NUTRI-REACH: PREDICTING NUTRITIONAL STATUS OF CHILDREN BELOW FIVE YEARS OLD IN THE MUNICIPALITY OF BANAYBANAY USING SUPERVISED MACHINE LEARNING ALGORITHM

An Information Technology Capstone Project Presented to

DAVAO ORIENTAL STATE UNIVERSITY

BANAYBANAY EXTENSION CAMPUS

In Partial Fulfillment of Requirements for the Degree of

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

CENIZA, AIRA MAE N.

PADPAD, JUSTIN JAY

Adviser

CAPA, WILJONE E.

June 2022

APPROVAL SHEET

This capstone project entitled **"NUTRI-REACH:PREDICTING NUTRITIONAL STATUS OF CHILDREN BELOW FIVE YEARS OLD IN THE MUNICIPALLITY OF BANAYBANAY USING SUPERVISED MACHINE LEARNING ALGORITHM"** Prepared and submitted by **AIRA MAE N. CENIZA and JUSTIN JAY PADPAD** has been examined and is hereby recommended for approval and acceptance.

Endorsed by:

WILJONE E. CAPA
Adviser

APPROVED by the Capstone Project Committee on oral examination with the grade of _____.

DR. JOHN M. BAGCAL
Chairman
06/15/22
Date

NEIL A. MUTIA, MIT
Member
06/14/22
Date

RUBEN L. QUINDOYOS JR., LPT
Member
06/10/22
Date

ACCEPTED as a partial fulfillment of the requirements for the degree of **Bachelor of Science in Information Technology.**

DR. EDNA B. BAGCAL
Campus Coordinator - BEC
06/16/22
Date

DR. ROSELYN V. REGINO
Director for Instruction
07.06.2022
Date

ACKNOWLEDGEMENT

We, the researchers express our heartfelt gratitude and appreciation to everyone who helped make this capstone project a success. Without their moral support this project would not be possible.

We are very much grateful to all our instructors who had the chance to work with on the process of creating this capstone project. Especially to our Capstone Coordinator, Mr. Neil A. Mutia and to our adviser for this project, Mr. Wiljone Capa who generously offered us their knowledge and never get weary in guiding us on this journey. We owe them a huge dept of gratitude to all their efforts to offer us an education and to do their best to make our studies as easy as possible.

This project would not have been possible without the support of our family. We are grateful for our parents whose constant love and support keep us motivated and confident. Our accomplishments and success happened because they believed in us. Deepest thanks to them, who keep us grounded, reminding us of what is important in life, and are always supportive throughout our journey. We are forever thankful for the unconditional love and support throughout the entire thesis process and every day.

Unfortunately, we were unable to give individual credit to the various people who contributed to the completion of this study; therefore, we, the researchers, would like to express our heartfelt gratitude to everyone who assisted in any way.

Above all, we, the researchers want to convey thanks to our Almighty God for His unfailing love, wisdom and mercies upon completing the study. Without His guidance, this achievement would not be possible.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

AIRA MAE N. CENIZA, JUSTIN JAY PADPAD. "NUTRI-REACH: PREDICTING NUTRITIONAL STATUS OF CHILDREN BELOW FIVE YEARS OLD IN THE MUNICIPALITY OF BANAYBANAY USING SUPERVISED MACHINE LEARNING ALGORITHM" (IT CAPSTONE PROJECT). DAVAO ORIENTAL STATE UNIVERSITY BANAYBANAY EXTENSION CAMPUS. JUNE 2022.

Adviser: Mr. Wiljone Capa

NUTRI-REACH: PREDICTING NUTRITIONAL STATUS OF CHILDREN BELOW FIVE YEARS OLD IN THE MUNICIPALITY OF BANAYBANAY USING SUPERVISED MACHINE LEARNING ALGORITHM had been developed to help the health sectors by predicting the nutritional status of children in order to design appropriate and effective intervention.

It primarily consists of module namely: the user module. The type of method used during the development process is the Rapid Application Development (RAD) Model. The researchers gathered data from different references to identify the systems scope and objectives. The proponent used various software tools such as Visual Studio Code as source code editor, MySQL as back end or data storage. The system developed using the Supervised Machine Learning which composed of C4.5 Algorithm, Multiple Linear Regression and the Gradient Boosting Regressor. This Supervised Machine Learning algorithms enable to come up with the prediction findings of the system.

The results were identified based on the user's evaluation. As a whole, the system provides satisfying solutions to the problems faced by the health sectors in giving publicity and early interventions on the nutritional status of children. The system gave a sufficient help towards the users with regards to health matters with the average of 4 out of 5.

CHAPTER I
INTRODUCTION

One of the measures that indicates the public nutrition condition is children's health and nutritional status. Malnutrition ailments are currently a standout amongst the most pressing issues confronting our society. Malnutrition is referred to a lack of, excess, or imbalance in an individual's energy and/or nutrient intake (Molina, 2012).

The number of patients with undernourishment or over nourishment ailments creating bit by bit anyway never diminishes. In expansion, this kind of diseases causes more than 500,000 passing in India consistently and is as of now the principal groundwork of death in India (Tanhim et al., 2019). Undernutrition hinders mental turn of events and actual development - at last prompting more unfortunate scholarly execution. According to Save the Children Philippines (2016), individuals from the labor force who endure child undernutrition and have signed up for school had higher risk of grade level reiteration and lower instructive accomplishment. The instructive part of undernutrition additionally adds to financial misfortunes. Fifteen percent of students who have rehashed a grade level expense the country an extra 1.23 billion pesos to cover the costs acquired by grade level repetitions in the academic year 2013-2014.

The risk of developing any difficulties increases when risk factors are identified late or not prominently. Early identification of a child's nutritional status is critical for preventing nutritional-related problems. Various strategies have been proposed to reduce this risk, but current strategies are insufficient to achieve this goal (Rahman et al., 2019). In determining the nutritional status, it has been done manually by the Community health centers and the problem of this is the incorrect analysis of results due to a large amount of data need to be analyzed. There is now a greater need for early identification of prominent

risk factors and prediction of child's nutritional status using an automated standard system (Ngiam & Khor, 2019). Nowadays, ML-based algorithms are very popular as an automated standard system for accurate disease prediction at an early stage, and their application is growing rapidly. However, several ML algorithms have been adopted for predicting disease like hypertension, diabetes, low birth weight, and child mortality using different demographic and health survey (DHS) datasets (Islam et al., 2021). There were also some ML-based studies conducted on child malnutrition in different locations (Bitew et al., 2020), but there were no studies in the municipality of Banaybanay that used ML algorithms to predict the nutritional status of children.

While highly trained and skilled physicians are in high demand in low and middle-income countries, providing decision support systems to health professionals and health facilities with insufficient resources to investigate the likelihood of child malnutrition is critical for reducing child mortality and improving child health. Therefore, this study aimed to identify determinants and build a web-based prediction system for child nutritional status by applying data mining techniques and algorithms.

1.1 PURPOSE AND PROJECT DESCRIPTION

As the world are now depending on innovation and technologies which lead to a stress-free life, this system is intentionally designed to lessen the workload of the healthcare workers, most especially in generating and keeping needed records. As well as it can lessen their time and effort into making records and getting important data of the children. Also, the purpose of this system is to apply machine learning and data mining techniques for extracting hidden patterns which are significant to predict the nutritional status of children below five years old in the municipality of Banaybanay, Davao Oriental.

The Supervised Machine Learning is used in this system which includes the Multiple Linear Regression, Gradient Booster Regressor and C4.5 as the algorithms to come up with the prediction process of the system. This project enables message developers, health sectors, researchers and policy makers to use baseline data to design appropriate and effective intervention.

In this system, the researchers provided a comprehensive interface that enables the users to input determinant factors in which it will be used to predict the nutritional status of the children. The system has a feature in which the users would be able to view the graphs consisting the factors that has the total numbers of the children's nutritional status. Through this graphical presentation, they can be able to generate data and ideas which can be used for further analysis. With this system, users are provided an easy viewing of areas where indicates the nutritional status rates of the children. The system has a map consist of the specific barangays of Banaybanay provided with the different nutritional status rates of the children per year. Making and keeping of children's records and data is easily generated by this system. In this way, the user consumes lesser time looking for children's records as this system provides an easy way to search for children's data.

1.2 OBJECTIVES OF THE STUDY

1.2.1 General Objective

The aim of this study is to develop a system that predicts the nutritional status of children below five years old in the municipality of Banaybanay, Davao Oriental.

1.2.2 Specific Objective

1. **Develop a system that predict the nutritional status base on the pre-determined factors**

The system used the pre- determined factors such as the child's sex and age, parent's education and their wealth index in which has impact into the child nutritional status. These pre- determined factors were used as the input parameters/ variables and was used as testing data to predict the possible nutritional status of children.

2. **Display the predicted nutritional status rates of children in a particular barangay using a GeoJSON map visualization.**

The municipality of Banaybanay with the nutritional status rates has been identified using a GeoJSON map, which contains a measured data. The map has the barangays of a specific municipality which contains the nutritional status and its ratings. Each barangay has its own color to represent the highest to lowest rates of child nutritional status. It also has table of every barangay that contains the rates per quarter and year to be able to view by the users in order for them to easily interpret the information given by the system.

3. **Generate a graphical presentation of the total number of children per pre-determined factors**

The data visualized in the form of a bar graph, which contains the total number of children per factor quarterly. The graphs have their own color, where it makes the data easier to see and interpret.

4. **Develop a system that keeps track of the child's profile information**

Since looking for the child's profiles and data in a paper- based time consuming, this system has a search button that allow users to easily search for a specific child's data. The system displays the children's profile, nutritional status, the date and time when did the health worker get the weight of the children. In this way, the users are able to learn about the children's data and for identification.

1.3 SIGNIFICANCE OF THE STUDY

This project will benefit to the following:

Health workers- The outcomes of this project will help healthcare providers to increase their awareness about such matter and can take preventive measures. As well as they can reduce the effect caused by malnutrition on children.

Parents- Knowing early the nutritional status of their child will aid them in understanding their children's necessities and assess what they can do to enhance their child's nutritional condition.

Children- it will help them improve their nutritional status, as well as this would lessen further complications into the children and leading them into having a better life.

Government and Community- The project's results will give them with enough nutrition knowledge, which will help them analyze preventative measures. And it would lower health-care costs, boost productivity, and accelerate economic growth, helping to break the cycle of poverty and illness.

Future Researchers - This project will broaden the researchers' understanding, allowing them to come up with new ideas and iterations of the project that have the same transaction mechanisms, which will be very useful in other projects.

1.4 SCOPE AND LIMITATION OF THE STUDY

NUTRI-REACH carried out to predict the nutritional status of children limited only to ages 5 years and below in municipality of Banaybanay, Davao Oriental. The data was based on the real time data on the current year of 2022. In extracting relevant data, the researchers used only a dummy data as the said scope cannot provide the desired data. This

data allows to determine the nutrition status and profile of the children. The C4.5 algorithm and the Multiple Linear Regression used in the system for producing predictions.

User Module - these are the health workers or anyone that belongs to the health sector. They are the ones that have the privilege to input information into the system. They can be able to view predicted results which can be used to assess a child's needs.

Limitation

- **Only selected variables used**

Only selected variables were used because taking all the variables in the database and feeding them to the data mining tool may not work very well. Only the z-scores of Weight-for-Age (WAZ) used for undernutrition measures. The analysis only put the present and updated profile and health related information of children. The proponents used parameters needed to input such as: name of child, address, child's sex, child's age in months, child's weight and height, Mother's name, parent's education, wealth index.

- **Children over the age of six is excluded**

The proponents used the data from children aged 5 and below. The data collection excludes those who are over the age of 5. This is done to ensure that the system can predict interventions from the beginning of a child's life. Based from the literatures, the majority of children under the age of five were the most prone to health problems.

- **Limitation about the child's continuous track record**

Based from the Health Center guiding data, they don't have the continuous track record of each child. If there is a new moved child in the area, they recorded the current age and other profile information of the child. This limits the need to have a continuous track record of the children in the said system.

- **Recommending medications and diagnosis from the predicted results is outside the scope of the system**

Since medical diagnosis and recommendation is an intricate task that needs to be carried out precisely and correctly, the system did not include a diagnosis recommendation. With this, the clinical decisions should be based on doctor's intuition and experience rather than on the knowledge rich data hidden in the database.

- **The system is only capable of predicting the next four (4) quarters**

Only data from quarters one through four were used and analyzed in the system because the Health Center only got data and records for each child by quarter. They excluded the beyond quarters because it only exceeded the preferred duration for obtaining the child's information.

CHAPTER II
REVIEW OF RELATED LITERATURE AND SYSTEMS

This chapter presents the different Review of Related Literature and Review of Related System which the proponents get an idea in regards to the knowledge about the system, as well as various findings from existing literature and online systems which are relevant to our topic.

2.1 REVIEW OF RELATED LITERATURE

The proponents have performed a series of researches on various sources or studies that are important to the system in order to create this capstone project. The studies and websites listed below have provided the proponents with helpful information that they have analyzed in order to build ideas for the system's future development.

2.1.1 Determinants of child malnutrition

2.1.1.1 Demographic and Parental Factors

- *Age of Child*

According to research, the risk of malnutrition increases with increasing age in months. Due to the protective effect of breast milk, children between the ages of 23 and 59 months are more at risk of malnutrition than younger children. As children grow older, they are introduced to new foods. As a result, adequate complementary or substitute food to breast milk is required, as inappropriate food supplementation may not meet a child's dietary needs. Although infants in developing countries may be well-nourished during their first year, their nutrition rapidly worsened until they reach the age of two. The child's nutritional status remains stable after the third or fourth year (Nkurunziza et al., 2017).

- *Sex of child*

In terms of gender, researchers discovered that girls were much more underweight than males, but there was no significant difference in stunting prevalence (Wahed et al., 2017). These findings contrast from those of the EDHS study, which focused on never-married female and male teenagers and young adults (10 to 19 years). Males (5.0%) were more underweight than females (3.0%) in the age range (10–19 years), with higher prevalence in Upper Egypt and frontier governorates, as well as rural areas, accor the EDHS research (El-Zanaty & Way, 2009).

- *Parent's Education*

The highest level of education that an individual has completed is referred to as educational attainment. This is distinct from the level of education that a person is pursuing. When a person has never attended school or has only attended kindergarten, they have no formal education (United States Censos Bureau, 2021). The Philippine educational system changed in 2011-2012, and the changes affect how the education background characteristic is presented in the NDHS 2017 in comparison to previous DHS surveys. Prior to 2012, the educational system consisted of six years of elementary school (primary school) followed by four years of high school (secondary school). Grades 1-6 correspond to primary school in the current K-12 system, and grades 7-12 correspond to secondary school. Higher education lasted four years and leading to a bachelor's degree. It is then divided into three phases: Undergraduate (Bachelor's Degree), Postgraduate (Master's Degree), Doctoral (PhD) (Granada, 2021).

Several studies in Indonesia report on the impact of parents' educational attainment on their children's nutritional status. Mothers who have never attended formal education

have a higher risk of having stunted children. Both the father's and mother's education levels have a significant negative effect on stunting, but the effect is greater for mothers with a higher level of education. The influence of having mothers with higher levels of education may be attributed to greater knowledge in childcare, feeding practices, the environment, and household hygiene. (De Silva & Sumarto, 2018).

- *Household Income*

Studies have indicated household income as a predictor of child malnutrition. Higher income entails a stronger purchasing power to access nutrient-dense and adequate diets. It noted that the exposure, availability and accessibility to food at home could affect taste preference and intake of children. Given that the cost is less expensive for high-energy dense food, children in low-income households could be more exposed to high energy than high-nutrient dense food for meals and snacks at home (De Silva & Sumarto, 2018).

Primarily, an individual's socioeconomic standing is determined by their overall household income, particularly in the Philippines where this classification is mostly associated with finances. According to the data from the Philippine Institute for Development Studies (PIDS), the income classes for an average household of five are as follows:

Table 2.1

Household Income Classes

Income classification	**Monthly income**
Rich	At least ₱219,140 and up
High Income (but not rich)	Between ₱131,484 to ₱219,140
Middle class	Between ₱21,194 to ₱131,484
Low income (but not poor)	Between ₱9,520 to ₱21,194
Poor	Less than ₱10,957

2.1.2 Related studies that used C4.5 Algorithm

Decision tree learning is a method commonly used in data mining. One approach that can be taken is to use the C4.5 decision tree method. The C4.5 method is an algorithm that works by applying the concept of a decision tree. The goal is to create a model that predicts the value of a target variable based on several input variables. Each interior node responds to one of the input variables; there are edges to children for each of the possible values of that input variable. Each leaf represents a value of the target variable given the values of the input variables represented by the path from the root to the leaf. The rules are generated to predict the nutritional status with the given dataset (Mukherji et al., 2013).

Also, there are previous researches that have definitively demonstrated the use of the C4.5 algorithm to produce the level of data accuracy. C4.5 algorithm is used in those studies to predict student achievement. The results show that the accuracy prediction can reach up to 84%, indicating that effective model prediction achievement can assist education management departments in identifying student misbehavior and providing guidance to students (Li et al., 2015). Another C4.5 algorithm research project aims to develop a classification model for improving student achievement. The outcome suggests that the C4.5 algorithm is useful and applicable for researching the application of student achievement assessment (Hashim et al., 2015). The C4.5 algorithm is used in health cases to find the important parameters reflecting the effects of diabetes on the kidney. The results show that the algorithm performs excellently and effectively in determining the important parameters that reflect the effects of diabetes on the kidney (Jain, 2014).

Based on these findings, the proponents finally encourage to do research using C4.5 algorithm on the prediction process which inline on the predicting the nutritional status of

the children. The result of this research hopefully enables message developers, health sectors, researchers and policy makers to use baseline data to design appropriate and effective intervention.

2.1.2.1 Predicting the risk of childhood overweight and obesity at 4–5 years using population-level pregnancy and early-life healthcare data

The aim was to use routinely gathered population-level healthcare data to construct a risk identification model for juvenile overweight/obesity that could be used during pregnancy and early life. The study was carried out in Hampshire, UK, using a population-based anonymized linked cohort of maternal prenatal records. Selecting model predictors and identifying transformations of continuous predictors that best predict the outcome were done using logistic regression models using multivariable fractional polynomials. The model predicted that the early pregnancy predictors included maternal BMI, smoking status, maternal age, and ethnicity and the early-life predictors included birthweight, baby's sex, and weight at 1 or 2 years of age. Maternal factors were consistent across all models, allowing high-risk groups to be detected at an early stage with more precise estimation as the child grew. Now a new tool can be used to estimate risk clusters for children obesity as early as the first trimester of pregnancy (Ziauddeen et al., 2020).

2.1.2.2 Expert Systems for Identifying Children's Severe Malnutrition

The aim of this study is to create and develop an expert system that can detect severe malnutrition in children between the ages of 0 and 5. The information comes from a nutrition expert's response to an inquiry. The information is gathered through the user's responses to the questions, and once all of the questions have been answered, the result will appear, displaying the user's nutritional status. To get at their conclusion, they employ a set of rules. This system application will allow the user to diagnose and treat a child's

nutritional or illness problem. Due to its ease of use, this system can be used by any type of user. This system also includes vital information on severe malnutrition as well as recent news regarding children's health, providing parents with more information about the importance of severe malnutrition prevention (Kartika et al., 2016).

2.1.2.3 Determinants and development of a web-based child mortality prediction model in resource-limited settings: A data mining approach

This study used a classification data mining technique to uncover determinants and construct a web-based child mortality prediction model in Ethiopian local language. On 11,654 records of Ethiopian demographic and health survey data, decision tree (J48 algorithm) and rule induction (PART algorithm) techniques were used. To create optimal models, researchers employed the Waikato Environment for Knowledge Analysis (WEKA) for Windows version 3.6.8. The accuracy, sensitivity, specificity, and area under the Receiver Operating Characteristics (ROC) curve were used to evaluate the model's validity. Following the development of an optimal prediction model, they used it to create a web-based application system for predicting child mortality. Using decision trees and rule induction approaches, almost accurate results were obtained in this study. Determinants are identified, and an Ethiopian local language web-based child mortality prediction model is constructed. As a result, the findings may be used to promote child health intervention initiatives in Ethiopia, where qualified health personnel are limited. To come up with the best models, advanced classification algorithms must be tested (Tesfaye et al., 2016).

2.1.3 Multiple Linear Regression

Multiple linear regression is a statistical technique for predicting a variable's outcome based on the values of two or more variables. Multiple regression is a type of

regression that is an extension of linear regression. The dependent variable is the one we aim to predict, whereas the independent or explanatory variables are the ones we use to forecast the value of the dependent variable. This method can be used to simulate clinical conditions, such as predicting the change in a disease-related blood marker when various therapies are given. The methodology includes methods for assessing which variables are significant, and it can be used to create a regression prediction system (Soni, 2020).

In medical research, multiple linear regression is not a new thing. Using a collection of electrocardiographic (ECG) and clinical factors, Ahmed et al., (2020), developed a multiple linear regression model for predicting left ventricular mass (LVM) in the heart. In resource-constrained settings, the prediction of LVM using only an ECG as a point-of-care tool, rather than any resource-intensive imaging modalities, can be a ready and cost-effective alternative. Multiple linear regression can also be used to determine disease and morbidity risk factors. In the database analysis of invasive meningococcal infection, researchers discovered a strong correlation between the incidence of the infection and the carrier population, as well as the percentage of susceptible in the sub-population.

Multiple research studies have used multiple linear regression modeling as a statistical method to evaluate risk variables and severity of communicable and noncommunicable disease. If the outcome (reaction to therapy) is a continuous variable, the approach can also be used to determine the determinants of response to therapy in a specific health condition. In order to judge the efficacy of dulaglutide as an add-on therapy to insulin in uncontrolled type 2 diabetes mellitus, the researchers looked at a variety of parameters for a possible association with the size of glycosylated hemoglobin at the end of 6 months of treatment. Baseline Hba1c was found to be a significant predictor which

used in a fixed effect multiple linear regression model (Lee et al., 2019). The list of examples of multiple linear regression in medical literature is very extensively, and its implications have common uses in medical research.

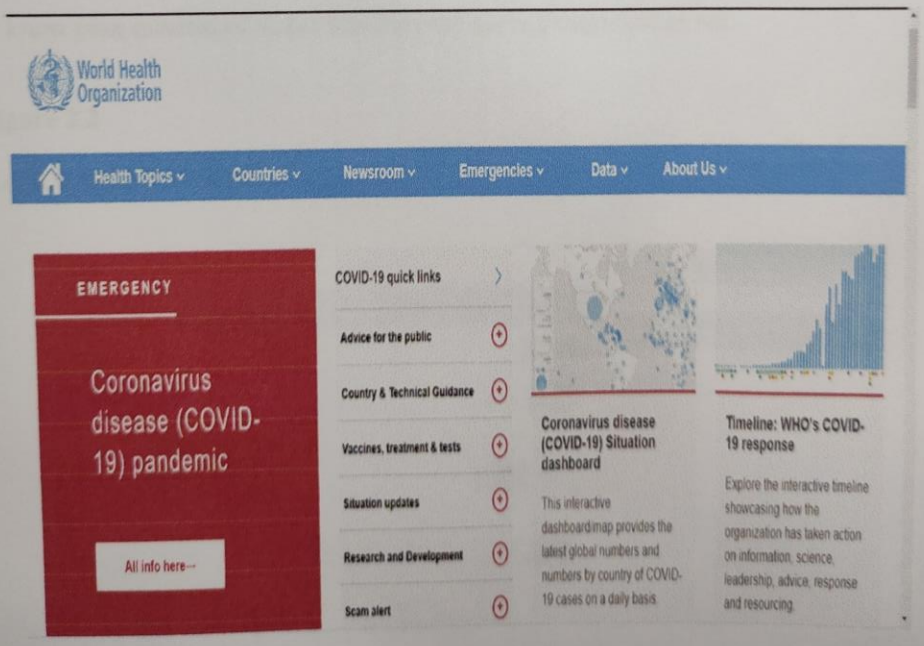
2.2 REVIEW OF RELATED SYSTEM

2.2.1 WHO Anthro Survey Analyzer

The World Health Organization's (WHO) Anthro Survey Analyzer is an online tool for analyzing anthropometric survey data for children under the age of five years old using weight and height measurements. The tool builds on WHO Child Growth Standards and gives results for four different indexes: height-for-age, weight-for-age, weight-for-height, and body-mass-index for-age.

Figure 2.1

WHO Anthro Survey Analyzer



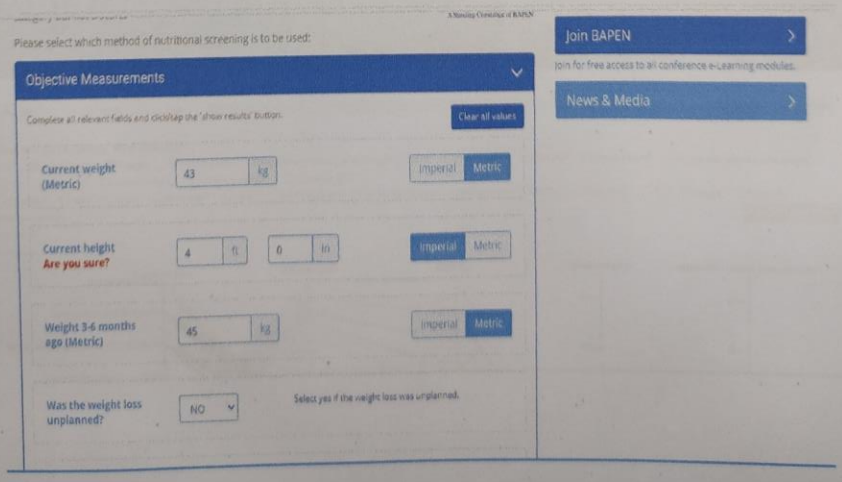
It includes measures of age, sex, type of residence, sub-regions/districts, wealth quintiles, mother's education, and other relevant country-specific factors. Calculations of confidence intervals and standard errors in estimates are available, and data quality can be assessed. It gives us the idea in analyzing anthropometric indicators among children under five years of age. As well as creating graphs and tables for visualization of findings, including z-score distribution and prevalence estimates by the various stratification variables.

2.2.2 BAPEN 'MUST' Calculator

BAPEN pulls together the skills of its Core Groups to promote malnutrition awareness and understanding in all settings, as well as provide education, advice, and resources to advance the nutritional care of patients and those at risk of malnutrition in the community. In their website you can input information in the fields provided. It allows you to know your nutritional status whether you are malnourished or not.

Figure 2.2

BAPEN 'MUST' Calculator

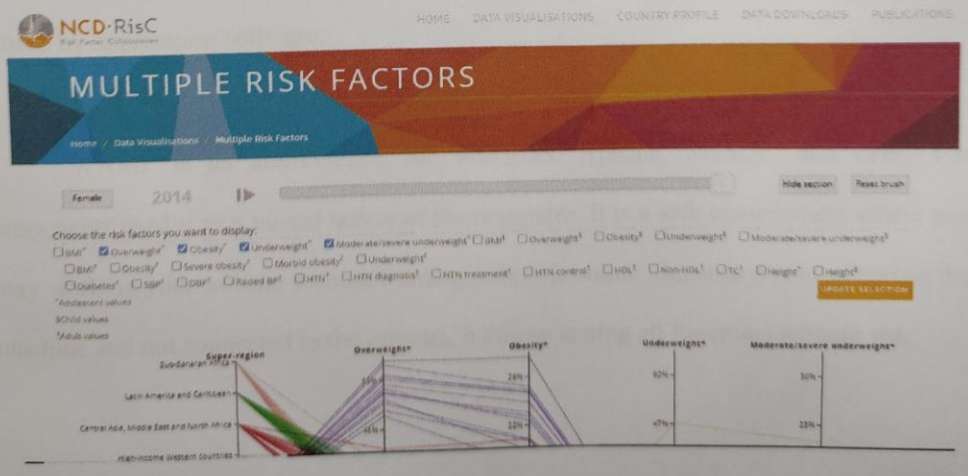


2.2.3 NCD Risk Factor Collaboration (NCD-RisC)

The NCD Risk Factor Collaboration (NCD-RisC) is a global network of health scientists which provide rigorous and timely data on major risk factors for noncommunicable diseases for all countries. NCD-RisC combines high-quality population-based data with advanced statistical methods specifically designed for analyzing NCD risk factors. Since 1957, the Collaboration has collected data from over 2,545 population-based surveys conducted in 193 countries, with nearly 129 million participants having their risk factor levels measured. It includes data visualization about various global trends, allowing users to gain knowledge from the visualized measurements of the trends. This website gives the proponents the idea about the development of visualization feature of the system which is about the risk factors on the children malnutrition.

Figure 2.3

NCD-RisC



CHAPTER III
METHODS AND MATERIALS

This chapter describes the various methods used in corresponding on working the system using multiple materials, as well as the strategies, processes, or techniques used in collecting data or evidence for analysis in order to uncover new information.

3.1 DETAILS OF THE TECHNOLOGIES BEING USED

The process of development of the project basically used laptops, other computer units and different software that helped upon the development of the project. The proponents also used portable Wi-Fi connections to access the internet. Some gadgets like android phones that used as a tool for communications matter.

3.1.1 MySQL Server 5.0

The proponent used MySQL server to construct a safe database. This software is a database storage utilized for storing and managing information, and the information gathered from the user's asset information, depreciation, and maintenance logs. MySQL includes user authentication, which is extremely important for securing data created or stored by application software.

3.1.2 WampServer 3.2.3 (64-bit)

WAMP is an abbreviation for Windows, Apache, MySQL, and PHP. The proponents used it as a virtual server of the computer. It is a safe environment where you may work on your website without needing to host it online. Because it is localized on the machine and not connected to the internet, it allows testing all functions without risk.

3.1.3 Microsoft Excel 2021 (Professional)

The proponents used Excel for storing, organizing, and manipulating data. Tables, which are made up of rows and columns of small rectangular boxes or cells, are used to hold linked data.

3.1.4 Python 3.8

Python is a strong programming language that is simple to learn. It contains high-level data structures that are efficient and a basic yet effective approach to object-oriented programming. The proponent used this to develop the back end of the website. This in sending data to and from the server, processing data and communicating with databases, URL routing, and ensuring security.

3.1.5 JSON 3.2.3

JSON (JavaScript Object Notation) is a data-exchange format that is simple to use. Reading and writing are simple tasks built for humans. Machines can easily parse and generate it and it is based on a subset of JavaScript Programming Language.

3.1.6 Visual Studio Code Version 1.66.2 (User Setup)

Visual Studio Code blends the ease of use of a source code editor with advanced development tools such as IntelliSense code completion and debugging. The proponents used Visual Studio Code for the debugging of the codes. As this debugging is frequently the functionality that developers miss the most in a lighter coding environment, so this Visual Studio Code is needed to be used. The proponents used the interactive debugger in Visual Studio Code to walk through source code, check variables, view call stacks, and run commands in the console.

3.1.7 HTML Version 5.3

HTML is an abbreviation for Hypertext Markup Language. HTML is not a programming language, which means it cannot create dynamic functionality. Instead, it allows to organize and format documents in the same way that Microsoft Word does. The proponents used HTML for things like home pages, about pages, and contact pages.

3.1.8 Microsoft Word 2021 (Professional)

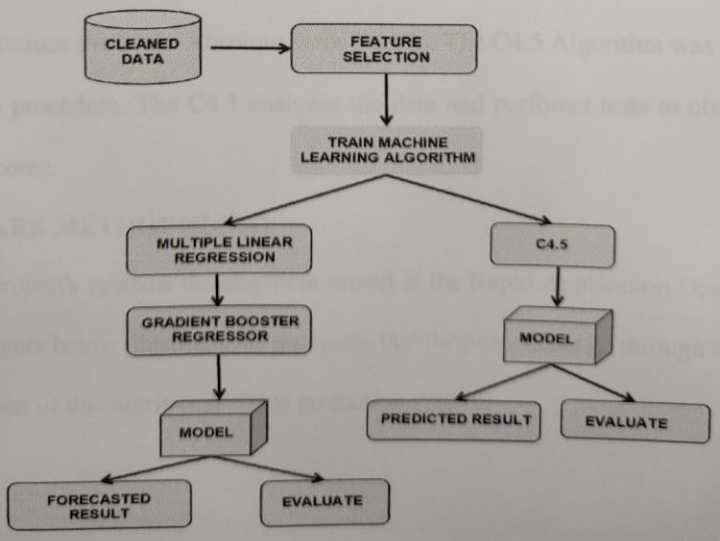
Microsoft Word, also known as WinWord, MS Word, or Word, is a word processor developed by Microsoft. The proponents used Microsoft Word for typing and editing documents. This enables the creation of error-free documents in which everything is formatted, aligned, and written in accordance with the need and importance.

3.2 CONCEPTUAL FRAMEWORK

Figure 3.1 shows the conceptual framework of this system. It shows the data flow from one entity to another.

Figure 3.1

Conceptual Framework



This is the conceptual framework used for the development of the system. Upon the discussion on to where the scope to obtain the datasets to be used in the project, the proponents chose Banaybanay Health Center. As the proponents were collecting the data, the Health Center provided the permission in the form of a certificate indicating to used or create dummy data specifically for the factors in line with the nutritional status of the children. The proponents created the raw dummy data that was used as the major dataset, as seen in figure 3.1. The data is imported as historical data into the database and used in the prediction process. Feature selection was applied to the cleaned data, which removed non-useful attributes from the dataset. The proponents used three algorithms: Multiple Linear Regression (MLR), Gradient Booster Regressor (GBR) and the C4.5 algorithm, all of which are very useful for creating a model.

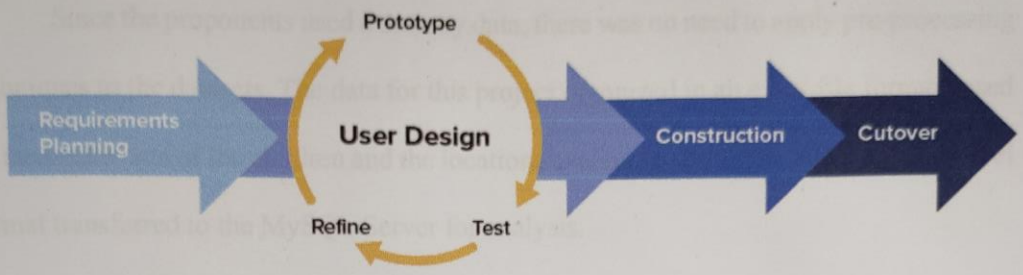
Multiple Linear Regression was used to forecast the dependent variable's rate. The proponents combined the data, which is now known as the independent and dependent variable. The forecasted rate was calculated using the Gradient Boosting Regressor model as an ensemble learning approach. It was utilized by the proponents to increase the model's accuracy and reduce the Mean Absolute Error (MAE). The C4.5 Algorithm was utilized in the prediction procedure. The C4.5 analyzes the data and performs tests to obtain at the predicted outcome.

3.3 SOFTWARE METHODOLOGY

This project's systems development model is the Rapid Application Development Model. The figure below illustrates the processes that the proponents go through to develop the final version of this nutritional status prediction system.

Figure 3.2

Rapid Application Development (RAD) Model



The proponents chose this approach because it is well-known for assisting small teams in developing software that can quickly adjust to market and customer demands. It also has the advantage of system component compartmentation, allowing the researcher to simply troubleshoot or modify any of the system's operations and components.

- **Requirement Planning**

Requirement planning evaluated and analysed to create collections of data items and information that were critical to the system's success. To comprehend the nature of the program to be developed, the proponents first gathered the important data to be used, understand the information domain for the software, as well as the required function, performance, and interfacing.

Data Requirements

The health data information of children under the age of five years old and below in the Municipality of Banaybanay was being considered for this project, and it consisted of data from the barangay health center. Upon collecting the data from the scope, they said that they cannot provide the proponents the data. It was because there were many missing values or attributes from their records which was the most important data that should be

collected; they just provided the proponents the consent to use and make a dummy data for processing the prediction system.

Since the proponents used a dummy data, there was no need to apply pre-processing techniques to the datasets. The data for this project organized in an excel file format based on the health data of the children and the locations evaluated; after that, the data in an excel format transferred to the MySQL Server for analysis.

Software Requirements

The main programming language used is the Python. It is for the code development of the system. It is integrated with several modules to realize the system's functionalities. Other related software requirement is Java that is incorporated with the WampServer that serves as the virtual server of the system. The proponents used the MySQL software for storing and analysing the datasets to be used. And as for the visualization of the nutritional status rates, the proponents utilized the GeoJSON map technology and bar and line graph for the visualization of predicted children nutritional status rates.

Algorithm used

The proponent reviewed several pieces of research to come up with the best algorithm for predicting children's nutritional status. Since the system is for predicting the nutritional condition of children, the proponent used the Supervised Learning Machine, which includes a C4.5 algorithm, Multiple Linear Regression and the Gradient Boosting Regressor component. The reason to why the proponent chosen this algorithm over the other is the various studies found in the literature review where researchers have used these algorithms to come up with the prediction process and resulted into confirming that this data mining algorithms is effective to extract hidden relevant information.

❖ **User Design**

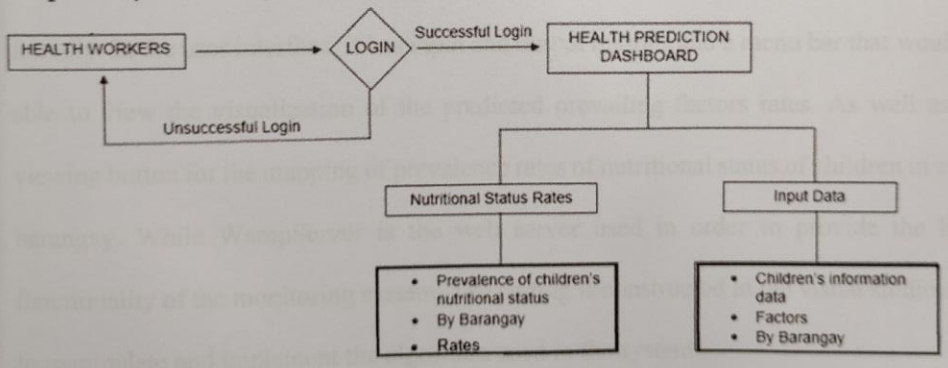
The development of the system began in this phase once the basic plans and requirements were finalized. In order to comply and meet the given requirements determined in the first stage, the proponents took into account the necessary hardware and software architecture, components, modules, and interfaces.

The user design of this system was done using the Unified Modelling Language tools (UML). The users of the system identified and selected based on the type of information either accessed or benefitting to the users, it is the:

Health Workers – are primary users who register with the system and provide their respective information as requested by the system in determining the associated factors and they require username and password in order to access and use the system.

Figure 3.3

Proposed System Workflow



In the system workflow, the health workers were able to provide the children's information and input parameters or variables needed for predicting the nutritional status of the children. The dashboard of the system allowed users to perform several functions which include: viewing the records stored in the system, viewing the health information

stored in the record of each child in each barangay and view the prevalence of children nutritional status for future decision-making purposes.

❖ **Construction**

All of the relevant information, plans, and tools for the development of the system was ready at this point, and prototype construction began. We'll finish by employing automation technologies to turn process and data models into actual prototypes, were finished which included in building and coding the actual system.

In order to construct the prototype, the system database developed using Python as the programming language. In the process of developing the system's database, different tables, files, records and fields was created. As a result, different variables regarding the prediction of children's nutritional status were captured from the users such as health information that stored in the database. The user interface and the facilitation of interaction with the database was constructed using JavaScript to make the system simple and user-friendly. In the user interface, it has input and output buttons and a menu bar that would be able to view the visualization of the predicted prevailing factors rates. As well as the viewing button for the mapping of prevalence rates of nutritional status of children in every barangay. While WampServer is the web server used in order to provide the basic functionality of the monitoring system. The coding is constructed in the visual studio code to manipulate and implement the algorithm used in the system.

The area of duty of logged-in barangay health workers account, municipal boundaries was built on GeoJSON Map using its array of latitude and longitude to construct the visualization and mapping. The proponents allowed users to click on the appropriate place and able to view the list of possible nutritional status predictions rates. Additional

data representation components, such as a color scheme on the map is added to the system to make the visualization results more thorough.

- **Cut-Over**

This is the last phase in which the system was deployed and were fully utilized by the prospective users. Following the completion of the proposed system, the proponents perform user testing to evaluate its major functions, features, and overall user friendliness. The system used by a sample of prospective front-end users, including health-care providers, to decide if the built system attained its goals. And all the users were trained on how to use and implement the system.

Each module's functionality enabled, and after determining its functionalities, prospective front-end users are required to rate the tested function on a scale of 1 to 5, indicating how satisfied they are with it.

3. 3.1 REQUIREMENTS SPECIFICATION

To get a good set of outcomes, it is critical that the obtained data is properly evaluated and given in order to fulfil the system's development requirements, and that is done in accordance with the desired output.

3.3.1.1 PRODUCT PERSPECTIVE

The researchers' project is an online website that provides platforms for health workers and others in the health sector to support and manage the health condition of children in their community. It allows them to determine the nutritional status of each child early on using a data mining technique, allowing them to take proactive measures.

3.3.1.2 PRODUCT FEATURES

The proponents provided various product features inside the system for the user's better experience beginning with the user's login. For login validation, the system has an email and password confirmation. The goal is to establish whether or not the information provided by users is reliable and true.

On the other hand, the proponents have embedded GeoJSON map in the system. The map is used to locate the nutritional status rates per barangay of the chosen municipality. The system also included the visualization feature where in this feature, it calculated and visualized the factors that influence children's nutritional status and its corresponding total number of children. It would be able to identify the numbers of children who are on the verge of malnutrition. This allows health-care organizations to take proactive interventions in response to the expected nutritional needs of youngsters.

3.3.1.3 USER CLASSES AND CHARACTERISTICS

3.3.1.3.1 User- they are the health workers or anyone that belongs to the health sector. They are the ones who have the privilege to input information into the system. They can be able to view predicted results which can be used to assess a child's needs.

3.3.1.4 OPERATING ENVIRONMENT

Various applications, tools, and technologies were used by the system during the development process, and proponents used them to execute the program.

3.3.1.4 .1 Software Specification

The system is developed to provide users with information about the nutritional status of children below five years old in Banaybanay, Davao Oriental.

Table 3.1

Software Specification

Database	MySQL Server 5.0
Local Server	WampServer version 5.5.8
Programming Language	Python
Coding Editor Tool	Visual Studio Code version 1.65.2

3.3.1.4 .2 Hardware Specification

The system is in a web-based format. The user must be able to readily access the system and explore it on their laptops or computers.

3.3.1.5 DESIGN AND IMPLEMENTATION CONSTRAINTS

The system runs on a web-based platform across a variety of devices, and users need a stable internet connection to use it. It is compatible with common online browsers such as Chrome, Opera Mini, Firefox, and others. The system also runs on any operating system.

3.3.1.6 USER DOCUMENTATION

The target audience for user documentation developed about the software system was anyone who were user of the software system. The proponents gave a variety of brief document types (e.g., guidelines and tutorials) in Portable Document Format (PDF) format that outline how to use the software system. It is to teach potential front-end users on how to utilize the system. It also included screenshots of system pages, as well as demonstrations of the system's features and sets of written chronological instructions that may be useful.

3.3.1.7 OTHER NON-FUNCTIONAL REQUIREMENTS

The proponents specified a number of requirements to ensure that the software is safe and has high quality attributes. These are the requirements for how the system meet the functional needs.

3.3.1.7.1 Performance Requirements

Table 3.2

Performance Requirements

Requirements	Description
PO1	The system can be able to handle request made by the user and process those request

Table 3.2 shows the requirements which include encryption and other security measures to prevent unwanted access. The system makes advantage of the current operating system's built-in default functions.

3.3.1.7.2 Operational Requirements

The table below illustrates the system's requirements in terms of the its operational aspects

Table 3.3

Operational Requirements

Requirements	Description
DO1	The system has a database which contains all inputs information
DO2	The system must authorize person to manage the system
DO3	The system provides username and password to prevent the system from unauthorized access

3.3.2 ANALYSIS

3.3.2.1 TECHNICAL FEASIBILITY

It is a study of resource availability that may have an impact on the ability to create a system that is acceptable. This assessment assessed if the technology required for the system is currently available. The analyst determined whether present technical resources can be updated or expanded in order to satisfy the request in question. This is where system analysts' expertise came in useful, as they answered the question of technological feasibility based on their own experience and contacts with the health-care industry.

3.3.2.2 ECONOMIC FEASIBILITY

Cost/benefit analysis is another term for economic analysis. It is the most common way for determining a new system's effectiveness. The procedure in economic analysis is to evaluate the projected advantages and savings from a proposed system and compare them to the costs. If the advantages outweigh the costs, the decision to develop and deploy the system is made.

The system did not require an enormous amount of money to develop. This can be done economically if planned judicially, so it is economically feasible. The cost of the project depends upon the number of man hours required.

3.3.2.3 OPERATIONAL FEASIBILITY

Operational feasibility is determined by the project's human resources and entails predicting whether the system was used after it was created and established. Operational feasibility is a measure of how well a system solves problems and exploits possibilities discovered during scope definition, as well as how well it meets the criteria determined during the requirements analysis phase of system development.

The system was acceptable to the users since it ensures entrance operability without shifting competition and creativity among users, to the benefit of the public both in terms of profitability and service quality. In order for the suggested system to operationally effective, it was created in a simple and friendly manner.

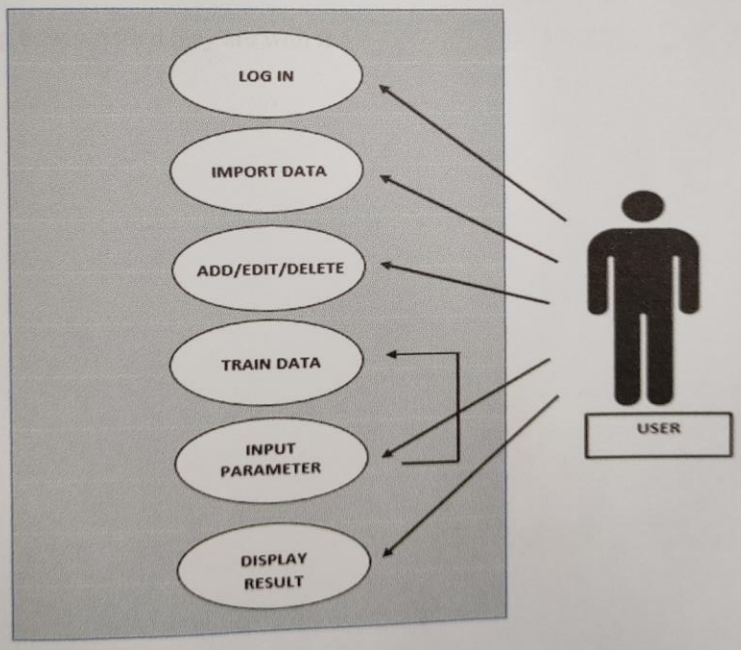
3.3.3 DESIGN

3.3.3.1 USE CASE DIAGRAM

The figure below, Figure 6 is the use case diagram of the proposed system. The figure shows that there are Admin and the Users.

Figure 3.4

Use Case Diagram



The end users made a request to the system, as shown in the figure. Users were able to log in, import data, add/edit, and delete data using the system. The system allows users to add parameters or data into the system, which was used as testing data to predict the

possible nutritional status of children. The system responded, and users viewed or displayed the result. After then, the data was saved in a database and was retrieved to respond to the user.

3.3.4 DEVELOPMENT AND TESTING

Following the completion of the proposed system, the proponents performed user testing to evaluate its major functions, features, and overall user friendliness. The system was used by a sample of prospective front-end users, including administrators and health-care providers, to decide if the built system attained its goals.

Each module's functionality was enabled, and after determining its functionalities, prospective front-end users are required to rate the tested function on a scale of 1 to 5, indicating how satisfied they are with it.

CHAPTER IV
RESULTS AND DISCUSSION

This chapter is the results section, which includes a discussion of the system's objectives, system's testing results in which consider as the system's criteria and provide the significance of the findings.

4.1 Achievement per Objective

1. **Develop a system that can predict the nutritional status base on the pre-determined factors**

Figure 4.1

Child Details

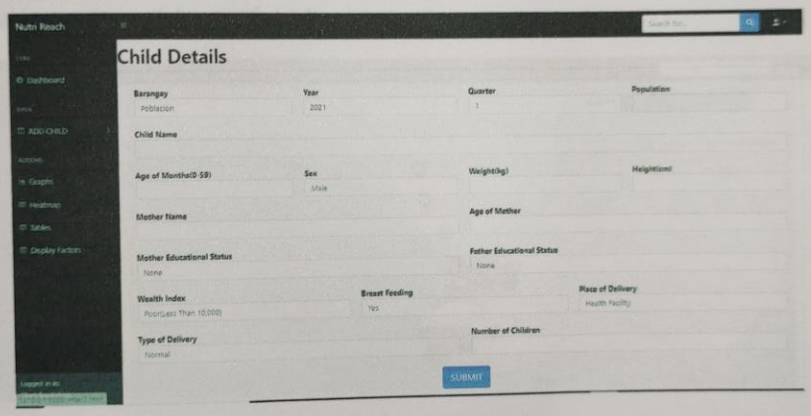
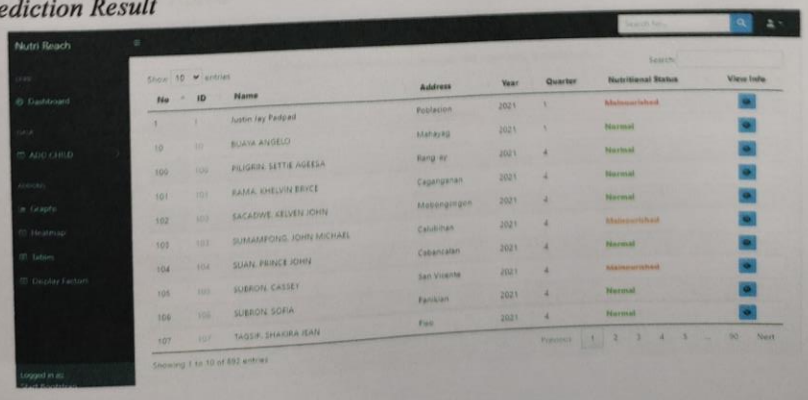


Figure 4.2

Prediction Result



Upon using the system, the user clicked into the child details to be able to input parameters or data into the system. These data included were used as testing data to predict the possible nutritional status of children. Clicking the submit button, the system tested the inputs parameter and directed into the predicted nutritional status of children page. The system used a data mining algorithm to predict the nutritional status of the children based on the data inputted by the users. A page appeared and viewed the predicted nutritional status of the children.

2. **Display the predicted nutritional status rates of children in a particular barangay using a GeoJSON map visualization.**

Figure 4.3

GeoJSON mapping of the predicted nutritional status rates

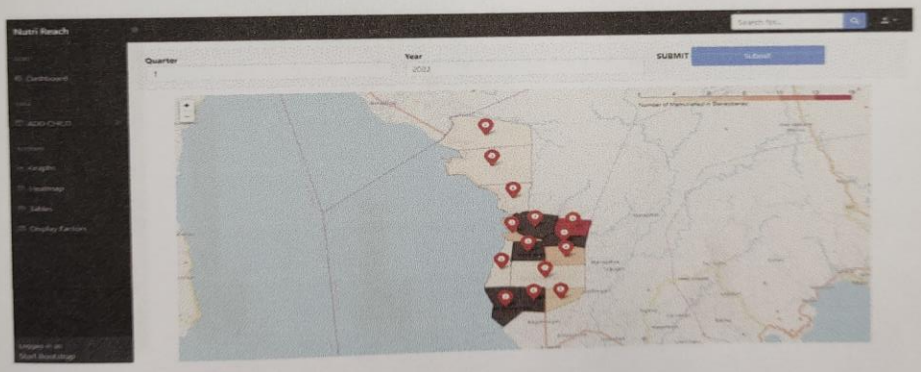
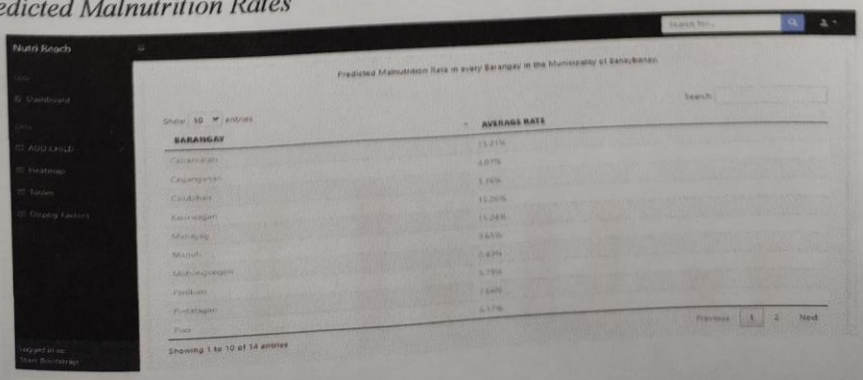


Figure 4.4

Predicted Malnutrition Rates



The barangay in the municipality of Banaybanay with the highest malnutrition rate is identified using the GeoJSON Map. Through this, user viewed the locations, in which it has an illustration of the matching percent. Each barangay has its own shade to represent the highest and lowest rates of child nutritional status. The system also has a table below the mapping area in which it contains the malnutrition rates per barangay. In this way, users saw the measured data and got idea about to where barangay has the highest to lowest rate of malnutrition.

3. **Generate a graphical presentation of the total number of children per pre-determined factors**

Figure 4.5

Bar graphs representation for wealth index

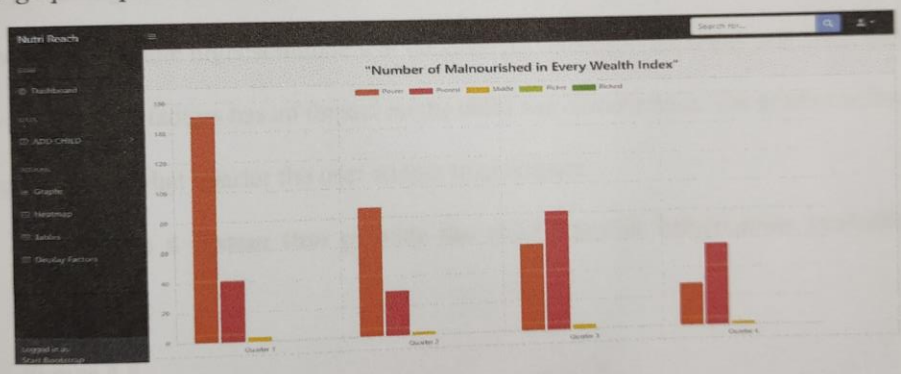


Figure 4.6

Bar graphs representation for educational status

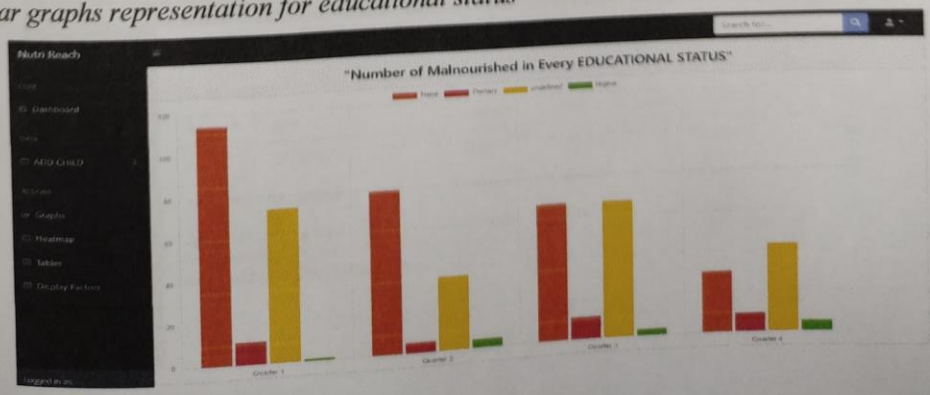
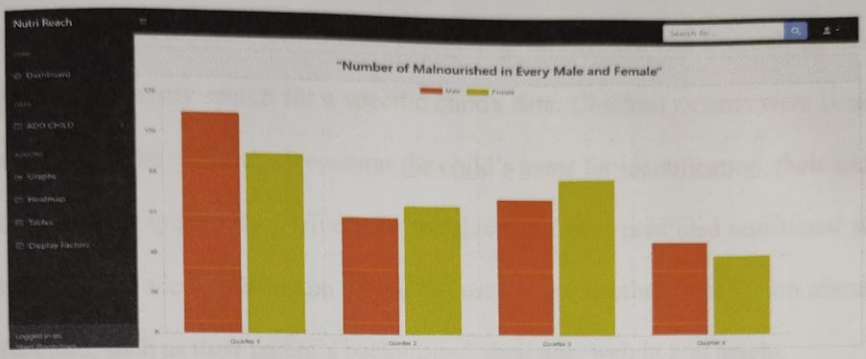


Figure 4.7

Bar graphs representation of number of malnourished in every make and female

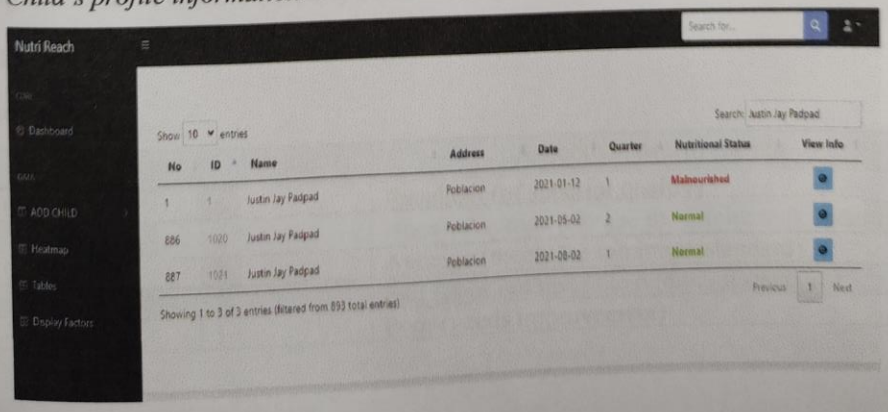


The system visualizes the data using a bar graph which contains the data that is maintained in the database and is displayed based on the selected factors. These graphs are the prevailing factors that has a total number of children. The user may view the exact rate where the probable highest numbers of children per factors by barangay and users may get an idea to what factors has an impact on the child nutritional status. The graph can be alter depending on what quarter the user wishes to anticipate.

4. **Develop a system that provide the child's profile information available for viewing**

Figure 4.8

Child's profile information



The system displays the children's profile and its nutritional status for the users to be able to learn about the children's data and for identification. Since looking for the child's profiles and data in a paper- based time consuming, this system has a search button that allowed users to easily search for a specific child's data. Children records were based on the data input by the users which contains the child's name for identification, their address, the date and what quarter they have been weighted and their predicted nutritional status. The system has a view info button where the users viewed other information about that specific child, such as their parent's background, their age, weight and height.

4. 2 Testing/Implementation Results

The proponents performed user testing to evaluate its major functions, features, and overall user friendliness. The system was used by a sample of prospective front-end users, including ten health-care works from the Health Center of Banaybanay, it was done to decide if the built system attained its goals. Each module's functionality was enabled, and after determining its functionalities, prospective front-end users were required to rate the tested function on a scale of 1 to 5, indicating how satisfied they were with it.

The table below was used by the respondents during the system's evaluation and the proponents of the system provided the following interpretation of the computed weighted mean in order to properly evaluate the performance of the developed system.

Table 4.1

Likert Scale

Range	Scale	Adjective interpretation
4.00 - 5.00	5	Excellent (of superior quality)
3.00 – 3.99	4	Above Average (exceed the minimum standard)
2.00 – 2.99	3	Average (meets the minimum standard)
1.00 – 1.99	2	Fair (does not meet the minimum standard)
0 – 0.99	1	Poor (needs improvement)

Table 4.2

Respondent's User Acceptance Testing

Criteria	5	4	3	2	1	WM
U-1 Log In						
Log in - Allows to interact with the system by using valid user name and password	3	6	1	0	0	4.2
U-2 Manage Information						
Add Information- Allow to add children and mother's information	5	3	2	0	0	4.3
Edit Information- Allow to edit children and mother's information	5	5	0	0	0	4.5
U-3 View Results						
Predict Status- Enable to predict the children's nutritional status	8	2	0	0	0	4.8
View Rates- It enables to view the rates of the children nutritional status	7	3	0	0	0	4.7
Graphical Representation- View the graphical representation on the prevailing factors	8	1	1	0	0	4.7
View Maps- Enables to view locations that has the rates of the children's nutritional status	2	8	0	0	0	4.2
General Weighted Mean	4.48					

4.3 Implication and Discussion Results

Results from the user testing evaluation were gathered according to the analysis of the individual testing. The user module was tested and the results per one prospected front-end user ranges only from Excellent (of Superior Quality) and above average (Exceeds the minimum standards). The Total average weighted mean was identified through merging the weighted mean per module and as a result, the developed system was rated and classified as Excellent (Of Superior Quality).

CHAPTER V
SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter presents the summary, conclusion and recommendation of the system.

5.1 SUMMARY

The "NUTRI-REACH: Predicting nutritional status of children below five years old in the Municipality of Banaybanay using Supervised Machine Learning Algorithm" is primarily created to apply data mining techniques for extracting hidden patterns which are significant to predict the nutritional status of children. It comprises of user's module who has its corresponding capability inside the system in terms of managing and viewing of the predicted results. This capstone project enable health sectors, researchers and policy makers to use baseline data to design appropriate and effective intervention.

5.2 CONCLUSION

Following a thorough evaluation of the system by the intended end-users, it was found out that the overall acceptance rating given by respondents on the developed system has a general weighted mean of 4.48. As a whole, the developed systems have attained its general and specific objectives through the functionalities available in the inside system. The conclusion was derived from the data discussed in the preceding chapters, and in general, the system is user-friendly, with the efficiency of its various functionalities as it is very simple to use.

5.3 RECOMMENDATIONS

The following is the recommendation that the system needs to make in order for the improvement of the future development and iterations.

- The system's scope may be widened and may be open even outside Banaybanay, Davao Oriental.

This project's aim was to develop a system that predicts the nutritional status of children below five years old in the municipality of Banaybanay, Davao Oriental. However, most of the real-time functionality of this system is only limited to the area of Banaybanay. Thus, future researchers, system developers, and system administrators are encouraged to open the system in a different geographical area or on a larger scale to see if the same statistical results are obtained. And to increase the system's usefulness in a broader application area in order to achieve conducive and healthy surroundings.

REFERENCES

Ahmed, S. N., Jhaj, R., Sadasivam, B., & Joshi, R. (2020). Prediction of Left Ventricular Mass Index Using Electrocardiography in Essential Hypertension – A Multiple Linear Regression Model. *Medical Devices: Evidence and Research*, 163-172.

Bitew, F. H., Nyarko, S. H., Potter, L., & Sparks, C. S. (2020). Machine learning approach for predicting under-five mortality determinants in Ethiopia: Evidence from the 2016 Ethiopian Demographic and Health Survey. *Genus*, 1-16.

De Silva, I., & Sumarto, S. (2018). Child Malnutrition in Indonesia: Can Education, Sanitation and Healthcare Augment the Role of Income? *Journal of International Development*, p 837- 864.

El-Zanaty, F., & Way, A. (2009). Egypt Demograaphic and Health Survey 2008. *Ministry of Health*, p.3.

Granada, A. (2021). A guide to the education system in the Philippines. *Kabayan Remit Blog*.

Hashim, H., Talab, A. A., Satty, A., & Talab, S. A. (2015). Data mining methodologies to study student's academic performance using the C4.5 algorithm. *International Journal of Computer Science and Information Security*, p 104.

Islam, M. M., Rahman, M. J., Roy, D. C., Tawabunnahar, M., Jahan, R., Ahmed, N. A., & Maniruzzaman, M. (2021). Machine learning algorithm for characterizing risks of hypertension, at an early stage in Bangladesh. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 877-884.

Jain, D. (2014). A Comparison of Data Mining Tools using the implementation of C4.5 Algorithm. *International Journal of Science and Research (IJSR)* , p 33-37.

Kartika, D., Gema, R. L., & Pratiwi, M. (2016). Expert Systems for Identifying Children's Severe Malnutrition. *Journal of Computer Science and Information Technology*, pp. 20-19.

Lee, J., Cho, Y. K., Kim, H. S., Jung, C. H., Park, J.-Y., & Lee, W. J. (2019). Dulaglutide as an Add-on to Insulin in Type 2 Diabetes; Clinical Efficacy and Parameters Affecting the Response in Real-World Practice. *Diabetes Metab Syndr Obes*, 2745-2753.

Li, L., Yao, S., Ou, Z., & Chen, Q. (2015). *Forecast of Student Achievement Variation Trend Based on C4.5 Decision Tree.* Atlantis Press.

Molina, H. (2012). The Review of Health and Nutrition indicators in childhood. *UNESCO* , 92.

Ngiam, K. Y., & Khor, I. W. (2019). Big data and machine learning algorithms for health-care delivery. *The Lancet Oncology*, 262-273.

DAVAO ORIENTAL STATE UNIVERSITY
BANAYBANAY EXTENSION CAMPUS
Panikian, Banaybanay, Davao oriental

CERTIFICATION

This is to certify that the undersigned has reviewed all the pages of the capstone project manuscript entitled, **"NUTRI-REACH: Predicting Nutritional Status of Children Below Five Years Old in the Municipality of Banaybanay Using Supervised Machine Learning Algorithm''** as against the set of structural rules that governed the composition of the sentences, phrases, and words in the English language:

Signed:

IVY M. BAGAY, LPT, M.A.E.D
SECONDARY SCHOOL TEACHER II
LUPON VOCATIONAL HIGH SCHOOL
Poblacion, Lupon, Davao Oriental
English Critic

DAVAO ORIENTAL STATE UNIVERSITY
BANAYBANAY EXTENSION CAMPUS
Panikian, Banaybanay, Davao oriental

CERTIFICATION

This is to certify that the **"NUTRI-REACH: Predicting Nutritional Status of Children Below Five Years Old in the Municipallity of Banaybanay Using Supervised Machine Learning Algorithm"** has completed and passed the Systematic Quality Assurance Testing.

Given this 27th day of June 2022 at Davao Oriental State University-Banaybanay Extension Campus, Banaybanay, Davao Oriental.

RUBEN L. QUINDOYOS JR.
Quality Coor. / Quality Assurance

DAVAO ORIENTAL STATE UNIVERSITY
BANAYBANAY EXTENSION CAMPUS
Panikian, Banaybanay, Davao oriental

June 27, 2021

WILJONE CAPA
Instructor
Banaybanay Extension Campus
Brgy. Panikian, Banaybanay, Davao Oriental

Re: **CAPSTONE PROJECT ADVISER**

Dear Mr. Capa,

Warm greetings!

This is to earnestly request your approval to be our Capstone Project adviser. We are currently working in the project entitled NUTRI-REACH: PREDICTING NUTRITIONAL STATUS OF CHILDREN BELOW FIVE YEARS OLD IN THE MUNICIPALITY OF BANAYBANAY USING SUPERVISED MACHINE LEARNING ALGORITHM in partial fulfillment of the IT140 (Capstone Project) this First Semester SY 2021-2022.

We believe that your expertise will be able to guide us in completing our project successfully.

Your Favorable response in this regard will be truly appreciated.

Very truly yours,

Aira Mae N. Ceniza

Justin Jay Padpad

WILJONE CAPA
Capstone Project Adviser

DAVAO ORIENTAL STATE UNIVERSITY
BANAYBANAY EXTENSION CAMPUS
Panikian, Banaybanay, Davao oriental

September 24, 2021

GINA SARDING
Nutritionist
Department of Health
Banaybanay Health Center
Banaybanay, Davao Oriental

Sir, Ma'am:

Greetings!

We, the fourth – year students taking up Bachelor of Science in Information Technology (BSIT) in Davao Oriental State University – Banaybanay Extension Campus (BEC) are currently undertaking a project entitled, **"NUTRI-REACH: PREDICTING NUTRITIONAL STATUS OF CHILDREN BELOW FIVE YEARS OLD IN THE MUNICIPALITY OF BANAYBANAY USING SUPERVISED MACHINE LEARNING ALGORITHM"** in partial fulfilment of the course subject ITP140 – Capstone Project and Research 1.

The above-mentioned capstone project is proposed to predict factors resulting to malnutrition incidents using previous data of specific time frame. In this regard, we are humbly asking for your consideration and support for our data analytics thesis.

In connection with the above-stated matter, we would like to ask permission from your good office to gather data in your health institution regarding child's information and other health status. We intend to use the data collected to assist in predicting malnourished children. The data collected will remain absolutely confidential and will be used solely for academic purposes.

Your positive response will highly be appreciated. You can reach us through our email airamaeceniza27@gmail.com or our phone number 09675542769.

Thank you.

Respectfully yours,
Aira Mae N. Ceniza
Justin Jay Padpad

Noted by:
Wiljone E. Capa
Capstone Research Adviser

Ouriginal

Document Information

Analyzed document	NUTRI REACH_CAPSTONE PROJECT_CENIZA_PADPAD.docx (D141280167)
Submitted	6/27/2022 3:19:00 AM
Submitted by	Cristian D. Jael
Submitter email	jaelcristian@gmail.com
Similarity	0%
Analysis address	jaelcristian.doscst@analysis.ouriginal.com

Sources included in the report

W URL: https://archpublichealth.biomedcentral.com/articles/10.1186/s13690-018-0267- 1
Fetched: 3/20/2020 11:11:55 AM

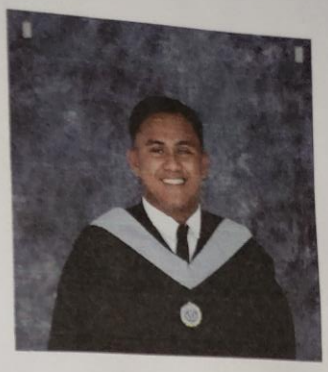
Entire Document

JUSTIN JAY PADPAD

Purok 6B Poblacion, Banaybanay,
Davao Oriental

(63) 950 957 8245

johncyndap143@gmail.com



PERSONAL DATA

Age	: 23 years old
Date of Birth	: February 12, 1999
Civil Status	: Single
Sex	: Male
Course	: Bachelor of Science in Information Technology

FIELDS OF INTEREST

- Data Processing
- Web Development
- Multimedia
- Java Programming
- Python Programming
- Analyst

EDUCATION ATTAINMENT

	School	Year Graduated
Tertiary	: Davao Oriental State University	2022
Secondary	: Eastern Davao Academy Inc.	2018
Primary	: Banaybanay Central Elementary School	2012

AIRA MAE N. CENIZA

Bagumbayan, Lupon,
Davao Oriental

(63) 967 554 2769

airamaeceniza27@gmail.com

PERSONAL DATA

Age	: 22 years old
Date of Birth	: January 20, 2000
Civil Status	: Single
Sex	: Female
Course	: Bachelor of Science in Information Technology

FIELDS OF INTEREST

- Computer literate (MS Word, MS Power Point, MS Excel)
- Networking
- English

EDUCATION ATTAINMENT

	School	Year Graduated
Tertiary	: Davao Oriental State University	2022
Secondary	: Lupon Vocational High School	2018
Primary	: Bagumbayan Elementary School	2012