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Implementation of RFID and Node-Red Dashboard In The System Asset Management at PT. Pama Persada Nusantara Head Office Jakarta

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ABSTRACT: *Implementation of RFID technology and Node-RED dashboard in the asset management system at PT. Pama persada Nusantara Head Office Jakarta. The aim of this research is to ensure the use and integration of RFID components in the implementation of a stock management system. The testing stages include ensuring the accuracy of reading RFID tags by the RFID reader, ensuring network connectivity between RFID components (RFID reader, RFID controller, and re terminal), as well as testing sending data from RFID tags read by the RFID reader to the MongoDB database via Node-RED. The Node-RED dashboard facilitates real-time inventory monitoring and management, registration of new assets, and status updates of assets stored in the warehouse space. The research results show successful implementation of RFID and Node-RED technology, which improves goods tracking and operational efficiency. Recommendations include improving the durability of RFID tags, maintaining network stability, optimizing dashboard usability, ensuring data integrity, scaling usage for future needs, increasing security measures for data storage and to create a smarter asset management implementation, it is necessary to create an item registration or description menu. condition of IN goods and description of the condition of goods OUT automatically. This research contributes to the development of an asset management system through the integration of RFID technology and the effective use of dashboards, especially the use of the Node-RED dashboard which can display data in real-time.*

KEYWORDS: *stock management, RFID, Node-RED, Node-RED dashboard, MongoDB.*

I. INTRODUCTION

Asset management is an important part of maintaining the wealth of a company. Goods are assets owned by the company and are maintained with good inventory, which can maintain and increase the value of assets. Asset management affects the finances of a company, with good management, assets can be utilized optimally [1].

Previous research on asset management has shown the implementation of RFID in web-based asset management, but has not been able to display data in real-time. The innovation in this research is the use of the Node-RED dashboard to display real-time data with an attractive and easy-to-use display.

This research was conducted at PT. Pama Persada Nusantara head office Jakarta, specifically in the Technology Acquisition and R&D Team. The Technology Acquisition and R&D team is part of one of the departments responsible for identifying, evaluating and implementing new technologies that can improve performance and innovation at PT. Pama persada Nusantara. This team also carries out research and development to create solutions that suit PT's business needs and challenges. Pama Persada Nusantara. As a team that uses and stores company assets, asset management is needed by the Technology Acquisition and R&D teams.

From the existing problems and from previous research, a tool was designed for "Implementation of RFID and Node-RED Dashboard in the Asset Management System at PT. Pama persada Nusantara Head Office Jakarta". Implementing RFID in an asset management system is an option because of the advantages of an RFID reader at Ultra High Frequency (UHF) which can read tags over a distance of three to five meters [8]. Then the Node-RED dashboard implementation was chosen because Node-RED provides a browser-based editor that makes it easy for users to connect workflows with the use of the required nodes by installing the available palette.

II. METHODOLOGY

A. TOOL PLANING STAGES

Tool design requires stages in the form of tool block diagrams, circuit workflow, hardware configuration design, software configuration design.

1) *Design of tool block diagrams*

Block diagram design is an important stage in creating a tool and system. At this stage all the components needed to build a tool and system that can work optimally.

The diagram design can be seen in Fig 1.

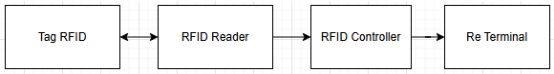

Fig 1. Tool Block Diagram

The asset management process can be carried out by utilizing technology. It is understood that a UHF 860 MHz-920 MHz RFID reader has been prepared which has a reading range of three to five meters and an RFID tag that uses passive tags because it is suitable for implementation in an asset management system with a simple and economical sticker form. The UHF RFID reader will capture the frequency of goods that have RFID tags attached when they pass through areas that can be reached by the RFID reader and the data will be displayed on the Node-RED dashboard interface using the DM re terminal.

2) Network Workflow

A series workflow is needed in tool making, so that the tool's work is structured and organized. A good circuit workflow can determine whether the final result is good or not. The circuit workflow can be seen in Fig 2.

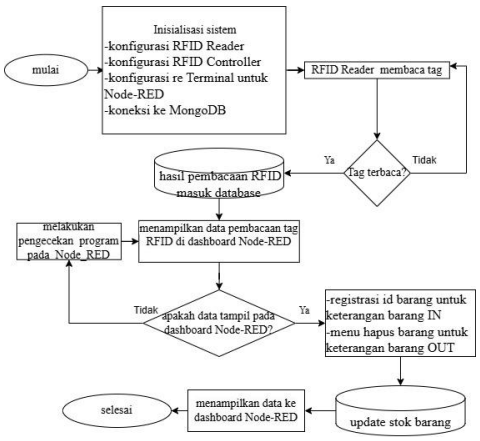

Fig 2. Network Workflow Diagram

B. NODE-RED CONFIGURATION

The use of Node-RED is divided into two, the first is for asset management programs using RFID technology and the second is for the interface, namely the Node-RED dashboard. The following is the configuration for using the Node-RED platform:

1) Flow Node-RED

Flow Node-RED in this research functions to program the implementation of RFID technology in stock management, starting from the results of reading RFID tags, the data is saved to the database, and until the data is displayed on the Node-RED dashboard. The following is an explanation and picture of the overall flow of Node-RED programming which can be seen in Fig 3.

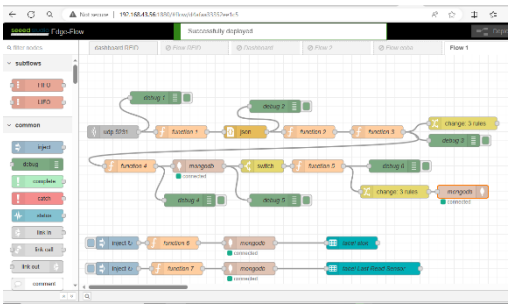

Fig 3. Node-RED Programming

2) Dashboard Node-RED

After processing the data from reading the RFID tag with an RFID reader until the data is sent to Node-RED and processed by Node-RED and sent to the database, the next step is to display the reading data on the Node-RED dashboard interface. You can see the overall flow of the Node-RED dashboard in Fig 4.

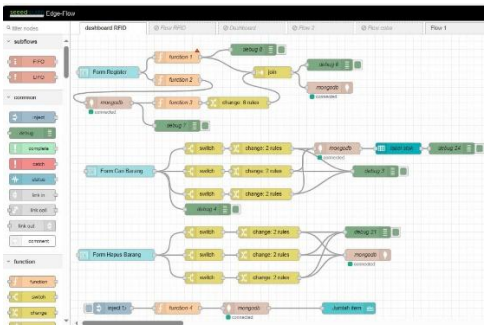

Fig 4. Node-RED Dashboard

C. CONFIGUR THE MONGODB COMPASS APPLICATION

The use of a database in storing data from RFID reading results uses the MongoDB database, the following is the MongoBD configuration used in this research:

First, carry out MongoDB connectivity using a previously available IP address, in this study a local IP address was used. The steps for MongoDB connectivity can be seen in Fig 5.

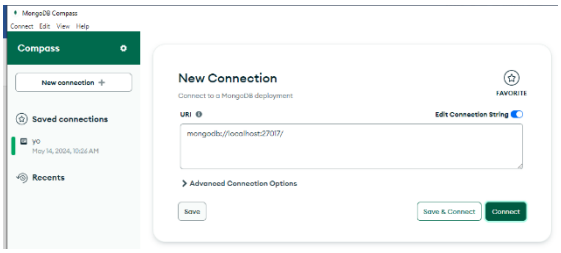

Fig 5. Performing MongoDB Connectivity

Creating a database name and collection name can be seen in Fig 6.

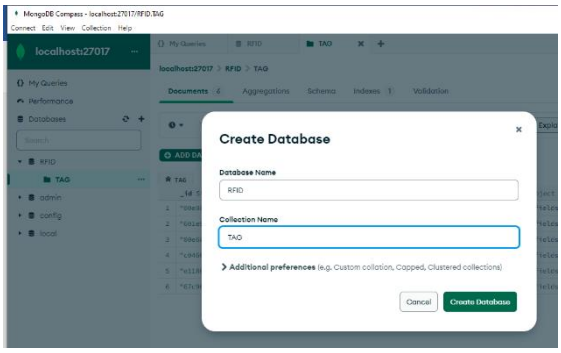

Fig 6. Create a Database Name and Collection Name

D. CONFIGUR THE NOSQL BOOSTER APPLICATION

The NoSQL Booster application is an additional application to complement the shortcomings of the MongoDB Compass application which cannot query new users and set passwords. The NoSQL Booster application can be seen in Fig 7.

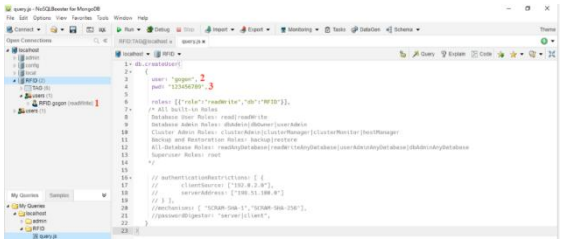

Fig 7. NoSQL Booster App

In Fig 7 you can see that number "1" creates a new user, then number "2" gives the name of the user to be used and number "3" sets the password for the user created.

1) *RFID Controller Configuration*

The RFID controller used in this research is to connect and send data from the RRID reader to the re terminal wirelessly. The RFID controller can be seen in Fig 8.

Fig 8. RFID Controller

First, set the IP address for the RFID controller "192.168.43.173", with device subnet "255.255.255.0", device gateway "192.168.43.1" IP address of the access point used, device port "4210" uses a port that has not been used, server IP "192.168.43.56" IP address of the re terminal which is a server, server port "5232" uses a port for communication with serial User Diagram Protocol (UDP), Wifi Service Set Identifier (SSID) "Gogon" for the name of the access point network connection used.

III. RESULTS AND DISCUSSION

Tool testing was carried out on the tools used. The goal is to find out that all the tools and applications used can function properly and that the conFigd tools are well integrated in an asset management system that uses RFID technology and the Node-RED dashboard. At this stage, the tool that has been created is tested by obtaining data on several parameters. Tests carried out include:

A. TEST RESULT FOR READING RFID TAGS BY AN RFID READER

To find out the correct value of reading RFID tags by an RFID reader, it is tested using the default application from the RFID reader brand. Ensure that the ID value read is correct. Can be seen in Fig 9.

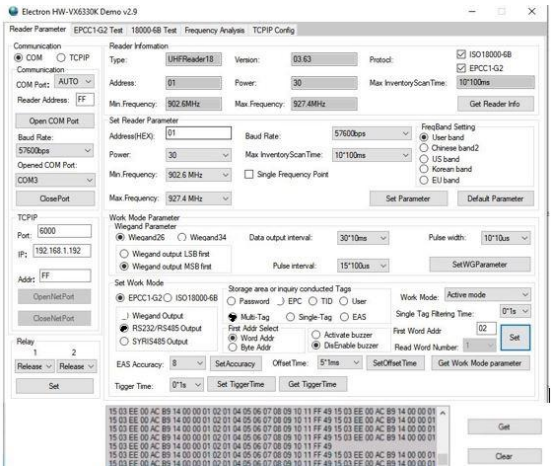

Fig 9. Test Result Reading RFID Tags by RFID Reader

From Fig 9, the reading results are obtained which show the ID of the RFID tag with the 6 samples taken. Can be seen in Tbl 1.

Tbl 1. RFID Tag ID Reading

No	RFID Tag ID
1	15 03 EE 00 AC B9 14 00 00 01 04 05 06 07 08 09 10 11 FF 49 15 03 EE 00 AC B9 14 00 00 FD AD
2	15 03 EE 00 AC B9 14 00 00 01 04 05 06 07 08 09 10 11 FF 49 15 03 EE 00 AC B9 14 00 00 AE CA
3	15 03 EE 00 AC B9 14 00 00 01 04 05 06 07 08 09 10 11 FF 49 15 03 EE 00 AC B9 14 00 00 FA CE
4	15 03 EE 00 AC B9 14 00 00 01 04 05 06 07 08 09 10 11 FF 49 15 03 EE 00 AC B9 14 00 00 AF EA
5	15 03 EE 00 AC B9 14 00 00 01 04 05 06 07 08 09 10 11 FF 49
6	15 03 EE 00 AC B9 14 00 00 01 04 05 06 07 08 09 10 11 FF 49 15 03 EE 00 AC B9 14 00 00 AA EF

Based on the data in Tbl 1, reading the RFID tag IDs shows a different ID for each RFID tag, but ID number 5 has fewer IDs due to damage to the RFID tag. These results confirm that the reading of RFID tags with an RFID reader has a good percentage.

B. TEST RESULT OF THE FID READER NETWORK CONNECTION WITH THE RFID CONTROLLER

To determine connectivity and data transmission between the RFID reader and the RFID controller, a test is carried out by ensuring that the indicator light on the RFID controller is on (green). This is because the integration of the RFID reader with the RFID controller uses cables to transmit data so you can check the cables used. Then, to be more certain, you can test the connectivity and data transmission from the RFID reader to the RFID controller and then to the re terminal.

The cable connecting the RFID reader to the RFID controller can be seen in Fig 10.

Fig 10. Test Result of RFID Reader Network Connection with RFID Controller

C. RESULT OF RFID CONTROLLER NETWORK CONNECTION WITH RE TERMINAL

To check the results of the RFID controller network connection with the re terminal, see the following explanation:

1) *1. Checking the IP of the re terminal that has been connected to the access point with the "ifconfig" command (Linux Ubuntu) can be seen in Fig 11.*

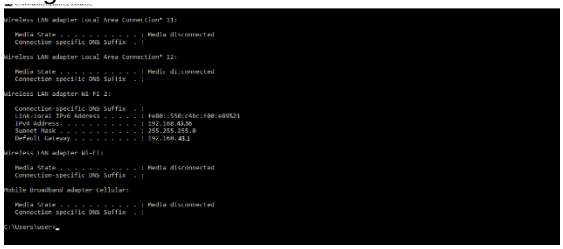

Fig 11. RFID Controller Network Connection Result with RE Terminal

2) *The IP address of the RFID controller is obtained when setting up the RFID controller. Can be seen in Fig 12.*

Then ping the IP from the RFID controller using Command Prompt. It can be seen in Fig 12.

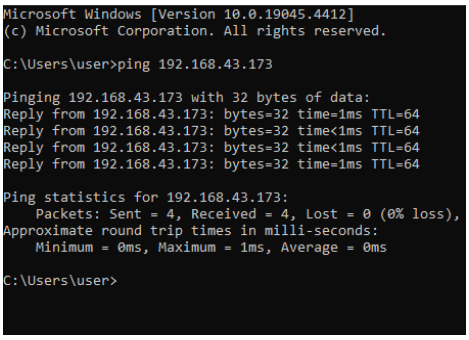

Fig 12. Ping IP of the RFID Controller

With the information in Fig 12 which provides information that the RFID controller and terminal are connected to each other.

D. OVERALL DATA DELIVERY TEST RESULT

After checking the connectivity of each component, data is sent from the RFID tag reading results. The aim of checking the overall data delivery from the RFID implementation and Node-RED dashboard is to find out whether each component used is integrated well and according to plan.

This test is carried out by attaching an RFID tag to the goods to be stored in the warehouse and passing through an area where the RFID reader can detect the presence of the RFID tag. Then see that the data from the RFID tag reading results has been successfully sent to the re terminal which has a program from the Node-RED flow and is displayed by the Node-RED dashboard.

The results of reading the RFID tag will be read by the UDP serial node in the Node-RED program and displayed by debug 1. It can be seen in Fig 13.

Fig 13. Debug 1 Flow Node-RES

The data in string form displays the RFID ID, MAC address of the RFID controller, IP of the RFID controller, name of the RFID controller, then the name of the access point connected to the RFID controller.

The results of reading the RFID tag are sent in string format and converted into JSON format to match the configuration and sending data to the MongoDB database displayed by debug 2. Can be seen in Fig 14.

Fig 14. Debug 2 Flow Node-RED

To display the next data, add information about the time when the object data was sent to the database, change the capital letters in the object data, and display the ID of the RFID tag with a selection of fewer ID combinations which are displayed in debug 3. Debug 3 can be seen in Fig 15.

Fig 15. Debug 3 Flow Node-RED

Displays RFID tag reading data in the form of an ID which will be saved to the MongoDB database with the aim of ensuring the correctness of the data. Can be seen in Fig 16.

Fig 16. Debug 4 Flow Node-RED

Displays RFID tag reading data that has been sent to the MongoDB database in debug 5 which aims to ensure the correctness of the data sent to the MongoDB database. Debug 3 can be seen in Fig 17.

Fig 17. Debug 5 Flow Node-RED

Next, displays the data programmed for global purposes on Node-RED, the aim is to find out whether the data programmed globally is correct which is displayed in debug 6. It can be seen in Fig 18.

Fig 18. Debug 6 Flow Node-RED

E. ANALYSIS AND DISCUSSION RESULT

The RFID implementation tool and Node-RED dashboard in the asset management system have been tested. The data taken is in the form of the ID of the RFID tag which goes through a process to be displayed on the Node-RED dashboard. Data from tool testing results are discussed with the aim of knowing the tool's performance in implementing RFID and the Node-RED dashboard in the asset management system. It can be seen in the following explanation:

After checking the data sent in the Node-RED flow, the next step is to test the function of the Node-RED dashboard whether it is working properly or not.

This can be done by opening a browser, then typing the IP from the re terminal (server) using the local host (127.0.0.0) and additional port from Node RED, namely 1880, and for dashboard (ui) access commands,"http://localhost:1880/.

DashboardsNode-RED displays the item inventory dashboard menu, registration menu, stock update menu. Can be seen in Fig19.

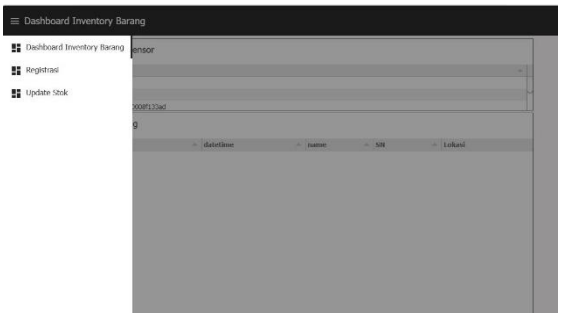

Fig 19. Dashboards Node-RED

The item inventory menu displays the last read sensor, item stock, and number of items. In the last read sensor table there is information for the number/ID of the RFID tag that is read by the RFID reader, in the asset table displays the ID, data and current time, name of the item, serial number, and location of the tag that has been registered. The item inventory menu can be seen in Fig 20.

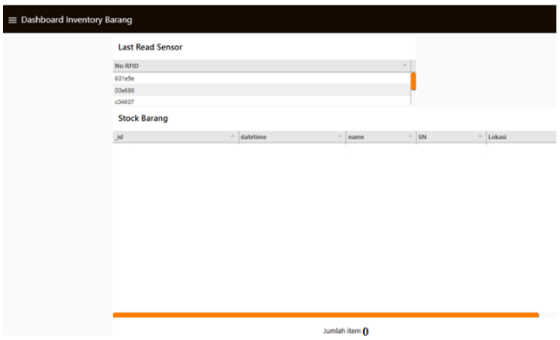

Fig 20. Item Inventory Menu

The registration menu displays a register form for registering goods, inputting the ID tag, item name, serial number, item location and description. Can be seen in Fig 21.

IV. CONCLUSION

From the analysis in Chapter IV the following conclusions are obtained:

1) *Implementation of RFID technology and the Node-RED dashboard in the asset management system at PT. Pama Persada Nusantara head office Jakarta, records assets in the R&D Team's warehouse where RFID tag stickers are attached, the tags are read by an RFID reader, then the data from these readings is processed and displayed using the Node-RED dashboard. The implementation of RFID technology and the Node-RED dashboard is in accordance with the goals and plans.*
2) *Implementing RFID and the Node-RED dashboard in the asset management system makes asset data collection and displaying data from assets easier to monitor. The data is stored in the MongoDB database and then displayed by the Node-RED dashboard. The Node-RED dashboard displays data from RFID tag readings, displays the registration menu for information on the condition of IN goods, the stock update menu for deleting assets for information on the condition of OUT goods. Then displays the item stock item menu, and displays the item storage location, item name, item serial number, item description, and time information when the item was detected by the RFID reader.*

This section contains the conclusions of the research. This section is written in essay form and not in numerical form.

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