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Classification of Device Addiction to Students using SAS-SV with K-Nearest Neighbor Algorithm Method

Basyir Al Musthoqfirin Majid[1], Abdul Mubarak[1], Salkin Lutfi[1]

[1]Department of Informatic Engineering, Universitas Khairun Ternate, Indonesia

ARTICLE INFO	ABSTRACT
	One of the most proliferating technology developments is a gadget. A gadget is a small electronic device with a particular purpose, often thought of as an innovation of new goods. Not only to help facilitate human activities, but gadgets are also a part of the lifestyle for modern citizens. In line with the growth of technology, gadgets are now equipped with various applications that can be adjusted based on user's preferences and wills, such as smartphones. With this innovative feature, the gadget has attracted users more and more, or in other words, users have become more addicted to the gadget. This study aims to investigate how addictive gadgets are to students at the Department of Informatic Engineering, Khairun University, Ternate, Indonesia using K-Nearest Neighbor (KNN) Algorithm. KNN is a classification method based on the distance of the new data to some nearest neighbors' data. In KNN, there is a Training dataset where one set of data contains the class's value and a predictor that will be used as one of the requirements for determining a suitable grade per the predictor. In contrast, the Testing dataset contains the new data that will be classified based on the model made and the accuracy of classification in the data collection process. Questionnaires were made using Google forms, then distributed through the internal groups of the Informatics Engineering department of Unkhair. A total of 78 questionnaires were successfully collected. The results showed that the testing accuracy with $k = 3$ is 86% and $k = 5$ is 80%. This show that KNN algorithm can be applied to measure the level of addiction to students in the Informatics Engineering Study program, Faculty of Engineering Unkhair.

Basyir Al Musthoqfirin Majid,
Department of Informatic Engineering, University of Khairun Ternate, Indonesia
Email: basyialmajid675@gmail.com

1. INTRODUCTION

One of the most proliferating technology developments is a gadget. A gadget is a small electronic device with a particular purpose, often thought of as an innovation of new goods. Not only to help facilitate human activities, but gadgets are also a part of the lifestyle for modern citizens. Today, almost everyone owns it, ranging from urban residents to rural residents [1]. In line with the growth of technology, gadgets are now equipped with various applications that can be adjusted based on user's preferences and wills, such as smartphones. Smartphones provide various features such as camera, MP3, GPS, website browsing, calling, e-mail, gaming, and social networking services (SNS) which are incorporated in one portable device []. With these innovative features, the gadget has attracted users more and more, or in other words, users have become more addicted to the gadget []. Addiction can be interpreted as a condition where people feel dependent on something they enjoy on various opportunities that exist due to the lack of control over attitudes so they feel punished if they do not fulfill their desires and habits [3]. Thus, our goal is to investigate the level of addiction in using gadgets for students at the Department of Informatic Engineering, Khairun University, Ternate, Indonesia using K-Nearest Neighbor (KNN) Algorithm.

KNN is a machine learning algorithm which has been widely used for classification problems [] by taking the closest distance from the majority of existing neighbor data (training-set) []. Previous research from

Sahambangung, et al [] used KNN to classify drug users based on the symptoms entered by users. Whereas Satrian et al [] used KNN to classify the school-age Gamers at the Holy Kalam Christian School. Their study also investigate which online games has an impact on the daily life and academic achievement of students. Their study successfully helps teachers at schools guide students who are addicted to games so that they can change for the better.

Based on those two studies, we aim to apply the K-NN algorithm by utilizing combined with the SAS-SV questionnaire. We expect that the system can help determine the extent of the influence of gadget addiction within four addiction levels: mild, normal, moderate and severe. SAS-SV is a short version of Smartphone Addiction Scale, an instrument to measure the Smartphone addiction developed by Korean National Information Society Agency (NIA) []. SAS-SV consists of 6 factors (i.e., interference with daily living, positive anticipation, withdrawal, cyber-oriented relationships, overuse, and tolerance) with a five-point Likert scale (1: "strongly disagree" and 5: "strongly agree") based on self-reporting. Next, to verify the concurrent validity of SAS-SV based on the previously published internet addiction scale and mobile phone addiction scale, Smartphone addiction proneness scale (SAPS) was added. The SAPS consists of 15 items scored on a four-point Likert scale (1: "not at all" and 4: "always") [2].

Data mining is needed to support this research. Data mining is a process that uses statistical techniques, mathematics, artificial intelligence, and machine learning to extract and identify useful information and related knowledge from large databases [4]. The term data mining has the essence as a discipline whose main goal is to find, explore, or mine knowledge from the data or information that we have. KNN is one alternative which can be used to extract valuable information in the data mining process. In KNN or machine learning principles, the dataset will be divided into two groups: training-set and testing-set [ANA]. The training-set is a group of data used to teach (train) the machine learning algorithm, how to extract useful features, and finally to make a prediction model [Ana]. Whereas, the testing-set is a secondary (or tertiary) data group used to assess (test) the prediction model after it has been trained.

The system development method used in this study is a prototype, a physical model of the system's work and serves as an initial version of the system [Ogedebe 2012]. In order for this prototyping process to work well, it is necessary to define the rules at an early stage: developers and users must have one understanding that the prototype was built to define initial requirements. The prototype will be removed or added to its part so that it is in accordance with the planning and analysis carried out by the developer until the trials are carried out simultaneously along with the development process [8]. We made the prototype of the system in the form of a website.

2. RESEARCH METHOD

The flowchart that describes the stage for making this prototype systems can be seen in **Fig. 1**.
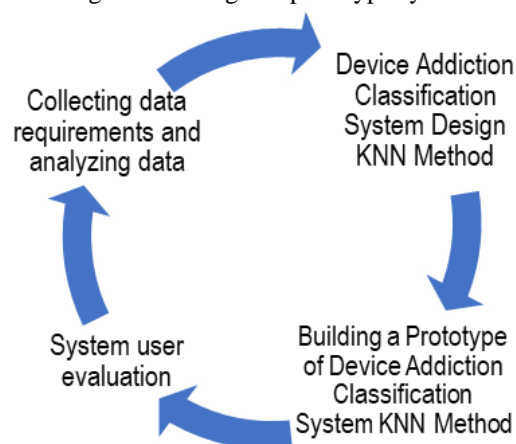
Fig. 1. Research flowchart

The following is an explanation of the above chart. Data collection here intends to meet the needs of the database of the program and the analysis phase of the researcher analyzes any data that has been collected whether it is in accordance with the needs or not. Such as preparing hardware that supports research and

supporting software. At the stage of data collection, the research students collected 63 questionnaire data filled out by Informatics Engineering students and tested with a system of 15 data.

At the design stage, here the researcher begins to design the level of student addiction using KNN. For convenience, users can easily find out the level of addiction required by the application with the KNN algorithm.

The next stage is to build a prototype, user needs in more detail because users often have difficulty in delivering their needs in detail without seeing a clear picture. To anticipate that the project can run according to plan, at this stage the design that has been designed is then made a program that presents the classification system for gadget addiction using the KNN method.

After the coding phase of the application is complete, this testing will be carried out to find errors from the application of the KNN algorithm application to measure whether the diagnosis produced by the expert is the same or not with the results given by the system. After completion, all stages of the research carried out have been completed.

2.1. Use Case

Use case is a description of the actions performed by the system that produce a measurable result for an actor. The use case here consists of two, namely the Admin use case and the Student use case, which can be seen in **Fig. 2** and **Fig. 3**.
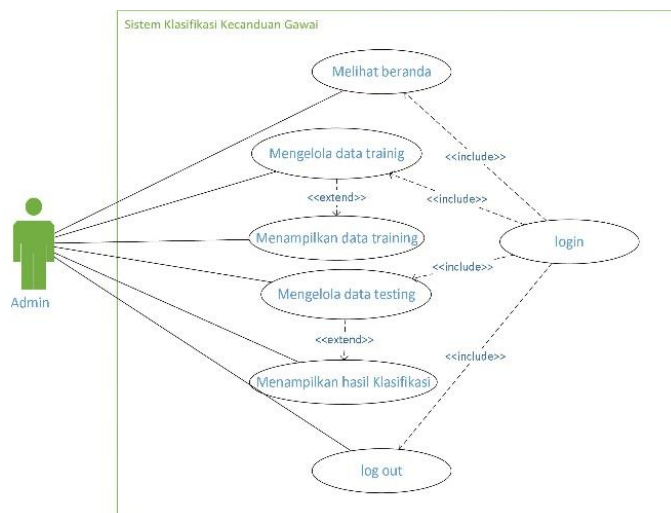
Fig. 2. Admin use case diagram
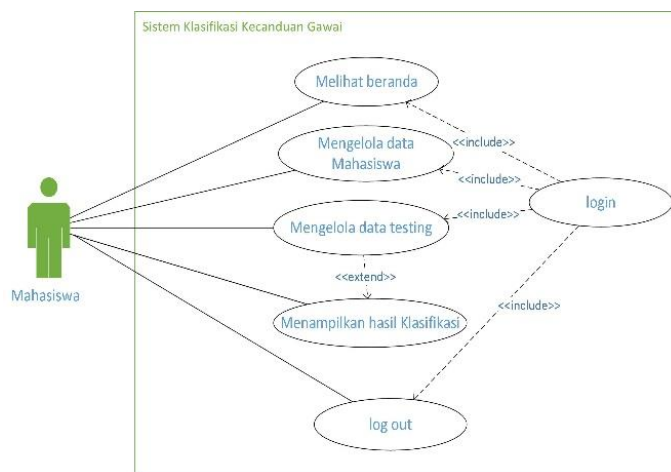
Fig. 3. Student use case diagram

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2.2. K-Nearest Neighbor Method

There are several stages that will be carried out in the K-NN method starting with data collection, determining the value of the K parameter, calculating the distance using the Manhattan Euclidean formula. How to calculate the K-Nearest Neighbor algorithm by using the distance calculation formulation The Manhattan distance equation is as follows:

$$D(x,y) = \sum_i^n \ |x_i - y_i| \tag{1}$$

Where n = large amount of data, i = represents the attributes used, x_i = training data, y_i = testing data. The sample data is used as training data, the criteria used in classifying gadget addiction are five criteria can be seen in **Table 1**.

Table 1. Symptom Testing Data

No	Symptom	Score
x_1	I'm leaving my job because I'm using my smartphone for other things	3
x_2	I feel calm or comfortable when using my device	2
x_3	I feel excited when I use my device	1
x_4	I feel confident when using my device	2
x_5	I'm able to relieve stress by using my smartphone	1

Table 2 shows examples of training data from gadget addiction data. The data displayed is an example of training data and testing data on 4 tests.

Table 2. Example of Training Data

Data	x_1	x_2	x_3	x_4	x_5	Status
1	1	5	4	4	6	Low
2	3	2	3	5	6	Low
3	4	5	5	6	1	Medium
4	2	3	6	1	5	High
y	3	2	1	2	1	-

Determine the parameter K, here the value of K = 3 and calculate the square of the Manhattan distance of each object to the sample data given for the 1st data to the 4th data (data testing). Calculate new data distance with all training data (Manhattan distance):

Data one using K-NN Method (1)
$$= \sum_i^n \ |x_i - y_i|$$
$$= |x1_1 - y_1| + |x2_1 - y_2| + |x3_1 - y_3| + |x4_1 - y_4| + |x5_1 - y_5|$$
$$= |1 - 3| + |5 - 2| + |4 - 1| + |4 - 2| + |6 - 1|$$
$$= 2 + 3 + 3 + 2 + 5$$
$$= 15$$

Data two using K-NN Method (1)
$$= \sum_i^n \ |x_i - y_i|$$
$$= |x1_2 - y_1| + |x2_2 - y_2| + |x3_2 - y_3| + |x4_2 - y_4| + |x5_2 - y_5|$$
$$= |3 - 3| + |2 - 2| + |3 - 1| + |5 - 2| + |6 - 1|$$
$$= 0 + 0 + 2 + 3 + 5$$
$$= 10$$

Data three using K-NN Method (1)
$$= \sum_i^n \ |x_i - y_i|$$
$$= |x1_3 - y_1| + |x2_3 - y_2| + |x3_3 - y_3| + |x4_3 - y_4| + |x5_3 - y_5|$$
$$= |4 - 3| + |5 - 2| + |5 - 1| + |6 - 2| + |1 - 1|$$

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Data four using K-NN Method (1)

$$= 1 + 3 + 4 + 4 + 0$$
$$= 12$$
$$= \sum_i^n |x_i - y_i|$$
$$= |x1_4 - y_1| + |x2_4 - y_2| + |x3_4 - y_3| + |x4_4 - y_4| + |x5_4 - y_5|$$
$$= |2 - 3| + |3 - 2| + |6 - 1| + |1 - 2| + |5 - 1|$$
$$= 1 + 1 + 5 + 1 + 4$$
$$= 12$$

Order from lowest score to highest is data two with 10 point (low), data three with 12 point (medium), data four with 12 point (high), and data one with 15 point (low). Because K = 3, the 3 closest distance data taken as classification are data two with a value of 10 and a low classification, data three with a value of 12 with a medium classification and data four with a high classification. From the sample 3 data, it is known that the result is low addiction.

3.   RESULTS AND DISCUSSION

3.1. Data Collection Process

In the process of collecting data, the researcher uses a coefficient to collect data. The researcher made a questionnaire using a Google form, then distributed it through The Unkhair Informatics Engineering internal group. From the results of the questionnaire distribution, the researcher got 78 questionnaire data that had been filled in, after the questionnaire data was filled in then the data was given to an expert on behalf of Amalia S.J Kahar, S. Psi. , M. Psi., Psychologist to be diagnosed and used as training data by researchers. The results of the data collection that has been collected can be seen in **Table 3**.

Table 3. Total Data

No	*Statement*	SS	S	AS	TS	STS
1	Due to the use of my smartphone, it is difficult to do work according to the schedule that I have set beforehand	6	10	16	20	11
2	I find it difficult to concentrate while in class, doing assignments, or working due to smartphone use	2	12	13	24	12
3	I feel pain in my wrists or back of neck when using my smartphone	5	16	11	23	8
4	I can't afford it if I am required to not have a smartphone	9	13	15	8	18
5	I feel impatient and restless when I'm not holding my smartphone	3	14	18	16	12
6	I think about my smartphone even when I'm not using it	1	12	14	22	14
7	I will never stop using my smartphone even though I know that my daily life has been greatly affected by smartphones	3	15	9	23	13
8	I check my smartphone regularly so I don't miss other people's conversations on social media	9	5	19	16	14
9	I always use my smartphone longer than I planned	15	19	16	9	5
10	People around me tell me that I use my smartphone excessively	8	7	15	20	13

3.2. K-Nearest Neighbors (KNN) Testing

In this test used 78 training data where mild addiction 31 moderate addiction 35 severe addiction 12 and 15 Testing data, the test is carried out using a questionnaire consisting of 10 questions where each question we can choose strongly agree, agree, somewhat agree, disagree, and strongly disagree. After calculating the 13 correct data and 2 incorrect data, using the value of K = 3 while the value of K = 5, 12 correct data and 3 incorrect data can be seen in **Table 4.**

Table 4. Comparison of Data Status Before and After Using the KNN Method.

No	Previous Status	Status After KKN with K = 3	Status After KKN with K = 5
1	Low Addiction	Low Addiction	Low Addiction
2	Low Addiction	Low Addiction	Low Addiction
3	Low Addiction	Low Addiction	Low Addiction
4	Low Addiction	Medium Addiction	Medium Addiction
5	Medium Addiction	Medium Addiction	Medium Addiction
6	High Addiction	High Addiction	High Addiction
7	Medium Addiction	Medium Addiction	Medium Addiction
8	High Addiction	High Addiction	Medium Addiction
9	Medium Addiction	Medium Addiction	Medium Addiction
10	Medium Addiction	Medium Addiction	Medium Addiction
11	Medium Addiction	Low Addiction	Low Addiction
12	Medium Addiction	Medium Addiction	Medium Addiction
13	High Addiction	High Addiction	High Addiction
14	High Addiction	High Addiction	High Addiction
15	Medium Addiction	Medium Addiction	Medium Addiction

3.3. System Interface

The User homepage display is a view that can be opened by users who are level as users who can only consult but cannot manage the data in it. The view of the user's homepage can be seen in **Fig. 4**.

Fig. 4. User Home Display

The display of the consultation results is the result of the user conducting a consultation where the results show whether the user is addicted to gadgets. The display of the results of the consultation can be seen in **Fig. 5**.

Fig. 5. Consultation Results Display

4.3. Analysis Results

In the research method, the results obtained from the beginning of making the system starting from collecting data requirements and analyzing data then after that the design of the gadget addiction classification system, the stages began and the design drawings were described using entity relationship diagrams, use case diagrams, activity diagrams, sequence diagrams, and flowcharts, where each diagram discusses the entirety of the system, how the actors operate the system that was built, an overview of the activities that occur in the system, what users do in the system, up to a description of what tables are displayed. is in the system database, how the tables can be related and an overview of the flow of the system being built. After the system is finished, the system testing process will be carried out, namely black box testing so that it is known whether the functions or features of the system are in accordance with what is desired or not. In testing the application of the KNN method, it shows that the KNN algorithm can be applied to measure the level of addiction to students in the Informatics Engineering Study program, Faculty of Engineering Unkhair with the results of testing the accuracy value for each k value with 78 training data and 15 testing data. different, namely the value of K = 3 obtained 86% accuracy. And the value of k = 5 obtained 80% accuracy.

4. CONCLUSION

Based on the discussion that has been described in chapter IV, the researchers can conclude that the research method results obtained from the beginning of making the system starting from collecting data requirements and analyzing data then after that the design of the gadget addiction classification system with the KNN method, shows that the KNN algorithm can applied to measure the level of addiction to students in the Informatics Engineering Study program, Faculty of Engineering Unkhair. With the results of testing the accuracy of each value of k with 78 training data and 15 test data (testing) it was found that for each different accuracy, the value of K = 3 obtained 86% accuracy. And the value of K = 5 obtained 80% accuracy.

In collecting data that has been managed by experts, it was found that 31 students experienced mild addiction, 35 students experienced moderate addiction and 12 students experienced severe addiction. Black box testing runs as expected by the system, in the form of testing the login process, registration, inputting training data and inputting testing data.

Then the researchers gave suggestions for students to change the pattern of excessive use of gadgets by simply using smartphones as needed according to their basic needs, namely for communication and information needs as necessary. The most important pattern to change is the duration of gadget use. Researchers also provide advice for health agencies to consider that technology is currently developing rapidly and its use can have an impact on health such as eyes, hearing, sleep patterns, and so on so that prevention is needed for this which can begin with impact assessment and then continue with counseling. The next researcher is expected to develop a system using different methods or combining the K-NN method with other methods in order to help improve accuracy results.

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Design of Styrofoam Cutting Machine Based on CNC 2 Axis Using Hot Wire

Fahrizal[1], Muhammad Fikriatul Aslam[1], Nurhikmah Anwar[1], Isminarti[1], Andi Fitriati[1]

[1]Departemen of Mechatronic Engineering, Politeknik Bosowa, Indonesia

ARTICLE INFO	ABSTRACT
	The development of the creative industry in the manufacture of decorations from styrofoam materials is increasing rapidly, the need for a 2-axis CNC-based automatic styrofoam cutting machine (Computer Numerical Control) using hot wire can facilitate the process of cutting styrofoam in large quantities and uniformly with machine drive on the X and Y axes. The purpose of this study is to design and manufacture a CNC based styrofoam cutting machine that can be programmed so that it can facilitate the cutting of styrofoam in large quantities and uniformly with movement on the X and Y axes. The method used is an experimental method in which the G-Code processing process is sent to the software which then produces 2 axis movements, namely on the X and Y axes. Then the styrofoam cutting process is continued using a hot wire whose temperature has been regulated using voltage and current which produces styrofoam cutting according to the size of the styrofoam used, which is 88 cm long, 42 cm high with a thickness of 2 cm and the accuracy level obtained for the X axis of 99.84% and the Y axis of 99.91%.

Fahrizal,
Departemen of Mechatronic Engineering, Politeknik Bosowa, Indonesia
Email: farizal.tmk19@student.politeknikbosowa.ac.id

1. INTRODUCTION

The development of the creative industry is currently growing rapidly. One example is the creative industry in making decorations of Styrofoam. Decorations from Styrofoam can be used in many ways, such as: congratulations on weddings, graduations, promotions, condolences, student art assignments, making safety pads for goods, decorations at carnival events, cultural festivals, and others. CNC stands for Computer Numerical Control. CNC is a system that uses a computer to control industrial machines such as lathes, milling machines, or laser machines. By using CNC, the machining process can be done more accurately and efficiently. CNC usually consists of computers, controllers, and related machines. Computers are used to store product designs and produce programs that controllers will use to control machines. The controller is a device that processes the programs created by the computer and sends signals to the machines to carry out the machining process. Related machines are industrial machines that the controller will control to carry out the machining process. There are styrofoam cutting tools that are manual and automatic. Examples of manual styrofoam cutting tools are cutter and hot wire. The increasing development and needs of industry, higher education institutions and vocational schools for CNC (Computer Numerical Control) machines in Indonesia are mostly based on the emergence of GRBL technology (software to control CNC movements that can be uploaded to the Arduino library). To fulfill its function, Styrofoam must be shaped in such a way to get the expected shape. The trick is to cut the material according to the desired shape. This cutting can be done in the form of two-dimensional cutting movements or 3D movements [1]. Styrofoam is also commonly found in the community in the form of several products, as a substitute for balsa wood to make aircraft aerofoil in aeromodelling, as well as for other uses [2]. CNC is a machine that is controlled by a computer using a numeric programming language as a movement command [3]. In general, in the work of CNC machining, it takes work that is fast and has good quality but with lower processing costs. This has become an attraction for industrial consumers to use CNC machines compared to using conventional machines. With the advantages in terms of productivity will be a separate competitiveness for industries that use CNC machines. The development from manual machining to machining that uses the CNC system is an advantage in increasing accuracy and speed settings as desired [4]. All CNC machines work on the same principle, the machine places a kind of tool in a sequence of positions determined by the program and the styrofoam cutting CNC machine also has the same working principle using hot wire as a styrofoam cutting tool [5]. In simple terms, the working principle is that electric power passes through a hot wire (usually 0.30 mm Nickel wire) then the wire is heated to the desired

temperature according to the input voltage. The wire arc is heated through an electrical resistance around 180˚C by passing a current through the wire [6]. Hot wire is a method that is widely used in styrofoam cutting [7].

In 2017 a research was conducted entitled "Design of 2 Axis CNC Machines". The way the CNC machine works is to make products with the same shape and dimensions from the production process which is carried out repeatedly by using the dental plaque test parameters [8]. In 2020, a research entitled "Design and Development of Semi-Automatic Styrofoam Cutting Tools Using the RULA Method was conducted in Kalisari Village". The workings of the CNC machine are semi-automatic styrofoam cutting tools using the RULA (Rapid Upper Limb Assessment) method which is a method developed in the field of ergonomics that investigates and assesses the working position of the upper body [9]. In 2020, a research entitled "Design and Development of CNC Wire Cutter for Styrofoam Products was conducted". The way the Cutter CNC 2 axis Styrofoam cutter works is to convert electrical energy into heat energy. This CNC wire cutter already uses numerical control using CNC programming and the cutting precision is much faster [10].

This research makes a CNC-based styrofoam cutting machine to make it easier to work and the size of the styrofoam cutter itself will be made small. This tool can cut Styrofoam according to the size of the image on the laptop, cut using Hot Wire and a GRBL controller in the form of G-Code, to drive the heating system using a stepper motor that can move towards X and Y. While the first RoadMap CNC machine uses a 2-axis system, the second using a semi-automatic styrofoam CNC cutting machine using the RULA foam cutter method and the third, a 2-axis CNC machine by sending the G-Code file to the microcontroller via the universal G-Code Sender software.

2. RESEARCH METHOD

Research in the process of making this machine uses experimental methods, including the design process, the manufacturing and assembly process and the testing process, the styrofoam cutting machine can be seen in **Fig. 1**.

Fig. 1 CNC2 Axis Based Styrofoam Cutting Machine Using Hot Wire.

The tool designed uses an aluminum profile V slot 240 with a thickness of 2 cm and the dimensions of the machine are 1080 mm long, 330 mm wide and 600 mm high. The type of cutter used is nickel wire with a thickness of 0.3 mm. **Fig. 2** is a flow diagram of the work system of a 2 axis CNC styrofoam cutting machine using hot wire as shown below.
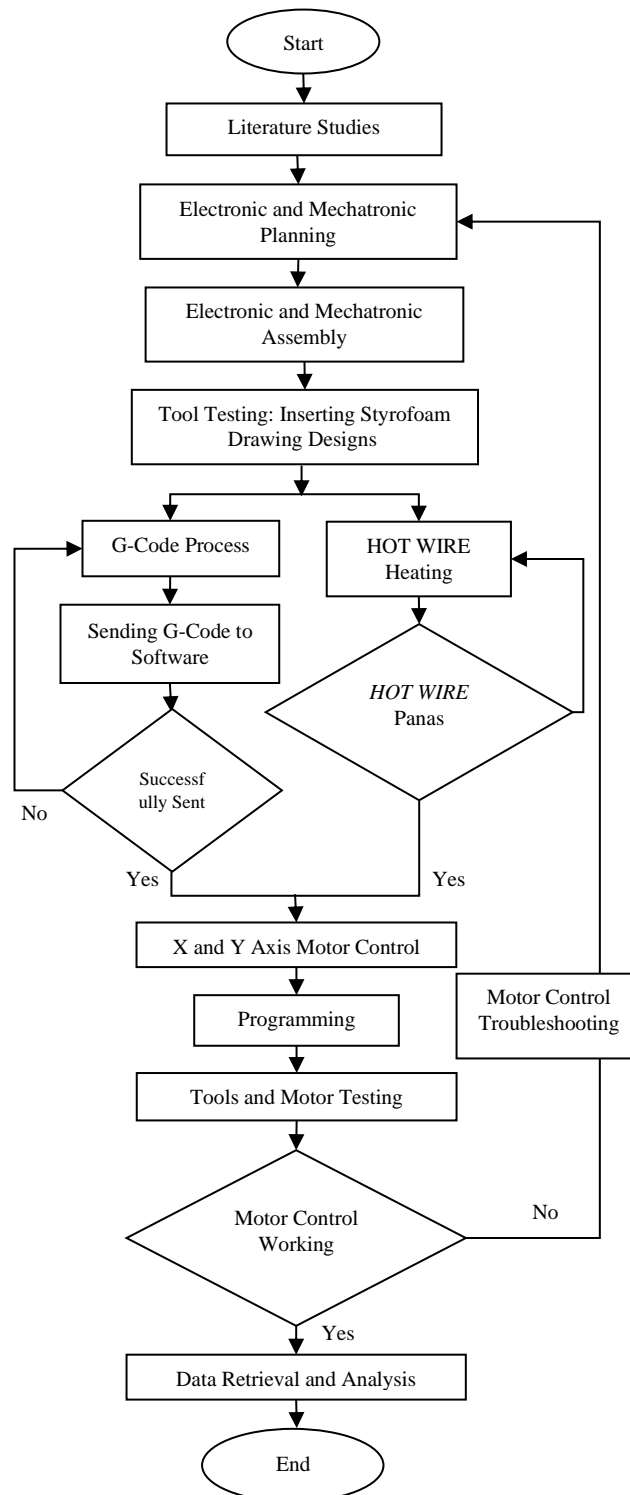
Fig 2. Workflow Diagram of 2 Axis CNC Based Styrofoam Cutting Machine Using Hot Wire

Based on the flow diagram in Fig 2, the process of working on a 2-axis CNC-based styrofoam cutting machine using hot wire starts from a literature study to find reference sources then the mechanical and electronic design process, then after the design is carried out the mechanical and electronic assembly process is carried out. Next do the styrofoam image design, after the design process is done, then the experimental method is carried out, namely the G-Code processing by sending the G-Code to the software and the hot wire heating process. If the G-Code is successfully sent and the hot wire heating process is successful, then proceed to the X and Y axis motor control process, if not, then go back to processing and sending the G-Code and hot

wire heating process. Then after the motor control process has been completed then proceed to the programming process and then testing the motor.

Figure 3 is a block diagram of a 2 axis CNC-based styrofoam cutting machine using hot wire consisting of input, process and output. Based on the block diagram in Figure 3, the input starts from working on the Styrofoam image design and the G-Code program, then the G-Code processing process is processed on the microcontroller, namely the TB6600 driver for the Nema 17 stepper on the X axis and the TB5660 driver for the Nema 17 stepper on the Y axis. Then the microcontroller adjusts the DC DC converter so that the voltage and temperature used on the hot wire are as expected. Furthermore, it will produce an output in the form of hot wire whose current will be regulated by a DC DC converter which will then be used for the styrofoam cutting process and produce movement on the Nema 17 stepper for the X and Y axes.

3. RESULTS AND DISCUSSION

In this study there are results and analysis of the trial system testing of Styrofoam cutting machine based on CNC 2 Axis using Hot Wire:

3.1. X and Y Axis Calibration Settings

Voltage and temperature regulation in this tool is to regulate the temperature of the hot wire by using voltage and current calibration to get the right temperature for the styrofoam cutting process precisely and maximally. **Table 1** shows the X-axis calibration process on a NEMA 17 stepper motor.

Table 1. X Axis Calibration Process

Stepper Motor
Deg/*step*: 1.8
Steps/rev: 200
Micro Stepping
Pulse/step: 16
Pulse/rev: 3200
Pulley Teeth
Pulley teeth: 16
Belt Pitch
Pitch: 2
Lead (mm/rev): 32
Result
Steps per mm: 100
Resolution (mm/step): 0,01

With the number of pulley teeth as many as 16 teeth and belt pitch as many as 2 pitches, the default condition of the stepper motor is 1.8 deg/step with the number of micro steps as many as 16 pulses/step. Based on the default specification of the machine components used, the X axis calibration results are 100 steps per mm. **Table 2** shows the Y-axis calibration process on a NEMA 17 stepper motor.

Table 2. Y Axis Calibration Process

Stepper Motor
Deg/*step*: 1.8
Steps/rev: 200
Micro Stepping
Pulse/step: 16
Pulse/rev: 3200
Pulley Teeth
Pulley teeth: 20
Belt Pitch
Pitch: 2
Lead (mm/rev): 40
Result
Steps per mm: 80
Resolution (mm/step): 0,0125

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With the number of pulley teeth as many as 20 teeth and belt pitch as many as 2 pitches, the default condition of the stepper motor is 1.8 deg/step with the number of micro steps as many as 16 pulses/step. Based on the default specifications of the machine components used, the X-axis calibration results are 80 steps per mm.

3.2. Temperature Variation and Current

Taking hot wire temperature measurement data based on voltage (V) and current (A) on the device using multimeter. **Table 3** shows the minimum voltage used is 1.3 V obtained hot wire27C temperature and maximum voltage used is 10.1 V on the grounds that if the voltage is greater than the maximum voltage it will cause the hot wire (nikelin wire) smoldering which will then cause the cutting results to be less precise and offset will be large so that the measurement error will also increase and the cutting results are not maximum.

Table 3. Temperature Measurement Based on Voltage, Current and Temperature of Hot Wire

Voltage (V)	Current (A)	Hot Wire Temperature (˚C)
1,3	0,00	27
2,2	0,00	27
3,1	0,07	31
4,1	0,15	38
5,1	0,23	52
6,1	0,29	76
7,1	0,38	85
8,1	0,47	104
9,1	0,56	170
10,1	0,67	190

3.3. Styrofoam Cutting

Styrofoam cutting is the process of cutting Styrofoam, a type of plastic foam material, into desired shapes and sizes. This is typically done using specialized tools such as hot wire cutters or foam cutting saws. The hot wire cutter uses an electrically heated wire to melt the foam, while the foam cutting saw uses a rotating blade to cut the foam. Styrofoam cutting is commonly used in a variety of applications, such as crafting, modeling, and packaging. It can be used to create complex shapes and intricate designs, and is a popular material for use in a variety of artistic and creative projects.

Based on **Table 4**, styrofoam measurement dimensions are calculated based on the size contained in the software and the size obtained in the cutting results.

Table 4. Styrofoam Cutting and Measurement Result

Software Dimension (mm)	Measurement Result (mm)
MEKATRONIKA (517x57)	(520x60)
Bosowa Politechnic Logo (39x32)	(35x40)

Software Dimension (mm)	Measurement Result (mm)
Bosowa Politechnic (170x108)	(140x100)
Happy Semhas (618x103)	(630x100)

3.4. X and Y Error Value Counting

Error value Data on the X and Y axes are taken based on the dimensions and measurement results of styrofoam. The existence of the error value is influenced by the presence of melt in the styrofoam cutting process which resulted in a difference in dimensions both on the X axis and on the Y axis, where the difference in dimensions produces a percentage of the error value as shown in **Table 5**.

Table 5. Counting Error Values of X Axis

Software Dimension (mm)	Measurement Results (mm)	*Error* (Software Dimension-Measurement Results)	*Error (%)* (Error/ X Software Dimension 100%)
517	520	3	0,5
39	35	4	0,10
170	140	30	0,17
618	630	12	0,019
450	470	20	0,04
Average			0,16 %

Based on Table 5, obtained x-axis accuracy = 100% - 0,16% = 99,84%. In **Table 6**, obtained Y-axis accuracy = 100% - 0,09% = 99,91%. Error values on the X and Y axes indicate that there is a percentage difference in value between the design in the software and the measurement directly. With an accuracy value for the X axis of 99.84% and Y axis accuracy value of 99.91%.

the x-axis and y-axis accuracy of the machine are quite high, with values of 99.84% and 99.91% respectively. This indicates that the machine is capable of producing cuts with a high level of precision and accuracy, with a small percentage difference between the designed shapes in the software and the actual measurements taken. The high accuracy values of the x and y axes are likely due to the use of a CNC (Computer Numerical Control) system, which allows for precise and automated control of the cutting process. Overall, the results indicate that the machine is capable of producing high-quality cuts with a high level of precision and accuracy.

Table 6. Counting Error Values of Y Axis

Software Dimension (mm)	Measurement Results (mm)	Error (Software Dimension-Measurement Results)	Error (%) (Error/ X Software Dimension 100%)
57	60	3	0,05%
32	40	8	0,25%
108	100	8	0,07%
103	100	3	0,02%
80	85	5	0,06%
Average			0,09%

The analysis of the data suggests that there is a small difference between the dimensions of the shapes designed in the software and the actual measurements taken. The error values indicate that the measured shapes are slightly larger than the designed shapes, with an average error of 0.09%. This indicates that there is some degree of imprecision in the cutting process, although the small error values suggest that the overall accuracy is still quite high. The error percentages are relatively small, with the largest being 0.25%, indicating that the machine is capable of producing shapes with a high level of accuracy and precision. Overall, the results suggest that the machine is capable of producing high-quality cuts with a high level of precision and accuracy.

4.   CONCLUSION

In the manufacture of this machine, experimental methods are used, namely the process of moving the X and Y axes, the G-Code delivery process is used, then the code will be processed in software and then produce output in the form of axis movement for hot wire whose heat has been regulated based on the right voltage and current.

Based on the design, manufacture and testing of the entire system in the manufacture of this machine has been designed and built styrofoam cutting machine based on CNC 2 axis using hot wire with an accuracy of X axis 99.84% and Y axis 99.91%, the percentage of dimensional differences in the software and measurements are directly influenced by the melt due to the process of cutting by hot wire. However, there are some limitations related to the machine that has been made, namely the hot wire type of nikelin with a size of 0.3 mm which is only able to use a maximum voltage of 12 volts. If a larger current is used, it can cause the hot wire to smolder. In addition, related to the dimensions of the styrofoam media used, it can only be 88 cm long and 42 cm high with a maximum thickness of 15 cm. Therefore, for further development, this machine must use a thicker type of hot wire and the dimensions of the working area are also larger.

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Smart Laboratory Using Radio Frequency Identification (RFID) Based on The Internet of Things

Firmansyah M. S. Nursuwars[1], Reza Fragaria Audika[1], Sutisna[1], Imam Taufiqurrahman[1]

[1]Teknik Elektro, Fakultas Teknik, Universitas Siliwangi, Tasikmalaya, Indonesia

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ABSTRACT

In Indonesia, traditional methods are still commonly used for managing laboratories. This has resulted in various issues, such as the loss of keys, and has hindered the efficiency of these laboratories. However, the integration of technology has the potential to improve laboratory management by up to 33%. A modernized laboratory system, known as an "Innovative Laboratory," combines technology with traditional management techniques. The proposed Internet of Things-based tool aims to assist laboratories in improving their management services, including a registration system, a locker system, and a desk system. This tool utilizes a Keypad 4x4 and PCF8574 to select desks and lockers, Node MCU as a microcontroller to publish identification data from an MQTT broker, and RFID technology to access and activate electronic locks and sockets. To ensure that data is successfully transferred and the selected locker and desk are available, the system requires a certain delivery time for the maximum of 251 bytes of data that can be sent at different signal strengths. Only registered users with valid identification are able to access the locker and desk systems, and users must unregister before switching to a new locker or desk. The goal of this system is to streamline and improve the management of laboratories.

Firmansyah M. S. Nursuwars,
Teknik Elektro, Fakultas Teknik, Universitas Siliwangi, Tasikmalaya, Indonesia.
Email: 167002104@student.ac.id

1. INTRODUCTION

The laboratory is a container of components needed in conducting experiments to prove a theory objectively and scientifically [1]. Various scientific aspects also require a laboratory as a supporting factor, one of which is the Electrical field which functions as a research place for students and lecturers in identifying and reviewing planning, organizing, mobilizing and supervising. However, the laboratory system used is generally still conventional. As is the case in opening lockers, free use of the contact box, etc. This is where if one day negligence occurs from Laboratory users, it can cause the loss of locker keys by irresponsible users.[2]

The incorporation of RFID technology into a laboratory enables real-time asset tracking and the automation of multiple processes, including inventory management and data collection. It can also improve the laboratory's safety and productivity by eliminating the need for manual tracking and minimizing the risk of human error.

By providing a platform for the integration and management of RFID data with other systems and devices, the IoT plays a vital role in a smart laboratory employing RFID technology. The Internet of Things enables the monitoring and analysis of RFID tag data in real-time, as well as the automation of processes based on this data.

Overall, a smart laboratory utilizing RFID technology based on the Internet of Things can significantly improve the laboratory's efficiency, productivity, safety, and accuracy.

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For the management, learning, and research activities in the laboratory to run well, the development of a good laboratory management and management system can increase the effectiveness of learning by up to ±33%.[3]

In the past few years, the development of information technology has proliferated, allowing automation systems to be applied in laboratories, or what we can call Smart Laboratory.[4]

Therefore, to minimize unwanted things, as well as with existing technological advances, a more modern laboratory management system is needed using the Internet of things. In this study, a system will be made which has three parts registers, locker devices, and tablet devices. The data from each Smart Laboratory user will be displayed on the MQTT Box so that it is expected to facilitate the monitoring process for each Smart Laboratory use.

2. METHODOLOGY

We split this research into three stages: the first stage is Literature Review, the second stage is System Development, and the last stage is System Testing.

2.1. Literature Review

We need to explain some material, system environment, and related terms we used in this research as the first stage. Then, the system and some materials are described in the following items.

a. Smart Laboratory

The laboratory is a closed or open room designed according to the needs to carry out activities related to education, research, and community service. Nowadays, the laboratory is evolving, as described in some research. *Smart Laboratory* is a method that combines laboratory elements with technological advances, which include several factors related to management and information systems, to create a more productive and conducive work environment.[5]

b. Internet of Things

A wireless communication technology widely used and growing rapidly is called the Internet of Things (IoT); the Control and monitoring equipment to support human needs is based on internet technology.[6]

c. RFID MFRC522

RFID MFRC522 is a wireless technology that reads objects via radio waves using an SPI connection. The MFRC522 RFID module can be seen in **Fig. 1**.[7]
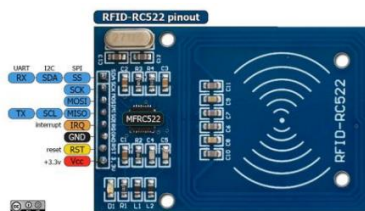
Fig. 1 Illustration of Module of RFID MFRC522.

d. Keypad 4x4

It is a common interface device in the form of a push button switch which is arranged in a matrix and functions to input data, as shown in **Fig. 2**.[8]

Fig. 2 Illustration of Module of Keypad 4x4.

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e.   BJPCF8574 GPIO extender

PCF8574 is an extender for additional pins on the microcontroller. This module works with I2C communication. With eight digital I/O pins each and three input addresses, as shown in **Fig. 3**.[9]

Fig. 3 Illustration of PCF8574 Module.

f.   Selenoid Door Lock (SDL)

It is an electric lock in the form of an actuator capable of performing linear movements. In this solenoid, there is a coil of wire which, when current flows, creates a magnetic field to push the iron core. As in **Fig. 4**.[10]

Fig. 4 Illustration of Solenoid Door Lock.

g.   LCD 20x4

LCD is an electronic component that functions as a data viewer in the form of characters or letters available in the form of an LCD display module along with supporting circuitry such as data pins, power supply control, and contrast control, as shown in **Fig. 5**.[11]

Fig. 5 Illustration of LCD 20x4.

2.2. Flowchart

Fig. 6 (Left) show a flowchart of the registration system that explains how the registration flow is in using SmartLab. **Fig. 6** (Right) show a flowchart of the system on the locker and table that explains the workflow of the system when it receives data from the MQTT broker.
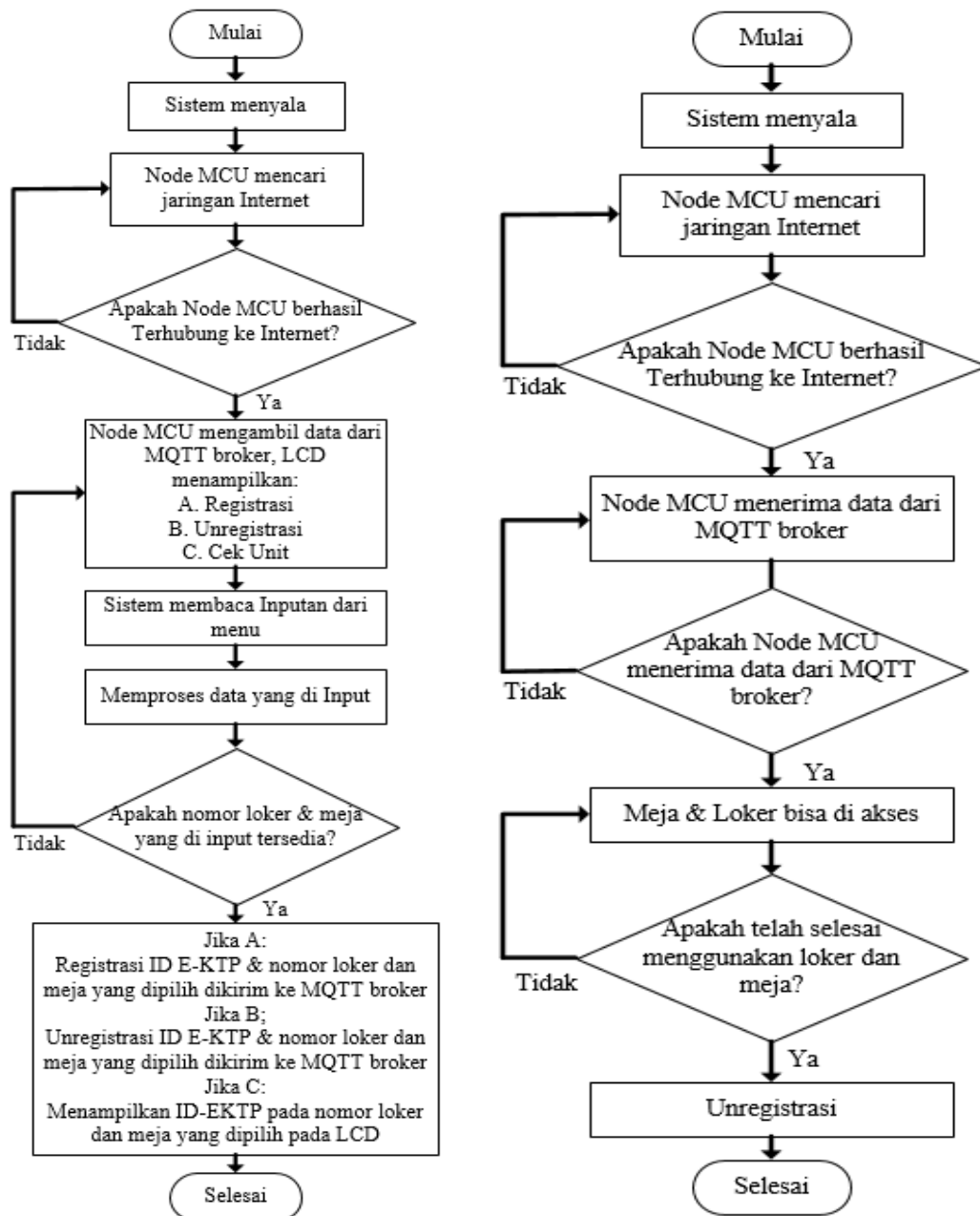
Fig. 6 (Left) Registration system flowchart. (Right) System flowchart on lockers and desks.

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2.3. System Architecture

In **Fig. 7** Is a System Architecture which consists of 3 parts. The Registration System section is for registering the user's EKTP card, monitoring existing units, and unregistering. If the user card has been registered, the data will be sent to the System on the Locker and the System on the available Desk, where the registered card can activate the relay on the Locker Node to move the solenoid and the relay on the Desk Node to activate the contact box.
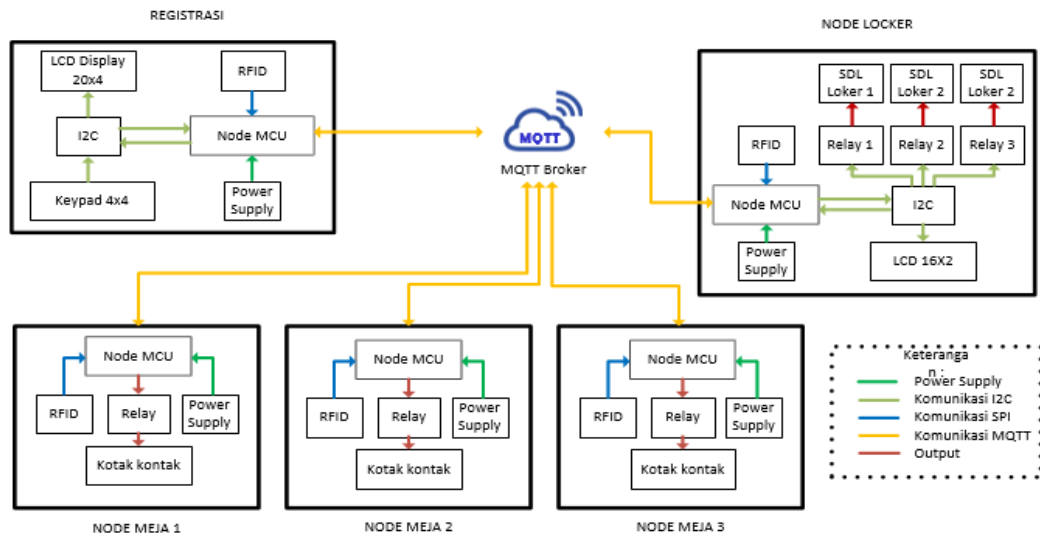
Fig. 7 System Architecture.

2.4. System Wiring Diagram

In system planning there is a Registration System section as shown in **Fig. 8**, System Diagram on Locker in **Fig. 9** and the System Diagram on the Table in **Fig. 10**.
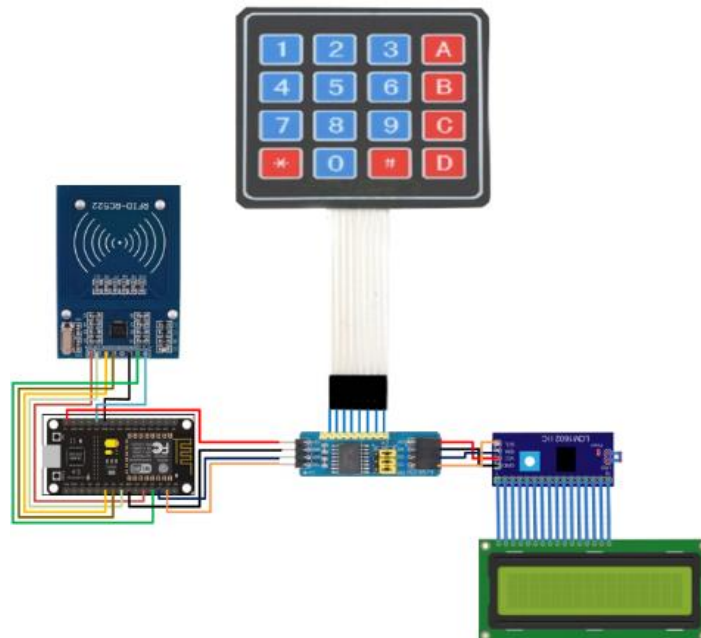
Fig. 8 Wiring System Registration

The registration system uses the Node MCU ESP8266 as a microcontroller, RFID, keypad and PCF8574 as input and LCD as display.
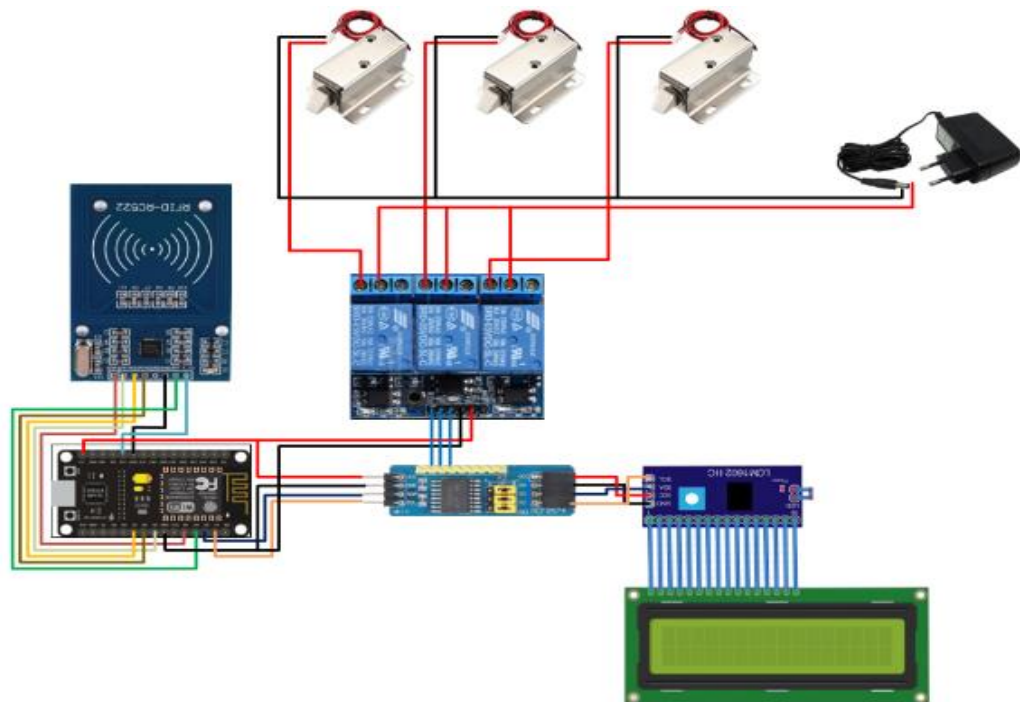
Fig. 9 Wiring System on Locker.

In the existing system, the locker uses Node MCU ESP8266 as a microcontroller, RFID as input, PCF8574 as I/O pin extender, Relay as output to activate Selenoid Door Lock and LCD as data viewer.
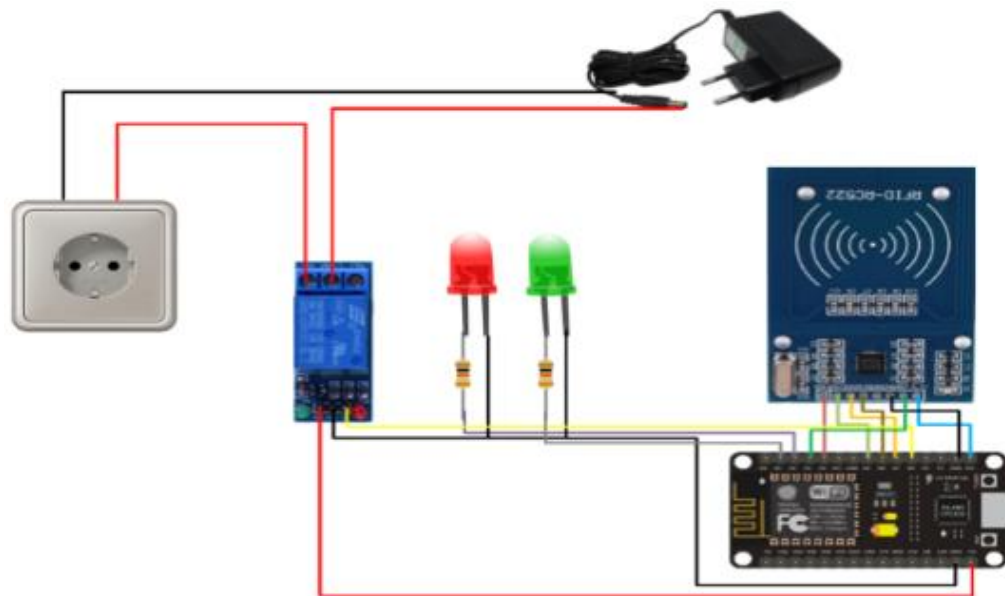
Fig. 10 Wiring System on Table.

The system on the table uses the Node MCU ESP8266 as a microcontroller, RFID as input, LED as an indicator, Relay as output to activate the contact box.

3. RESULTS AND DISCUSSION

3.1. Unit Test

In unit testing, it aims to find out whether the unit can work according to its function, so that it can be used on the system, there are several components being tested.

The first test is done by connecting the MCU Node to an internet connection, the LED will light up, and when not connected to the internet the LED will turn off. From **Table 1**, itcan be concluded that the unit has been functioning properly.

Table 1. MCU Node Connection Test with LED

Number of Testing	Node MCU ESP8266				Description
	Connected to Internet	LED ON	Not Connected to Internet	LED OFF	
1	Yes	Yes	Yes	Yes	Good
2	Yes	Yes	Yes	Yes	Good
3	Yes	Yes	Yes	Yes	Good
4	Yes	Yes	Yes	Yes	Good
5	Yes	Yes	Yes	Yes	Good
6	Yes	Yes	Yes	Yes	Good
7	Yes	Yes	Yes	Yes	Good
8	Yes	Yes	Yes	Yes	Good
9	Yes	Yes	Yes	Yes	Good
10	Yes	Yes	Yes	Yes	Good

Other test is carried out by testing the effect of the signal on the amount of data sent, from 3 signal conditions, with various data sizes. From **Table 2**, it can be concluded that the signal strength does not affect data transmission, but the maximum amount of data that can be sent from the MCU node is 251 bytes.

Table 2. Testing the influence of the signal on the amount of data

No	Low Signal (RSSI Range 0-33)					
	75 byte	125 byte	251 byte	252 byte	260 byte	300 byte
1	Yes	Yes	Yes	No	No	No
2	Yes	Yes	Yes	No	No	No
3	Yes	Yes	Yes	No	No	No
4	Yes	Yes	Yes	No	No	No
5	Yes	Yes	Yes	No	No	No
-	Medium Signal (RSSI Range 34-67)					
1	Yes	Yes	Yes	No	No	No
2	Yes	Yes	Yes	No	No	No
3	Yes	Yes	Yes	No	No	No
4	Yes	Yes	Yes	No	No	No
5	Yes	Yes	Yes	No	No	No
-	Strong Signal (RSSI Range 68-100)					
1	Yes	Yes	Yes	No	No	No
2	Yes	Yes	Yes	No	No	No
3	Yes	Yes	Yes	No	No	No
4	Yes	Yes	Yes	No	No	No

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| 5 | Yes | Yes | Yes | No | No | No |

Another test is carried out by providing input voltages of 1V, 3V, 5V, 10V and 15V on the Solenoid. From **Table 3**, it can be concluded that Solenoid can be actively unlocked at a voltage of 10V and 15V.

Table 3. Solenoid Door Lock Test

No	Voltage (v)	Results
1	1 V	Not Open
2	3 V	Not Open
3	5 V	Not Open
4	10V	Open
5	15 V	Open

Another test is done by providing a program on the LCD to display characters in the form of letters and numbers. From **Table 4**, we can say LCD can function properly.

Table 4. 20x4 LCD Testing

No	20x4 LCD Testing		Results
	Text Input	Text Output	
1	Reza Fragaria Audika 167002104	Reza Fragaria Audika 167002104	Good
2	Reza Fragaria Audika 167002104	Reza Fragaria Audika 167002104	Good
3	Reza Fragaria Audika 167002104	Reza Fragaria Audika 167002104	Good
4	Reza Fragaria Audika 167002104	Reza Fragaria Audika 167002104	Good
5	Reza Fragaria Audika 167002104	Reza Fragaria Audika 167002104	Good

Another test is done by reading the ID of the E-KTP card with an ordinary RFID card. From **Table 5**, it can be concluded that the E-KTP card has a 14-digit ID, while an ordinary RFID card has an 8-digit ID.

Table 5. MFRC522 RFID Testing

No	MRFC522 RFID Testing				Results
	E-KTP		Non E-KTP		
	ID Detected	Digit	ID Detected	Digit	
1	04 67 4B AA AB 4F 80	14	D6 D9 6C D9	8	Baik
2	04 67 4B AA AB 4F 80	14	D6 D9 6C D9	8	Baik
3	04 67 4B AA AB 4F 80	14	D6 D9 6C D9	8	Baik

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4	04 67 4B AA AB 4F 80	14	D6 D9 6C D9	8	Baik
5	04 67 4B AA AB 4F 80	14	D6 D9 6C D9	8	Baik

3.2. System Test

In system testing, a test is carried out which aims to ensure whether all components that have been combined previously can work according to their functions or not. Overall system testing is carried out in several ways, including:

a. Testing the input of the locker and table numbers available in the registration system against the system at the lockers and desks, when the lockers and desks are still empty.

b. Test the input of locker and table numbers that are not available in the registration system against the existing system at lockers and desks, when lockers and tables are still empty.

c. Testing the input of locker and table numbers available in the registration system against the system at lockers and desks, when lockers and tables are filled.

d. Test the input of locker and table numbers that are not available in the registration system against the existing system at lockers and desks, when lockers and tables are filled.

e. Tests input from unregistered cards on the system on lockers and desks.

f. PCF8574 test results with a matrix concept to produce 16 different outputs so that they can be active according to the given input

The following **Table 6** show the results of system testing:

Table 6. Testing the input of available and unavailable locker numbers
when the initial state of the locker is still empty

Number of Testing	Initial Status	Registration			Relay on Locker						Results
		ID E-KTP	Status	Input	Before Tapping			After Tapping			
					1	32	64	1	32	64	
1	Still Empty	05-8B-B0-75-6B-D1-00	Sent	1	TA	TA	TA	A	TA	TA	Match
2	Still Empty	04-72-28-E2-EB-2E-80	Sent	32	TA	TA	TA	TA	A	TA	Match
3	Still Empty	04-16-46-3A-02-2C-80	Sent	64	TA	TA	TA	TA	TA	A	Match
4	Still Empty	05-8B-B0-75-6B-D1-00	Not Sent	65	TT	TT	TT	TT	TT	TT	Match
5	Still Empty	04-67-4B-AA-AB-4F-80	Unregistered	1	TA	TA	TA	TA	TA	TA	Match
Description: A = Active, TA = Inactive, TT = not available										Conclusion: Good	

After testing, entering the available and unavailable locker and table numbers when the initial state of the lockers and tables are still empty in **Tables 6** and **Table 7**, the system will only be active if tapped using a registered E-KTP, and will not be active if tapped using Unregistered E-KTP, while in testing the input of available and unavailable locker and table numbers when the initial state of the lockers and desks have been filled in **Tables 8** and **Tables 9**, the system cannot receive new E-KTP data before unregistering the locker and the table. And last **Table 10** show testing result produce 16 outputs.

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Table 7. Testing the input of available and unavailable locker numbers
when the initial state of the locker is filled

Number of Testing	Initial Status	Registration		Input	Relay on Locker						Results
		ID E-KTP	Status		Before Tapping			After Tapping			
					1	32	64	1	32	64	
1	Already Filled	05-8B-B0-75-6B-D1-00	Not Sent	1	TA	TA	TA	TA	TA	TA	Match
2	Already Filled	04-72-28-E2-EB-2E-80	Not Sent	32	TA	TA	TA	TA	TA	TA	Match
3	Already Filled	04-16-46-3A-02-2C-80	Not Sent	64	TA	TA	TA	TA	TA	TA	Match
4	Already Filled	05-8B-B0-75-6B-D1-00	Not Sent	65	TT	TT	TT	TT	TT	TT	Match
5	Already Filled	04-67-4B-AA-AB-4F-80	Unregistered	1	TA	TA	TA	TA	TA	TA	Match
Description: A = Active, TA = Inactive, TT = not available										Conclusion: Good	

Table 8. Testing available and unavailable table number input when the initial table state is empty

Number of Testing	Initial Status	Registration		Input	Relay on Locker						Results
		ID E-KTP	Status		Before Tapping			After Tapping			
					1	32	64	1	32	64	
1	Still Empty	05-8B-B0-75-6B-D1-00	Sent	1	TA	TA	TA	A	TA	TA	Match
2	Still Empty	04-72-28-E2-EB-2E-80	Sent	32	TA	TA	TA	TA	A	TA	Match
3	Still Empty	04-16-46-3A-02-2C-80	Sent	64	TA	TA	TA	TA	TA	A	Match
4	Still Empty	05-8B-B0-75-6B-D1-00	Not Sent	65	TT	TT	TT	TT	TT	TT	Match
5	Still Empty	04-67-4B-AA-AB-4F-80	Unregistered	1	TA	TA	TA	TA	TA	TA	Match
Description: A = Active, TA = Inactive, TT = not available										Conclusion: Good	

Table 9. Testing of available and unavailable table number inputs when the initial state of the table is filled

Number of Testing	Initial Status	Registration		Input	Relay on Locker						Results
		ID E-KTP	Status		Before Tapping			After Tapping			
					1	32	64	1	32	64	
1	Already Filled	05-8B-B0-75-6B-D1-00	Not Sent	1	TA	TA	TA	TA	TA	TA	Match
2	Already Filled	04-72-28-E2-EB-2E-80	Not Sent	32	TA	TA	TA	TA	TA	TA	Match
3	Already Filled	04-16-46-3A-02-2C-80	Not Sent	64	TA	TA	TA	TA	TA	TA	Match
4	Already Filled	05-8B-B0-75-6B-D1-00	Not Sent	65	TT	TT	TT	TT	TT	TT	Match
5	Already Filled	04-67-4B-AA-AB-4F-80	Unregistered	1	TA	TA	TA	TA	TA	TA	Match
Description: A = Active, TA = Inactive, TT = not available										Conclusion: Good	

Table 10. PCF8574 test results using the matrix concept to produce 16 outputs

No	Input	Output	Description
1	Locker 1	Led 1	Turn ON
2	Locker 2	Led 2	Turn ON
3	Locker 3	Led 3	Turn ON
4	Locker 4	Led 4	Turn ON
5	Locker 5	Led 5	Turn ON
6	Locker 6	Led 6	Turn ON
7	Locker 7	Led 7	Turn ON
8	Locker 8	Led 8	Turn ON
9	Locker 9	Led 9	Turn ON
10	Locker 10	Led 10	Turn ON
11	Locker 11	Led 11	Turn ON
12	Locker 12	Led 12	Turn ON
13	Locker 13	Led 13	Turn ON
14	Locker 14	Led 14	Turn ON
15	Locker 15	Led 15	Turn ON
16	Locker 16	Led 16	Turn ON
Conclusion: Working Good			

Based on the test results on **Table 10**, PCF8574 makes it possible to generate and manage 16 different outputs. Using the matrix concept to group the positive and negative poles into col and row. So that when providing input for locker 1 it will turn on led 1, and so on until locker 16 and led 16.

4.   CONCLUSION

Based on the results of research and discussions that have been carried out, it can be concluded that in registering the E-KTP card can only be processed when the available locker and table numbers are still empty. The system at the locker and at the table can only be accessed using a card that has been previously registered. The registration will not be successful if the designated locker and table numbers are not available, meaning that cards that have not or are not registered will not be able to access the available lockers and tables. Meanwhile, new users cannot register their E-KTP for already filled locker and table numbers, so unregistration must be carried out first before being registered for new users.

This system, of course, requires additional features in its refinement, for example, the loan feature, the room temperature and humidity monitoring feature and external memory for data storage.

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Development of a Web-Based Administrative Information System for Owned Enterprises (BUMDes) in Macolliloloe Village

Astry[1], Dyah Darma[1], Satria Gunawan Zain[1], Akhyar Muchtar[1]

[1]Educational Informatic and Computer Engineering, Universitas Negeri Makassar, Indonesia

ARTICLE INFO	ABSTRACT (10 PT)
	This study aims to determine the results of developing a web-based BUMDes administrative information system in Macolliloloe Village and testing a website-based BUMDes administrative information system using the ISO 25010 standard. This study is a Research and Development (R&D) research. It uses a prototype development model consisting of the stage of gathering requirements, building prototypes, evaluating prototypes, coding the system, testing the system, evaluating the system, and using the system and collecting data in this study using interviews, questionnaires, measurement software, and documentation. System testing in this study uses several quality standards for software development, namely ISO 25010, including the functional suitability aspect with the results of a decent and acceptable category, the performance efficiency aspect with class B results, the usability aspect with excellent category results, the reliability aspect with the acceptable category results. Received is worth 100% without errors and portability with very decent results. Based on the results of this study, a web-based BUMDes administrative information system development was produced in Macolliloloe Village. It could be used to manage BUMDes administration using the prototype method with aspects of the ISO 25010 standard.

Astry,
Educational Informatic and Computer Engineering, Universitas Negeri Makassar, Indonesia
Email: astryniss0123@gmail.com

1. INTRODUCTION

Information is essential for everyone, especially information technology, which brings many changes in both the organization and the progress of business processes. Usually, information technology demands increased performance in almost all fields, and the resulting speed and accuracy will obtain information that makes all activities easier. Information systems will help companies to present financial reports in the form of accurate and reliable information so that many parties use information systems to achieve excellence for the company.

Based on the rapid development of the technology sector, the business sector is the sector most affected by the development of information technology and telecommunications. Through e-commerce, we can have the same opportunities to compete and succeed in business in cyberspace. E-commerce lately has been booming that offering merchandise on the website.

The website itself has an administration that helps the preparation and recording of information data can be done systematically to provide information and ease of obtaining comprehensive information in the relationship between each other [1].

Financial administration consists of several components: planning, budgeting, management, search, storage, control, and financial audits. The government optimizes village functions through Law no. 6 concerning village-owned enterprises are business entities that all or most of their capital comes from the village. The establishment of BUMDes aims to encourage village economic potential, increase original village income, encourage the development of rural community economic activities, increase creativity and village business opportunities and encourage the development of informal micro-enterprises to absorb labor for rural communities. BUMDes has a role in regulating the village economy [2]. BUMDes can carry out the business

potential in this effort, including simple social, e.g., rent, financial, financial, and joint ventures. Each type of business mentioned can be run in the village by adjusting the conditions and potentials that exist in the village. One of the villages that have BUMDes is Macolliloloe Village, Wajo Regency.

The BUMDes in Maccolliloloe Village is headed by a BUMDes unit head whose task is to manage business units under the BUMDes and report profits and losses to the village head. However, in Macolliloloe Village, there are still several obstacles in empowering BUMDes, including the lack of adequate human resources in the management of BUMDes, and the recording and reporting of BUMDes are still in the form of archival bookkeeping. To achieve this goal, the governance that must be fulfilled, such as the BUMDes administration report, is neatly arranged. Reports of capital, expenditure, and results from the BUMDes business unit can be appropriately accommodated. This report can certainly be used as a guide for the village to manage BUMDes.

Therefore, to overcome the problems that occur, a website-based information system is needed that can be used as a means of supporting BUMDes activities. In this case, it is essential because a website can help consumers convey detailed product and price information. In addition, the website will also be able to access the information needed anytime and anywhere. The existence of a website also expands the reach of marketing because it is not only within the village but can reach other villages or even more than that. It is hoped that this can be realized with a Website-based information system using PHP and CSS programming using the programming language. The information system will help the effectiveness of BUMDes business activities.

Based on the background described, this study aims to produce a website-based BUMDes administrative information system and to determine the feasibility test of the information system using ISO/IEC 25010.

2. RESEARCH METHOD

The discussion in part II describes the type of research, development model, time and place of research, research procedures, needs collection techniques, and data analysis techniques.

2.1. Research Type

Research and development (R&D) is a series of processes or steps to develop a stone product or improve existing products [3].

2.2. Development style

In the manufacture and development of the BUMDes information system, a system development model is needed to determine the process of completing software engineering. The system approach used is the prototype method. A prototype is a rapid development and testing of a new application's working model (prototype) through an iterative and interactive process commonly used by information systems experts and business experts [3].

2.3. Place and time of research

This research was conducted at the Maccolliloloe Village Office, Wajo Regency, South Sulawesi. This research was carried out for two months, January 2022 - March 2022.

2.4. Research procedure

Based on the selected development model, the stages in this research are:

2.4.1. Needs Collection

The client and developer define the software's format and identify the requirements for the system created.

2.4.2. Building Prototype

Build a prototype by making temporary plans to present to customers, e.g., making input and output formats.

2.4.3. Prototype Evaluation

At this stage, the customer will evaluate the prototyping that has been made. If inappropriate, the prototyping will be revised by repeating the previous steps. However, if appropriate, the next step will be implemented.

2.4.4. Encoding System

The agreed prototype is translated into the appropriate programming language.

2.4.5. Testing System

After the system has become ready-to-use software, the software must be tested before use to minimize software errors.

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2.4.6. System Evaluation

At this stage, the customer or client evaluates the system that has been made and whether it is as desired. If not, then the developer will repeat steps four and five, but if yes, then step seven will be performed.

2.4.7. Using the system

The software tested and accepted by the client or customer is ready for use.

2.4.8. Using the system

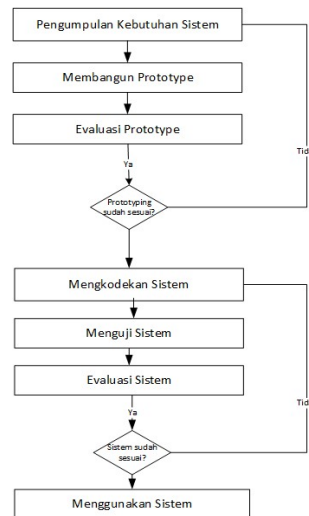The software tested and accepted by the client or customer is ready for use.

Fig.1 Research Procedure

2.3. Data collection technique

There are several ways to collect needs, namely:

2.3.1. Interview

Interviews are used as a data collection method if the researcher wants to conduct a preliminary study to find problems that must be investigated. This study requires a data collection method to dig deeper into the problems in the BUMDes administration application in Macolliloloe village [4].

2.3.2. Questionnaire

The questionnaire is a data collection technique that gives respondents a set of questions or written statements to answer. This study uses a questionnaire method to test the functional suitability and usability characteristics of the website-based BUMDes administration application in Macolliloloe village [4].

2.3.3. Measurement *Software*

Software is used to assist the data collection process in testing aspects of functionality suitability, performance efficiency, usability, reliability, and portability.

2.3.4. Documentation

Documentation is a record of events that have passed. Documents can be in the form of writing, pictures, or monumental works of someone. In this study, the authors took from the village office.

2.4. Research Instruments

2.4.1 Instrumental *Functional Suitability*

Functional characteristic test *suitability* using *test cases* and *guttman scale.* This test is carried out to determine whether the function of the information system has been running as expected.

2.4.2. *Performance efficiency* research instrument

Performance efficiency testing is done using GTMetrix software. Testing is done with the GTMetrix web service. GTMetrix provides a complete picture of site load and helps detect where data flow density lies. DTMetrix measures page load time, total page size, and the number of HTTP requests.

2.4.3. *Usability* research instrument

Usability testing is carried out using questionnaires or questionnaires by employees and the public directly after trying the information system. The questionnaire used is the U SE Questionnaire. The questionnaire questions are divided into four criteria: usability, ease of use, ease of learning, and user satisfaction. The questionnaire used the Likert scale method with five answers, namely Strongly Disagree (STS), Disagree (ST), Disagree (KS), Agree (S), and Strongly Agree (SS).

2.4.4. Research Instruments *Reliability*

Reliability testing is done by using the Web server stress tool to test the resilience or capability of the software and whether the software can run well when given a load.

2.4.5. *Portability* Research Instruments

Portability testing is done by cross-browsing compatibility testing on the desktop to test the quality of the software running correctly and whether no errors occur when run on different browsers, such as Mozilla Firefox, Opera, Google Chrome, and Internet Explorer.

2.5. Data analysis technique

2.5.1. *Functional Suitability* Analysis Techniques

This *website*-based testing uses instruments in the form of *checklists.* The Guttman scale is used if we want a firm answer to a problem being asked and the answer to each item uses an answer that is "Yes" or "No".

Table 1 Guttman Penilaian Assessment Criteria

No.	Information	Score
1.	Yes	Score 1
2.	Not	Score 0

Source: Sugiono,2011

The test results are calculated by the formula of the *features completeness matrix*, which measures the extent to which the function can be implemented correctly. The following is the formula for calculating the questionnaire, namely:

$$= \_ \text{-}$$

X: Value obtained

Q: Number of functions designed

I: Number of successfully implemented functions

features completeness matrix, the software can be feasible if the function items' calculation results are close to one.

2.5.2. *Performance Efficiency* Analysis Techniques

This test was carried out by analyzing the performance efficiency data, and the system was tested with tools. The conditions needed in the test are web addresses on different system pages.

Table 2 Assessment of *performance efficiency*

Score %	Grade
90-100	A
80-89	B
70-79	C
<69	D

Source: Zumrotul, 2016

2.5.3. *Usability* Analysis Techniques

Testing usability characteristics on information systems using a USE Questionnaire and a Likert scale. The Likert scale is a type of scale that can be used to measure a person's attitudes, opinions, and perceptions. The score criteria for the answer items are:

Table 3 *Likers . Scale Assessment Criteria*

Answer	Score

Strongly Disagree	1
Don't agree	2
Just Agree	3
Agree	4
Strongly agree	5

Source: Sugiono, 2017

The score is calculated using the conversion formula to score percentage to find the interpretation criteria for *usability test scores.* The scores obtained from the respondents were then searched for the criteria for the presentation of the percentage of *usability test results* with the feasibility percentage formula [4] :

$$\text{Eligibility Percentage:} \frac{\text{skor yang diperoleh}}{\text{skor yang diharapkan}} \times 100\%$$

After obtaining the percentage of answers, the respondent is then given an interpretation or assessment of the research results.

No	Eligibility Percentage (%)	Interpretation
1	0% - 20%	Very Not Good
2	21% - 40%	Not good
3	41% - 60%	Pretty good
4	61% - 80%	Well
5	81% - 100%	Very good

Table *4 Usability* Assessment Categories

Source: Guritno, 2011

Reliability testing is an analysis using a stress tool application by testing stress testing, which aims to see the resilience of the software working under normal circumstances. Stress testing simultaneously simulates visitors at a particular time and shows the performance of the infrastructure when the server is serving many requests.

2.5.4. *Portability* Analysis Techniques

This test is carried out by direct observation by experimenting with various environmental conditions in various browsers. Programming expert responses are seen based on a questionnaire that uses the Guttman scale. This study uses a checklist form with yes-no answer choices. The respondent's answer with the highest score (yes) is worth one, and the lowest score (no) is 0.

Guttman . Scale Rating

Answer	Score
Yes	1
Not	0

Source: Sugiono,2017

The test results are calculated by the formula of the features completeness matrix, which measures the extent to which the function can be implemented correctly. The following is the formula for calculating the questionnaire, namely:

$$= \_\ \_$$

X: Value obtained

Q: Number of functions designed

I: Number of successfully implemented functions

features completeness matrix, the software can be feasible if the function items' calculation results are close to one.

3. RESULTS AND DISCUSSION

After explaining the method that will be used in part two, then in the third part, the results of the research and discussion are explained, namely:

3.1. Research result

The development of this Website-based administrative information system for Owned Enterprises (BUMDes) information system aims to facilitate the administrative process of BUMDes. The following is a description of the process of developing a Web-based Administration Information System for Owned Enterprises (BUMDes) in Macolliloloe Village that has been developed and the results of the tests that have been carried out.

3.1.1. Needs Collection

At the stage of analyzing the needs of the BUMDes information system, it is done by analyzing and collecting information by conducting interviews and direct observations to obtain the data needed for system development. The results of this stage obtained data on the needs of the BUMDes Administrative Information System as follows:

a. Users in the BUMDes information system are *Admin,* Head of Unit, and *Customer.*

b. BUMDes information system is needed in managing BUMDes data.

c. The data performed by the *user* to access the information system is in the form of a *username* and *password.*

d. Admin can add, edit, and delete rental, savings, loan, and sales data..

e. The unit head can see all customer data for savings, loans, and rentals.

3.1.2. Building *Prototype*

Based on the results of gathering requirements, the next step is to build a *prototype.* This stage is done by helping the temporary design that focuses on presenting to the user. This design consists of context diagram design, DFD, *Use case diagram,* and *interface design.*

3.1.3. *Prototype* Evaluation

Based on the results of the evaluation by Macolliloloe Village Office employees. Developers are asked to add several features, namely: adding a vision and mission to the profile menu, and adding a savings and loan menu, adding a rental menu, adding printing to the savings and loan rental menu. m added an e-commerce menu.

3.1.4. Encoding System

The agreed prototype is translated into the appropriate programming language at this stage. The programming languages used are PHP, JavaScript, HTML, CSS, and bootstrap programming languages.

3.1.5. Testing System

3.1.5.1. Material Test

Material testing carried out is content validation. Content validation is done to validate the content of the system. As content experts, two validators from the Macolliloloe Village Office carried out this validation. Content validation is related to content feasibility, presentation feasibility, and language assessment developed by filling out a 1-5 scale questionnaire consisting of 10 statement points.

Table 6 Recapitulation of content validation results

No	Name	Earning Score	Expected score	Average (M)	Category
1	Content Validation I	39	50	78.0%	Worthy
2	Validation II	41	50	82.0%	Very Worthy
	Average	40	50	80.00%	Worthy

Data Source: 2022

3.1.5.2. ISO 25010 Testing

This testing phase is carried out after the information system has been created, which aims to determine the quality and feasibility of the information system before it is used. Software quality testing refers to the ISO 25010 testing standard by using aspects of functional suitability, performance efficiency, usability, reliability, and portability. The following are the results of testing each of these aspects.

3.1.5.2.1. Functional Suitability Test

Functional suitability testing is carried out to validate the system from the application. Two system expert validators carried out this test. The validator will provide a checklist in the "Yes" column; if it is 1, it means that it was successfully executed. However, if the system fails or has an error, the validator will provide a checklist "No" section with a value of 0.

Table 7 *Functional Suitability* Recapitulation

Validator	Number of Features (P)	Number of Features Tested Successfully (1)	*Feature Completeness*	Category
System Expert I	165	165	1	Worthy
System Expert II	165	165	1	Worthy
Average	165	165	1	Worthy

Source: Data processing, 2022

Based on the calculation of Feature Completeness, if the average number is calculated, it can get a value of I = 165 and P = 165, with Feature Completeness worth one and successfully operated. This Feature Completeness means that the functionality suitability aspect of the information system developed is in the appropriate and acceptable category.

3.1.5.2.2. Performance efficiency test

Performance efficiency testing is the level of reloading performance on the resources used in the specified conditions. This test is done by calculating the total score of all pages and tested using web testing GTMetrix. The results obtained by the GTMetrix class get a B value with a performance of 81%, structure of 89%, and load time of 2.2 seconds. This website is said to be good if the load time is less than 10 seconds.
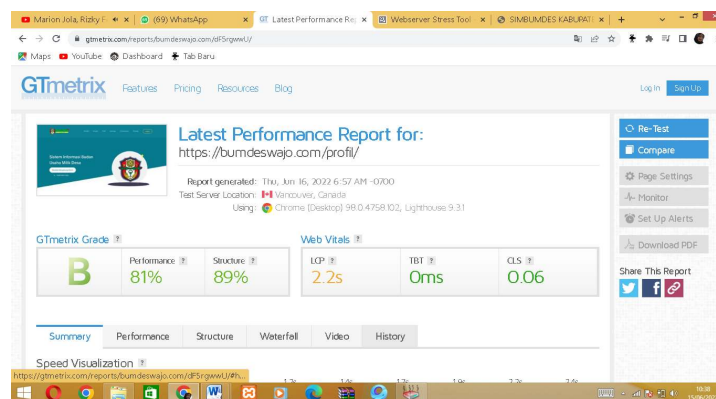

Figure 2 *Performance efficiency test*

3.1.5.2.3. Usability Test

Usability testing aims to determine the user's response to the BUMDes information system that has been created. The *usability test* was carried out by testing the system directly to users with a total of 20 respondents and the respondents were asked to fill out a questionnaire containing 15 questions.

Table 8 Recapitulation of *Usability Test Results*

Respondent	Total Score	Expected Score	Percentage (%)	Category
20	1216	1500	81.1 %	Very good

Source: Data analysis, 2022

Based on the analysis of the calculations in table 4.4, the total score obtained is 1216, and the expected score is 1500 from the responses of 20 respondents to the BUMDes information system in Macolliloloe Village. The grouping level is according to the Likert scale, so a percentage of 81.1 % is obtained in usability testing. The score indicates that the quality of the software from the usability aspect is appropriate, and if it is interpreted, the feasibility is in an excellent category.

3.1.5.1.4. Reliability Test

Reliability testing is carried out on information systems, one of which is by using the stress testing method. Stress testing in this test uses the Webserver stress tool software, which has three test categories, namely click test, Time Test and Ramp Test.

3.1.6. Click Test

Click test is an action that is carried out to test the resilience of the system, and then each click action will calculate the time lag and delivery that can be made by the server if accessed simultaneously

User No.	Clicks	Hits	Errors	Avg. Click Time [ms]	Bytes	kbit/s	C
1	10	10	0	157	173.610	885,64	
2	10	10	0	154	173.610	900,01	
3	10	10	0	153	173.610	909,88	
4	10	10	0	148	173.610	936,96	
5	10	10	0	152	173.610	913,70	
6	10	10	0	151	173.610	916,79	
7	10	10	0	150	173.610	927,52	
8	10	10	0	151	173.610	916,94	
9	10	10	0	149	173.610	931,12	
10	10	10	0	157	173.610	883,08	

Fig.3 Reliability Test on Click Test Per User

URL No.	Name	Clicks	Errors	Errors [%]	Time Spent [ms]	Avg. Click Time [ms]
1	IKM	99	0	0,00	15.078	152

Fig.4 Reliability Test on Click Test Per URL

The results obtained in the click test per user and per URL show that the number of clicks given is ten times with the number of hits 10 with errors that occur as much as 0, for the fastest time used is 157 ms, bytes speed reaches 173,610, and access speed reaches 936, 96 kbit/s.

- ***Time Test***

A time test is a Run Test with a constant load at a predetermined time.

User No.	Clicks	Hits	Errors	Avg. Click Time [ms]	Bytes	kbit/s	Cookies
1	116	115	0	183	1.996.515	759,25	
2	116	115	0	185	1.996.515	749,99	
3	116	115	0	182	1.996.515	764,13	
4	115	115	0	182	1.996.515	762,74	
5	115	114	0	181	1.979.154	766,29	
6	115	115	0	175	1.996.515	792,23	
7	115	114	0	181	1.979.154	766,85	
8	115	114	0	174	1.979.154	799,62	
9	115	114	0	167	1.979.154	831,60	
10	115	114	0	170	1.979.154	815,02	

Fig.5 *Time Test Results Per URL*

URL No.	Name	Clicks	Errors	Errors [%]	Time Spent [ms]	Avg. Click Time [ms]
1	IKM	1.138	0	0,00	202.375	178

Fig.6 Time Test Results *Per User*

The results were obtained by testing the Time Test with a constant load at a predetermined time. The Time Test was carried out by producing the most significant number of clicks, 116, a click time of 185 ms, a speed of bytes of 1,996,515, and an access speed of 764,13 kbit/s.

- *Ramp Test*

A ramp test is a Run Test with an increasing number of loads at a predetermined time.

User No.	Clicks	Hits	Errors	Avg. Click Time [ms]	Bytes		kbit/s	Cookies
1	173	172	0		166	2.986.092	834,83	
2	160	159	0		160	2.760.399	867,24	
3	146	145	0		170	2.517.345	818,49	
4	132	131	0		164	2.274.291	846,55	
5	118	117	0		158	2.031.237	879,14	
6	104	103	0		172	1.788.183	805,61	
7	90	89	0		159	1.545.129	873,00	
8	76	75	0		174	1.302.075	800,01	
9	62	61	0		177	1.059.021	785,87	
10	49	48	0		176	833.328	789,43	

Ramp Test Results Per URL

URL No.	Name	Clicks	Errors	Errors [%]	Time Spent [ms]	Avg. Click Time [ms]
1	IKM	1.087	0	0,00	180.575	166

Fig.8 *Ramp Test Results Per User*

The Ramp Test was carried out to produce the most significant number of clicks, as many as 173 with 172 hits. The bytes speed reached 2,986,092, and the access speed was 834.83 kbit/s.

Table 9 *Reliability* Test Results

Test Type	Percentage *Error* per *URL*	Percentage *Success* per *URL*
Click test	0%	100%
Time Test	0%	100%
Ramp Test	0%	100%
Average _		100%

Source: Data processing, 2022

Based on the table above, it can be concluded that the percentage of success of the Reliability test using the click test, Time Test, and Ramp Test is 100% acceptable without errors.

3.1.5.1.5.   Portability Testing

The results of portability testing of BUMDes information systems are used to measure software capabilities. Testing for portability was carried out by running the system on several different devices and on several browsers. The following portability tests were carried out on several devices:
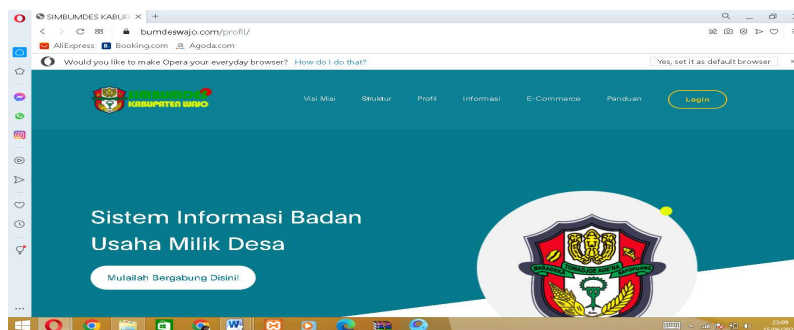

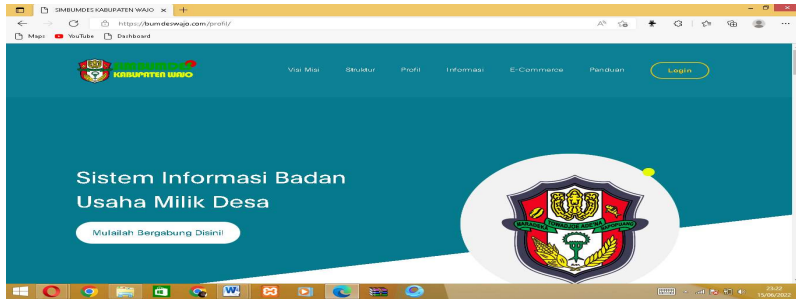Fig 9 Testing *portability* using *Opera*

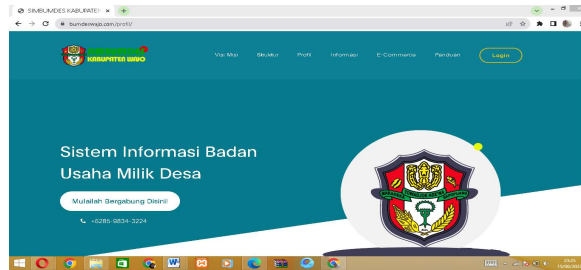Fig 10 Portability testing *on* Microsoft *Edge*

Fig 11 Portability *testing* on *Chrome*

Fig 12 Portability testing *on* Mi *Browser*

Fig 13 Testing *portability* on *Safari*

Portability Test Results

No	Device	Browser	Succeed	Fail
1.	Acer Intel Celeron n2840	Chrome	1	0

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2.	Acer Intel Celeron n2840	Microsoft Edge	1	0
3.	Acer Intel Celeron n2840	Opera	1	0
4.	Redmi Note 9 Smartphone	Mi Browser	1	0
5.	iPhone Xr Smartphones	Safari	1	0
	Total		5	-
	Average		1	-
	Category	**Very Worthy**		

It can be seen in the column table that the total success values of the five operating systems tested on this system have met the portability aspect.

3.2. Discussion

The BUMDes information system at the Macolliloloe Village office is in the form of one of the business entities established by Macolliloloe Village that suits users' needs. The development of the BUMDes information system is expected to assist in managing BUMDes data.

This information system is built using HTML, PHP, and Javascript programming languages, as well as database storage using MySQL, where XAMPP is a stand-alone server (localhost) due to the advantages of HTML and PHP programming languages, which are easy to learn. This stand-alone server makes it easier for developers in system development. The development of the BUMDes information system uses research and development (R&D) research with a prototype development model consisting of the stages of collecting system requirements, building prototypes, evaluating prototypes, coding the system, testing the system, evaluating the system, and using the system.

The system requirements gathering stage is the stage where the developer and the client work together to determine the general objectives of the program to be made. Building a prototype is building a temporary plan that focuses on presenting it to users. This stage provides an initial overview of the system, which includes context diagrams, DFD, use cases, activity diagrams, and interface designs. In addition, the client will evaluate the prototyping that has been made or built so that developers can proceed to the next stage. The coding stage of the system will translate into the appropriate programming language. The testing stage will determine the sustainability of the system that has been created. The tests carried out include the validation developed. In the system evaluation stage, the system developed is as desired. If it is not appropriate, the development will repeat steps 4 and 5, but if it is appropriate, the next stage will be using the system.

The result of the development of the BUMDes information system is information that can assist in managing the administration of BUMDes based on the prototype development method by fulfilling the testing aspects of ISO 25010.

The feasibility of the BUMDes information system in Macolliloloe Village is carried out by testing the system built using the ISO 25010 standard test using five characteristics: functional suitability, performance efficiency, usability, reliability, and portability. The five aspects were chosen based on the needs of the Macolliloloe BUMDes information system.

Functional suitability testing is carried out to assess the extent to which the software can provide functions that meet the requirements that can be used under certain conditions. This test involves two experienced experts in the field of systems by testing the system directly by trying all its functions. Based on the research results of two system experts, a score of 1 was obtained with suitable criteria. Functional suitability testing is assessed using the Guttman scale. The test results are calculated using the feature completeness formula. A value of 1 based on the functional suitability measurement formula is categorized as feasible if it is close to or has a value of 1.

Performance efficiency testing is carried out to see the developed system's performance level. This test using online GTMetrix obtained the results of a B value with a performance of 81%, structure of 89%, and load time of 2.2 seconds. The website is said to be good if the load time is less than 10 seconds. From these results, it can be concluded that the administrative information system of BUMDes Macolliloloe has met the characteristics of performance efficiency.

Usability testing uses user responses from the information system by introducing the system to respondents, then being asked to fill out a questionnaire. If interpreted, it gets an excellent category based on the feasibility percentage of 81.1%.

Reliability testing is done by using a web server stress tool to see the resilience of software in handling resource requirements beyond normal usage limits. This test is divided into three tests: a click test with 100%

results without errors. Ten virtual users successfully use the buttons available on the website page according to the amount of constant load until the virtual user meets the number of clicks that have been generated. Ten virtual users used the time test with 100% results without errors, who succeeded in constant loading for 15 minutes. Ramp test with 100% results without errors, ten virtual users managed to access the application with an increasing number of loads for 15 minutes and has met the reliability aspect based on the Telcordia standard of software reliability that can be accepted if the success of the software is more than 95% or 0.95.

Portability testing measures the software's ability if it is transferred from one environment to another. Testing for portability is done by running the system on a browser from several devices. The test results are declared to run well from 3 different devices tested by several browsers and have met the portability aspect.

4. CONCLUSION

4.1. Conclusion

BUMDes administrative information system is an information system that can assist data administration on the BUMDes based on user needs using a prototype development model. This includes gathering requirements, building prototypes, evaluating prototypes, coding the system, testing the system, and evaluating the system. The system has met the aspects of the ISO 25010 testing standard with functional suitability, performance efficiency, usability, reliability, and portability.

Based on the results of the system test using the characteristics of the ISO 25010 test, which consists of functional suitability with the results of a decent category, Performance efficiency with class B results, usability with a percentage result of 81.1 in the excellent category, reliability with an acceptable category result with a value of 100% without errors, and portability with the results of the category are very feasible. It can be concluded that the BUMDes information system is suitable for use by users.

4.2. Suggestion

The researchers give the following suggestions for implementing this system:

If there is a system development, it is expected to add features to the Macolliloloe BUMDes information system.

This system is expected to be able to implement this *web -based BUMDes information system* so that the use of the system can provide much better service information.Provide a statement that what is expected as stated in the "Introduction" chapter can ultimately result in "Results and Discussion" chapter, so there is compatibility. Moreover, the authors can elaborate the prospect of the development of research results and inspire further studies (based on result and discussion).

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