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**LOAN RENEWAL RECOMMENDER SYSTEM OF PANTUKAN CHESS  
CLUB MULTIPURPOSE COOPERATIVE USING C4.5 MACHINE  
LEARNING ALGORITHM**



An Information Technology Capstone Project Presented to  
**DAVAO ORIENTAL STATE UNIVERSITY**  
**BANAYBANAY EXTENSION CAMPUS**

In Partial Fulfilment of Requirements for the Degree of  
**BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY**

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## APPROVAL SHEET

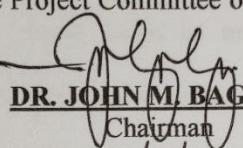
This capstone project entitled "**LOAN RENEWAL RECOMMENDER SYSTEM OF PANTUKAN CHESS CLUB MULTIPURPOSE COOPERATIVE USING C4.5 MACHINE LEARNING ALGORITHM**" Prepared and submitted by **JOHN LOYD M. SARITA, KLYNSEE M. JULAKIT, and REYNALDO D. HILARIO JR.** has been examined and is hereby recommended for approval and acceptance.

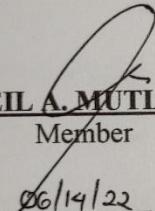
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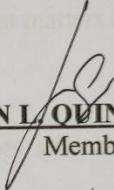
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EVALUATION RECOMMENDER SYSTEM OF PANTHAN CHESS  
COMPETITION COOPERATIVE USING GAS MACHINE LEARNING  
An application had been developed to help the Pantan Chess Club Madiun  
members in doing activities of approaching, learning and

The system consists primarily two modules, the browser module and the administrator module. The Rapid Application Development (RAD) Model is a technique used during the development phase that has four phases; requirement planning, user design, construction, and review. Because of many different rules and objectives, the administrator and library data developed by the Pantan Chess Club Madiun cooperative Corporation (PCMC). The administrator and library of software tools, including Visual Studio Code as a programming environment and MySQL as a database.

The administrator's dashboard is used to determine the position of each player in the competition, the current status of each player, the current position of each application, viewing or updating data in PCMC, adding new players, and before to take their turn, can view previous games played. And the administrator can also see the report from the system, the ready for implement, last time use the system, and the history of implemented in making of an annual application. Figure 6.14 is the user interface of the administrator's dashboard.

## **ABSTRACT**

**JOHN LOYD M. SARITA, KLYNSEE M. JULAKIT, REYNALDO D. HILARIO JR.. “LOAN RENEWAL RECOMMENDER SYSTEM OF PANTUKAN CHESS CLUB MULTIPURPOSE COOPERATIVE USING C4.5 MACHINE LEARNING ALGORITHM”(IT CAPSTONE PROJECT). DAVAO ORIENTAL STATE UNIVERSITY BANAYBANAY EXTENSION CAMPUS. JUNE 2022.**

**Adviser: Mr. Wiljone E. Capa**

**LOAN RENEWAL RECOMMENDER SYSTEM OF PANTUKAN CHESS CLUB MULTIPURPOSE COOPERATIVE USING C4.5 MACHINE LEARNING ALGORITHM** had been developed to help the Pantukan Chess Club Multipurpose Cooperative making decisions of approving loan renewal.

It contains primarily two modules: the borrower module and the administrator module. The Rapid Application Development (RAD) Model is a technique used during the development phase that has four phases: requirement planning, user design, construction, and cutover. To identify different rules and objectives, the researchers used dummy data approved by the Pantukan Chess Club Multipurpose Cooperative(PCCMPC). The proponent used a variety of software tools, including Visual Studio Code as a source code editor and MySQL as a database.

The user's assessment was used to determine the outcomes. Overall, the system suggested a decision of loan application, viewing of important data in PCCMPC, adding payments of borrowers, and helping to make their loan renewal process faster. Users were delighted and accepted that the system was ready for implementation because the system will help them in decision making of a loan renewal applications, scoring 4.14 in the user

module and 4.16 in the administrator module out of 5 on average, indicating that the system is Above Average.

After the evaluation, the proponents were able to develop suggestions and insights for the system's development plans based on the feedback from potential users.

bad loans rates (Bank of America, 2021). The global financial crisis, triggered by the European sovereign debt crisis, resulted in a major increase in the number of bad loans in the banking sector (Kaneko et al., 2021).

There are several drawbacks to a paper-based loan process. The fact that the application is still done manually is one of the factors that makes the loan approval process difficult for many lending companies. For one thing, copying and sending documents is expensive. There may also be delays in receiving the paperwork (Gutierrez, 2018). Furthermore, Consumer lending has traditionally involved several manual processes that significantly lengthen the time required to complete a loan transaction and increases the risk of human error or mis-entry (Gutierrez, 2019).

A borrower who has missed payments is already considered a delinquent client, which is a common problem in the Philippine banking industry (Peter, 2021). In 2021, non-performing loans held by the Philippines are continuing to rise. According to data released by the Bangko Sentral ng Pilipinas (BSP), gross NPLs increased by 30% to P479.61 billion in May 2021, an increase proportional to the increase of bad loans by 3.4%, from P461.679 billion in April 2021 (Lapul, 2021).

According to PCCMPC, bad loans were also faced in the Financial Crisis that Multiservice Corporation (FMC). The percentage of problematic loans in FMC's portfolio grew by 16.20% to 17.48% per year. At FMC, the initial loan review process that takes a long time. This might the approval process may difficult and costly at the

## **CHAPTER I**

### **INTRODUCTION**

Commercial banks and cooperative banks play a vital role in the economy by providing credit, accepting deposits, facilitating payments, and assisting consumers with risk management (Barone, 2022). The global financial crisis, followed by the European sovereign debt crisis, resulted in a major increase in the number of bad loans in Europe's banking sector (Kenton et al., 2021).

There are several drawbacks to a paper-based loan process. The fact that the application is still done manually is one of the factors that makes the loan approval process difficult for many lending companies. For one thing, copying and sending documents is expensive. There may also be delays in receiving the paperwork (Peterson, 2018). Furthermore, Consumer lending has traditionally involved several manual processes that significantly lengthen the time required to complete a loan transaction and increases the risk of human error or mis-entry (Gnatyuk, 2019).

A borrower who has missed payments is already considered a delinquent client, which is a common problem in the Philippine banking industry (Perez, 2021). In 2021, non-performing, loans held by the Philippines are continuing to rise. According to data released by the Bangko Sentral ng Pilipinas (BSP), gross NPLs increased by 83% to P479.481 billion in May 2021, an inversely proportional to the increase of bad loans by 3.4% from P463.659 billion in April 2021 (Noble, 2021).

According to PCCMPC, bad loans were also faced in the Pantukan Chess Club Multipurpose Cooperative (PCCMPC). The percentage of problematic loans in (PCCMPC) fluctuates between 15% to 20% per year. At PCCMPC, the manual loan renewal process takes a long time. This makes the approval process more difficult and involves the

assessment of more documents to ensure a member's loan renewal eligibility. Pantukan Chess Club Multipurpose Cooperative has a web-based system that is in use, although it is not automated. The researcher designed an automated system for the cooperative to assist in decision-making revolving around the process of approving loan renewal applications.

### **1.1 Purpose and Project Description**

The purpose of this project is to automate the Pantukan Chess Club Multipurpose Cooperative regarding loan renewal of members based on their previous loan credit. Along with that, this will also allow the members of PCCMPC to view and track their loan/credit history by visiting the ALR-PCCMPC System.

The project is being built using a Decision Tree C4.5 algorithm that predicts a member's eligibility for renewal based on the entire loan/credit history. The system can also assist the PCCMPC administrator to retrieve loan information/Credit history as well as personal information for each member of PCCMPC. Members can view their history of credit/loans and also can apply for loan renewal online, and the admin can decide whether to approve or disapprove the loan renewal application. The system will then send the member a message/notification, to inform them of the status of their loan renewal application via Short Message Service (SMS). Additionally, the PCCMPC administrator can view the collection situation of the cooperative in every branch in every loan type using a graphical representation.

### **1.2 Objectives of the study**

The developed capstone project entitled, "Loan Renewal Recommender System of Pantukan Chess Club Multipurpose Cooperative using C4.5 Machine Learning Algorithm" is designed to create an automated loan renewal approval web-based system.

**Create a system that can suggest the eligible amount for loan/credit renewal and displays the amortization of the loan renewal amount requested.**

The proponents established a system that allows the administrator to determine the maximum amount for loan/credit renewal based on the members' monthly net income, as well as display the amortization of the loan renewal amount requested.

**Create a system that can show a graphical representation of PCCMPC's important reports.**

The proponents created a system that shows a graphical presentation of Pantukan Chess Club Multipurpose Cooperative's vital reports, such as the total amount released each year in each loan category, a list of approved and disapproved loan applications, and a list of PCCMPC members. Using this graphical representation of PCCMPC's vital data, the system will allow PCCMPC administrators to examine or view the cooperative's state.

**Create a system that will allow the user/members of PCCMPC to file a renewal of loans online.**

The proponents created a system in which the members can apply for loan renewal online. The members have their own account that enables them to input the necessary information for applying for loan renewal that is prescribed by the recommender system. Also, members can upload a picture of any proof of payslip for their income or business permit for their business. The system also sends a direct message if the application of that member is approved or disapproved via Short Message Service(SMS).

**Create a system that can suggest the approval of a loan renewal application of the members of PCCMPC using the C4.5 machine learning algorithm.**

The proponents created a system that helps the administrator in terms of decision-making for the approval of loan renewal by utilizing previous loan records of PCCMPC and the C4.5 machine learning algorithm. The recommendation of the system is still subject to approval by viewing the members' credit history and their loan renewal application.

**Create a system that allows PCCMPC members to access/view their credit history/loan status.**

The system that has been created allows the members to see their credit history and see how they handle their loan credits in the past. The members will have a user interface where they can view their payments on their previous loans and also their pending loans.

### **1.3 Significance of the study**

The development of this project was found to be beneficial to the following entities:

#### **PCCMPC Administrator**

The PCCMPC administrator has real-time monitoring of all the collections in every branch in every loan type. In terms of making decisions for every application for loan renewal the administrator can view the borrowers' credit history and their application and with that the administrator can create real-time decision making.

### **Borrowers/Members**

The borrower will be able to login into the system, which enables them to apply for loan renewal online. This will reduce their physical contact as well as the time it takes to apply for loan renewal because this system is web-based and automated.

### **Future Researchers**

This research will assist future researchers in becoming aware of and knowledgeable about the processes involved in the bank cooperatives. It will help them become better analysts and will serve as a future reference for future studies.

#### **1.4 Scope and Limitation**

The scope of this project focused on developing a Web-based system that helps in automating loan renewals at Pantukan Chess Club Multipurpose Cooperative (PCCMPC) to make decisions on issuing loans. The administrator manages the members of the cooperative and they can add and edit also they can search for the basic information of that borrower in terms of their loans/credits. Also, the administrator can add payments of the borrower to its applied loan/credit. The system has two users: PCCMPC's admin and the loan renewal applicants or members. Loan renewal applicants on the other hand will have their corresponding user interface which will allow them to file loan renewals online.

The system is only available to Pantukan Chess Club Multipurpose Cooperative (PCCMPC). The system is only accessible to PCCMPC and its members. To gain access to the system's content, the user must be a registered member of the cooperative, and those who are not members of PCCMPC will unable to apply for a loan renewal. Those new applicants or new members will be unable to file their loans since the system

is for the user/members applying for loan renewal only. The system has a payment module so the administrator can add payments for specific loans.

sources or studies that are relevant to the system

## 2.1 Related Literature

The researchers conducted extensive research on various sources or studies relevant to the system while developing this capstone project. The following are the various articles from which we have gathered information, regardless of the scope, but they used the Decision tree algorithm, which helps us in making the study.

### 2.1.1 How Much Do Existing Borrowers Value Microfinance? Evidence From An Experiment On Bundling Microcredit And Insurance

This research focuses on the United States by Banerjee, et al. (2017), who says that a randomised evaluation of the impact of microfinance on established microfinance borrowers. The paper draws on an incident in which established microfinance clients in randomly selected villages in India were required to purchase a health insurance policy as part of the renewal of their microfinance loans. They investigate the causal effects of microfinance on established borrowers, as well as the valuation of those clients' ongoing microfinance relationships. As a result, they found out that a microfinance institution modestly increased their clients' fees in randomly selected villages in exchange for a mandatory health insurance policy (which turned out to be entirely useless due to administrative failure). The first finding is that the modest increase in fees increased by 0.7 percentage point (or 30%) decrease in fees received in the treated villages.

## **CHAPTER II**

### **REVIEW OF RELATED LITERATURE AND SYSTEMS**

In creating this project, The researchers gathered related research from various sources or studies that are relevant to the system.

#### **2.1 Related Literature**

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when compared to control villages where the policy was not implemented. The proponents will be using this review-related literature in the aspect of knowing the members' loan history.

### **2.1.2 Loan Repayment Prediction Using Machine Learning Algorithms**

A study conducted in Los Angeles by Han, (2019). In the lending industry, this research focuses on the borrowers to determine if they can repay their loans in exchange for the promise of interest-bearing repayment. The lender will profit from the interest if the borrower repays the loan. However, if the borrower fails to repay the loan, the lender suffers a financial loss. As a result, lenders must forecast the risk of a borrower's inability to repay a loan.

So as stated above, the proponents would train several Machine Learning models and evaluate their performance in terms of determining if they can repay their loan using a specific algorithm.

### **2.1.3 Prediction Of Loan Approval Using Machine Learning**

This research focused on prediction loan approval using machine learning algorithms, Logistic Regression (LR), Decision Tree (DT), and Random Forest (RF) (Kumar et al., 2019). The experimental results concluded that the accuracy of the Decision Tree machine learning algorithm is better as compared to Logistic Regression and Random Forest machine learning approaches. The proponents used the research prediction of loan approval using machine learning in the aspect of predicting the loan renewal using a decision tree algorithm.

#### **2.1.4 Decision Tree C4.5 Algorithm**

A common classification technique used to build models is decision tree induction. The learning algorithms that decision trees use differ in the methods that they employ to select the attribute that is used to split the records at a given point in the tree (Rim et al., 2020). C4.5 Decision Tree is the very first fundamental supervised machine learning classification algorithm that has been widely implemented and consistently achieves very good prediction performance (Indrea, 2019). A decision tree is a flowchart-like tree structure that can be built from a given set of attributes, with each branch representing a test outcome and each leaf node representing a class (Yadav, 2018).

Hence, the information gained due to maximized uncertainty of a particular event in the Decision Tree has a part of variable E = Particular event, and based on that event we identify lots of different outcomes which have a variable of N=number of outcomes. With that different outcomes, PRUNING will be performed which is to remove the branches in our decision tree which do not contribute significantly to our decision process and avoid overfitting of the regression or classification model process.

Along with that process, two possible outcomes were chosen and have a variable of P and Q. In addition, the variables P and Q have a 50% chance of becoming the possible outcome. This is where decisions are made (Saha, 2018).

The proponents used the C4.5 Decision Tree as an algorithm in developing this capstone project. Along with that, it was found that this research entitled, “Implementation of a decision tree using C4.5 algorithm” in decision making of

loan application by the debtor (Case study: Bank Pasar of Yogyakarta Special Region) focused on the performance of C4.5 or decision algorithm in identifying debtor's eligibility (Amin et al., 2015).

#### **2.1.5 Creation Of Loan Automation Application**

On the other hand, this research focuses on designing and developing a loan automation application. It also includes the discussion of why automation loan applications are needed for many banking organizations. The researchers of this study discuss how the manual process of obtaining and granting loans is stressful, inconvenient, and time-consuming for both the lender and the borrower in this study. A lender with geographically dispersed branch offices needs a more effective and efficient way to standardize and control loan procedures and processes (Adebayo et al., 2014).

The result is a loan automation application that saves paperwork throughout the loan's life cycle and makes its design available as a guide or foundation for the creation of similar or improved systems. In many ways, Loan Automation Application Software would improve a lending institution's customer service and make lending operations more efficient and transparent. To make it all work, the computer's computational speed, accuracy, and storage capabilities would be combined with the human's creativity and intuition.

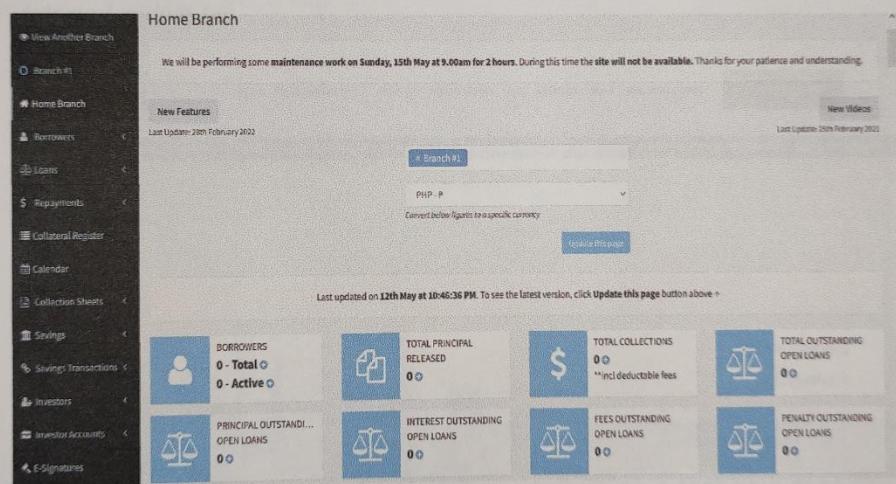
Since it focuses on creating a loan automation application, the proponents used the research in the aspect of automation, creating a system that automated and predicted the eligibility of a member for a loan renewal.

## 2.2 Related Systems

### 2.2.1 Loandisk – Lending System Software

The Loandisk system was conceived by one of the founders who also happens to run a recruitment company in Australia. Having hundreds of employees meant that some employees required loans from the company and it was becoming increasingly difficult to manage the loans. Loandisk is online software that allows lending businesses to manage their borrower, loans, repayments, and collections with ease while being affordable at the same time.

**Figure 1**  
*Loandisk*



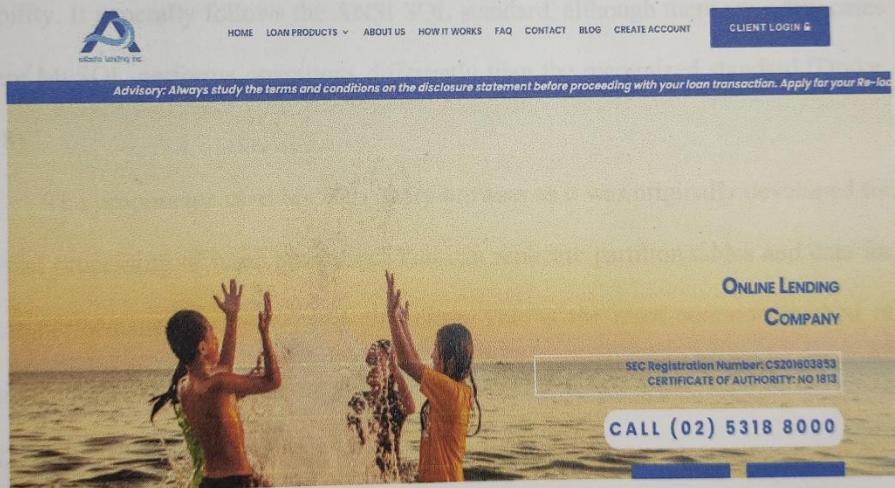
So the idea was to develop an internal software that will manage all the loans and repayments. After exploring the software the structure of this system gave the researchers the idea that may apply to the current system, it became evident that this was a great tool that made it easy to manage the staff loans.

This website gave the idea of predicting loan renewal in PCCMPC. The feature of Loan Management is where the admin can view information and loan details and through that details, it can predict if that member can be approved to renew a loan or not.

### 2.2.2 Asteria Lending Inc.

Asteria Lending Inc. is an online financing and online lending site where both personal and business loans fulfill the financial requirements of a member. The main priority of Asteria is to provide an easy, hassle-free, customizable loan service, where the member's needs are to be put first.

**Figure 2**  
*Asteria Lending Inc.*



Additionally, Asteria Lending Inc. manages all the loans and repayments. When it comes to cash, the Asteria team understands the importance of quick service. Asteria provides loans with a manageable and equitable repayment structure. This gives the clients the freedom to repay their loans without undue stress.

## **CHAPTER III** **METHODS AND MATERIALS**

The chapter is about the technologies used to develop the whole system. The framework and its functionalities are also included in the chapter. This would give us the whole picture of how the system is implemented.

### **3.1 Details of the Technologies being used**

The following are the lists of tools and software being used by the proponents in the development of this project.

#### **3.1.1 MySQL Query Browser 1.2.20**

MySQL is an open-source relational database management system. One of the most widely deployed SQL databases, MySQL prioritizes speed, reliability, and usability. It generally follows the ANSI SQL standard, although there are a few cases where MySQL performs operations differently than the recognized standard (Drake, 2018).

The proponents used MySQL query browser as it was originally developed for the fast processing of large databases. You can replicate partition tables and data for better performance, usability, and durability. This is the most common method of adding, accessing, and managing content in the database.

#### **3.1.2 Visual Studio Code 1.66.2**

Visual Studio Code is a streamlined code editor with support for development operations like debugging, task running, and version control. It aims to provide just the tools a developer needs for a quick code-build-debug cycle and leaves more complex workflows to fuller featured IDEs, such as Visual Studio IDE. The proponents used

Visual Studio Code, because it is a good editor for many coding fields, from software scripting to web development.

The proponents used Visual Studio Code for employing Python, which is a sensitive language. Visual Studio Code, unlike other text editors, can quickly discover and locate errors with the help of visual studio code extensions.

### **3.1.3 Microsoft Word 2016**

Microsoft Word, also known as MS Word, is a graphical word processing program that allows users to type. It is created by Microsoft, a computer company. Its function is to enable users to type and save documents. It has document creation tools that are similar to those found in other word processors (Rensburg, 2020).

Microsoft Word was used as the text editor as it is for creating high-quality documents, reports, letters, and resumes. Microsoft Word, unlike a plain text editor, included features such as spell check, grammar check, text and font formatting, HTML support, image support, advanced page layout, and more.

### **3.1.4 WampServer 5.6.17**

WampServer is a web development platform. It refers to a Microsoft Windows software stack that includes the Apache web server, OpenSSL for SSL support, the MySQL database, and the PHP programming language (WampServer, 2018).

WampServer was used for it is lightweight and simple to set up, as well as to run the website offline.

### **3.1.5 Microsoft Excel 2016**

Microsoft Excel is a useful piece of software for storing and organizing large amounts of data. It is a tool to make information datasheets by utilizing their features

and formulas. For example, you could use a spreadsheet to track data and see sums, averages, and totals automatically.

The proponents used Microsoft excel for viewing a dataset. The proponents' utilized Excel to solve and calculate the algorithm's information gains, gain ratio, gains, split info, and entropy.

### **3.1.6 Google Chrome 91.0.4472.106 (Official Build) (64-bit)**

Google Chrome is a free web browser created by Google that can be used to access web pages on the internet (Moreau, 2020). Google Chrome is a simple web browser that is easy to use, versatile, and compatible with a wide range of operating system devices. It has a very clean and minimal design, as well as an interface that is appealing to all users.

The proponents used Google Chrome in creating this project to search for any studies that were related to the topic and also it is easy to use, versatile, and compatible.

### **3.1.7 Python 3.9.6**

Python is an object-oriented, high-level programming language with dynamic semantics that is interpreted. Its high-level built-in data structures, combined with dynamic typing and dynamic binding, make it very appealing for Rapid Application Development, as well as used as a scripting or glue language to connect existing components (Mahnken, 2021).

The proponents used Python for implementing the algorithm. Python is stable and flexible, and it's perfect for various machine learning and artificial intelligence projects that have a high-level programming language.

### **3.1.8 HTML 5**

HTML (Hypertext Markup Language) is a web markup language that specifies the structure of web pages. The structure of web pages is determined by HTML. This structure is insufficient to make a web page attractive and interactive. As a result, you'll employ CSS and JavaScript to make your HTML more visually appealing and interactive, respectively (Chris, 2021). The proponents used HTML, CSS, and Javascript for the front-end design of the system.

### **3.1.9 CSS 2.1**

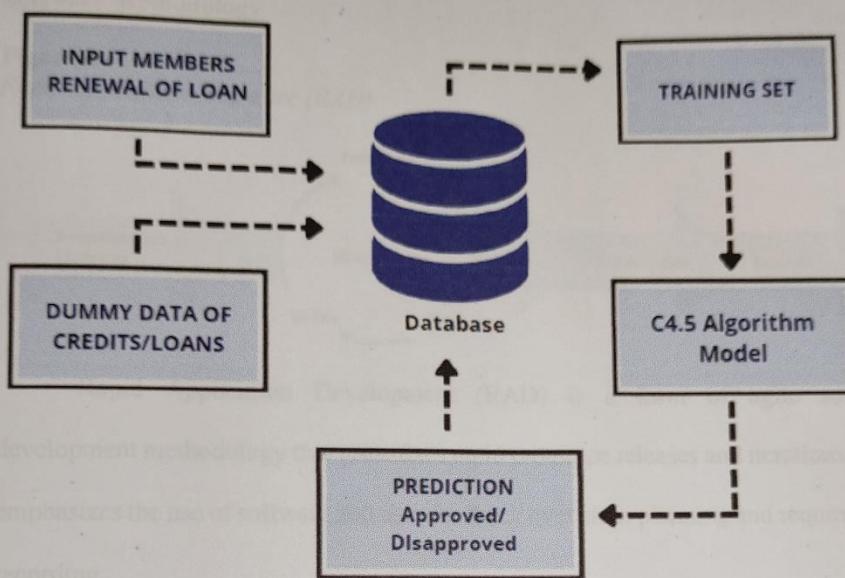
CSS is an abbreviation for Cascading Style Sheets, with an emphasis on the word "style." While HTML is used to structure a web document like headlines and paragraphs, as well as allowing you to embed images, video, and other media, CSS comes in and specifies the style of your document page layouts, colors, and fonts are all determined by CSS (Morris, 2020). CSS is preferable to use because it can be used by any web page that references the CSS file. It controls different parts of the page, such as the design, layout, and other aspects of web pages.

### **3.1.10 JSON 2020-12**

JSON is an acronym for JavaScript Object Notation. It is a data interchange technology that is both human-readable and extremely lightweight. Though JSON is based on JavaScript, it also employs conventions familiar to programmers of other languages such as C, C++, C#, Perl, Python, and many others. JSON is a text format that makes it completely easy for humans to read and write. Parsing and generating JSON to the system is equally easy for the machines. The proponents used JSON for the back-end functions of the system.

### 3.2 Conceptual Framework

**Figure 3**  
*Conceptual Framework*



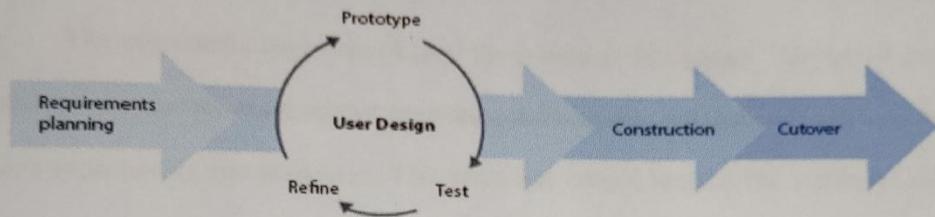
The figure above shows the process of automating loan renewal in Pantukan

Chess Club Multipurpose Cooperative (PCCMPC). In the “Input Members Renewal of Loan,” the borrowers apply for loan renewal online. Second, in “Dummy Data of Credits/Loans” the proponents used dummy data for the cooperative due to their data privacy. Dummy data and members’ renewal of loan applications will be stored on the database and will be included in the “Training Set” and will be processed using the “C4.5 Machine Learning Algorithm” to create rules for decision making in the loans renewal process; last, “Prediction Approved/Disapproved” prediction or the suggested result of the system. This

algorithm will be in charge of accurately processing and testing a member's eligibility for loan renewal whether that applicant is approved/disapproved.

### 3.3 Software Methodology

**Figure 4**  
*Rapid Application Software (RAD)*



Rapid Application Development (RAD) is a form of agile software development methodology that prioritizes rapid prototype releases and iterations. RAD emphasizes the use of software and user feedback over strict planning and requirements recording.

#### Requirements Planning

In this phase, the proponents gathered all the important information that helped in making the system such as conducting an interview, reading some studies and articles on the internet that are related to the topic, and any other way to help make the system. In gathering the data, the proponents created a letter or other requirements in obtaining the data needed. Afterward, the letter was sent to the target organization where the data has been requested. Following completion of all requirements is the brainstorming ideas to fully understand all requirements in carrying out such a capstone project.

#### User Design

In this phase, the proponents created a basic design that shows the ideas gathered from requirements planning. Then, testing the system components and

features to ensure that the user's needs are met at every stage of the design process. Afterward, consult with a designated adviser to inform of the proposed design and to see if there were any processes or designs that needed to be refined. If there was, the cycle was repeated until the processes and designs no longer need to be refined.

### **Construction**

The proponents began developing the system in this phase. Throughout the development process, ensuring that everything ran smoothly and that the result met the user's expectations and objectives. This stage was critical because the user-provided input throughout the process. The proposed modifications, changes, or even new ideas to solve problems as they arise.

### **Cutover**

This is the last phase where the deployment of the finished product goes to lunch. It included data conversion, testing, and changeover to the new system, as well as user training.

#### **3.3.1 Requirements Specification**

It is important that the requirements were defined and analyzed in detail to give the proper analysis and design. It has gathered and defined the requirements of the system and must be carefully evaluated to achieve the desired result.

##### **3.3.1.1 Product Perspective**

The system is an online web-based system that used historical data from the cooperative and uses the data to determine the common attributes of eligible applicants for a loan renewal. The system automatically approved or disapproved the members for loan renewal using the processed dataset.

### **3.3.1.2 Product Features**

In the administrator field, the system provided a feature that managed the members of PCCMPC and automated the members who are eligible for loan renewal using a C4.5 Machine Learning Algorithm. Furthermore, in the user field, the system has a feature that allows the user to login an account and also included a feature for the members where they can read the terms and conditions of Pantukan Chess Club Multipurpose Cooperative (PCCMPC) and the system provides a feature where they can apply loan renewal also they can view their credit history.

### **3.3.1.3 User Classes And Characteristics**

The following are the people who will be using the system:

**Admin** – The administrator is the loan officer who can manage the members. The administrator can also add a member who goes directly to the office of PCCMPC to apply for a loan renewal. Each member's loan history can also be viewed by the administrator whether they are approved or disapproved.

**Users** – Members of PCCMPC are the system's users. To proceed with the loan renewal, the user will enter their loan details online. Users will be notified by the administrator if their loan renewal has been approved or disapproved.

### **3.3.1.4 OPERATING ENVIRONMENT**

Throughout the development process, the system makes use of various software, tools, and technology, which users used to run the system. It contains the following items:

#### **3.3.1.4.1 Software Specification**

**Table 1**  
*Software Specification*

Local Server	WampServer 5.6.17
Database	MySQL Server 1.2.20
Integrated Development Environment	Visual Studio Code 1.66.2
Word Processor	Microsoft word 2013
Spreadsheet	Excel 2013
Browser	Google Chrome 91.0.4472.106 (Official Build) (64-bit)

These are the software that was used to develop the project. WampServer and MySql were linked because WampServer is used to connect to MySql and access the data stored in it. Visual Studio Code or VScode is an integrated development environment that is used for developing the system. Microsoft Word is used to create file documents and to view the dataset using Microsoft Excel. Google Chrome is used to access project-related web pages.

### **3.3.1.5 OTHER NON-FUNCTIONAL REQUIREMENTS**

Having non-functional requirements are good. The non-functional requirements of the system included Portability (access from various software and hardware platforms) and deployment to various hardware platforms.

### **3.3.1.4.2 Hardware Specification**

**Table 2**

*Hardware Specification*

DESKTOP APPLICATION	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz 1.80 GHz
	4.00 GB (3.88 GB usable)
	64-bit operating system
	x64-based processor

These are the hardware specifications that were used by the proponents in creating this project.

### **3.3.1.5 DESIGN AND IMPLEMENTATION CONSTRAINTS**

The system did not function unless an internet connection is available. The members cannot apply for a loan renewal online unless they first log in to an account. Users may be dissatisfied if certain functions and designs were not properly implemented.

### **3.3.1.6 USER DOCUMENTATION**

The system was built in a documented manner, and one of the system's requirements is that it would be simple to follow and use for the users. In addition to these operating environments, the proponents provided a user manual with step-by-step instructions on how to use and apply for loan renewal to the system.

### **3.3.1.7 OTHER NON-FUNCTIONAL REQUIREMENTS**

Having non-functional requirements are good. The non-functional requirements of the system included Portability (access from various software and hardware platforms, and deployment to various hardware platforms),

Efficiency (loan contents managed efficiently and content structure well organized and precisely represents the system; interface concise and precise for all users), Security (identities of each registered client kept private; each registered client logs-in with username and password; without appropriate permissions, clients cannot access any data in the system), Reliability (the system will not crash on software bugs; platform failures must be recoverable by the program developers), Speed (system function must not be seen as slow), and Fault tolerance issues (back-up and clean-up).

### **3.3.2 Analysis**

#### **3.3.2.1 Technical Feasibility**

To develop this project, the proponents used a variety of tools and software which are currently available on the internet. Also, they needed a laptop or computer and internet to run that software. In terms of computers, the company was able to afford/buy a computer for the system. In the deployment process, the users needed a browser and internet connection to access the system. PCCMPC can use these analytics to determine which members were eligible for a loan renewal.

#### **3.3.2.2 Economic Feasibility**

The researchers used different hardware and software in developing this system and we used a laptop and internet connections to gain an access to the system. The proposed system did not require a large sum of money to develop. This can be done economically if planned properly, making it economically feasible. In addition, Pantukan Chess Club Multipurpose Cooperative (PCCMPC) can benefit from this system.

### 3.3.2.3 Operational Feasibility

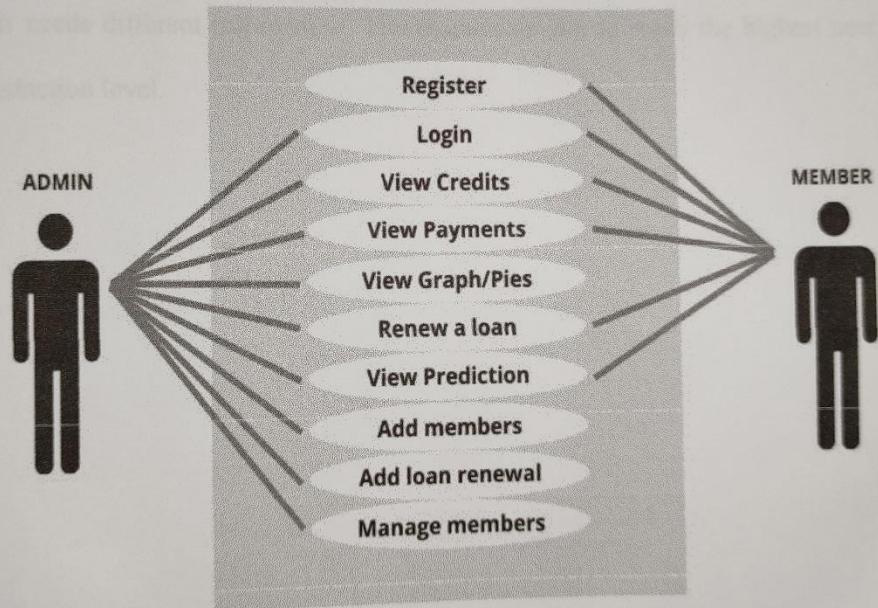
The system was developed to be easy to use and it provided a user manual to know more about the features of the system. The system did not require any special technical assistance, and all of the views available were self-explanatory. All actions were well-guided for the users, with warning and failure messages.

### 3.3.3 Design

#### 3.3.3.1 Use Case Diagram

**Figure 5**

*Use Case Diagram*



In this figure, the admin is logged in and has direct access to the system.

Each member's personal information and credit history were viewed by the administrator. The administrator can also file a loan renewal to a member who visits their offices directly, and the predicted result (approved/disapproved) will appear automatically once the renewal was completed. A member who has been

inactive for a long time can be deactivated by the administrator. The user/member may register or log in to view their credit history and apply for a loan renewal. Once the user/member has completed the loan renewal form, the admin notified them whether they were approved or not.

### **3.3.4 DEVELOPMENT AND TESTING**

Using different data and information gathering techniques, the developers of the system accomplished the main objectives of the system. The researchers used methods and materials such as rating sheets, close-up interviews, research, and data compilation. Data gathering plays a very important role especially for our system as it needs different information. The proponents aim to reach the highest user satisfaction level.

## CHAPTER IV RESULTS AND DISCUSSION

This chapter presents the results of every objective and discusses how it is being attained. Screenshots of the software were attached here as proof.

### 4.1 Achievement per Objective

- 1. Create a system that can suggest the eligible amount for loan/credit renewal and displays the amortization of the loan renewal amount requested.**

**Figure 6**

*Show Possible Highest Loan Amount*

Loan Term \*

12 Months

Mode of Payment \*

Monthly

Actual net Income per Month \*

35000

Attach file/picture for Proof (optional)

Choose File colorful-pro...4556919.jpeg

Loan Amount: \*

Approximate Highest Loan Amount: ₦ 396000

Monthly Payment: ₦ 2875

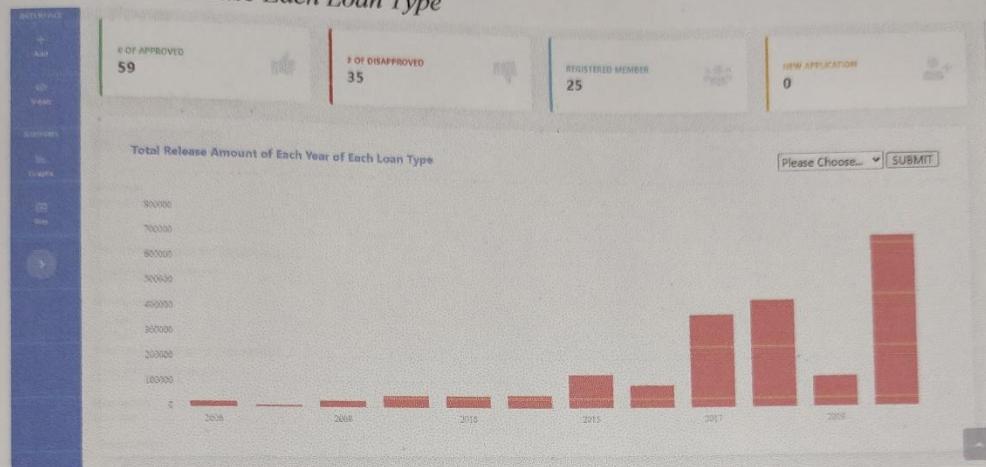
30000

The proponents created a system that allows the administrator to analyze and track the members' credit history when they were applying for loan renewal, and also the administrator can determine the right amount for loan/credit renewal using the members' payment performance history and monthly net income.

**2. Create a system that can show a graphical representation of PCCMPC's important reports.**

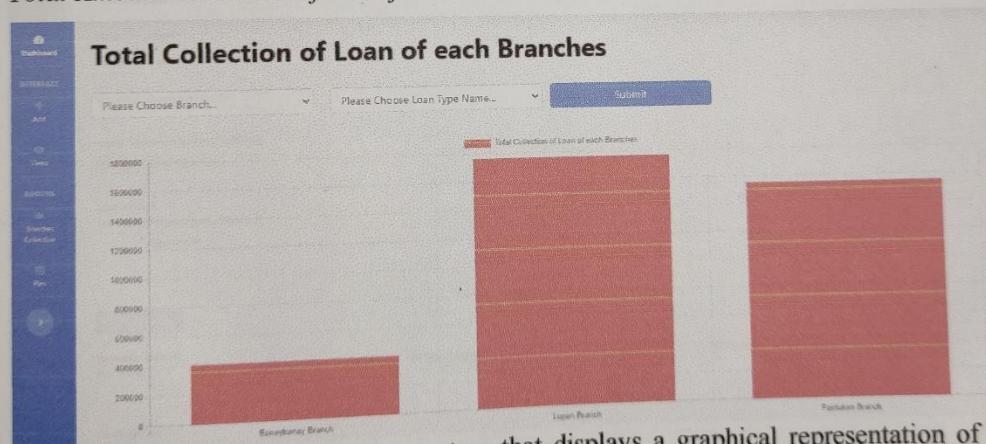
**Figure 7**

*Total Amount Release Each Loan Type*



**Figure 8**

*Total Amount Collection of Loan for PCCMPC Branches*



The proponents created a system that displays a graphical representation of Pantukan Chess Club Multipurpose Cooperative's important data about a loan renewal. The System allowed the PCCMPC administrator to see or view the condition of the cooperative using this graphical representation of PCCMPC's imperative data.

**3. Create a system that will allow the user/members of PCCMPC to file a renewal of loans online.**

**Figure 9**

*Renewal Form*

The screenshot shows a web-based renewal form titled "Renewal Form". The form is divided into several sections:

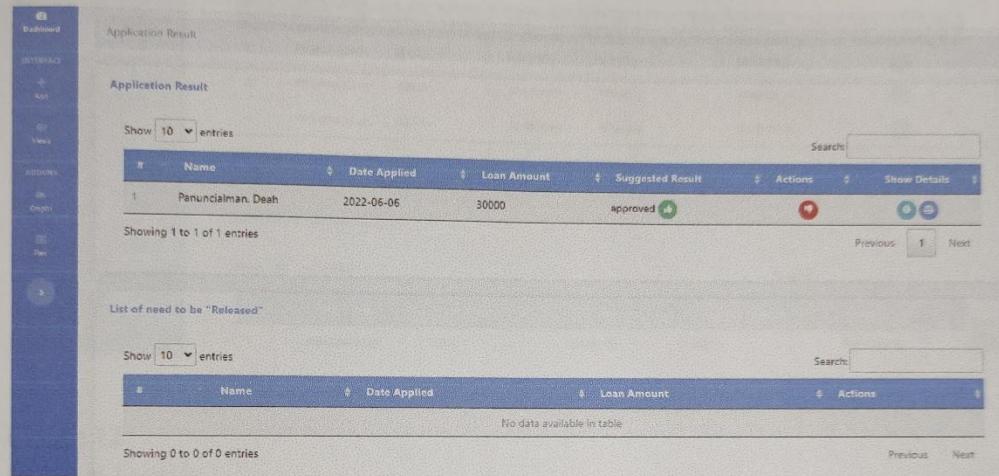
- Job Details**:
  - Employed? \*  
 Yes  
 No
  - If Yes Attach file/picture for Proof (optional)  
[Choose File] No file chosen
- Self-employed? \***
  - Yes  
 No
  - If Yes Attach file/picture for Proof (optional)  
[Choose File] No file chosen
- Loan Details**:
  - Loan Type \*  
Please Choose...
  - Collateral Type \*  
Please Choose...
  - Loan Term \*  
Please Choose...
  - Mode of Payment \*  
Please Choose...
  - Actual net Income per Month \*  
Attach file/picture for Proof (optional)  
[Choose File] No file chosen
- Loan Amount:**
  - Approximate Highest Loan Amount:
  - Payment:
- Select Calculator**
- Co-maker Details**:
  - First Name \*
  - Middle Name \*
  - Last Name \*
  - Co-maker Income \*
- Apply**

The proponents created a system in which the applicants/members can apply for loan renewals online. The members have a user interface where the administrator

will ask for additional information from the member that could help their application for the loan renewal process.

**4. Create a system that can suggest the approval of a loan renewal application of the members of PCCMPC using the C4.5 machine learning algorithm.**

**Figure 10**  
*Suggested Result Loan Application*



The screenshot displays a web-based application interface for managing loan renewals. On the left, a vertical sidebar lists navigation options: Dashboard, INTERFACE, View, ADDONS, and Help. The main content area has a header 'Application Result'.

**Application Result:** This section shows a table titled 'Application Result' with the following data:

#	Name	Date Applied	Loan Amount	Suggested Result	Actions	Show Details	
1	Panuncialman, Deah	2022-06-06	30000	approved			

Below the table, a message says 'Showing 1 to 1 of 1 entries'. At the bottom right, there are 'Previous' and 'Next' buttons.

**List of need to be "Released":** This section shows a table with the following columns: #, Name, Date Applied, and Actions. The table is currently empty, displaying the message 'No data available in table'.

Below this table, a message says 'Showing 0 to 0 of 0 entries'. At the bottom right, there are 'Previous' and 'Next' buttons.

The proponents created a system that will know the specific member whether he/she is approved or disapproved based on the previous loans of PCCMPC by using the C4.5 machine learning algorithm. The system suggested decisions to the administrator regarding the members' application for approving loan renewal.

**5. Create a system that allows PCCMPC members to access/view their credit history/loan status.**

**Figure 11**  
*Credit History*

The screenshot shows two tables of loan history. The top table, titled "Credit History (Approved)", lists three entries with columns for No., Loan Type, Loan Amount, Loan Term, Mode of Payment, Date Applied, and Payment Details. The bottom table, titled "Credit History (Disapproved)", lists one entry with similar columns. Both tables have search and pagination features.

No.	Loan Type	Loan Amount	Loan Term	Mode of Payment	Date Applied	Payment Details
1	Personal Loan	20000	6 Months	Weekly	2006-04-22	
2	Personal Loan	20000	12 Months	Monthly	2022-04-26	
3	Personal Loan	20000	12 Months	Monthly	2022-04-27	

No.	Loan Type	Loan Amount	Loan Term	Mode of Payment	Date Applied
1	Personal Loan	15000	12 Months	Monthly	2017-08-05

**Figure 12**  
*Payment Details*

The screenshot shows a table of payment details for a specific loan. It includes columns for Due Date, Balance, Principal, Interest, Total, and Balance. The table shows six payments starting from 2006-5-22.

	Due Date	Balance	Principal	Interest	Total	Balance
1	2006-5-22	24000.00	3333.33	666.67	4000.0	20000.00
2	2006-6-22	20000.00	3333.33	666.67	4000.0	16000.00
3	2006-7-22	16000.00	3333.33	666.67	4000.0	12000.00
4	2006-8-22	12000.00	3333.33	666.67	4000.0	8000.00
5	2006-9-22	8000.00	3333.33	666.67	4000.0	4000.00
6	2006-10-22	4000.00	3333.33	666.67	4000.0	0.00

The proponents created a system that gave users/members limited access to their credit history and allowed them to see how they handled their loan credits in the

past. The members have a user interface where they can see or view their payments on their previous loans.

#### 4.2 Testing/Implementation Results

**Table 3**  
*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**  
*User Acceptance Testing Result in User*

**User Module**

Criteria	5	4	3	2	1	WM
<b>U-1 View Credit History</b>						
View Credit history allows the user to view their credit history.	3	6	1			4.2
<b>U-2 View Payment Details</b>						
View Payment Details allows the user to view their Payment Details.		8	2			3.8
<b>U-3 View Personal Information</b>						
View Personal Information allows the user to view their Personal information.	6	4				4.6
<b>U-4 Apply for Loan Renewal</b>						
Apply for Loan Renewal allows the user to apply for Loan Renewal online.	4	6				4.4
<b>U-5 Edit Personal Information</b>						

Edit Personal Information allows the user to edit their Personal Information.	3	5	2			4.1
<b>U-6 User can Change Username/Password</b>						
Users can change their Username/Password- allows the user to change their desired Username and Password.	5	4	1			4.4
<b>U-7 View Prediction Result</b>						
View Prediction Result allows the user to view their application result.	1	3	6			3.5
<b>Total Weighted Mean</b>						4.14

**Table 5**  
*User Acceptance Testing Result in Admin*

#### Administrator Module

Criteria	5	4	3	2	1	WM
<b>A-1 View List of Borrowers</b>						
View List of Borrowers allows the admin to view the List of Borrowers.	2	8				4.2
<b>A-2 View Borrowers' Personal Information</b>						
View Borrowers Personal Information- Allows the admin to view the Borrowers Personal Information.	2	8				4.2
<b>A-3 Edit Borrowers' Personal Information</b>						
Edit Borrowers' Personal Information allows the admin to edit the Personal Information of specific members.	3	6	1			4.2
<b>A-4 View Borrowers Loan Details</b>						
View Borrowers Loan Details allow the admin to view the Borrowers Loan Details.	5	3	2			4.3
<b>A-5 View Borrowers Payment Details</b>						

View Borrowers Payment Details allows the admin to view the Borrowers Loan Payment Details.	7	3				3.7
<b>A-6 View all Registered Members</b>						
Viewing all Registered Members allows the admin to view all Registered Members.	7	3				4.7
<b>A-7 Generate Username/Password of Specific Borrowers</b>						
Generate Username/Password of Specific Borrowers allows the admin to generate the username/password of specific borrowers.	5	4	1			4.4
<b>A-8 Activate/Deactivate Members Status</b>						
Activate/Deactivate Members Status allows the admin to activate/deactivate the Members status.		10				4
<b>A-9 View all Credit History</b>						
Viewing all Credit History allows the admin to view all Credit History.	2	6	2			4
<b>A-10 View Application Prediction Result</b>						
View Application Prediction Result allows the admin to view Application Prediction Result.	1	3	6			3.5
<b>A-11 Admin can Approve/Disapprove Borrowers Application</b>						
Admin can Approve/Disapprove Borrowers Application allows the admin to Approved/Disapproved Borrowers Application.	1	9				4.1
<b>A-12 View Application Details of Borrowers</b>						
View Application Details of Borrowers Allows the admin to view the Borrowers Application Details.	3	7				4.3
<b>A-13 View PCCMPC's Imperative Data</b>						

View PCCMPC's Imperative Data allows the admin to view the Imperative Data of PCCMPC.	6	3	1			4.5
<b>Total Weighted Mean</b>						<b>4.16</b>

#### 4.3 Implication and Discussion of Results

User Acceptance Testing was performed to determine the viability and legitimacy of the system. The researchers gave 1 copy to the user for the user module and 1 copy for the Administrator module. Based on the user evaluation results, the overall total weighted mean is 4.14 which implies the systems' Excellency. Users were satisfied and approved that the system was ready to be implemented. The functions in administrator also rated by the user overall weighted mean is 4.16 They were also satisfied and approved that the system is ready to be implemented.

## **CHAPTER V** **SUMMARY, CONCLUSION, AND RECOMMENDATIONS**

This chapter discussed the Summary of the results of the objectives being set. It also includes the conclusion formulated based on the results of the study. Several recommendations were also presented here for the improvement of this capstone project.

### **5.1 Summary**

Loan Renewal Recommender System of Pantukan Chess Club Multipurpose Cooperative (PCCMPC). LRRS-PCCMPC is a web-based system that automates the loan renewal of such a member in PCCMPC with the help of machine learning. Through this, users/members can file online. It also allows the user to view his/her credit history. The system was specifically designed for the users to apply for a loan renewal in PCCMPC.

### **5.2 Conclusion**

This web-based system approving loan renewal in PCCMPC used Decision Tree C4.5 algorithm to predict the loan renewal application of the members of PCCMPC. By using this system it is more convenient for PCCMPC to manage the loan renewal of the members. Each data running inside the system is encrypted and secured as the data is stored in a database. The rating sheets given to the users served as the system rating on how realistic and reliable the system is. The User module's overall weighted mean is 4.14 and the admin module's overall weighted mean is 4.16. The two modules' weighted mean is above average which tells that the functionality of the system was very good and users were satisfied with the system. The proponents can now conclude that LRRS-PCCMPC has a positive impact on the users/members and also on Pantukan Chess Club Multipurpose Cooperative.

### 5.3 Recommendations

The following are the recommendations that the system needs to be improved in future development and iterations.

- The system can also handle new loan applications for the new applicants.
- The system may be used in other cooperatives not only in the Pantukan Chess Club Multipurpose Cooperative (PCCMPC).

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## CERTIFICATION

This is to certify that the undersigned has reviewed all the pages of the undergraduate thesis entitled "**LOAN RENEWAL RECOMMENDER SYSTEM OF PANTUKAN CHESS CLUB MULTIPURPOSE COOPERATIVE USING C4.5 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 V. BAGAY, LPT, M.A.E.D.

SECONDARY SCHOOL TEACHER II

LUPON VOCATIONAL HIGH SCHOOL

DEPED DIVISION OF DAVAO ORIENTAL

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## CERTIFICATION

This is to certify that the "Loan Renewal Recommender System Of Pantukan Chess Club Multipurpose Using C4.5 Machine Learning" has completed and passed the systematic Quality Assurance Testing.

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

APPENDIX B

COMMUNICATION LETTERS

RUBEN L. QUINDOYOS JR., LPT  
Quality Assurance Testing in Charge

GUANG-GUANG, DAVAO ORI



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

May 24, 2021

**Feraldine B. Revisa, CPA**

*General Manager*

Pantukan Chess Club Cooperative

National Highway, Kingking, Pantukan

Davao De Oro

Greetings of peace and prosperity!

We, the third-year students taking up Bachelor of Science in Information Technology (BSIT) in Davao Oriental State University – Banaybanay Extension Campus (BEC) are currently undertaking a Capstone Project entitled, "**“LOAN RENEWAL RECOMMENDER SYSTEM OF PANTUKAN CHESS CLUB MULTIPURPOSE COOPERATIVE USING C4.5 MACHINE LEARNING ALGORITHM”**". In this regard, we are humbly asking for your cooperation 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 allow us to acquire data. We intend to use the data to be collected to assist us in predicting possible underlying factors around financial management, especially in loan transactions. Rest assured that the data collected will remain confidential and will be used for academic purposes only.

I am hoping for your positive response. You may reach us through this contact number 09631897916 (TNT) or 09979162178 (TM). May God bless you always!

Respectfully Yours,

**JOHN LOYD M. SARITA**

**KLYNSEE M. JULAKIT**

**REYNALDO D. HILARIO JR.**

BSIT Students/Researchers

Noted by:

**WILJONE A. CAPA**

Research Adviser

Banaybanay Extension Campus



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

June 27, 2021

**Wiljone E. Capa**

*Instructor*

Banaybanay Extension Campus  
Brgy. Panikian, Banaybanay, Davao Oriental

**Re; CAPSTONE PROJECT ADVISER**

Dear Sir Capa:

Warm Greetings!

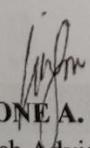
We, John Loyd M. Sarita, Klynsee M. Julakit, and Reynaldo D. Hilario Jr. pursuing a degree in Bachelor of Science in Information Technology are currently enrolled in ITP 141 Capstone Project.

We are writing to humbly request your service and expertise to serve as an adviser for our capstone project. We believe that your knowledge and insights will be valuable and will greatly enrich our work.

Thank you for your consideration and we hope you will be able to fulfill our request.

Respectfully yours,

**JOHN LOYD M. SARITA  
KLYNSEE M. JULAKIT  
REYNALDO D. HILARIO JR.**

  
**WILJONE A. CAPA**  
Research Adviser  
Banaybanay Extension Campus



**PANTUKAN CHESS CLUB  
MULTIPURPOSE COOPERATIVE**  
our coop. our way. our life

CDA Reg. No 9520-11008336  
CIN No. 101110333  
TIN No. 003-052-696

October 5, 2021

**MR. NEIL A. MUTIA**  
CAPSTONE Instructor  
Davao Oriental State University  
Banaybanay Campus  
Banaybanay Davao Oriental

Thru: **MR. KLYNSEE M. JULAKIT**  
**MR. REYNALDO D. HILARIO JR.**  
**MR. JOHN LOYD S. PASTOLOERO**  
IT Students

Dear Mr. Mutia,

Greetings!

We sending this letter to you in regards to the capstone project research of your students for the title "Approving Loan Renewal in Pantukan Chess Club Multipurpose Cooperative using Decision Tree Algorithm", as they asking for sample data and dummy data from us.

In regards to these, we would like to make an apology for declining the request of your students for the reasons that we will not disclose any data to other entities without due process, the Data Privacy Officer rejection of their request, and the implementation of our internal policy in line to the Data Privacy Act of 2012.

Hoping for your kind understanding. Thank you.

Cooperatively yours,  
  
**FERALINE B. REVISA, CPA**  
General Manager



National Highway, Pantukan, Davao de Oro



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Pantukan Chess Club Cooperative or PCCMCollc01

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#### Sources included in the report

#### Entire Document

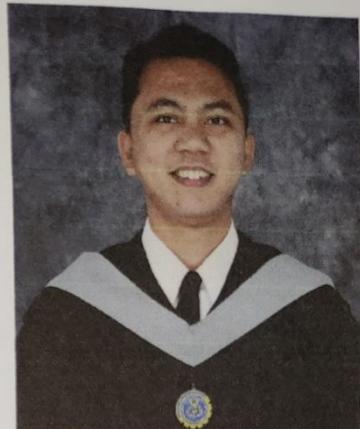
## **JOHN LOYD M. SARITA**



Brgy. Poblacion, Banaybanay,  
Davao Oriental  
(63) 963 189 7916



dorsu.pastolero23@gmail.com



### **PERSONAL DATA**

Date of Birth	:	June 23, 1999
Civil Status	:	Single
Citizenship	:	Filipino
Religion	:	Roman Catholic
Sex	:	Male
Height	:	5'10 feet
Weight	:	69 kls.

### **TECHNICAL SKILLS**

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

## KLYNSEE M. JULAKIT



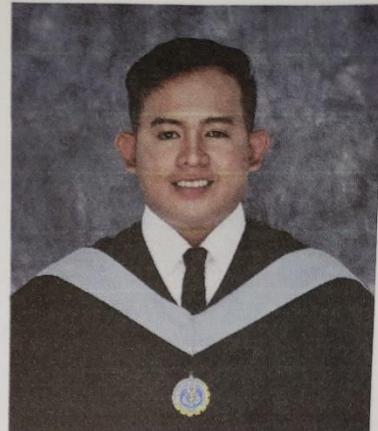
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klynseejulera@gmail.com



### PERSONAL DATA

Date of Birth	:	December 21, 1999
Civil Status	:	Single
Citizenship	:	Filipino
Religion	:	Islam
Sex	:	Male
Height	:	5'0 feet
Weight	:	68 kls.

### TECHNICAL SKILLS

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

## **REYNALDO D. HILARIO JR.**



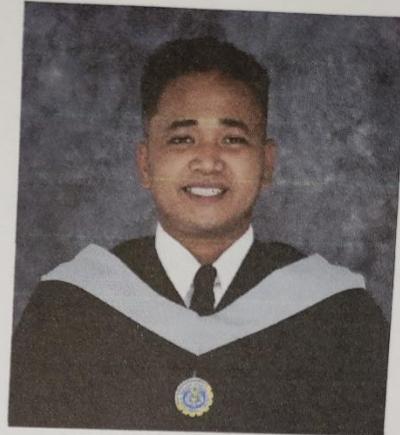
Brgy. Cabangcalan, Banaybanay,  
Davao Oriental



(63) 997 916 2178



hilarioreyaldo187@gmail.com



### **PERSONAL DATA**

Date of Birth	:	April 19, 1995
Civil Status	:	Single
Citizenship	:	Filipino
Religion	:	Roman Catholic
Sex	:	Male
Height	:	5'7 feet
Weight	:	83 kls.

### **TECHNICAL SKILLS**

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