Development of Automatic Oil Refueling System Model based on Internet of Things

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Abstract. The current application of technology has played a large role in human activities, especially in industry [1]. Automation processes in the industrial world automatically control system operations and equipment with mechanical or electronic equipment that can replace humans in observing and making decisions. The purpose of this automation is the use of electricity or mechanics to run certain machines or tools accompanied by a brain that controls the machine or tool so that productivity increases and production costs decrease. One of the technologies applied is an automatic filling and packaging system for cooking oil using a filling machine. The application of cooking oil packaging technology using modern machines is usually carried out in the large-scale cooking oil industry. However, the packaging for bulk cooking oil which is common in traditional markets that are classified as a small scale still uses the conventional method of measuring and packaging it. To improve the quality of bulk cooking oil sales and answer this problem, we need a tool that can fill the oil with an adjustable number of measures as needed and has high accuracy and can be run automatically. This research uses descriptive qualitative research methods, this type of qualitative descriptive research displays the results of the data as they are without any manipulation or other treatment processes. The overall results of the work system design of this tool discuss the results of the automatic oil filling system and the sending of oil expenditure data to the Antares ID webserver. The resulting delay value is still below the normal limit, which is around 1-2 seconds. The deviation that occurs is in the ratio 0.11 and the percent error is in the range of 0.2%.

1. Introduction

The current application of technology has played a large role in human activities, especially in the industry [1]. Automation processes in the industrial world automatically control system operations and equipment with mechanical or electronic equipment that can replace humans in observing and making decisions. The purpose of this automation is the use of electricity or mechanics to run certain machines or tools accompanied by a brain that controls the machine or tool so that productivity increases and production costs decrease. One of the technologies applied is an automatic filling and packaging system for cooking oil using a filling machine. The application of cooking oil packaging technology using modern machines is usually carried out in the large-scale cooking oil industry. However, the packaging for bulk cooking oil which is common in traditional markets that are classified as a small scale still uses the conventional method of measuring and packaging it [2].

To improve the quality of bulk cooking oil sales and answer this problem, we need a tool that can fill the oil with an adjustable number of measures as needed and has high accuracy and can be run automatically. Meanwhile, in terms of supervision, a webserver is needed that makes it easy for sellers to monitor the amount of oil sold without the need to directly monitor workers in the field. This system
can be used by both small and medium industries so that they are able to fill and measure bulk cooking oil automatically in liters and in rupiah values. In terms of calculating the amount of oil sold in liters, oil expenditure data will be sent using the Internet of Things (IoT) [3] network with the wifi Node MCU module to the wifi Router Access Point then the data is wirelessly distributed and can be viewed on the client's Personal Computer (PC) with the display in the form of liters with the Antares ID platform as the webserver [4].

In this research [5], [6], the application of remote control technology on automatic refueling machines has been carried out, but the object used in this research is motorized vehicle fuel. Then in research [7]–[9], the internet of things technology began to be implemented in the form of control and monitoring through applications to the system used. To get good network connection performance so that the system is able to work optimally, it is necessary to design a network infrastructure that can support this internet of things based system [10].

![System Circuit Block Diagram](image)

**Figure 1.** System Circuit Block Diagram

2. Material and method

This research uses descriptive qualitative research methods. This type of qualitative descriptive research is a research method that utilizes qualitative data and is described descriptively. This type of qualitative descriptive research displays the results of the data as they are without any manipulation or other treatment processes. The initial stage of this research, first determines the problems to be solved and seek solutions to these problems. Next, collect literature in the form of journals, articles, reference books, and other sources to deepen the concept. Then design the form of the tool, arrange the components needed, and apply it to the program used and integrate with Arduino as the microcontroller. This research is based on applicative problems, which can be formulated into 3 main problems, namely how to design and make a device that can fill oil in an automatic way and can send oil expenditure data to the webserver so that it can be monitored in real-time. For this reason, the implementation steps of this research will include literature studies to study the required supporting theory, design of tools and systems, testing and analysis, and drawing conclusions.
The program flowchart above is an automatic oil filling program flow, starting from the program running. The program that is run for the first time will initialize the input and output components that will be used, such as the keypad, LCD, flow meter, and relay. Then the program will process and read the EEPROM memory, in this case, it reads the number of prices that have been stored on the Arduino EEPROM. In the looping process, the program will display the menu displayed on the LCD. The menu in question is a charging mode, which is charging by inputting prices and charging mode by inputting liters. In the next mode, it will display the price per liter change mode and display the price that has been stored on the Arduino EEPROM.
The whole system circuit is a combined circuit consisting of an interface circuit, a series of sensors and actuators, and a serial communication circuit. In the whole system circuit, there are components that function as input, process, and output in the system. Components that function as input consist of a Keypad and Flow Meter, for the process components, are Arduino and MCU nodes, while the components that function as output consists of LCD, Relay, Pump, and solenoid Valve.

![Flowchart](flowchart.png)

**Figure 4.** Flowchart of Send Oil Data

In the flowchart, send oil data, describing how the program flow when receiving and processing oil data which will then be sent to the Antares ID Platform. The program is run by initializing the address of the webserver that will receive data, in this case, the intended address is Antares ID with "ProjectName" and "device name" as the storage address. The initialization process is also carried out on the network that will be used to connect with the Antares ID, namely, "Wifissid" and "Password". In the program looping process, the MCU node will perform serial communication and receive data from Arduino in the form of the amount of oil discharged. Furthermore, the data that has been obtained will be sent to Antares ID with the command program, "Antares.Send".

3. Results and discussion

The results of the overall design of this tool system discuss the results of hardware design that have been discussed in the previous chapter, using several components that are divided into several circuits, namely, a series of interfaces, a series of sensors/actuators, and serial communication circuits. The series is then produced in the design results in a real field. In this discussion, all of these sequences will be assembled using a panel box. The components contained in the panel box are assembled in two parts, namely, the components on the panel body and the components on the panel cover. In addition, there are also components that are placed outside the panel box, namely components in the sensor and actuator circuit. The components in the sensor and actuator circuit are assembled using a paralon pipe, with the intention that these components are connected to the liquid element.
Based on the test results, the oil delivery system can be carried out after the oil filling process is complete. The data on oil expenditure is sent in the form of the amount of oil in liters and the data is sent to the Antares ID web server which can be monitored in real-time.

![Graph of Oil Expenditure Data on Webserver](image)

**Figure 5.** Graph of Oil Expenditure Data on Webserver

The test is carried out based on the research hypothesis, namely, making a tool that can fill oil accurately and can send the amount of oil expenditure to the webserver. The first test was carried out by filling the oil based on the input value in the form of liters, by doing 10 filling experiments and comparing the results of the experiment with a measuring cup to find the ratio between the amount of filling produced from the tool, and the measurement of the liquid volume in the measuring glass.

**Table 1. Data of Verification Results of Filling with the Number of Liters**

| No | Number of Liters Filled (L) | Measuring Cup Volume (L) |
|----|-----------------------------|--------------------------|
| 1  | 1                           | 1.02                     |
| 2  | 2                           | 2                        |
| 3  | 3                           | 3                        |
| 4  | 4                           | 4.02                     |
| 5  | 5                           | 5.06                     |
| 6  | 6                           | 6.01                     |
| 7  | 7                           | 7                        |
| 8  | 8                           | 8                        |
| 9  | 9                           | 9                        |
| 10 | 10                          | 10                       |
| Average (χ) | 55 | 55.11 |
| Deviation | 0.11 |
| Percent Error (%) | 0.2% |

Table 1 above is the result of the comparison/verification of the value of the filling amount and the volume of the measuring cup in oil filling. The data was collected by filling the oil from 1 liter to 10 liters. From the table, it can be seen that the average value, deviation, and error presentation. In the
process of comparison or verification between the number of filling liters and the volume of the measuring cup, there is a difference in value. Based on the table above, the average deviation is 0.11 and the percent error is 0.2%, which is still at the fair value limit.

4. Conclusions

Overall, the system is made to function properly. The process of sending data values to cloud computing between the IDs does not experience significant obstacles. The resulting delay value is still below the normal limit, which is around 1-2 seconds. The deviation that occurs is in the ratio 0.11 and the percent error is in the range of 0.2%. To obtain better test results in the future, it is necessary to upgrade the system hardware, especially the sensors used so that the values obtained are more precise and accurate.

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