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DIVISION OF PHYSICAL SCIENCES AND MATHEMATICS**

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Filipino Automatic Speech Recognition for Filipino Children Aging six to 14

Chapter 3
Materials and methods

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Chapter III

MATERIALS AND METHODS

This chapter provides an overview of the materials and methods used in this project. The development of the prototype is divided into two phases, the creation of a machine learning model for Filipino speech recognition for Filipino children, and the development of its mobile application.

Development Tools and Software Requirements

For the machine learning phase, the proponents will be utilizing the Python (python3) programming language through an open-source web program called Jupyter Notebook that allows the proponents to collaborate and share project documents with the text, live code, equations, and visuals. The proponents will be using libraries, namely, NumPy, panda, Scikit.learn to build the machine learning model, and matlab and seaborn for data analysis as well as for the results discussions.

For mobile application development, the proponents will be using the Kotlin Programming Language through the use of Android Studio.

For the development of the project, the proponents will be using their respective devices (laptops, computers, phones, etc) for progress tracking, communication, and documentation. A common repository will be used in GitHub for the synchronization of work and the efficient development of best practices.

Entity Relationship Diagram of the Speech Recognition Process

The figure below describes the relationship between the speech recognition system, the user, and the language model. The process starts when the Filipino speech recognition system processes raw recordings of sentences from the user. The Filipino language model contains the phonetic library that consists of sounds used in speech. It

verifies the processed data (computational data that describes the sounds used in speech) and returns the corresponding words based on the data. The speech recognition system recognizes each word in text format and forms it into a sentence and presents the output on the screen. This diagram will be used to implement the functionalities and features and identify the user stories of the prototype.

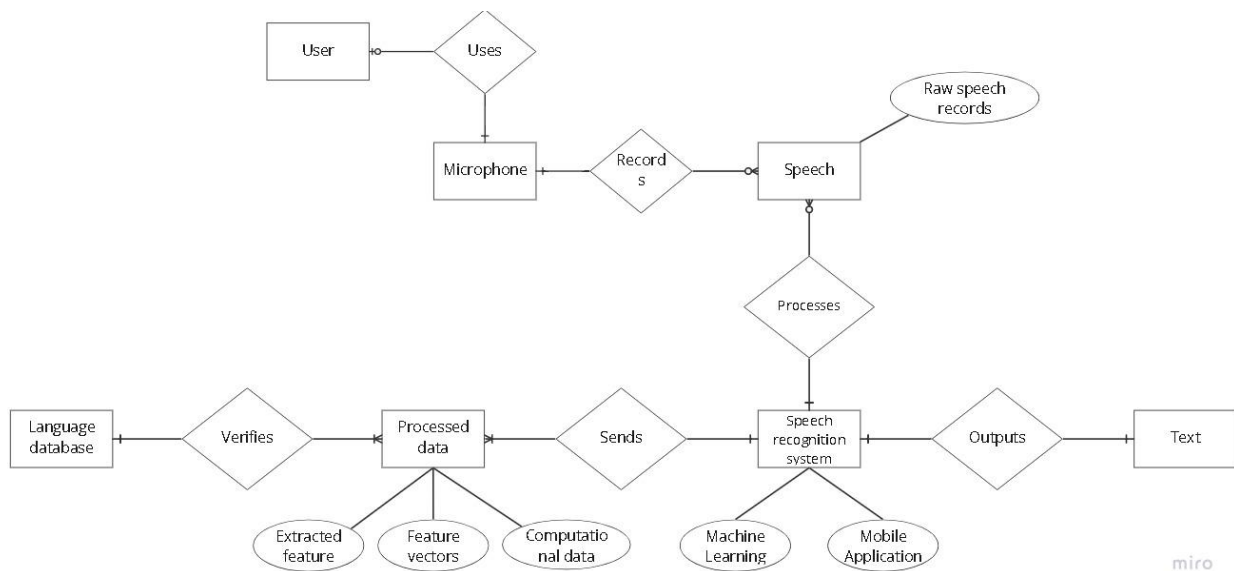


Figure 1. ER Diagram of Speech Recognition Process

Hardware Requirements

Each of the proponents will use a laptop with minimum processor speed and memory required for using the development tools and software requirements mentioned above. Since the proponents will use Github, and Jupyter Notebook, specifically JupyterLab, for collaboration during the development phase, this will require them to have a stable internet connection in order to run the live code simultaneously. The project requires less hardware for the project but focuses more on machine learning and creating a model for a Filipino speech recognition system.

Methodology

In this section, the proponents discussed the software development processes and procedures for developing the prototype. The proponents will follow these methods to ensure the successful development of the software.

I. Software Development Process

The proponents will implement the prototype model. In this model, a quick design is implemented to create the functional prototype to be used for the development of a complete system. Figure 1 shows the steps in implementing the prototype model. In the figure below, the software development will start with requirement gathering. After understanding the needs and user stories, the proponents will decide which features and functionalities to implement on the prototype based on priority in the user stories. After making the decision, the development of the prototype will begin. After building the prototype, an evaluation will be conducted through varied tests to confirm a working prototype. However, if the prototype needs refinement, the proponents will build the prototype with the updates and changes obtained from the prototype review. The tested and acceptable prototype will proceed with the development of the complete system.

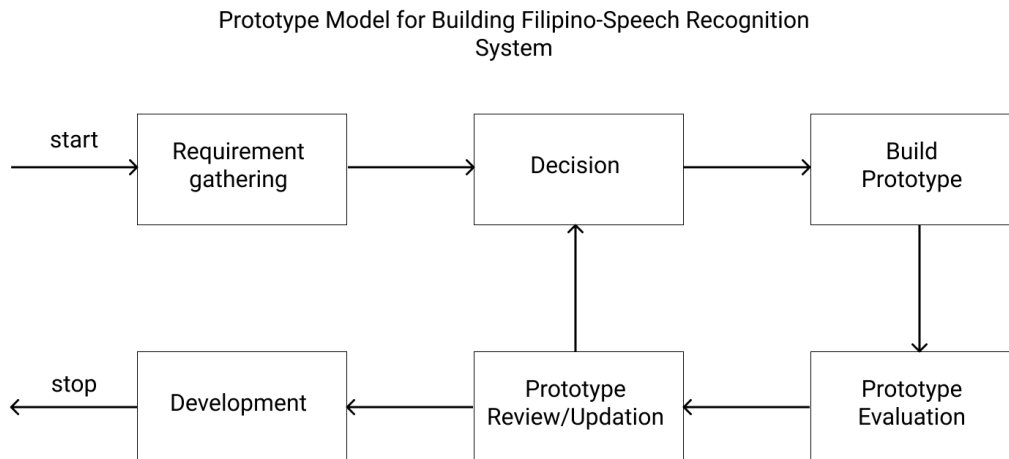


Figure 2. Prototype Model for Building Filipino-Speech Recognition System

II. Procedures

Requirement Gathering. Identify the necessary user stories for the first prototype and the requirements from start to finish. In this project, the proponents will identify the user stories and requirements and select which will be necessary for the first prototype. The proponents will work on the stories based on priority.

Decision. Make a quick decision for the design and development cycle of the prototyping. Making a quick design will help with the development. In this project, the proponents will create an acceptable prototype design prototype as a brief idea for building the system.

Build Prototype. The actual building of the functional prototype is based on the design.

Prototype Evaluation. A Series of tests with different variables and levels will be conducted to evaluate the features and functionality of the prototype. In this project, the proponents will feed the Filipino speech recognition system with recordings(data) of varying accents, tones, quality, and pitch. In the prototype phase, the proponents will use recordings from adult speakers as datasets to create the model. Afterward, the proponents will gather recordings of organized Filipino phrases and words from Filipino children aging six to 14 years old and use them to train and test the created model.

Review/Updation. Document the refinements and changes obtained from the testing/evaluation. In this project, necessary refinements of fixes, bugs, or errors listed during the evaluation will be recorded and documented for future reference. When refinements are necessary, the process will repeat from building the model to testing and reviewing.

Development. The actual development of the complete system once the prototype is functional and acceptable. In this project, the proponents can only proceed to the development phase once the prototype achieved the acceptance criteria (user stories).

Gantt Chart of the Prototype Development

In the Gantt chart figure below, the project's total duration is 37 days. The project starts with Task A, which is the project planning and the gathering of requirements. After the planning, Task B will begin where the proponents will gather speech recognition data and convert it into cleaned computational data for training and testing the machine

learning algorithm. After data gathering, designing the prototype of the statistical model and mobile application (Task C) will begin. Once the designing of the prototype is done, the proponents will start building the prototype of Filipino speech recognition (Task D) using a combination of the Hidden Markov Model HMM and Neural Network (NN), and the mobile application to use the speech recognition. After building the prototype, the proponents will evaluate it through a series of tests with varying complexity and levels (Task E). Then, the proponents will proceed with Task F, which is refining the prototype with the updates and changes reviewed in task E. After building a functional prototype, the proponents will document the testing and results of the prototype development (Task G), and present the functional prototype and documentation to the Instructor (Task H).

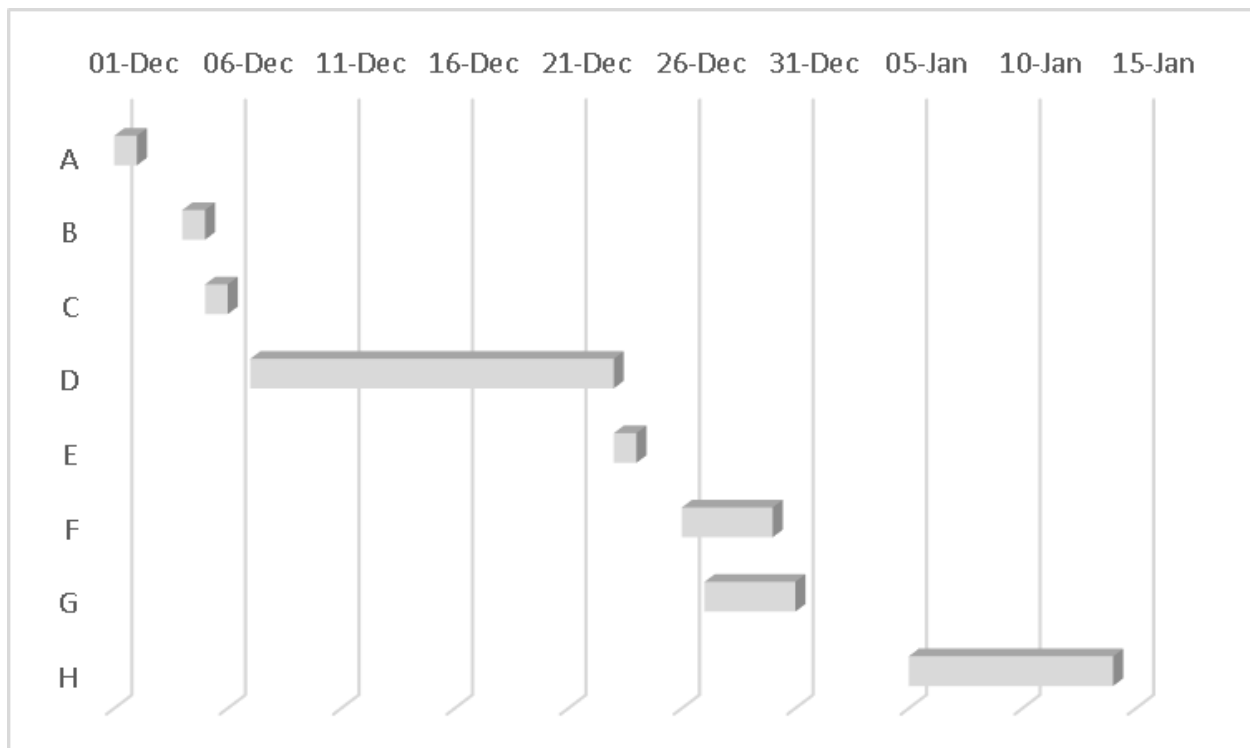


Figure 3. Gantt Chart for the Prototype Development of Filipino Speech Recognition.