers have adopted the Agile model as the conceptual framework to explore the development and performance of a translation device operating between Tagalog and Cebuano. The Agile approach emphasizes iterative development, stakeholder collaboration, and adaptability to change. This involves structuring the research process into short, iterative cycles or sprints, each dedicated to developing and testing specific aspects of the device. Throughout these cycles, stakeholder feedback, including input from users, developers, and language experts, is important, ensuring the device aligns with user needs and expectations. In this model, the cycle is composed of the following phases:

The Planning Phase initiates the project, focusing on collecting user and system requirements through surveys and consultations with experts. This stage establishes clear objectives for the device and outlines the project timeline and milestones.

Next, the Design Phase involves designing a user-friendly interface and ensuring all components are compatible to each other. The Development Phase follows, where the core functionalities such as the translation algorithms are programmed, and the initial hardware prototype is assembled.

The Testing Phase is crucial, as it involves rigorous validation of both software and hardware to ensure the system meets all design specifications and user needs under varying conditions. Following successful testing, the Deployment

Phase involves releasing the software to the end users. The developers must ensure that the software is installed correctly and instruct the end-users to ensure they can effectively use the software.

Finally, the Review Phase assesses the device's performance against initial objectives and gathers user feedback for future improvements. This last stage is essential for iterative updates and helps refine the device in preparation for subsequent releases, ensuring the product evolves in response to user needs and technological advances.

Objective of the Study

The study aims to address language barriers in the Philippines, particularly Tagalog and Cebuano speakers, by developing a portable translation device. This research seeks to have meaningful outcomes in understanding language barriers, with the following specific objectives:

1. Develop Portable Language Translator Device for Cebuano and Tagalog Speakers with respect to;
    1.1. Parts and Materials;
    1.2. Visual Presentation; and,
    1.3. Diagram and Flowchart.
2. Determine the effect of sentence complexity of the developed translation device in terms of:
    2.1. Accuracy of translated words and;

2.2. Response time.

3. Determine the perception of the experts and end-users on the acceptability of the Portable Language Translator Device for Cebuano and Tagalog Speakers in terms of:

3.1. Functional Suitability;

3.2. Performance Efficiency;

3.3. Usability.

3.4. Reliability, and;

3.5. Portability.

4. Determine if there is a significant difference between the level of perception of the experts and end-users on the acceptability of a Portable Language Translator Device for Cebuano and Tagalog Speakers with a verdict to the above-mentioned.

Scope and Limitation

This study focuses on the development and evaluation of a portable translation device designed to bridge the language gap between Tagalog and Cebuano speakers in the Philippines. The research will cover the development of the device, its technological foundation, usability testing, and impact assessment on communication between speakers of the two languages. The study will be conducted within the timeframe of the academic year 2024-2025.

It will be limited to the translation between Tagalog and Cebuano only. Due to time constraints, the device might be able to translate a few hundred words commonly used by tourists, rather than covering the entirety of both languages. Additionally, the study's findings will be based on the responses and perceptions of a selected group of participants, which may not fully represent the entire population of Tagalog and Cebuano speakers.

Given the diversity of Tagalog dialects, the device will specifically cover the Manila Tagalog dialect. This choice is made because Manila Tagalog is widely recognized as the standard form of the language, often used in education, media, and government. As such, it is the most comprehensible and accessible variant for a broad audience, ensuring that the translations provided by the device are understood by the largest possible number of Tagalog speakers.

The evaluation of the translation device's effectiveness and user satisfaction will be conducted through surveys and practical tests. The acceptance and feasibility of implementing the device on a wider scale will be gauged through feedback from both experts and end-users involved in the study.

Significance of the Study

This research benefits the following:

Local Communities: The device makes it easier for people who speak Tagalog and Cebuano to understand each other. This means people in the community can work together better, learn from each other, and get along more easily. It helps everyone feel included and important.

Schools and Universities: This device is great for education. Teachers and students who speak different languages can talk to each other more easily. This makes learning more fun and inclusive for everyone, no matter what language they speak.

Business Owners: This device can streamline communication between businesses and customers who speak Tagalog and Cebuano. By using the device, business owners can ensure smooth transactions and deals, improving customer experience and satisfaction.

Tourists and Tourism Industry: Tourists will have an easier time understanding and exploring the Philippines with this device. It makes the trips more fun and interesting. This is good for tourism because more visitors will want to experience what the Philippines has to offer.

Government Agencies and NGOs: Government agencies and non-governmental organizations (NGOs) can utilize the device to facilitate communication with diverse communities during outreach programs, public

services, and disaster response efforts. This promotes inclusivity, enhances access to essential services, and strengthens community engagement and participation.

Future Researchers: This study creates new possibilities for making better language translation devices. It shows how to make a tool that helps people speak Tagalog and Cebuano understand each other better. Future studies can use this work to create even better translation tools and explore new ways to help people communicate. This research also gives a good starting point for anyone looking to study how technology can help with language problems.

Definition of Terms

Communication Effectiveness. A quality that states whether the communication is clear and understandable on both ends.

Innovation. Defined as the process of bringing about new ideas, methods, products, services, or solutions that have a significant positive impact and value.

Language Attrition. The loss of native language skills or knowledge over time, often due to learning a second language.

Language Barriers. A difficulty in communication when people speak different languages.

Language. The words, their pronunciation, and the methods of combining them used and understood by a community.

Multilingual. The ability to use several languages especially with equal fluency.

Portable Translation Device. A handheld device that can translate speech or text between different languages in real time.

Portable. Light and small enough to be easily carried or moved.

Speech Recognition. Also known as automatic speech recognition (ASR), computer speech recognition, or speech-to-text, is a capability which enables a program to process human speech into a written format.

Text-To-Speech Technology. A type of assistive technology that reads digital text aloud. It's sometimes called "read aloud" technology.

Translation Accuracy. The degree to which a translation conveys the original meaning, tone, and intent of a message from one language to another.

Translator. A tool to facilitate the conversion of text from one language to another.

Usability. It is the quality that refers to whether the device is easy to use or not.

User Satisfaction. It refers to the overall satisfaction of the user after interacting with the device.

Chapter 2

RESEARCH METHODOLOGY

This chapter presents the research method and procedure used in the study. This includes research design, setting, vicinity map, subject of the study, sources of data, and procedure.

Research Design

This research will utilize the developmental research design, an iterative approach ideal for developing new technologies like the language translation device in this research. This methodology, commonly applied in product development, involves cycles of creation, testing, and refinement (Richey & Klein, 2007). The researchers will iteratively develop, test, and improve the device, focusing on the accurate translation between Tagalog and Cebuano and ensuring usability in real-world scenarios.

Additionally, the study will employ a quasi-experimental research design, which is appropriate for testing hypotheses about cause-and-effect relationships without random assignment of participants. As defined by Fraenkel, Wallen, and Hyun (2011), quasi-experimental designs are used when randomization is not feasible but controlled experiments are still necessary to evaluate outcomes. This approach is fitting for assessing the device's performance across varying levels of sentence complexity—simple, moderate, and complex—and understanding its accuracy in translation.

In this study, purposive sampling will be used to select three language experts fluent in both Tagalog and Cebuano to evaluate the device's translation output. These experts will assess the accuracy of translations using a semantic scoring rubric designed to measure how well the device conveys meaning and context. The use of purposive sampling justifies the selection of evaluators who possess the specialized knowledge necessary for assessing the translations accurately.

Unlike randomized designs, this quasi-experimental approach focuses on structured comparison rather than randomization, ensuring that the impact of sentence complexity on translation performance can be directly observed. By systematically testing translations of sentences categorized as simple, moderate, and complex, this design enables the researchers to investigate the cause-and-effect relationship between sentence complexity and translation accuracy while maintaining controlled experimental conditions

Setting of the Study

The researchers will conduct the study in Antipolo City, Rizal. The researchers chose this city as it offers a realistic scenario where the Tagalog speakers are the majority while the Cebuano speakers are the minority. Nonetheless, Antipolo still holds a strategic advantage as it is diverse with people with various language backgrounds. According to wanderlog (2024), the distance between Antipolo to Manila is between 19 kilometers or 11.8 miles. A key factor that suggests its language diversity is closely similar to Manila, which is known to

be filled with people from different ethnic groups. As stated by newworldencyclopedia (2022), there are constant migration of Visayans (Including Cebuanos), Bicolanos, Ilocanos, Maranaos, and Kapampangans in Manila from the past years.

In addition, the researchers also take into consideration the population within the chosen location. According to PhilAtlas (2020), Antipolo City has a population of 887,399 or approximately 27% of the total population in Rizal province. Making it the most populated city in Rizal.

The researchers also give thought of tourists of Antipolo as a factor in the decision of selecting it as the place to conduct the study. The Antipolo Cathedral, a renowned pilgrimage site, draws visitors from diverse regions, creating a unique setting for testing the real-world functionality of the language translation device. An article published by Manila Bulletin (2022) says that Antipolo city is the top 1 tourist destination in Rizal province, it is also stated that 75% of the people that visit the province come to Antipolo. Further suggest that Antipolo City is a great location for the setting of this study.

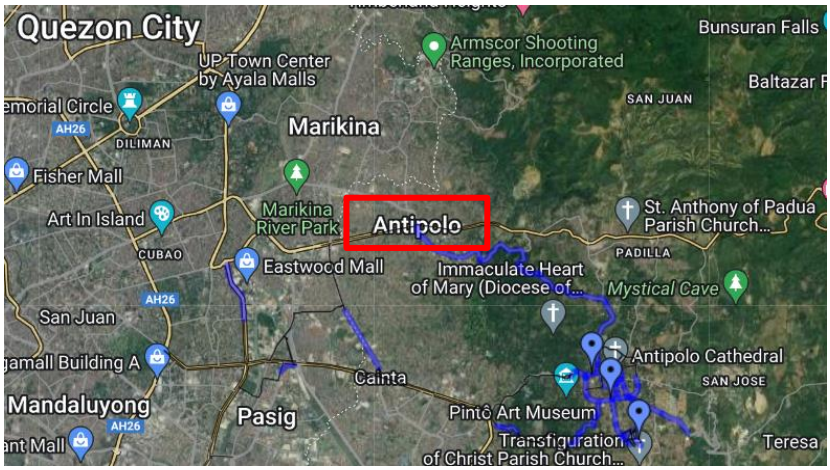

Figure 2:
Vicinity Map of Antipolo City, Rizal

Subject of the Study

The study focuses on developing the Portable Translator Device, designed to translate between Cebuano and Tagalog speech. This device aims to enhance communication between individuals speaking these different languages. The Portable Translator Device is user-friendly and incorporates multilingual technology. It features an algorithm based on machine learning, ensuring accurate translations between Tagalog and Cebuano.

The device boasts bidirectional capabilities, facilitating two-way communication. Users can express themselves in either Cebuano or Tagalog, and the device provides real-time, accurate translations. To ensure ease of use, the device's controls are clearly labeled, enhancing its user-friendliness. The device is intended for practical use in various scenarios, including daily conversations, business interactions, and community engagements.

Sources of Data

The researchers will primarily utilize the internet, literature, and other studies to gather the data needed to conduct this study. Additionally, a stopwatch and record sheets will be employed to track recorded results, such as translation response time and accuracy. To measure the usability and the users’ satisfaction of the device, a questionnaire-checklist with a scale of 5 to 1 will also be utilized.

Scale and Verbal Interpretation for the Portable Language Translator Device for Cebuano and Tagalog Speakers

SCALE	RANGE	VERBAL INTERPRETATION
5	4.21 – 5.00	Very Much Accepted
4	3.41 – 4.20	Very Accepted
3	2.61 – 3.40	Accepted
2	1.81 – 2.60	Less Accepted
1	1.00 – 1.80	Not Accepted

Procedure of the Study

A. Development of the System

The development of the speech translator device will commence with in-depth online research. The researchers will engage with internet communities on platforms such as Discord, Reddit, and Facebook to gather insights into user needs and preferences, informing the initial phase of software development. This stage will focus on creating a prototype for the software component, emphasizing accuracy and efficiency in translation. Subsequently, attention will shift to the hardware aspects. Essential components, including a microcontroller, microphone, speakers, and PCB, will be integrated to construct the physical device. The software will then be coded into the microcontroller, a crucial step towards realizing a functional prototype. This stage will involve rigorous testing, adjustments, and calibration to fine-tune the device's performance and ensure its effectiveness in real-world scenarios.

B. Conduct of the Study

The study will begin with the proposal of the thesis to a panel of faculty members from the engineering department. Once approved, the researchers, under the guidance of our research coordinator and other instructors, will start drafting Chapter 1. Alongside this theoretical groundwork, the team will embark on the practical development phase, as outlined in the "Development of the System" section. This process will involve iterative testing and refinement of both the software and hardware components of the speech translator device. The researchers will continually assess each stage of development to ensure it meets the project's standards for accuracy and efficiency. Throughout the study, the methodology will be shaped by a combination of theoretical guidance from academic mentors and practical insights gained from user communities. This dual approach will ensure a well-rounded development process, integrating theoretical research with real-world applications and user feedback.

C. Conduct of the Experiment

The experiment will involve three bilingual experts proficient in both Tagalog and Cebuano, selected through purposive sampling. These experts were chosen for their ability to accurately assess the quality of translations based on meaning and context. The experiment will focus on evaluating the translation device’s performance in translating sentences of varying

complexity. A total of 15 Tagalog sentences will be prepared and categorized into three levels of complexity: simple, moderate, and complex. Simple sentences will include short and straightforward statements, moderate sentences will have slightly more complex structures, and complex sentences will feature idiomatic expressions, cultural references, and intricate grammar. Each Tagalog sentence will have a correct Cebuano reference translation prepared in advance to ensure accurate benchmarking.

During the experiment, the researchers will operate the translation device to translate each sentence from Tagalog to Cebuano. The translations generated by the device will be documented in the translation record sheet. The time taken for each translation will also be recorded by the researchers on the response time record sheet to analyze the device's efficiency. The bilingual experts will then receive the translated outputs and the prepared accuracy evaluation sheets. Using the semantic scoring rubric, the experts will rate each translation based on how well it conveys meaning, accounts for grammatical correctness, and preserves context. The rubric uses a five-point scale, ranging from "5" for perfectly accurate translations to "1" for translations that fail to convey the intended meaning or are incomprehensible.

The researchers will collect the accuracy evaluation sheets from the experts after the assessment. The scores will then be analyzed to determine the average accuracy for each category of sentence complexity: simple,

moderate, and complex. Statistical analysis, specifically a One-Way ANOVA, will be conducted to identify whether there are significant differences in accuracy scores across the three levels of complexity. This approach allows the researchers to comprehensively evaluate the impact of sentence complexity on the translation device's performance, providing valuable insights for further refinement and optimization.

Statistical Treatment

To address the objectives outlined in the previous chapter, the following statistical methods will be employed:

1. No statistical tools were utilized in addressing the first objective. This section focused on presenting the device's development process using diagrams, flowcharts, and other visual representations.
2. One-Way ANOVA was used to determine the effect of sentence complexity on translation accuracy and response time. This method compared the means of the three complexity levels (simple, moderate, and complex) to identify significant differences.
3. Mean and standard deviation were computed to summarize the perceptions of experts and end-users regarding the device's acceptability in terms of functional suitability, performance efficiency, usability, reliability, and portability.
4. An Independent T-Test was conducted to determine if there is a significant difference between the perceptions of experts and end-users. The two-

tailed p-value and t-statistic were calculated to evaluate the variance between the two groups.

These statistical tools were selected to provide a comprehensive understanding of the device's performance, effectiveness, and user satisfaction, aligning with the research objectives, and ensuring a robust analysis of the collected data

Chapter 3

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter outlines the comprehensive methodology employed to achieve the objectives of developing and evaluating the Portable Language Translator Device for Tagalog and Cebuano Speakers in the Philippines.

Development of the Portable Language Translator Device for Cebuano and Tagalog Speakers

1. Parts and Materials Used and Steps Taken to Build the Device

The development of the Portable Speech Translation Device followed a systematic process, beginning with the software, which is the core component of the system.

The first step in constructing the Portable Speech Translation Device was to develop a Python program to manage the translation process. The program prompts the user to select the desired language upon execution, after which it begins to listen for the user's voice. The user speaks and then presses Enter to conclude the listening phase. The program converts the recorded speech into text and translates it into the target language. The translated text is then converted back into speech, allowing the other user to hear it in their native language. Specialized APIs were utilized to ensure that the output voice retains the nuances of a native Filipino speaker, rather than sounding like an English speaker.

The next step involved integrating the validated software with various hardware components. A Raspberry Pi was chosen as the central processing

unit, and several other components were selected to enhance the device's functionality and portability. These components include a SIM card module for cellular connectivity, a USB microphone to capture the user's speech, speakers to output the translated speech, a power bank to power up the Pi, and a custom-designed 3D printed casing to house and protect the internal components.

Lastly, the device will undergo several trials to ensure it functions as intended and meets the desired output. The following table presents a detailed list of the components used in the development of the Portable Speech Translation Device, including a brief description of their roles in the system.

Table 1

Tabular Presentation of the Different Materials of the Portable Language Translator Device for Cebuano and Tagalog Speakers

Component and Image	Description
 **Raspberry Pi 4 Model B**	The central processing unit for the device, running the translation software.
 **Power Bank**	It serves as battery, power button, and a charging port to the device.

 **USB Microphone**	Captures the user's speech for processing and translation.
 **PAM 8403**	The PAM8403 is a compact, low-power audio amplifier used to drive clear sound output for the device's mini speakers.

Table 2

Bill of Materials used in the Development of Video Enhancing Application

Qty	Unit	Items/Description	Unit Price	Total Price
1	Piece	Raspberry Pi 4 Model B	₱ 4,500	₱ 4,500
1	Piece	Power Bank	₱ 800	₱ 800
1	Piece	USB Microphone	₱ 105	₱ 105
1	Piece	PAM 8403	₱ 20	₱ 20
Total			₱ 5,425	

Table 2 presents the materials, devices, and components used in the development of the Portable Speech Translation Device. It includes the quantity,

unit, items/description, unit price, and total price, which amounts to ₱ 7,740.00 spent on developing the prototype.

Figure 3

Visual Presentation of the Developed Portable Language Translator Device for Cebuano and Tagalog Speakers

Figure 3 is a prototype language translator device designed with portability and usability in mind, combining advanced hardware and software components to facilitate real-time translation between Cebuano and Tagalog. The device features a compact and durable housing made of lightweight materials, ensuring portability

for users in various environments. It integrates functional parts, such as a central processing unit with a Raspberry Pi 4 Model B, a USB mini microphone for voice input capture, and speakers connected via an amplifier module for audio output delivery.

Inside, it uses a 10,000mAh power bank, which provides reliability and portability without needing to draw power from any external source. The Raspberry Pi processes input from the microphone, turning it to text through speech recognition. This text is then translated using Google API services that are accessed by a USB broadband stick. Once it has been translated, it changes back to speech, and it gets outputted from the speakers. The interconnection of this system occurs by jumper wires; jumper wires connect all the different components appropriately so that each part functions smoothly.

The design has three touch buttons that enable users to access features such as choosing an input/output language or requesting translation. The three buttons are strategically located to enable easy access. The small housing has a glossy outside and still keeps the contents secure and safe from harm. Overall, this device combines functionality, portability, and simplicity to efficiently bridge real-time language barriers.

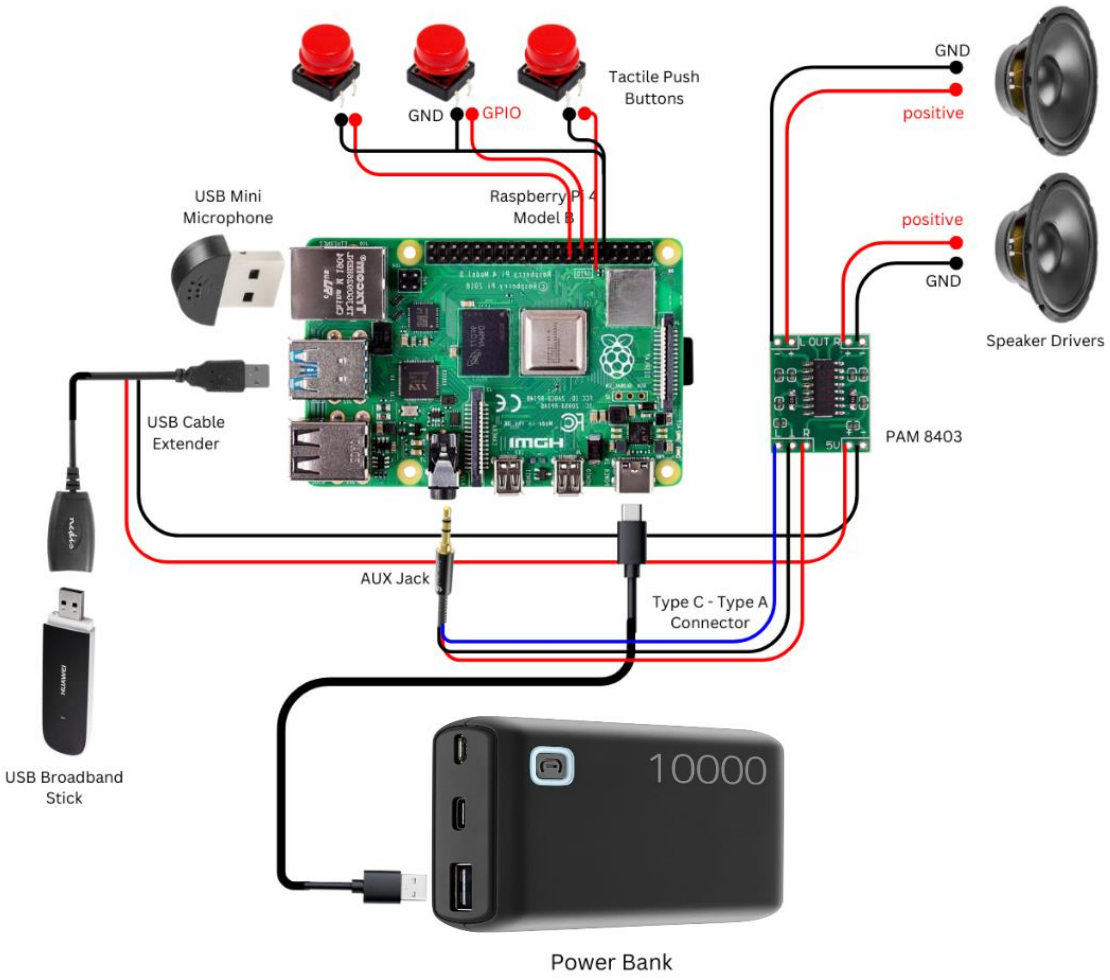

Figure 4

Pictorial Diagram of the Developed Portable Language Translator Device for Cebuano and Tagalog Speakers

Figure 5 provides a detailed illustration of the connections between the various materials and components within the portable language translator device for Tagalog and Cebuano speakers. The device is powered by a 10,000mAh power bank, which supplies energy to the Raspberry Pi Model 4, ensuring its portability and functionality. The Raspberry Pi serves as the central processing unit, handling

translation tasks and controlling the input and output. A USB mini microphone is connected to the Raspberry Pi, allowing users to input their voice. The voice is processed for translation, while three tactile push buttons connected to the GPIO pins provide additional functionality, such as selecting a language or initiating the translation process.

For audio output, the PAM8403 amplifier module is connected to the Raspberry Pi via an AUX jack, amplifying the signal for the two speaker drivers. These speakers, wired with positive and GND terminals, play back the translated voice clearly. To enable internet connectivity, a USB broadband stick is plugged into one of the Raspberry Pi's USB ports via USB Cable Extender, facilitating real-time translation. The power bank supplies energy to the system using a Type-C to Type-A cable, making the device fully portable and functional in various locations. This configuration ensures a seamless, user-friendly device for facilitating communication between Tagalog and Cebuano speakers.

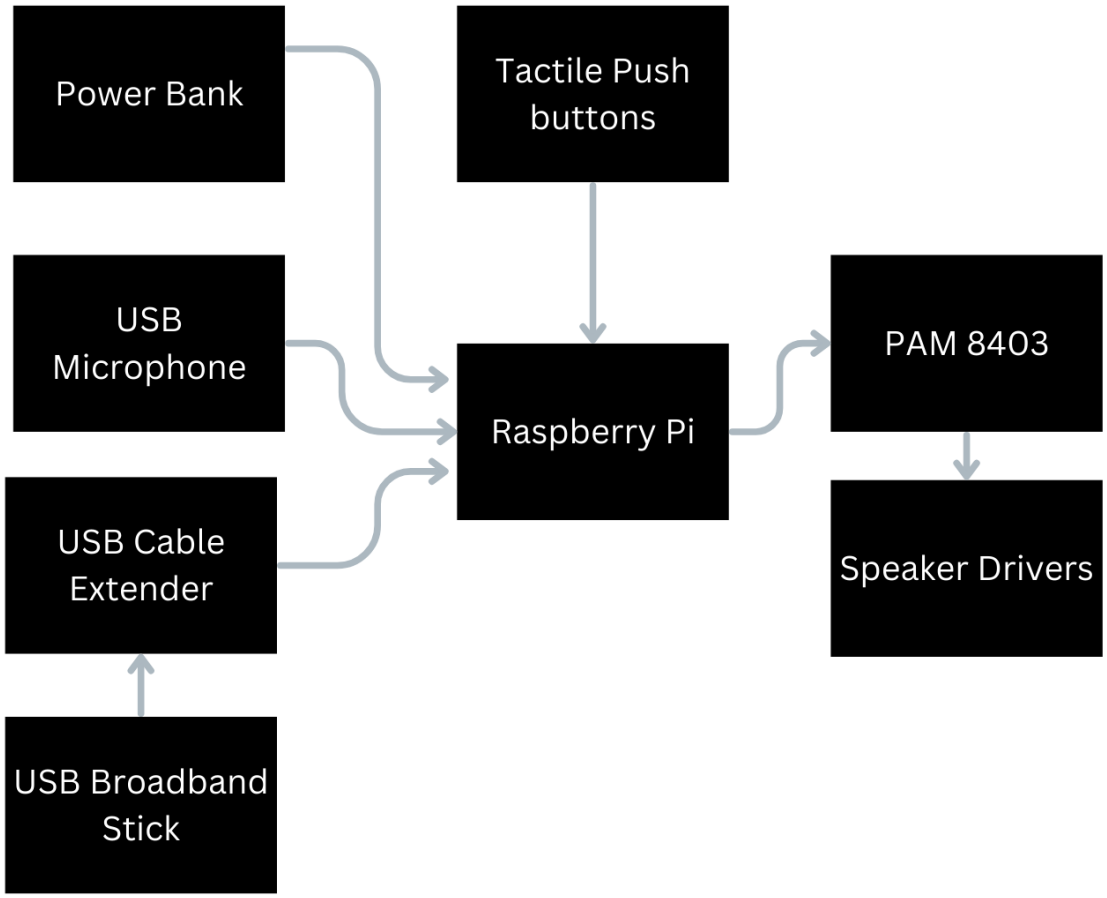

Figure 5

Block Diagram of the Developed Portable Language Translator Device for Cebuano and Tagalog Speakers

Figure X illustrates the block diagram of the portable language translator device, demonstrating the flow of operations from user input to audio output. The diagram emphasizes the interaction between the core components, showing how they work together to achieve the desired functionality.

At the center of the system is the Raspberry Pi, which serves as the main processing unit. The system begins with the user speaking into the USB

microphone, connected through a USB cable extender for added flexibility. The Raspberry Pi processes the captured audio and uses the internet connection provided by the USB broadband stick to perform real-time language translation.

The tactile push buttons, connected to the GPIO pins, enable the user to control the device by selecting specific actions or switching between languages. Once the translation is complete, the Raspberry Pi sends the audio output to the PAM8403 amplifier, which boosts the signal and drives the speaker drivers for clear audio playback. The entire system is powered by a portable power bank, ensuring reliable and mobile operation.

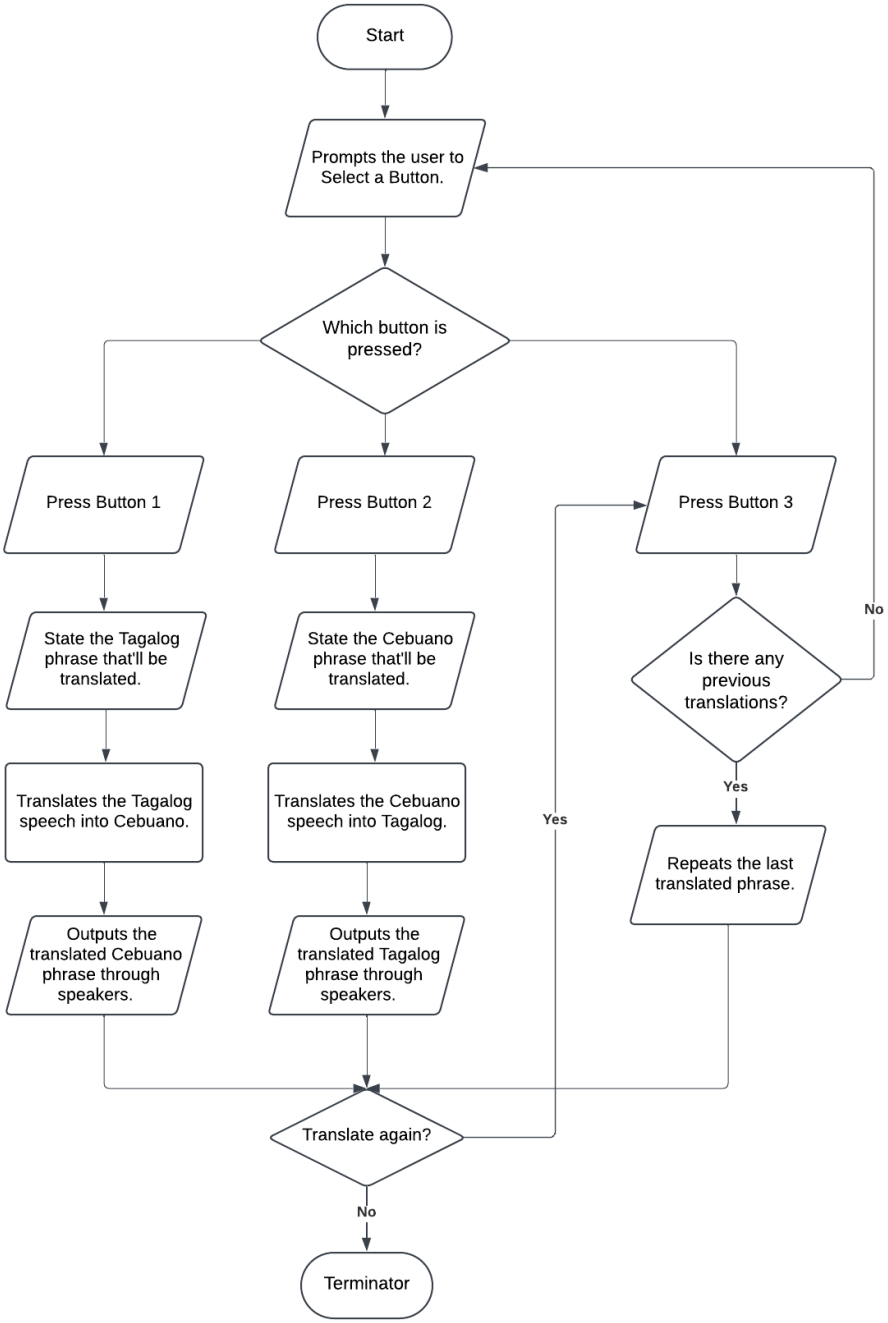

Figure 6

Flowchart of the Developed Portable Language Translator Device for Cebuano and Tagalog Speakers

Figure 6 illustrates the flowchart for the operational logic of a portable language translator device designed for Tagalog and Cebuano speakers. The flow begins when the user presses one of the designated buttons to indicate their desired translation mode. Three buttons are available: one for Tagalog-to-Cebuano translation, another for Cebuano-to-Tagalog translation, and a third to repeat the last output. The system captures the user's input and determines the corresponding process based on the button pressed.

If the user selects the Tagalog-to-Cebuano button, they are prompted to speak a Tagalog word or phrase, which the device translates into Cebuano. The translated Cebuano word is then outputted through the speaker. Similarly, if the Cebuano-to-Tagalog button is chosen, the user speaks a Cebuano word or phrase, which is translated into Tagalog and outputted audibly. The repeat button replays the most recent translated output without requiring additional input. These processes ensure minimal user interaction, promoting an intuitive and user-friendly experience.

After completing a translation or repeating an output, the system prompts the user to decide whether they want to perform another translation. If the user chooses to continue, the process loops back to the button selection step. Otherwise, the system ends the session. This flowchart demonstrates the device's simplicity and efficiency in facilitating seamless communication between Cebuano and Tagalog speakers.

Acceptability of the Portable Language Translator Device for Tagalog and Cebuano Speakers as Perceived by the Experts and End-users with Respect to Functional Suitability, Performance Efficiency, Usability, Reliability, and Portability

The acceptability of the Portable Language Translator Device (PLTD) was evaluated by gathering feedback from both experts and end-users through structured questionnaires. These tools were designed to capture detailed perspectives on various aspects of the device, such as its usability, reliability, and overall performance. By analyzing the feedback from these two groups, the study aimed to identify strengths and areas for improvement, ensuring the device meets the needs of its intended audience.

Data collected through this process provided insights into how the device performs in real-world scenarios, its ease of use, and the effectiveness of its core features like voice recognition and translation accuracy. This feedback serves as a crucial benchmark for refining the PLTD and enhancing its alignment with user expectations.

Table 1 summarizes the computed mean, standard deviation, and corresponding interpretation of user responses regarding the functional suitability aspect of the device.

Table 3

Computed Mean, Standard Deviation, and Verbal Interpretation on the Level of Acceptability of the Portable Language Translator Device for Tagalog and Cebuano Speakers as Perceived by Experts and End-users in Terms of Functional Suitability

1. Functional Suitability	End-User			Expert		
	Mean	sd	VI	Mean	Sd	VI
1.1. The Portable Language Translator Device or PLTD accurately translates spoken Tagalog or Cebuano to the desired output language (Tagalog or Cebuano) without significant errors.	4.70	0.47	VMA	4.90	0.32	VMA
1.2. The PLTD correctly identifies and translates different speech inputs from various users, regardless of accent or speech clarity.	4.65	0.67	VMA	4.80	0.42	VMA
1.3. The PLTD provides timely and relevant output that matches the user's spoken input and context.	4.90	0.31	VMA	4.80	0.42	VMA
1.4. The PLTD is able to handle a variety of speech patterns and dialects within Tagalog and Cebuano.	4.75	0.44	VMA	4.90	0.32	VMA
1.5. The PLTD maintains the integrity of the translated content, preserving meaning and context accurately.	4.80	0.52	VMA	4.90	0.32	VMA
Overall	4.76	0.48	VMA	4.86	0.36	VMA

Legend: sd-standard deviation, VI – Verbal Interpretation, VMA – Very much acceptable

Table 3 reveals the evaluation results of the Portable Language Translator Device's (PLTD) functional suitability as rated by end-users and experts. The device achieved mean scores of 4.76 (Very Much Acceptable) from end-users and

4.86 (Very Much Acceptable) from experts. These high scores reflect the PLTD's excellent performance in accurately translating Tagalog and Cebuano, handling various dialects and speech patterns, and maintaining the contextual integrity of translations. Notably, the ability to provide timely and relevant output received the highest ratings, indicating its critical role in user satisfaction. This is corroborated by the study of Chen and Liu (2020), which emphasizes that the accuracy and contextual relevance of machine translation significantly influence user satisfaction. Similarly, Reyes et al. (2019) found that language translation tools must effectively handle various dialects and speech patterns to ensure inclusivity and reliability for diverse user groups.

Table 4 summarizes the computed mean, standard deviation, and corresponding interpretation of user responses regarding the performance efficiency aspect of the device.

Table 4

Computed Mean, Standard Deviation, and Verbal Interpretation on the Level of Acceptability of the Portable Language Translator Device for Tagalog and Cebuano Speakers as Perceived by Experts and End-users in Terms of Performance Efficiency

2. Performance Efficiency	End-User			Expert		
	Mean	Sd	VI	Mean	sd	VI
2.1 The PLTD processes and translates speech input quickly, with minimal delay between input and output.	4.45	0.69	VMA	4.40	0.52	VMA
2.2 The PLTD efficiently handles multiple translation tasks in	4.60	0.68	VMA	4.60	0.52	VMA

succession without performance degradation.						
2.3 The PLTD has consistent response time and meets user expectations for real-time translation.	4.60	0.60	VMA	4.80	0.42	VMA
2.4 The PLTD operates smoothly without noticeable lag or performance issues under typical usage conditions.	4.35	0.67	VMA	4.60	0.70	VMA
2.5 The PLTD uses system resources efficiently, avoiding excessive battery drain or processor load.	4.75	0.44	VMA	4.90	0.32	VMA
Overall	4.55	0.62	VMA	4.66	0.49	VMA

Table 4 shows that in terms of performance efficiency, the Portable Language Translator Device (PLTD) received ratings of 4.55 (Very Much Acceptable) from end-users and 4.66 (Very Much Acceptable) from experts. These ratings indicate that the PLTD performs well in translating inputs quickly, handling multiple tasks efficiently, and maintaining consistent response times. The highest-rated item by experts was the device's efficient use of system resources, with a score of 4.90, highlighting its capability to manage performance without excessive energy consumption. This is supported by the study of Cho et al. (2014), which emphasizes that efficient real-time processing in translation devices is crucial for minimizing delays between input and output. Their research highlights the need for systems that can handle multiple translation tasks consecutively without performance degradation. Similarly, Vaswani et al. (2017) stress the importance of optimizing system resources in neural machine translation models to ensure smooth operation without excessive processor or battery load. These studies align

with the PLTD's performance in maintaining real-time translation while conserving system resources.

Table 5 summarizes the computed mean, standard deviation, and corresponding interpretation of user responses regarding the usability aspect of the device.

Table 5

Computed Mean, Standard Deviation, and Verbal Interpretation on the Level of Acceptability of the Portable Language Translator Device for Tagalog and Cebuano Speakers as Perceived by Experts and End-users in Terms of Usability

3. Usability	End-User			Expert		
	Mean	sd	VI	Mean	sd	VI
3.1 The PLTD has a button interface that is easy to understand and navigate, even for first-time users.	4.80	0.52	VMA	4.90	0.32	VMA
3.2 The PLTD has buttons that are clearly labeled, making it straightforward to operate without requiring a manual.	4.85	0.37	VMA	4.80	0.42	VMA
3.3 The PLTD has a design that facilitates comfortable handling and operation, avoiding any user strain or difficulty.	4.70	0.47	VMA	4.90	0.32	VMA
3.4 The PLTD includes a clear and user-friendly guide or manual for troubleshooting and usage instructions.	4.80	0.41	VMA	5.00	0.00	VMA
Overall	4.79	0.44	VMA	4.90	0.26	VMA

The usability of the Portable Language Translator Device (PLTD) was rated as Very Much Acceptable (VMA) by both end-users and experts, with overall mean

scores of 4.79 and 4.90, respectively. The device was praised for its easy-to-understand button interface (4.80 end-user, 4.90 expert) and clearly labeled buttons, which enable straightforward operation even without a manual (4.85 end-user, 4.80 expert). Users also noted that the PLTD's design facilitates comfortable handling, minimizing strain or difficulty during use (4.70 end-user, 4.90 expert). Additionally, the inclusion of a clear and user-friendly guide or manual was highly appreciated, especially by experts, who gave it a perfect rating of 5.00. These findings highlight the importance of intuitive design in ensuring accessibility and ease of use for diverse users. As emphasized in a study by Norman (2013), user-friendly interfaces improve device acceptance and satisfaction, particularly for first-time users.

Table 6 summarizes the computed mean, standard deviation, and corresponding interpretation of user responses regarding the reliability aspect of the device.

Table 6

Computed Mean, Standard Deviation, and Verbal Interpretation on the Level of Acceptability of the Portable Language Translator Device for Tagalog and Cebuano Speakers as Perceived by Experts and End-users in Terms of Reliability

4. Reliability	End-User			Expert		
	Mean	sd	VI	Mean	sd	VI
4.1 The PLTD consistently performs accurate translations without frequent errors or failures.	4.75	0.55	VMA	4.90	0.32	VMA
4.2 The PLTD operates reliably in environments with	4.15	0.81	VA	4.60	0.52	VMA

high background noise, such as crowded public spaces.						
4.3 The PLTD maintains stable performance over time, with minimal need for recalibration or maintenance.	4.65	0.49	VMA	4.80	0.42	VMA
4.4 The PLTD handles unexpected inputs or errors gracefully, providing appropriate error messages.	4.75	0.64	VMA	5.00	0.00	VMA
4.5 The PLTD is durable and withstands typical wear and tear associated with regular use.	4.50	0.69	VMA	4.80	0.42	VMA
Overall	4.56	0.64	VMA	4.82	0.34	VMA

The reliability of the PLTD was also rated as Very Much Acceptable (VMA) by end-users (4.56) and experts (4.82). The device was commended for consistently performing accurate translations without frequent errors (4.75 end-user, 4.90 expert) and its ability to operate reliably in noisy environments, such as crowded public spaces (4.15 end-user, 4.60 expert). Additionally, the PLTD maintained stable performance over time with minimal need for recalibration or maintenance (4.65 end-user, 4.80 expert) and handled unexpected inputs gracefully, providing appropriate error messages (4.75 end-user, 5.00 expert). The device's durability, withstanding wear and tear associated with regular use, also received favorable ratings (4.50 end-user, 4.80 expert). These findings align with the study by Kumar et al. (2020), which emphasizes that reliability and robustness are critical factors in ensuring the long-term usability of portable electronic devices.

Table 7 summarizes the computed mean, standard deviation, and corresponding interpretation of user responses regarding the portability aspect of the device.

Table 7

Computed Mean, Standard Deviation, and Verbal Interpretation on the Level of Acceptability of the Portable Language Translator Device for Tagalog and Cebuano Speakers as Perceived by Experts and End-users in Terms of Portability

5. Portability	End-User			Expert		
	Mean	sd	VI	Mean	sd	VI
5.1 The PLTD is compact and lightweight, making it easy to carry and use in different locations.	4.65	0.59	VMA	4.60	0.70	VMA
5.2 The PLTD operates effectively in various environmental settings, such as different rooms or outdoor locations.	4.65	0.59	VMA	4.60	0.70	VMA
5.3 The PLTD does not require special setup or adjustments when moving between different usage scenarios.	4.80	0.41	VMA	4.70	0.48	VMA
The PLTD has a design that allows for easy transport without risk of damage.	4.70	0.47	VMA	4.70	0.67	VMA
The PLTD accommodates different user needs and preferences, adapting to various contexts of use.	4.85	0.37	VMA	4.90	0.32	VMA
Overall	4.73	0.48	VMA	4.70	0.57	VMA

Table 7 indicates that in terms of portability, end-users and experts rated the Portable Language Translator Device (PLTD) with mean scores of 4.73 and 4.70, respectively, both corresponding to "Very Much Acceptable." This suggests that

both groups highly value the device's portability, likely due to its compact and lightweight design, which facilitates easy transport and use across various locations without the need for special setup. This is supported by the study of Parra et al. (2018), which states that a hand-held translation system enhances user convenience and adaptability in diverse environments.

Table 8 shows the composite table on the level of acceptability of the Portable Language Translator Device for Tagalog and Cebuano Speakers concerning Functional Suitability, Performance Efficiency, Usability, Reliability, and Portability.

Table 8

Composite Table of the Computed Mean of the Level of Acceptability of the of the Portable Language Translator Device for Tagalog and Cebuano Speakers

Aspects	End-User		Expert	
	Overall Mean	**Verbal Interpretation**	**Overall Mean**	**Verbal Interpretation**
1. Functional Suitability	4.76	VMA	4.86	VMA
2. Performance Efficiency	4.55	VMA	4.66	VMA
3. Usability	4.79	VMA	4.90	VMA
4. Reliability	4.56	VMA	4.82	VMA
5. Portability	4.73	VMA	4.70	VMA
Grand Mean	4.68	VMA	4.79	VMA

Table 8 reveals that the Portable Language Translator Device (PLTD) for Tagalog and Cebuano speakers achieved a grand mean score of 4.68 ("Very Much

Acceptable") from end-users and 4.79 ("Very Much Acceptable") from experts across all evaluated aspects. This indicates that both groups regard the PLTD as highly acceptable, with particular strengths in Usability (4.79 and 4.90) and Functional Suitability (4.76 and 4.86). The results suggest that the device effectively meets user needs, performs efficiently, and adapts well to different contexts of use.

This is supported by the study of Camburn et al. (2017), which emphasizes that a well-designed prototype significantly impacts resource efficiency, project success, and user satisfaction, ultimately contributing to the innovation and usability of new technologies.

Table 9 presents the analysis of variance on the level of acceptability of the Portable Language Translator Device for Tagalog and Cebuano Speakers.

Table 9

Independent T-Test of the Perception of Experts and End-Users on the Level of Acceptability of the Portable Language Translator Device for Tagalog and Cebuano Speakers

Aspects	Respon-dents	Mean	Vari-ance	df	t-valu e	p-valu e	Ho	VI
1. **Functional Suitability**	Experts	4.86	0.06	25	-0.88	0.37	FR	NS
	End-Users	4.76	0.13					
2. **Performanc e Efficiency**	Experts	4.66	0.12	25	-0.72	0.48	FR	NS
	End-Users	4.55	0.24					
3. **Usability**	Experts	4.90	0.03	28	-1.16	0.26	FR	NS
	End-Users	4.79	0.13					
4. **Reliability**	Experts	4.82	0.08	27	-1.89	0.07	FR	NS
	End-Users	4.56	0.23					
5. **Portability**	Expert	4.70	0.22	13	0.18	0.86	FR	NS

	End-Users	4.73	0.10					

Legend: df- degree of freedom, Ho- Null Hypothesis, FR – Fail to Reject, NS – Not significant

The analysis from Table 9 indicates that for all evaluated aspects—Functional Suitability, Performance Efficiency, Usability, Reliability, and Portability—the null hypothesis (stating no significant difference between expert and end-user perceptions) was not rejected, as all p-values exceeded the 0.05 significance threshold. This suggests a consensus between experts and end-users regarding the acceptability of the PLTD.

These findings align with the study by Alexandre et al. (2018), which emphasizes that both acceptability (pre-use judgment) and acceptance (post-use evaluation) are crucial in understanding user interactions with new technologies. Their research highlights that consistent evaluations across different user groups can indicate a well-designed product that meets diverse user expectations.

Chapter 4

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the findings derived from the collected data. It also includes the researchers' conclusions and recommendations for future studies.

Summary of Findings

The following key insights have been drawn from the comprehensive analysis of the data collected and the outcomes discussed earlier:

1. **On the Development of The Portable Language Translator Device for Tagalog and Cebuano Speakers.**

   As demonstrated in the visual representations, the researchers successfully developed an effective Portable Language Translator Device for Tagalog and Cebuano Speakers by utilizing programming languages, flowcharts, diagrams, and a selection of components and materials.

2. **On The Level of Acceptability of The Portable Language Translator Device for Tagalog and Cebuano Speakers in Terms of Functional Suitability, Performance Efficiency, Usability, Reliability, and Portability.**

   2.1. The functional suitability of the PLTD was rated as Very Much Acceptable, with an overall mean score of 4.76 from end-users and 4.86 from experts. The device was particularly commended for its

accurate translation capabilities, ability to manage diverse dialects and speech patterns, and its contextual accuracy.

2.2. In terms of performance efficiency, the PLTD achieved mean scores of 4.55 from end-users and 4.66 from experts, both interpreted as Very Much Acceptable. Experts gave the highest rating to the device's efficient use of system resources (4.90), reflecting its ability to manage tasks without excessive energy consumption.

2.3. Usability was also rated as Very Much Acceptable, with end-users giving an overall mean score of 4.79 and experts assigning a slightly higher score of 4.90. Both groups appreciated the device's user-friendly interface, clearly labeled buttons, and intuitive operation. The manual provided with the PLTD received a perfect score (5.00) from experts, emphasizing the importance of comprehensive user guidance.

2.4 The reliability of the PLTD was evaluated as Very Much Acceptable, with mean scores of 4.56 from end-users and 4.82 from experts. The device consistently performed accurate translations (4.75 end-user, 4.90 expert) and maintained stable operation in noisy environments (4.15 end-user, 4.60 expert). Its ability to handle unexpected inputs and provide appropriate error messages also received favorable ratings (4.75 end-user, 5.00 expert).

2.5. The portability of the PLTD was rated as Very Much Acceptable, with end-users assigning a mean score of 4.73 and experts rating it at 4.70. The device's compact and lightweight design allowed for easy transport and operation in various settings, making it highly practical for mobile use.

2.6. The grand mean scores of 4.68 from end-users and 4.79 from experts confirm that the PLTD is considered Very Much Acceptable across all criteria. Usability (4.79 end-user, 4.90 expert) and Functional Suitability (4.76 end-user, 4.86 expert) emerged as the device's most notable strengths.

3. On The Significant Difference in The Respondents' Evaluation of The Level of Acceptability of The Portable Language Translator Device for Tagalog and Cebuano Speakers as Perceived by Experts and End-Users in Terms of Functional Suitability, Performance Efficiency, Usability, Reliability, and Portability.

The analysis of differences between expert and end-user evaluations across all criteria—Functional Suitability, Performance Efficiency, Usability, Reliability, and Portability—revealed no significant difference in their perceptions. All p-values exceeded the significance threshold of 0.05, leading to the non-rejection of the null hypothesis. This indicates a consensus between the two groups regarding the PLTD's high level of acceptability.

Conclusion

Based on the summary of findings and the results obtained, the following conclusions are drawn:

1. The Portable Language Translator Device (PLTD) excelled in translating Tagalog and Cebuano efficiently and accurately, earning high ratings in all evaluation criteria and proving its effectiveness in real-world use.

2. Multiple trials and evaluations confirmed that the PLTD consistently performed its intended functions effectively, showcasing its ability to translate accurately, maintain consistent response times, and manage unexpected inputs gracefully.

3. Both expert and end-user respondents expressed a high level of satisfaction with the PLTD, with the device achieving "Very Much Acceptable" ratings across all evaluation criteria. This indicates the device's success in meeting diverse user expectations.

4. Statistical analysis revealed no significant difference in the perceptions of experts and end-users regarding the acceptability of the PLTD. The null hypothesis, which posited no significant difference between the groups, was not rejected, indicating a consensus between the two groups. The findings affirm PLTD’s acceptability as a robust and reliable solution for enhancing communication between Tagalog and Cebuano speakers.

Recommendations

Based on the summary of findings and conclusions drawn, the following recommendations are suggested:

1. To further enhance portability, the researchers recommend exploring more compact and lightweight alternatives to improve the device's convenience and usability across various locations such as schools, offices, and public spaces.
2. Consider integrating additional features, such as support for more languages or dialects, to expand the device's applicability and appeal to a broader audience.
3. To improve performance efficiency and reliability, future iterations could incorporate advanced materials and components to optimize processing speed, energy consumption, and durability.
4. Researchers should focus on refining the device's user interface and functionality based on real-world feedback, ensuring accessibility for users with varying levels of technical expertise.
5. Future researchers could explore adding innovative features, such as offline translation capabilities or enhanced security measures, to further improve the device's versatility and functionality.

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Appendix A

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal

CERTIFICATE OF CONTENT VALIDATION

This is to certify that the following experts validated the researchers-made Questionnaire Checklist for the undergraduate thesis titled **"PORTABLE LANGUAGE TRANSLATOR DEVICE FOR CEBUANO AND TAGALOG SPEAKERS"** has been validated by the experts.

(Sgd.) **JOHN DENNIS Z. ESPIRITU, MIT**

(Sgd.) **EVA B. MARANAN, Ph. D**

(Sgd.) **RAYMUNDO M. ROSALES, RECE**

(Sgd.) **FROILAN JOSEPH P. PAZ, CpE**

(Sgd.) **MICHAEL B. INTIA, Ph. D**

Noted by:

JUAN PAULO D. JURADA, RECE, ECT
Research Adviser

Appendix B

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal

Portable Language Translator Device - Translation Record Sheet

This record sheet is designed to document and compare the device-generated translations with the correct reference translations from **Tagalog to Cebuano.**

Simple		
Input Sentence	**Translated Sentence**	**Correct Translation**
1.		
2.		
3.		
Moderate		
Input Sentence	**Translated Sentence**	**Correct Translation**
1.		
2.		
3.		
Complex		
Input Sentence	**Translated Sentence**	**Correct Translation**
1.		
2.		
3.		

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal

Portable Language Translator Device - Translation Record Sheet

This record sheet is designed to document and compare the device-generated translations with the correct reference translations from **Cebuano to Tagalog.**

Simple		
Input Sentence	**Translated Sentence**	**Correct Translation**
1.		
2.		
3.		
Moderate		
Input Sentence	**Translated Sentence**	**Correct Translation**
1.		
2.		
3.		
Complex		
Input Sentence	**Translated Sentence**	**Correct Translation**
1.		
2.		
3.		

Appendix C

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal

Accuracy Evaluation Sheet of the Portable Language Translator Device

Evaluator Name: _____ Date: _____

Directions: Please check (✓) the appropriate column to score the accuracy and meaning of translations generated by the developed translation device from **Tagalog to Cebuano.**

Score	Description
5	The translation perfectly conveys the meaning and is grammatically correct.
4	The translation conveys the meaning accurately but with minor grammatical errors.
3	The translation conveys most of the meaning, but some details are missing or incorrect.
2	The translation conveys only part of the meaning, with significant errors or omissions.
1	The translation fails to convey the meaning or is incomprehensible.

A. Simple

Sentence / Phrase	5	4	3	2	1
1					
2					
3					

B. Moderate

Sentence / Phrase	5	4	3	2	1
1					
2					
3					

C. Complex

Sentence / Phrase	5	4	3	2	1
1					
2					
3					

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal

Accuracy Evaluation Sheet of the Portable Language Translator Device

Evaluator Name: _____ Date: _____

Directions: Please check (✓) the appropriate column to score the accuracy and meaning of translations generated by the developed translation device from **Cebuano to Tagalog.**

Score	Description
5	The translation perfectly conveys the meaning and is grammatically correct.
4	The translation conveys the meaning accurately but with minor grammatical errors.
3	The translation conveys most of the meaning, but some details are missing or incorrect.
2	The translation conveys only part of the meaning, with significant errors or omissions.
1	The translation fails to convey the meaning or is incomprehensible.

A. Simple

Sentence / Phrase	5	4	3	2	1
1					
2					
3					

B. Moderate

Sentence / Phrase	5	4	3	2	1
1					
2					
3					

C. Complex

Sentence / Phrase	5	4	3	2	1
1					
2					
3					

Appendix D

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal

Portable Language Translator Device - Response Time Record Sheet

This scoring sheet is designed to assess the response time of translations generated by the developed language translation device from Tagalog to Cebuano.

A. Simple

Sentence / Phrase	Response Time	
	Tagalog to Cebuano	Cebuano to Tagalog
1	8.5 seconds	5.7 seconds
2	7.3 seconds	6.1 seconds
3	6.7 seconds	10.2 seconds

B. Moderate

Sentence / Phrase	Response Time	
	Tagalog to Cebuano	Cebuano to Tagalog
1	9.6 seconds	7.3 seconds
2	7.3 seconds	14. 2 seconds
3	5.2 seconds	5.4 seconds

C. Complex

Sentence / Phrase	Response Time	
	Tagalog to Cebuano	Cebuano to Tagalog
1	10 seconds	14.5 seconds
2	10.3 seconds	13.5 seconds
3	10.1 seconds	13.2 seconds

Appendix E

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal

QUESTIONNAIRE CHECKLIST

PORTABLE LANGUAGE TRANSLATOR DEVICE FOR CEBUANO AND TAGALOG SPEAKERS

Name (Optional): _____

Type of Respondents: ☐ Non-Expert
☐ Expert

Directions: Please check (✓) the appropriate column to rate the level of acceptability of the Portable Language Translator Device for Cebuano And Tagalog Speakers.

5 – Very Much Accepted

4 – Very Accepted

3 – Accepted

2 – Less Accepted

1 – Not Accepted

1.	**Functional Suitability**	**5**	**4**	**3**	**2**	**1**
1.1.	The Portable Language Translator Device or PLTD accurately translates spoken Tagalog or Cebuano to the desired output language (Tagalog or Cebuano) without significant errors.					
1.2.	The PLTD correctly identifies and translates different speech inputs from various users, regardless of accent or speech clarity.					
1.3.	The PLTD provides timely and relevant output that matches the user's spoken input and context.					
1.4.	The PLTD is able to handle a variety of speech patterns and dialects within Tagalog and Cebuano.					

1.5.	The PLTD maintains the integrity of the translated content, preserving meaning and context accurately.					
2.	**Performance Efficiency**	**5**	**4**	**3**	**2**	**1**
2.1.	The PLTD processes and translates speech input quickly, with minimal delay between input and output.					
2.2.	The PLTD efficiently handles multiple translation tasks in succession without performance degradation.					
2.3.	The PLTD has consistent response time and meets user expectations for real-time translation.					
2.4.	The PLTD operates smoothly without noticeable lag or performance issues under typical usage conditions.					
2.5.	The PLTD uses system resources efficiently, avoiding excessive battery drain or processor load.					
3.	**Usability**	**5**	**4**	**3**	**2**	**1**
3.1.	The PLTD has a button interface that is easy to understand and navigate, even for first-time users.					
3.2.	The PLTD has buttons that are clearly labeled, making it straightforward to operate without requiring a manual.					
3.3.	The PLTD has a design that facilitates comfortable handling and operation, avoiding any user strain or difficulty.					
3.4.	The PLTD includes a clear and user-friendly guide or manual for troubleshooting and usage instructions.					
4.	**Reliability**	**5**	**4**	**3**	**2**	**1**
4.1	The PLTD consistently performs accurate translations without frequent errors or failures.					
4.2.	The PLTD operates reliably in environments with high background noise, such as crowded public spaces.					
4.3.	The PLTD maintains stable performance over time, with minimal need for recalibration or maintenance.					
4.4.	The PLTD handles unexpected inputs or errors gracefully, providing appropriate error messages.					
4.5.	The PLTD is durable and withstands typical wear and tear associated with regular use.					
5.	**Portability**	**5**	**4**	**3**	**2**	**1**

5.1.	The PLTD is compact and lightweight, making it easy to carry and use in different locations.					
5.2.	The PLTD operates effectively in various environmental settings, such as different rooms or outdoor locations.					
5.3.	The PLTD does not require special setup or adjustments when moving between different usage scenarios.					
5.4.	The PLTD has a design that allows for easy transport without risk of damage.					
5.5.	The PLTD accommodates different user needs and preferences, adapting to various contexts of use.					

Appendix F

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal
College of Engineering

April 22, 2024

ENGR. JUAN PAULO D. JURADA
Instructor

Dear Engr. Jurada:

Greetings!

We are undergraduate students from the College of Engineering at the University of Rizal System, Antipolo City, and are currently developing our thesis titled "Portable Language Translator Device for Cebuano and Tagalog Speakers." Our project aims to create a user-friendly, portable device that facilitates effortless communication between Tagalog and Cebuano speakers.

We seek your guidance as our adviser to help us structure our research effectively, manage documentation thoroughly, and ensure adherence to academic standards. Your oversight and expert advice would be invaluable in enhancing the success of our project.

We are looking forward to receiving your positive response.

Respectfully yours,

Jarius Miguel C. Ballesteros
Josh Vernon G. Barcenal
Kheil Anthony S. Cunanan
Jhestin I. Digap
Researchers

Conforme:

ENGR. JUAN PAULO D. JURADA
Instructor

Appendix G

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal
College of Engineering

April 22, 2024

ENGR. JOHN DENNIS Z. ESPIRITU
Instructor

Dear Engr. Espiritu:

Greetings!

We are undergraduate students from the College of Engineering at the University of Rizal System, Antipolo City, and are currently developing our thesis titled "Portable Language Translator Device for Cebuano and Tagalog Speakers." Our project aims to create a user-friendly, portable device that facilitates effortless communication between Tagalog and Cebuano speakers.

We are requesting your esteemed feedback to critically evaluate our proposal and share your expert insights during a session scheduled for May 3, 2024, from 11:15 AM to 11:55 AM. Your suggestions will be crucial in enhancing the functionality and effectiveness of our translation device.

We are looking forward to receiving your positive response.

Respectfully yours,

Jarius Miguel C. Ballesteros
Josh Vernon G. Barcenal
Kheil Anthony S. Cunanan
Jhestin I. Digap
Researchers

Noted by:

ENGR. JUAN PAULO D. JURADA
Research Adviser

Conforme:

ENGR. JOHN DENNIS Z. ESPIRITU
Instructor

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal
College of Engineering

April 22, 2024

ENGR. FROILAN JOSEPH P. PAZ
Instructor

Dear Engr. Paz:

Greetings!

We are undergraduate students from the College of Engineering at the University of Rizal System, Antipolo City, and are currently developing our thesis titled "Portable Language Translator Device for Cebuano and Tagalog Speakers." Our project aims to create a user-friendly, portable device that facilitates effortless communication between Tagalog and Cebuano speakers.

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We are looking forward to receiving your positive response.

Respectfully yours,

Jarius Miguel C. Ballesteros
Josh Vernon G. Barcenal
Kheil Anthony S. Cunanan
Jhestin I. Digap
Researchers

Noted by:

ENGR. JUAN PAULO D. JURADA
Research Adviser

Conforme:

ENGR. FROILAN JOSEPH P. PAZ
Instructor

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal
College of Engineering

April 22, 2024

DR. MICHAEL B. INTIA
Instructor

Dear Dr. Intia:

Greetings!

We are undergraduate students from the College of Engineering at the University of Rizal System, Antipolo City, and are currently developing our thesis titled "Portable Language Translator Device for Cebuano and Tagalog Speakers." Our project aims to create a user-friendly, portable device that facilitates effortless communication between Tagalog and Cebuano speakers.

We are requesting your esteemed feedback to critically evaluate our proposal and share your expert insights during a session scheduled for May 3, 2024, from 11:15 AM to 11:55 AM. Your suggestions will be crucial in enhancing the functionality and effectiveness of our translation device.

We are looking forward to receiving your positive response.

Respectfully yours,

Jarius Miguel C. Ballesteros
Josh Vernon G. Barcenal
Kheil Anthony S. Cunanan
Jhestin I. Digap
Researchers

Noted by:

ENGR. JUAN PAULO D. JURADA
Research Adviser

Conforme:

DR. MICHAEL B. INTIA
Instructor

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal
College of Engineering

April 22, 2024

DR. WILFREDO P. MARIÑO
Instructor

Dear Dr. Mariño:

Greetings!

We are undergraduate students from the College of Engineering at the University of Rizal System, Antipolo City, and are currently developing our thesis titled "Portable Language Translator Device for Cebuano and Tagalog Speakers." Our project aims to create a user-friendly, portable device that facilitates effortless communication between Tagalog and Cebuano speakers.

We are requesting your esteemed feedback to critically evaluate our proposal and share your expert insights during a session scheduled for May 3, 2024, from 11:15 AM to 11:55 AM. Your suggestions will be crucial in enhancing the functionality and effectiveness of our translation device.

We are looking forward to receiving your positive response.

Respectfully yours,

Jarius Miguel C. Ballesteros
Josh Vernon G. Barcenal
Kheil Anthony S. Cunanan
Jhestin I. Digap
Researchers

Noted by:

ENGR. JUAN PAULO D. JURADA
Research Adviser

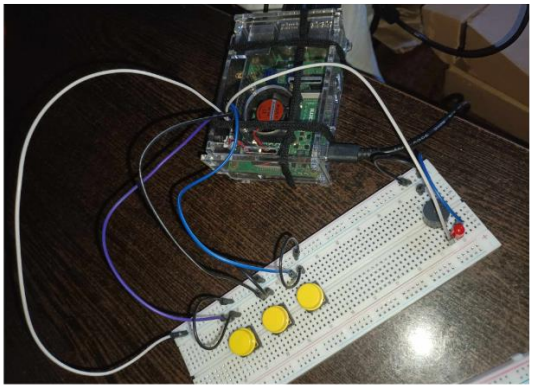
Conforme:

DR. WILFREDO P. MARIÑO
Instructor

Appendix H

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal

DOCUMENTATION



Appendix I

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal

GANTT CHART

	2024												2025				
Activities	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**
Preparation of Title	■	■															
Title Defense		■															
Preparation of Proposal			■	■													
Proposal Defense					■												
Device Planning						■	■	■									
Device creation						■	■	■	■	■							
Testing the Device										■	■						
Device evaluation											■	■					
Preparation of Ch. 3 onwards											■	■					
Submission of Manuscript (Ch 1-4)												■					
Device additional evaluation													■				
Finalization of device and manuscript													■	■			
Final defense														■			
Finalization of thesis															■	■	■

Appendix J

Republic of the Philippines
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Antipolo City, Rizal

PLAGIARISM CHECK

Appendix K

Republic of the Philippines
UNIVERSITY OF RIZAL SYSTEM
Antipolo City, Rizal
College of Engineering

DATASHEET

A. RASPBERRY PI 4 MODEL B

3 Mechanical Specification

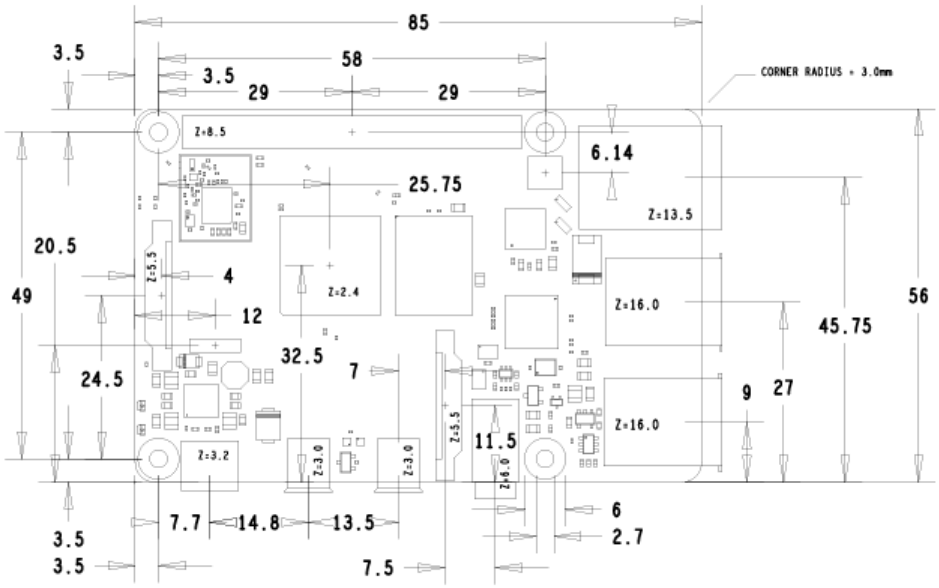

Figure 1: Mechanical Dimensions

4 Electrical Specification

Caution! Stresses above those listed in Table 2 may cause permanent damage to the device. This is a stress rating only; functional operation of the device under these or any other conditions above those listed in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Minimum	Maximum	Unit
VIN	5V Input Voltage	-0.5	6.0	V

Table 2: Absolute Maximum Ratings

Please note that VDD_IO is the GPIO bank voltage which is tied to the on-board 3.3V supply rail.

Symbol	Parameter	Conditions	Minimum	Typical	Maximum	Unit
V_{IL}	Input low voltage[a]	VDD_IO = 3.3V	0	-	0.8	V
V_{IH}	Input high voltage[a]	VDD_IO = 3.3V	2.0	-	VDD_IO	V
I_{IL}	Input leakage current	TA = +85°C	-	-	10	μA
C_{IN}	Input capacitance	-	-	5	-	pF
V_{OL}	Output low voltage[b]	VDD_IO = 3.3V, IOL = -2mA	-	-	0.4	V
V_{OH}	Output high voltage[b]	VDD_IO = 3.3V, IOH = 2mA	VDD_IO - 0.4	-	-	V
I_{OL}	Output low current[c]	VDD_IO = 3.3V, VO = 0.4V	7	-	-	mA
I_{OH}	Output high current[c]	VDD_IO = 3.3V, VO = 2.3V	7	-	-	mA
R_{PU}	Pullup resistor	-	18	47	73	kΩ
R_{PD}	Pulldown resistor	-	18	47	73	kΩ

[a] Hysteresis enabled
[b] Default drive strength (8mA)
[c] Maximum drive strength (16mA)

Table 3: DC Characteristics

Pin Name	Symbol	Parameter	Minimum	Typical	Maximum	Unit
Digital outputs	t_{rise}	10-90% rise time[a]	-	TBD	-	ns
Digital outputs	t_{fall}	90-10% fall time[a]	-	TBD	-	ns

[a] Default drive strength, CL = 5pF, VDD_IO = 3.3V

Table 4: Digital I/O Pin AC Characteristics

Figure 2: Digital IO Characteristics

4.1 Power Requirements

The Pi4B requires a good quality USB-C power supply capable of delivering 5V at 3A. If attached downstream USB devices consume less than 500mA, a 5V, 2.5A supply may be used.

B. POWER BANK

Brand	Bisen
Name	10000 mAh powerbank
Model	BP-131
Interface	USB/USB-C/Micro-USB
Color	Black
Battery Capacity	10000mAh/22.3 W
USB TYPE-C Input:	5V/ 3A 9V/2A 12V/1.5A
USB TYPE-C Output:	5V/3A 5V/4.5A 4.5V/5A 9V/2A 12V/.5A
USB Output:	5V/3A 5V/4.5A 4.5V/5A 9V/2A 12V/1.5A
Type C Cable Output:	5V/3A 5V/4.5A 4.5V/5A 9V/2A 12V/ 1.5A
Lightning cable output:	5V/2A
Material	Color Box
Cable	USB to USB-C

C. USB MICROPHONE

Product:USB Mini Microfone Working voltage: 4.5V Package Included:1 x USB Microphone Use:Computer Microphone Size: 2cm x 2cm x 0.5cm Noise-cancelling microphone filters out unwanted background noise. Power switch illuminates when microphone is active. Advanced digital USB provides superior clarity with the simplicity of a single USB plug and play connection. Can be used with any computers with USB port, plug and play; automatically shielded built-in sound card microphone of computer (certain computer will not shield which only manually switch once.</p>

D. PAM 8403

Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability. All voltages are with respect to ground.

Parameter	Rating	Unit
Supply Voltage	6.0	V
Input Voltage	-0.3 to V_{DD} +0.3V	
Operation Temperature Range	-40 to +85	°C
Maximum Junction Temperature	150	
Operation Junction Temperature	-40 to +125	
Storage Temperature	-65 to +150	
Soldering Temperature	300, 5 sec	

Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Parameter	Rating	Unit
Supply Voltage Range	2.5 to 5.5	V
Operation Temperature Range	-40 to +85	°C
Junction Temperature Range	-40 to +125	°C

Thermal Information

Parameter	Package	Symbol	Max	Unit
Thermal Resistance (Junction to Ambient)	SOP-16	θ_{JA}	110	°C/W
Thermal Resistance (Junction to Case)	SOP-16	θ_{JC}	23	

CURRICULUM VITAE

Jarius Miguel C. Ballesteros

Computer engineering student with expertise in software development, hardware design, and system optimization. Experienced in programming languages such as Vb.net, C++, and Python with a focus on creating scalable and efficient solutions. Skilled in hardware architecture, including microprocessors, circuit design, and embedded systems.

CONTACT

jrsmglctpngbllstrs@gmail.com
@gmail.com
+639667148056
San Jose, Antipolo City

TECHNICAL SKILLS

- Knowledgeable in basic programming languages such as HTML, CSS, Java script, and VB.Net as also as C++ and python
- Have a firm foundation in databases such as MSSQL and MySQL.

SOFT SKILLS

- Communication Skills
- Knowledgeable
- Trustworthy
- Hardworking
- Socializing

EDUCATION

Bachelor Of Computer Engineering
2021-Present
University of Rizal System

EXPERIENCES

University of Rizal System | Supreme Student Government Officer

Aug 2021- May 2023

Managed budget, oversaw financial reporting, led Information Dissemination Committee, and crafted executive decisions.

D&L Industries | Backend Developer

June - July
Skilled in building scalable web applications, proficient in front-end and back-end technologies, and delivering innovative solutions efficiently.

KEY PROJECTS

Bless the City church Website
HTML, CSS
I took part as a User Interface of the system with good User experience.

Movie Ticketing System
PHP, JavaScript, HTML, CSS
Took part as the backend developer for a my sql database of movie ticketing website.

RDCHIME Inventory System
User Interface/ User Experience
Design the system user interface to make it appealing for the user using figma.

Josh Vernon G. Barcenal

Computer Engineering student at the University of Rizal System with a passion for software and web development. Proficient in JavaScript, React.js, VB.NET, Python, HTML, CSS, Java, C++, C#, Tailwind CSS, and Android Studio, with skills in creating interactive front-end interfaces, backend solutions, and mobile applications.

CONTACT

Jvern2603@gmail.com

+6393-609-6781

San Jose, Antipolo, Rizal

TECHNICAL SKILLS

- Familiar with programming languages such as Java, C++, C#, VB.NET, Python.
- Knowledgable in web development such as HTML, CSS, Tailwind, Javascript, React js.
- Experienced with database like Oracle database, MyPHPahmin, XAMPP, SQL Server Management System

SOFT SKILLS

- Communication
- Critical Thinker
- Problem solving
- Commitment to continuous learning.

EDUCATION

Bachelor Of Computer Engineering
2021-Present
University of Rizal System

EXPERIENCES

AP Global IT solutions | Software Engineer

June 2024 - July 2024
Skilled in developing scalable web applications, specializing in front-end and back-end technologies. Focused on delivering innovative solutions with efficiency, performance, and exceptional user experience.

KEY PROJECTS

Cinema Ticketing System

VB.NET, MyPHP
A dedicated system project that is aimed to help cinemas for proficient ticketing system.

Veggies & Fruit Point of Sale System

VB.NET, SQL Server Management System
A commissioned project of a proficient and easy to manage selling of vegetables and fruits.

Mental Health Blog

HTML, CSS, Javascript, MySql
A web blog to be a safe space for people to release their thoughts, feelings, and a professional help.

RDCHIME Inventory System

Node.js, Tailwind
Contributed to the project by handling front-end tasks, and assisting in the design and features implementation.

Kheil Anthony Cunanan

Computer Engineering student at the University of Rizal System, with a passion for software development. Proficient in C#, VB.NET, HTML, CSS, C++, Kotlin, JavaScript, and Python. Proven ability in software development, data structures, and backend web development. Enthusiastic about contributing to a technology-focused organization.

CONTACT

c.kheilanthony@gmail.com

+63919-341-0312

Sto. Domingo, Cainta, Rizal

TECHNICAL SKILLS

- Foundational C# with Microsoft.
- Well-versed in the basics of Visual Basic .NET, HTML, CSS, Kotlin, C++, Python, and JavaScript.
- Familiar with development tools including Visual Code Studio, Visual Studio, Android Development Studio, XAMPP, MSSQL, CodeBlocks.

SOFT SKILLS

- Strong leadership
- Effective communication skills
- Proactive team collaboration
- Commitment to continuous learning.

EDUCATION

Bachelor Of Computer Engineering
2021-Present
University of Rizal System

EXPERIENCES

University of Rizal System | Student Organization Active Leader

Sep 2021 - Present

Managed budget, oversaw financial reporting, led Information Dissemination Committee, and crafted executive decisions.

Zyberlab | Software Engineer

July - Present

Skilled in building scalable web applications, proficient in front-end and back-end technologies, and delivering innovative solutions efficiently.

KEY PROJECTS

Library Management System

VB.NET, MSSQL

Developed a functional system with separate interfaces for students and librarians.

PDF Cloud Storage

PHP, JavaScript, HTML, CSS

Took part as the backend developer for a PDF-specialized cloud storage solution.

RDCHIME Inventory System

Node.js, Tailwind, MongoDB

Led the project, planned task distribution, designed the system architecture, and took part in developing the website.

Jhestin Digap

I am a Computer Engineering student at University of Rizal System, driven by passion for crafting intuitive UI/UX designs and developing engaging web applications. Eager to contribute my skills and creativity to innovative projects and collaborate with like-minded individuals

CONTACT

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TECHNICAL SKILLS

- Well-versed in web development using HTML, CSS, Vanilla JavaScript, React JS, and Next JS.
- Proficient with designing tools such as Canva and Figma.
- Experienced with development tools such as visual code studio, firebase, and git.
- Familiarity with the basics of VB.NET, C++, and Python.

SOFT SKILLS

- Active listening
- Attention to detail
- Commitment to continuous learning.
- Critical Thinking

EDUCATION

Bachelor Of Computer Engineering
2021-Present
University of Rizal System

EXPERIENCES

AP Global IT Solutions | Full Stack Developer

Jun 2024 - July 2024

Focused in developing web applications using various web stacks such as Vanilla JavaScript, React JS and Next JS.

KEY PROJECTS

Self-Service Kiosk System

VB.NET, MSSQL

Developed a self-service kiosk system for customers with a corresponding admin interface for inventory management and customization.

PDF Cloud Storage

PHP, JavaScript, HTML, CSS

Took part as the UI/UX designer and frontend developer of the team for a PDF-specialized cloud storage solution

Game Characters' Information Webpage

HTML, CSS, JavaScript

Created a static webpage containing basic information of Genshin Impact characters.

Remote Controlled Car App

HTML, CSS, JavaScript

Built an RC Car with Arduino Uno, bluetooth module, and various sensors controlled via a custom app that can manage driving modes (Automatic and Manual).