Jurnal Scientia
Volume 13 , Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

Simulation Design Of A Baggage Handling System Based On Arduino Uno At The Airport Departure Terminal Dr. Ferdinand Lumban Tobing Sibolga

Ahmad Fahrur Rozi Matondang[1], Adi Sastra P Tarigan[2], M. Rizki Syahputra[3]
[1,2,3]Universitas Pembangunan Panca Budi, Medan, North Sumatra, Indonesia

Article Info	ABSTRACT
Keywords: Baggage Handling System, Design, Dr. Airport Ferdinand Lumban Tobing Sibolga	Baggage handling plays an important role in ensuring the comfort of passengers traveling by airplane and ensuring that the baggage can be transported with the passenger on the same aircraft. However, passengers often do not know how to handle the luggage they have handed over at the check-in counter until it finally arrives in the plane's hold. This system is very important to support flight security and safety at an airport. The implementation of an automated baggage handling system (BHS) / Hold Baggage Screening (HBS) is very necessary to minimize cases of baggage theft. where this research aims to determine the Baggage Handling System (BHS) design planning at Dr. Ferdinand Lumban Tobing Sibolga, which is planned to use the Aerotropolis Airport concept. Apart from that, this research also aims to understand how the BHS components workDr. Airport Ferdinand Lumban Tobing SibolgaWhat is Planned.Where this research was carried out using the AutoCAD 2012 application and other engineering applications that allow easier planning and design. The BHS design used in this research refers to the BHS framework that has been implemented at Kuala Namu International Airport in Deli Serdang. The research results show that the BHS design has seven main stages, starting from check-in inspection, Out of Gauge (OOG) inspection to baggage that has a weight and dimensions that exceed the maximum size, X-Ray inspection MVXR 5000 (Screening Level 1/2), Manual Coding Station (MCS), X-Ray inspection RTT 110 (Screening Level 3/4), inspection by Avsec experts and reconciliation (Level 5/6), to the use of SCADA (Supervisor Control Data Acquisition).
	Corresponding Author: Ahmad Fahrur Rozi Matondang Universitas Pembangunan Panca Budi

INTRODUCTION

Baggage handling has an important role in maintaining the comfort of passengers traveling by plane and processing the baggage so that it can be transported together on the same plane as the passengers. But so far, passengers do not know how to process the luggage that has been handed over at the check-in counter to the plane's baggage. Along with the growth of aviation movements (passengers and aircraft), currently the technology applied for handling passenger baggage has developed rapidly. Several modern airports have implemented an automated Baggage Handling System (BHS) / Hold Baggage Screening

Jurnal Scientia
Volume 13 , Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

(HBS) as an efficient, effective and secure baggage handling solution for goods that endanger flight safety (Airport Engineering, 2004).

To support the security and safety of flights at an airport, it is very necessary to use an automated baggage handling system (BHS) / Hold Baggage Screening (HBS) to minimize various baggage thefts. As an airport located in a strategic region/area in the fields of tourism, education and a good bureaucratic system, the operation of the airportDr. Airport Ferdinand Lumban Tobing Sibolgalt is expected to be able to accommodate the movement of passengers, cargo and aircraft in large numbers. Based on the Decree of the Minister of Transportation number KP 1164 of 2013 concerning the determination of the location of the new airport in Sibolga, North Sumatra, it is prepared to serve both domestic and international passenger movements of 20,000,000 pax/year, cargo movements of 55,380 tons/year, and 131,830 aircraft. aircraft/year. To handle such a large passenger capacity and movement, a baggage handling system that is integrated with an inline screening system is needed to support flight efficiency, effectiveness and safety in airport operational activities. The aim of this research is to find out the Baggage Handling System (BHS) design planning inDr. Airport Ferdinand Lumban Tobing Sibolgaas one of the airports planned to use the aerotropolis airport concept. And to find out how the Baggage Handling System (BHS) components work inDr. Airport Ferdinand Lumban Tobing Sibolgaplanned.

Theoretical Basis

Design and Planning Hypothesis

Design is a process that aims to analyze, assess, improve and develop a system, both physical and non-physical systems, that is optimal for the future by utilizing existing information. Planning occurs in all types of activities. Planning is also the basic process in which management decides goals and how to achieve them. Planning is a process that does not end when the plan has been determined, the plan must be implemented. At any time during the implementation and monitoring process, plans may require modification to remain useful. Re-planning can sometimes be a key factor in achieving ultimate success. There are two basic reasons for the need for planning. Planning is done to achieve.

1. Protective benefits.Which results from reducing the possibility of errors in decision making,
2. Positive benefits.This is in the form of increased success in achieving organizational team goals.

The design of a tool is included in the engineering method, thus the steps for making the design will follow the engineering method. Merris Asimov explained that engineering design is an activity with a specific purpose towards the goal of fulfilling human needs, especially those that can be accepted by the technological factors of our civilization. From this definition, there are three things that must be considered in design, namely.

1. Activities with a specific purpose
2. Targets at fulfilling human needs
3. Based on technological considerations.

Jurnal Scientia
Volume 13 , Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

The design process, which is a general stage of design techniques, is known as NIDA, which stands for Need, Idea, Decision and Action. This means that the first stage of a designer is determining and identifying needs.

Baggage Handling System (BHS)

*Baggage Handling*is an activity of handling passenger luggage from the departure station to the destination station. The work carried out by a ground handler has a sequence starting from checking the baggage by security check, weighing the baggage and labeling the baggage and giving the baggage claim tag, then making payment if the baggage exceeds the provisions, then the baggage is carried and put on the plane (loading process), and after arriving at the destination station, the baggage will be unloaded or unloaded (unloading process) by the officer and then the baggage will be taken to the baggage claim area. baggage claim tag, then make payment if the baggage exceeds the provisions, then the baggage is carried and put on the plane (loading process), and after arriving at the destination station the baggage will be unloaded or unloaded (unloading process) by the officer then the baggage is taken to the baggage claim section (baggage claim area). Some aspects that should not be ignored from baggage handling are:

1. Safety & Secure (security & safety).
2. Punctuality (punctuality).
3. Reality (reliability of services provided).
4. Customer Satisfaction (customer satisfaction, in this case in the form of passengers and the airline).

To support the security and safety of flights at an airport, it is very necessary to use an automated baggage handling system (BHS)/ Hold Baggage Screening (HBS) to minimize various baggage thefts. In KP No. 1164 of 2013Dr. Airport Ferdinand Lumban Tobing Sibolgaprepared to serve the movement of passengers and goods as shown in table 1 below.

Table 1. Estimated number of requests inDr. Airport Ferdinand Lumban Tobing Sibolga

No	Description	Stage 1	Stage 2	Stage 3
1	Passenger (per year)			
1.	Domestic	9,132,000	12,251,600	16,475,200
N 2	Cargoes (Tons/year) Domestic	30,240	39,150	50,450
3	Aircraft movements (per year)Domestic	3,222	3,842	5,006

To handle such a large passenger capacity, a baggage handling system that is integrated with an inline screening system is needed to support flight efficiency, effectiveness and safety in airport operational activities. Along with the growth of aviation movements (passengers and aircraft), currently the technology applied for handling passenger baggage has developed rapidly. By installing an automated baggage handling system (BHS)/hold baggage screening (HBS), it is hoped that problems in the field can be resolved.

Dr. Airport Ferdinand Lumban Tobing

Dr. Airport Ferdinand Lumban Tobing (also known as Pinangsori Airport; (IATA: FLZ,ICAO: WIMS)) is an airport located in the DistrictPinangsori,Central Tapanuli Regency,North Sumatra. The airport is named after himFerdinand Lumban Tobing, Indonesian national hero from North Sumatra.

Jurnal Scientia
Volume 13 , Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

The new terminal building at dr. Ferdinand Lumban Tobing was inaugurated on February 22 2013 by the Director General of Civil Aviation, Ministry of Transportation, Herry Bak. The domestic passenger terminal building of dr. Ferdinand Lumban Tobing previously only had 300 m2, after the construction of the new domestic terminal building, the area is now 733 m2, not including the Regional Government VVIP space.

Dr. Airport Ferdinand Lumban Tobing is a third class airport which has an airport area of 183.03 Ha and has a runway length of 2260 m x 30 m, taxiway 150 m x 23 m, apron 120 m x 80 m and is capable of landing Airbus A320, Boeing 737 Classic and Next Generation aircraft. Fokker F-28 or similar.

In the future, new flight routes specifically for Air Cargo will be implemented in order to operate the Pinangsori Cargo terminal specifically for exports of superior commodities. Because dr. Ferdinand Lumban Tobing in Pinangsori District, Central Tapanuli Regency is the gateway for passenger and goods air trade in Central Tapanuli Regency. Increasing the capacity of this terminal is one of the efforts made to accelerate infrastructure development in Central Tapanuli Regency which is ultimately expected to encourage increased regional economic growth and improved public services.

METHODS

This research was carried out on siteat Dr. Airport. Ferdinand Lumban Tobingwas chosen as the research location considering that the airport was a temporary airport built to replace the role of Kualanamu Airport. This research was carried out using the help of the AutoCAD application and other engineering applications which make it easy to design the baggage handling system.

The design analysis model in this research refers to the baggage handling system design concept that was created by the Beumer Group as one of the providers of baggage handling system technology at several airports in the world that use baggage handling system technology. Apart from referring to the design concept from the Beumer Group, in designing the researcher also referred to the design model from one of the airports in Indonesia, namely Kuala Namu International Airport in Deli Serdang, North Sumatra. After analyzing the design models from the two models above, the researchers created a new design that could be implemented at Dr. Ferdinand Lumban Tobing The planning concept refers to the baggage handling system (BHS) framework that has been implemented by Kuala Namu international airport in Deli Serdang as shown in Figure 2 below.

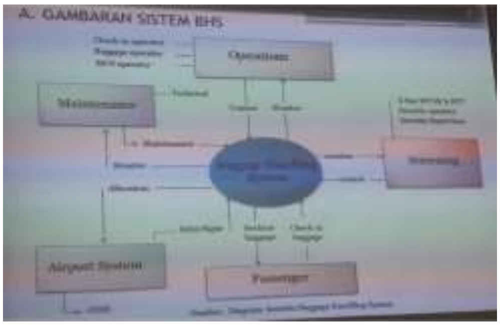


Figure 2. KBHS connection with other systems

Figure 2 shows the connection relationship between the baggage handling system (BHS) and other systems in airport activities, namely the Operation, Screening, Maintenance, Airport system and Passenger systems. In general, this connection relationship is a Controlling and Monitoring relationship. Controlling This means that baggage handling system (BHS) is an abbreviation for a system that helps control the process of checking passengers in and checking the baggage they carry. Apart from the Controlling and Monitoring functions, there is also an Allocation function where the baggage handling system (BHS) provides updated information to the Airport System to then publish it on the Flight Information Display System (FIDS).

RESULTS AND DISCUSSION

Baggage Handling System (BHS) Design.

In creating a baggage handling system (BHS) design that can be applied to the New Yogyakarta International Airport, researchers used the AutoCAD 2012 graphic application, then each component of the baggage handling system (BHS) design was given an explanation as one of the design method requirements, namely the Transformation principle where the design solution specifications are can serve as better guidelines for traditional and contemporary various design activities (architectural, graphic, industrial, information, interaction, and so on) and/or require a multidisciplinary response.

Baggage Handling System Planning

Baggage handling systemdesigned to connect automatically with other systems running in airport activities, these systems are.

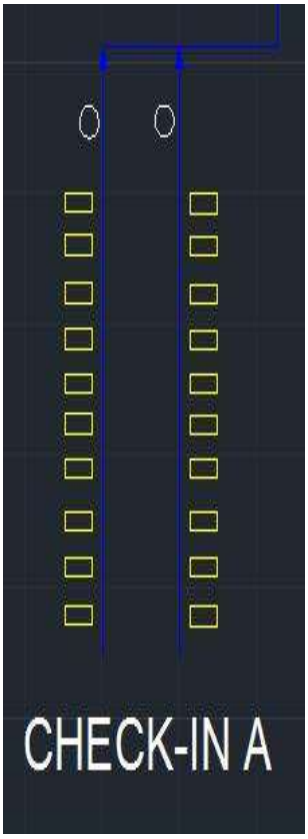
1. Operations, Service activities for passengers consisting of check-in activities for airplane passengers originating from Dr. Ferdinand Lumban Tobing as airport origin and check in for transit passengers. Next is Passenger Baggage Services. Passenger baggage will be processed at BHS before going to the make up area and then being put into the aircraft compartment. Third, the baggage service activity is Manual Baggage Attachment or what is called the Manual Coding System (MCS) where baggage that cannot be read by the scanning system will be scanned manually.
2. Screening, Activities connected to the baggage handling system are one of the most important activities of concern to airport managers. Screening or baggage inspection uses several security levels that gradually increase. Starting from Level 1 to Level 6 screening as a Final Inspection involving Airport Security (AVSEC) and Aircraft Passengers. Passenger Baggage Inspection uses 5 X ray tools MVXR and RTT.
3. Maintenance, The smooth process of the baggage handling system is very important to keep baggage flowing smoothly. Care and maintenance of the baggage handling system is carried out periodically involving related parties, at Kuala Namu International Airport the parties responsible are Vanderlande Operator and PT. Jaya Teknik as Vanderlande license holder in Indonesia. This care and maintenance is carried out continuously 1 x 24 hours without stopping, this is also very possible to be adopted by Dr. Airport. Ferdinand Lumban Tobing.

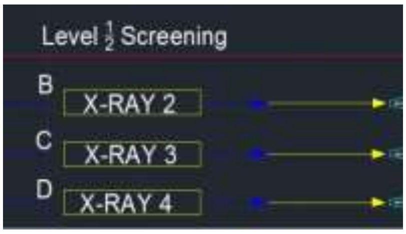
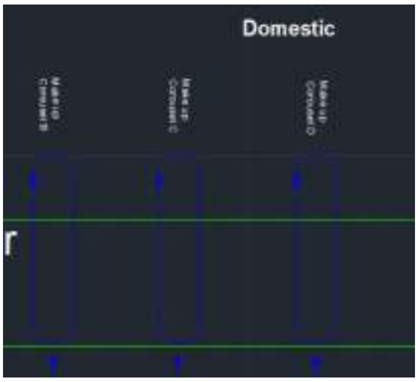
Jurnal Scientia
Volume 13 , Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

4. Airport Systems, The sophistication of the system that has been implemented in this baggage handling system is an automatic connection with the Flight Information Displays System (FIDS) system which makes it easier for passengers to control and monitor flight schedules via display boards throughout the airport. The Airport System will periodically send Bag Source Messages (BSM) which will then be recorded on the BHS system and then processed and returned to FIDS.
5. Passanger, Passengers are also involved in baggage handling system activities. Passengers check in and get a baggage tag, which is the initial process of the baggage handling system. Apart from checked baggage, another thing that can be connected is baggage reclaim, where the baggage of passengers arriving at KNO or transiting will receive BHS procedure treatment for their respective baggage.

Design is a process that aims to analyze, assess, improve and develop a system, both physical and non-physical systems, that is optimal for the future by utilizing existing information. Planning occurs in all types of activities.

Table 2. Description of BHS design

No	Baggage Handling Items *Systems*(BHS)	Image Cut	Explanation
1	Number of Check-in desks Counters		Number of Check-in Desks counter of 80 tables check-in counter. Obtained with using formulation $N= (a+b).t1/60 + 10\ \%$ a = Number of Passengers leaving on time busy (Data KP 1164 2013 Total rush hour passengers 3,547 Pnp/hour) b = Number of Passengers Transfer (Data KP 1164 2013 Total hourly transfer passengers busy 307 Pnp/hour t1 = Processing Time *check in*per passenger (estimate 2 minutes/passenger) So it can be calculated

			number of check counter tables *in*= 83.77 but at round up to 80 tables check-in counter.
2	Number of X-Rays		Number of X-Rays on the design This BHS is 5 X-Ray, consisting of 4 X-Rays liver ½ screening and 1 X-Ray RTT (Real Time *Tomography*)
3	Amount of Baggage *Conveyor Belts*(BCB)		Number of Baggage Conveyors *Belts*(BCB) is calculated by using the formula is as follows N=cq / 425 where c = Number of passengers came at a busy time amounting to 3547 pnp (KP Data 1164 of 2013) q = proportion of passengers come with use a wide body *aircraft* (B747-400) as many as 428 pnp (data Garuda airline) So the amount is obtained The ideal BCB is 5 with the provisions of 4 BCB for flights domestic and 1 BCB for international flights

How Baggage Handling System Components Work

The Baggage Handling System (BHS) works based on a pattern that has been designed from the start to adapt to the volume of incoming baggage every minute. The main aim of implementing BHS is to provide improved service to passengers both in terms of service quality, baggage security and also processing speed. The target time set for a piece of

Jurnal Scientia
Volume 13 , Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

baggage from the start of the check-in process until it is stacked in the make-up area is 05 minutes.

Check In

*Check In*is the beginning of the BHS process where passengers sequentially queue to register themselves before boarding the aircraft. This registration is carried out for 2 things, namely:

a. Passengers, Passenger Registration by showing airplane tickets and personal identification. If you are flying internationally, you need to be accompanied by a passport and visa. The ticket is then exchanged for a Baording Pass which provides information on the passenger's seat number and aircraft departure time.
b. Baggage, checked baggage will be exchanged for a Baggage Tag Number (BTN) either on the baggage or affixed to the passenger's boarding pass as proof of baggage claim collection at the arrival hall.

The next process at BHS is that the baggage will go through a conveyor line or conveyor belt to the baggage inspection machine, namely the X ray MVXR 5000. Baggage that is deemed to be at risk and susceptible to damage will be equipped with a baggage tray which will protect it during the process while running on the conveyor belt.

Baggage entering via the conveyor line is limited to maximum dimensions and weight so that it does not interfere with the subsequent process of baggage screening at level 1/2. The standard dimensions for conveyor lines are as shown in table 4.2 as follows.

Table 3. Dimensions **of Normal Luggage Size**

Dimensions	Minimum	Average	Maximum
Length (mm)	300	700	900
Width (mm)	500	500	750
Height (mm)	50	250	650
Weight (Kg)	2	15	50

If a Passenger's baggage exceeds the dimensions above in Length, Width and Height or the maximum weight permitted, the baggage will go through a different stage from the Normal BHS stage, namely Screening via OOG (Out of Gauge) where OOG is a different stage from the normal procedure because does not go through the stages of screening, Sorting, Identification and Hold Baggage System.

Out of Gauge(OOG)

As the name suggests, Out of Gauge is baggage that has dimensions and weight that exceed standard baggage size and the maximum normal weight set in accordance with table 5.2. Luggage will be checked via an OOG X-ray Machine and if the baggage is more than 1 meter long, for example a Surfboard or has even larger dimensions and this does not include Normal baggage or conversely baggage that is too small in size and has the potential for interference then this also included in OOG Baggage.

MVXR 5000 X-Ray Examination (Screening Level 1/2)

Normal Baggage that goes through the Line Conveyor after the Check-in process will then pass through the MVXR 5000 X-Ray Machine to undergo Level 1 and 2 Screening Process. Basically BHS has 6 different levels of baggage inspection. The first and second levels form one inspection unit. At level 1, the baggage passes through an X-ray machine and you will see the inside of the baggage with a 3D view. Baggage that passes this stage will go to the next stage, namely Accept, which goes through the SVD (Sorter Vertical Dual) Machine and heads downwards. The SVD machine is mechanical equipment that functions as a lane mover for baggage accept or reject. If the baggage is rejected, the baggage will automatically move to the top lane of the conveyor, namely Screening stage 3/4.

Baggage that does not pass level 1 will undergo a 2nd Screening Process where if it is indicated as suspected, the MVXR 5000 X-ray machine will reject/reject the baggage and will display an image on the AVSEC Monitor (Level 2). The officer will read the scanning results on the monitor which will then analyze whether the contents of the baggage are truly suspicious or declared safe within a certain time limit that has been set.

Manual Coding Station(MCS)

Normal baggage that passes through the Helixorter will end up in two areas, namely Carousel and Lateral. Carousels have been discussed in the discussion above. Lateral is the part where baggage that cannot be detected by the Automatic Barcode Scanner Machine will automatically be connected to Lateral and will receive re-scanning treatment. The officer will carry out the scanning manually and this process is called MCS (Manual Coding Station). At MCS, the baggage will be scanned by a barcode sensor scanner, after which the baggage will enter the Helixorter again to be separated according to the type of airline and flight destination.

X-Ray Examination RTT 110 (Screening Level 3/4)

Baggage that does not pass / Reject the Level 1 / 2 inspection/Screening or is called Suspect will undergo a Level 3 and Level 4 Examination/Screening process. Level 3 Screening is an examination using the RTT110 X-ray machine which has better capabilities and accuracy than X-Ray MVXR 5000 machine. Baggage that passes through the X-Ray RTT 110 (Level 3) will produce two possibilities. First, the baggage will be declared safe/accepted so that the baggage can go straight to the Helixorter and then to the Make Up Area. The two pieces of baggage are declared not passed or Suspect, this baggage will receive further treatment where the Avsec PC Monitoring Engine will display the baggage on the monitor screen (Level 4) to make a decision whether the baggage is categorized as safe or not.

Examination by Avsec and Reconciliation Experts (Level 5 / 6)

Baggage that is categorized as Suspect at Level 3/4 will then proceed to the final stage of Baggage Inspection. At this stage, the role of expert and experienced audit officers becomes the most important part. The baggage will then go to the Baggage Claim Elevator to undergo Manual Inspection. This inspection is to ensure that there are no items that are prohibited from boarding the aircraft. The inspection officer will decide whether the baggage is safe to carry on the plane or whether it requires re-analysis. The officer's accuracy and foresight in observing the PC Supervisor (Level 5) is very important. If the baggage is re-analyzed, the officer will monitor it via the Workstation Reply screen and this stage is called Inspection Level 6.

SCADA (Supervisor Control Data Acquisition)

The main function of SCADA is to display graphical visualization of technical Processes and the ability to interact with these processes and by issuing Control Commands. The status value of the monitored system is continuously checked and when this value meets certain criteria, an alarm will sound. These alarms are displayed to SCADA system users in a clear and concise manner so that the problem and required action are clear. The next process of SCADA is recording and storing data. This is the process of collecting specified data from a monitored system and storing this data in a file or database for retrievable retrieval or export.

CONCLUSION

After carrying out research, researchers can make the following conclusions. The design in this research refers to the baggage handling system (BHS) model that has been implemented by Kuala Namu International Airport in Deli Serdang as seen in Figure 5.1 Page 27 with the provision that the number of check-in counters is 80, the number of X-Rays in this BHS design a total of 5 X-Rays consisting of 4 X-Ray lever ½ screening and 1 X-Ray RTT (Real Time Tomography), and the ideal number of Baggage Conveyor Belts is 5 with the provisions of 4 BCB for domestic flights and 1 BCB for international flights. The way the baggage handling system (BHS) works is designed to have 7 stages starting from use for check-in inspection, Out of Gauge (OOG) inspection or baggage that has a weight and dimensions that exceed the maximum baggage size, MVXR 5000 X-Ray Inspection (Screening Level 1/2), Manual Coding Station (MCS), X-Ray Inspection RTT 110 (Screening Level 3/4), Inspection by Avsec and Reconciliation Experts (Level 5/6), SCADA (Supervisor Control Data Acquisition).

REFERENCES

[1] Aryza, S., Lubis, Z., & Lubis, SA (2020). Strengthening Industry 4.0 Based on Arduino Uno and GSM SIM900A Inside Sliding Doors.JET (Journal of Electrical Technology),5(2), 80-87.
[2] Yudhanto, Yudha & Wijayanto, Ardhi. 2017. Easily Create and Run an Android Application Business with Android Studio.
[3] Birmano, MD and Bastori, I., (2008), Economic Calculations and Funding for NPPs and Conversional Generators Using Innovation Spreadsheets, Nuclear Energy Development, 10(2), 77–86.
[4] Suntoro, Joko. 2019. Data Mining Algorithm and Implementation with PHP Programming. Jakarta: PT. Elex Media Komputindo.
[5] Madubaru, SKP, (2013), Steam Boiler Operations and Maintenance Manual, Yogyakarta.
[6] Napitupulu, GR and Warman, E., (2015), Economic Feasibility Study of a PLTU Fueled by Fiber and Palm Oil Shells as Domestic Power, University of North Sumatra, 11(30), 53–58.
[7] Putra, AD, Yusuf, I. and Ganit, UA, (2016), Study of the Potential of Palm Oil Biomass Waste as a Steam Power Plant (PLTU) at PT. Perkebunan Nusantara XIII PKS Parindu, Tanjung Pontianak University, 2(1), 1–8.

Jurnal Scientia
Volume 13 , Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

[7] Winardi, B., (2009), Analysis of Fuel Consumption in Steam Power Plants (Case Study at PT. Indonesia Power Semarang), National Seminar on Electrical Informatics and It's Education, Diponegoro University, (2), 34–37 .
[8] Simbolon, FH, Anisah, S., & Aryza, S. (2023). INCREASING HYDROPONIC PLANT CULTIVATION WITH SMART RESOURCE CONTROLLING.Scientia Journal,12(04), 2285-2296.