Design a Mini Cooking Oil POM by Utilizing Internet of Things (IoT) Technology

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***Abstract*— The development of technology at this time cannot be separated from everyday life. To meet the needs of life and standard of living, one of the businesses is cooking oil. The sale of cooking oil at this time is still using manual literants which is likely to spill large. In overcoming this problem, a tool was made to measure the discharge and volume value of cooking oil to be released using a water flow sensor which is then displayed through seven segments. For oil production, use a faucet to facilitate the process of literating cooking oil.The design of POM Mini Cooking Oil is made with the aim of ensuring that the water flow sensor can measure the amount of cooking oil that comes out precisely. This final project uses a water flow sensor to measure the oil liquid that comes out, and a level float sensor to measure the volume of oil in the container used. The measurement results at the time of testing showed that the sensor worked well because the average accuracy error was less than 5%.**

Keywords : arduino uno, cooking oil, internet of things, POM mini, water flow sensor.

Manuscript received 28 Sept. 2024; revised 11 Dec. 2024; accepted 12 Jan. 2025. Date of publication 3 Mei. 2025.

I. INTRODUCTION

Cooking oil is the main food ingredient that is often used by people to fry food. Cooking oil is liquid fat and consists of vegetable fats that have been processed through refining or refining processes, with or without chemical modification [1]. There are two types of cooking oil, namely, bulk cooking oil and packaged cooking oil. The difference between these two types of cooking oil is due to the filtering process that affects the quality of the cooking oil. Bulk cooking oil is produced from palm oil that is only filtered once, so it differs in colour from well-known brand cooking oil which is clearer. Bulk cooking oil is usually sold without a brand or product label and sold in large jerry cans or drums and then sold per litre to customers [2].

In modern times like today, where technology is an inseparable part of everyday life. People try to find business opportunities that can be expected to provide maximum profit. To fulfil their needs and improve their standard of living, one of the businesses is selling cooking oil. There are two things that concern buyers when buying bulk cooking oil. First, the volume of cooking oil sold is less than it should be. Second, the cooking oil is mixed with certain cheaper ingredients. Efforts to increase buyer confidence are by using a digital pertamini equipped with a volume indicator (in litres) [3].

Previously, it was made 'Designing a Prototype SBPU-Mini Based on ATMega8535 Microcontroller with Output Based on Input Value in Rupiah' by Fajar Guntara, 2015. In this research, a mini petrol station prototype was designed using an ATMega8535 microcontroller and

displayed via LCD and was not equipped with Internet Of Things (IoT). With the rapid development of technology, I as the author designed a Mini POM machine for cooking oil automatically by utilising Internet Of Things (IoT) technology.

In the sale of cooking oil in traditional markets and small stalls, the sale of cooking oil still uses manual litres which are likely to spill when poured very large. In overcoming this problem, a tool is made to measure the discharge and volume value of cooking oil that will be released using a flowmeter sensor which will then be displayed by Seven Segment. And for the release of cooking oil, a faucet is used to facilitate the process of per litre of cooking oil.

II. METHODS AND MATERIALS

A. Method

The method used is the hardware, software and Internet of Things (IOT) design method. This tool consists of several components, including a power supply circuit as a voltage source, Arduiono (IDE) to design a control system, Arduino uno R3 ATMEGA38P to support the microcontroller circuit, water flow sensor for water discharge sensor and several additional attributes to complete this design such as LED, seven segment and keypad.

B. Material

1.Arduino Uno R3 ATMEGA328P

The method used is the hardware, software and Internet of Things (IOT) design method. This tool consists of several components, including a power supply circuit as a voltage source, Arduiono (IDE) to design a control system, Arduino uno R3 ATMEGA38P to support the microcontroller circuit, water flow sensor for water discharge sensor and several additional attributes to complete this design such as LED, seven segment and keypad.

TABLE 1
Arduino Uno R3 Specifications

Features	Specifications
Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14
PWM Digital I/O Pins	6
Analog Input Pin	6
DC Current per I/O Pins	20 mA
DC Current for 3.3v Pin	50 mA
Flash Memory	32 KB
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
LED BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

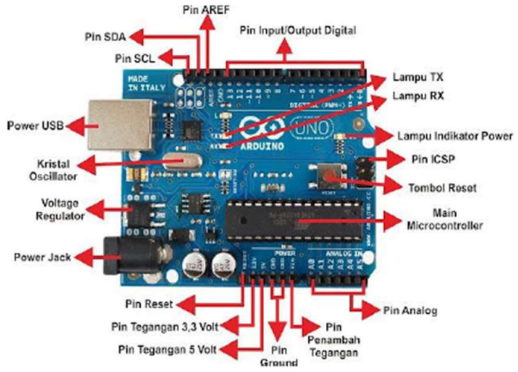

Figure 1 Arduino Uno R3 ATMEGA328P

2. Arduino Software(IDE)

Arduino IDE stands for Integrated Development Environment which is a software used in the context of Arduino because through this software Arduino is programmed to carry out functions that are embedded through programming syntax to enter a command into the Arduino IDE. in the microcontroller so that Arduino can be used according to what is ordered [8].

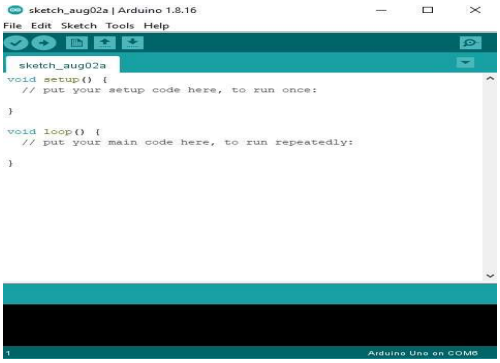

Figure 2 Arduino Software(IDE)

3.Max7219 LED IC

MAX7219 is an IC designed to control the 8x8 LED MATRIX. The IC is a serial input common-cathode display driver that connects the microprocessor to a 7-segment to 8-digit numeric LED display, bar graph display or 64 individual LEDs [9].

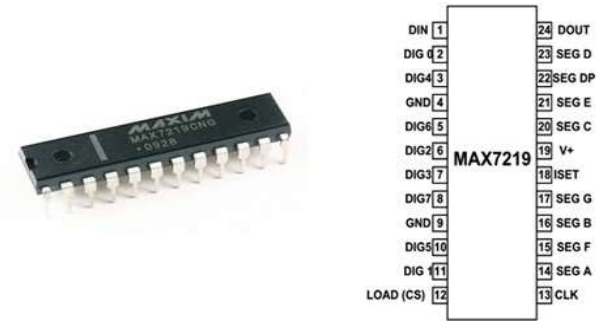

Figure 3 Max 7219 LED IC

4. Water Flow Sensor

Water Flow Sensor is a sensor that functions as a water flow discharge meter. This sensor consists of several parts including a valve body, a water rotor, and a hall effect sensor. There is an engine on the inside of the sensor module that can move with the speed of the water flow.

The hall effect sensor in this sensor module acts as a signal reader in the form of a voltage which is converted into a pulse and then transferred to the microcontroller to be processed as water flow measurement data [10].

Figure 4 Water Flow Sensor

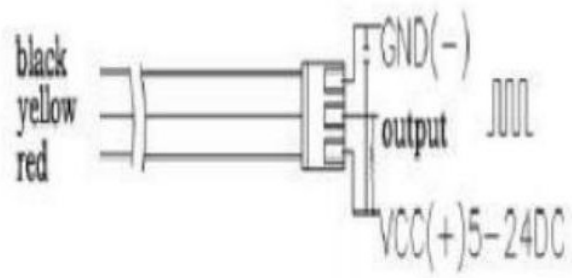

Figure 5 Pin ater Flow Sensor

The working principle of the Water Flow Sensor is that when water flows through the valve, the water rotor will rotate at a certain speed according to the level of the water flow rate. In the water rotor there is a magnetic field that influences the hall effect sensor to produce a pulse signal in the form of a voltage (Pulse Width Modulator). The output in the form of this voltage pulse has

voltage level that is equal to the input frequency of the water flow velocity. This signal is then processed in the microcontroller into digital data [10}.

5.Mini Water Lev el Float Sensor Switches

Figure 7 Level Float Sensor

Mini water level float sensor switches are sensors to detect if the water in a container or tank has reached a height at a certain point (according to the position of the sensor). The working principle of this sensor is to use reed switches (stick switches) in the rod and magnets in the float around the Arduino rod. When the water lifts the float, the magnet will deactivate the reed switch [11].

6.Internet Of Things(IOT)

Internet of Things (IoT) is a program idea that is in charge of processing and sending data in the form of digital information obtained from components used in the system through a network without requiring human-to-human interaction. The purpose of IoT is to expand benefits and continuous internet connectivity. The concept of IoT refers to 3 main elements, namely, objects/objects equipped with IoT modules. Devices that connect objects to the internet such as modems and cloud platforms to store applications and databases [12].

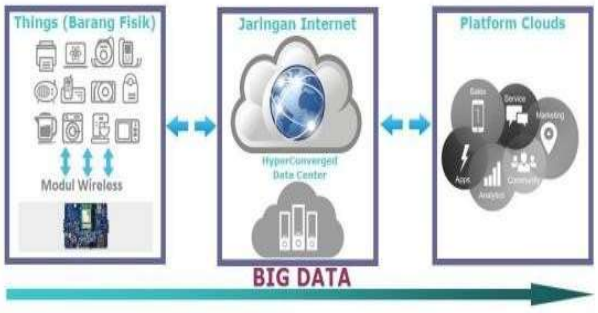

Figure 8 Inernet Of Things

The working principle of IoT is to use a programming algorithm that each instruction generates an interaction between connected machines automatically. The communication network of IoT is very complicated, so it requires significant effort in configuring the IoT [10].

7.ThingSpeak Platform

ThingSpeak is an internet service that provides services for the application of the Internet of Things. ThingSpeak is a service that contains open source applications and APIs to store and retrieve data from the Internet of Things.

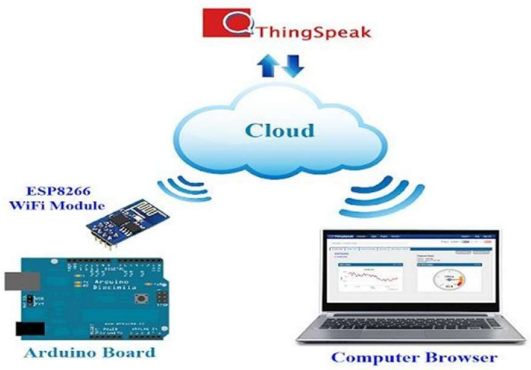

Figure 6 ThingSpeak Working Principle

Various devices that use HTTP (Hypertext Transfer Protocol) over the internet or over a LAN (Local Area Network). By using ThingSpeak, one can create sensor logging applications, location tracking applications and social networks from everything connected to the internet with status updates [13].

8.Submersible Oil Pump

A pump is a device used to transfer a liquid from one place to another by increasing the pressure of the liquid. The increase in fluid pressure is used to overcome flow resistance. These flow barriers can be in the form of pressure differences, height differences or friction. Basically, pumps convert mechanical energy into fluid flow. The energy received by the fluid will be used to increase the pressure of the fluid.pressure and overcome the obstacles that exist in the channel being traveled [14].

Figure 9 Oil Pump

9.Power Supply Switchng

Power Supply is a component used to flow or provide electricity to one or more devices. Power Supply has been designed in such a way as to convert natural resources such as solar power, wind, to chemistry into electrical energy. The function of the Power Supply is, channeling electricity so that it does not exceed the maximum limit on a device, making alternative sources such as batteries, and converting electricity that has a high voltage (AC, alternating current) into low voltage electricity (DC, direct current) [15].

Figure 10 Power Supply

10.Keypad

The keypad is used to determine the text data to be selected by the user. Then the input data will be processed by the microcontroller. The buttons on the keypad are coated with a loga plate that has been given a braille code according to the number on the keypad. Thus, the buttons on the keypad can be recognized by blind people [8].

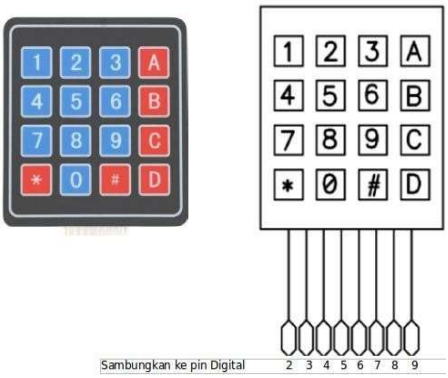

Figure 11 4x4 Keypad

The 4x4 keypad consists of 4 rows and 4 columns with a push button switch placed at each crossing of the column and row. The keypad circuit consists of 16 push button switches with a configuration of 4 rows and 4 columns. The row side of the keypad matrix is marked with the names Row1, Row2, Row3 and Row4 then the column side is marked with Col1, Col2, Col3 and Col4

11.Seven Segment Cathode

Segment has 7 segments where each segment is controlled ON and OFF to display the desired number. Numbers from 0 to 9 can be displayed using several combinations of segments. In addition to 0-9 also

can display hexadecimal letters from A-F. The elements on the seven segment are arranged to form a number 8 which is slightly tilted to the right with the aim of making it easier to read. In some types of seven segment, there is also the addition of a point that shows the decimal point [16].

In the cathode type seven segment LED, the cathode leg on all LED segments is connected to 1 Pin, while the anode leg will be the input of each LED segment. The cathode leg connected to 1 pin is a negative terminal or ground while the control signal will be given to each anode leg of the LED segment [17].

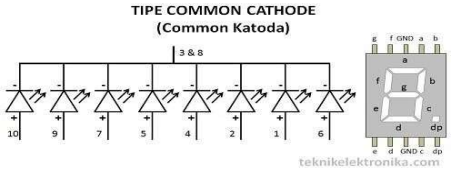

Figure 12 Seven Segment

C.Overall Component Set

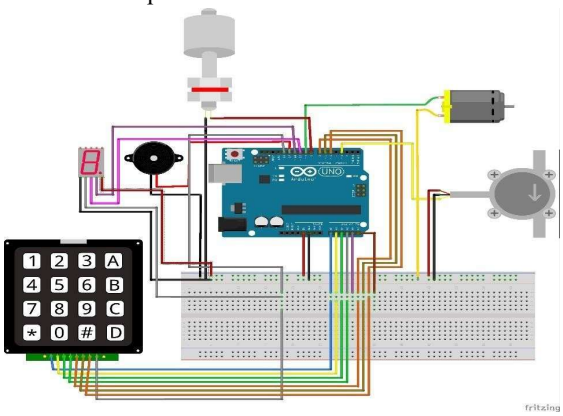

Figure 13 Overall Set

III. Result and Discussion

Figure 14 Mevhanical circuit of external display

After completing the design and manufacture of the cooking oil mini pom tool, the next step is to test the tools that have been made. By testing we can find out whether the tools made and designed can work properly and as expected or not. The purpose of testing and measuring this tool is to determine the accuracy of making tools to ensure that each component part of the entire tool circuit has functioned properly and has been in accordance with what is desired. The results of these tests and measurements will later be used as data for further analysis. Based on the results of these tests and measurements, evaluations and improvements can be made to the system or tool to obtain maximum results.

Testing is done by testing whether the water flow sensor, level float sensor and pump can work properly and whether the data taken by the device has been collected on the ThingSpeak platform

1. Testing te Water Flow sendor

In testing the water flow sensor, measurements are made by measuring the volume of cooking oil using a measuring cup.

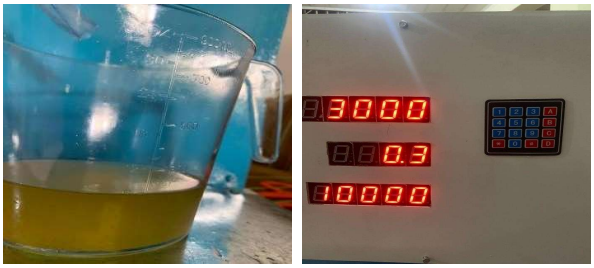

Figure 15 Oil mensurement in a cap and on Display

Water flow sensor functions to measure the amount of cooking oil released by the mini cooking oil pom. Which when the user enters the value of the number of liters of oil or the desired amount of oil price, the pump will pump cooking oil according to the desired amount.

Inserted. If the number of liters or the price amount has reached the desired number, the oil pump will stop.

TABEL II
Water Flow Sensor Testing Data

No	Volume Reading on Serial Monitor(ml)	Measuring Cup (ml)	*Error*
1	102	125	18,4 %
2	212	220	3,6 %
3	330	330	0
4	425	435	2,29 %
5	527	530	0,5 %
6	615	661	6,9 %
7	730	772	5,4 %
8	850	869	2,1 %
9	940	978	3,8 %

Table II is the result of data from testing the water flow sensor which in the first experiment obtained data of 102 ml on the serial monitor and in the measuring cup obtained 125 ml which has an error of 18.4%, then in the second experiment obtained data of 212 ml in the serial monitor and in the measuring cup obtained 220 ml which has an error of 3.6%, and the ninth experiment obtained data of 940 ml from the serial monitor and in the measuring cup obtained data of 978 ml which has an error of 3.8%.

2.Testing on Level Float Sensor

In this float sensor level test, measurements are taken by detecting the volume of cooking oil fluid contained in the jerry can. For the results of the float sensor level measurement can actually be heard from the buzzer contained in the device, if the oil condition has passed the limit of the provisions of the float sensor level, the buzzer will continue to sound until the jerry can is refilled with cooking oil. To see the data results from the float sensor level measurement, the author uses the ThingSpeak platform which can be seen in Figure 16

The buzzer will continue to sound until the jerry can is refilled with oil marked with a value of 0.

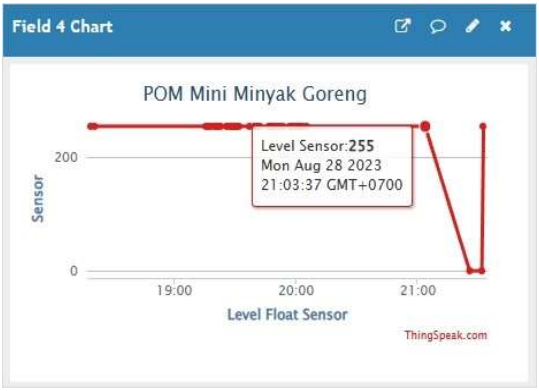

Figure 16 Float Sensor Levels Oil Has Passed the Limit

Figure 17 Float Sensor Level when Oil Has noat crossed the limit

In Figure 16 is the result of data from the float sensor level which means that the jerry can still has oil in it which is marked with a value of 255.

3.Tool Testing

Testing the overall system of the tool is done to see the process that occurs as a whole, starting from pressing the keypad to select the number of liters and the desired amount of rupiah until the cooking oil is pumped according to the number of liters and the amount of price entered and calculated by the water flow sensor and then displayed on the seven segment display.

A.Testing on Display and ThingSpeak

In display testing, measurements are taken where the user enters the desired number of liters or rupiah amount and then will be displayed by a seven segment display and ThingSpeak will collect data results that will be issued by the hardware device.

TABEL III
Testing Rupiah

No	Rupiah (Rp)	Volume of Oil be removed (L)	Volume of Oil dispensed(L)	Price	Float Sensor
1	1000	0.1	0.13	10000	255
2	2000	0.2	0.21	10000	255
3	3000	0.3	0.31	10000	255
4	5000	0.5	0.53	10000	255
5	10000	1.0	1.02	10000	255

In table III the rupiah test obtained data results where the amount issued is more than it should be as can be seen in the data results from the ThingSpeak platform in figure.

Figure 18 Example of Rupiah testing data

TABEL IV
Liter Testing

No	Rupiah (Rp)	Volume of Oil be removed (L)	Volume of Oil dispensed(L)	Price	Float Sensor
1	1000	0.1	0.13	10000	255
2	2000	0.2	0.21	10000	255
3	3000	0.3	0.31	10000	255
4	5000	0.5	0.53	10000	255
5	10000	1.0	1.02	10000	255

In table IV of the liter test, the data results are obtained where the amount of rupiah that should be spent is in accordance with the Price table. However, from the data obtained, the rupiah results increase due to the use of water flow.

The sensor is not linear which results in the numbers issued are not consecutive. The data results in table 18 are obtained from the platform in figure 19 below

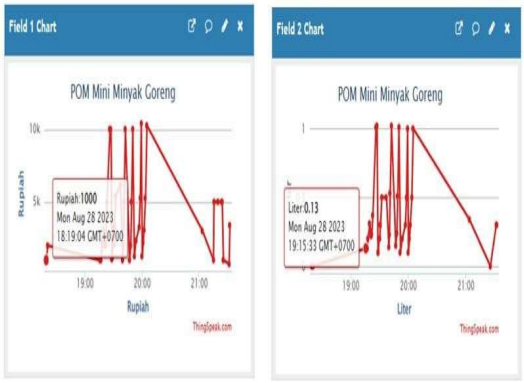

Figure 19 Liter Testing Data

B. Overall Tool Testing

The results of testing the entire mini pom control system using various prices can be seen in table V below.

TABEL V
Overall Tool Testing

No.	Price Entry					
	Testing Rp.2000,-		Testing Rp.5000,-		Testing Rp.7000,-	
	Liter (ml)	*Error*	Liter (ml)	*Error*	Liter (ml)	*Error*
1	214.6	7.3%	503.2	0.64%	717.8	2.54%
2	207.2	3.6%	518.0	3.6%	710.6	1.51%
3	207.2	3.6%	518.2	3.64%	725.2	3.6%
4	207.2	3.6%	518.0	3.6%	703	0.42%
5	222.2	11.1%	525.4	5.08%	717.8	2.54%
Flat Average Error						
	5,84%		3.31%		2.12%	

The results obtained from table 4.6 above are, in testing Rp.2000 obtained an average error of 7.3%. Testing Rp.5000 obtained an average error of 3.31% and testing Rp.7000 obtained an average error of 2.12%. Testing with variable prices has an average error of 3.7%. In testing this mini cooking oil pom tool, it can be analyzed that during the process of testing the entire tool obtained from the results of the cooking oil volume output system from the seven segment display compared to the measuring cup has an error caused by devices that work on the tool is not well controlled which results in the volume of cooking oil released by the sensor will calculate the volume of cooking oil output on the seven segment display. During the process of removing the volume of cooking oil, the cooking oil pressure on the pump and the length of the hose cause the volume of cooking oil that comes out to vary in volume.

C.Toolmaking Analysis

After testing and collecting data, an analysis can be made of the working principle of the cooking oil mini pom design tool system by utilizing the Internet of Things (IoT). The design of this tool requires several components in order to work according to what has been discussed previously.

The use and data collection of this mini cooking oil pom tool is done by entering the number of liters or the amount of price the user wants, then it will be sensor by the water flow sensor and will be issued using a pump. Which the pump will stop automatically if it has reached the number of liters or the amount of price the user wants.

The design of this tool is also equipped with a float level sensor that functions to measure the volume of cooking oil in the jerry can. If the volume of cooking oil is less than expected, it will activate the reed switch which makes the buzzer sound as a sign.

Then the design of the cooking oil mini pom tool also utilizes Internet of Things (IoT) technology. Which uses the ThingSpeak platform to collect, store, analyze and visualize data in realtime.

IV CONCLUSION

Based on the discussion and description that has been discussed, it can be concluded as follows:

Overall testing of the Mini POM Design by Utilizing Internet of Things (IoT) Technology was carried out by testing 3 different prices, each price test was carried out 5 times. The results obtained from the test are that there is an error with an average error of 3.7%. Experiencing an error because it is caused during the process of releasing the volume of cooking oil, the cooking oil pressure on the pump and the length of the hose cause the volume of oil that comes out to vary in volume.

In the cooking oil stock tracking test, the float level sensor is used, which is measured by detecting the volume of cooking oil fluid contained in the jerry can. For the results of the float sensor level measurement, the buzzer will sound if the value is 0 or the oil volume is insufficient.

REFERENCES

[1] A. S. Fitri And Y. A. N. Fitriana, "Analysis Of Acid Number In Cooking Oil And Olive Oil," Sainteks, Vol. 16, No. 2, Pp. 115-119, 2020, Doi: 10.30595/St.V16i2.7128.

[2] H. Parida Hutapea, Y. S. Sembiring, And P. Ahmadi, "Quality Test Of Bulk Cooking Oil Sold In Surakarta Traditional Market With Determination Of Water Content, Acid Numbers And Peroxide Numbers," Quim. J. Kim. Science And Appl., Vol. 3, No. 1, Pp. 6-11, 2021, Doi: 10.33059/Jq.V3i1.3311.

[3] F. Guntara And W. -, "Design Of Prototype Spbu-Mini Based On Atmega8535 Microcontroller With Output Based On Input Value In Rupiah," J. Fis. Unand, Vol. 4, No. 1, Pp. 43-50, 2015.

[4] Denni And N. Putu Rianti, "Quality Of Cooking Oil Among Fried Food Vendors In North Denpasar District," J. Chem. Inf. Model., Vol. 53, No. 9, Pp. 1689- 1699, 2019.

[5] K.Expected End, "Tkt312-Production System Automation Material #5 Control Systems Meeting Material #5 (Online #4)," Vol. 5, Pp. 1-13.

[6] A.R.L.Francisco,"Arduino Ide," J. Chem. Inf. Model., Vol. 53, No. 9, Pp. 1689-1699, 2013.

[7] Aldy Razor,"Learning And Creating With Arduino,"Https://Www.Aldyrazor.Com/,2021. Https://Www.Aldyrazor.Com/2020/04/Gambar-Arduino-Uno.Html (Accessed Jul. 25, 2023).

[8] D. L. Fay, "Application Of Sketchup Media With Direct Learning Models In The Basic Competencies Of Applying Procedures For Making Detailed Bridge Construction Drawings At Smkn 1 Mojokerto," Angew. Chemie Int. Ed. 6(11), 951-952., Vol. 3, Pp. 3-15, 2017.

[9] Nn-Digital.Com, "Nn Digital," Https://Www.Nn-Digital.Com/, 2019. Https://Www.Nn-Digital.Com/Blog/2019/10/29/Ic-Max7219-8-Digit-7-Segment- Dot-Matrix-8x8-Led-Display-Driver-Ic/ (Accessed Jul. 25, 2023).

[10] A. A. Ramadhan And N. N. Fazila, "Iot-Based Water Meter Control And Monitoring System For Regional Water Supply Company (Pdam)," 2021, [Online]. Available: Http://Repository.Polman-Babel.Ac.Id/Id/Eprint/376/1/Pa21_Adamramadhan_Nilafazila.Pdf

[11] B. A. B. Ii And T. Supporting, "Chapter Ii Supplementary Theory2.1.Definition Of Aquaphonic Control System Aquaphonic Control System Is A System Designed In," 1996.

[12] Saverus, "No Covariance Structure Analysis Of Health-Related Indicators In Parents' Homes Focusing On Title Subjective Health," J. Kaji. Educ. Econ. And Econ. Science, Vol. 2, No. 1, Pp. 1-19, 2019, [Online].Available:Http://Www.Scopus.Com/Inward/Record.Url?Eid=2-S2.0-84865607390&Partnerid=Tzotx3y1%0ahttp://Books.Google.Com/Books?Hl=En&Amp;Lr=&Amp;Id=2limmd9fvxkc&Amp;Oi=Fnd&Amp;Pg=Pr5&Amp;Dq=Principles+Of+Digital+Image+Processing+Fundamental+Techniques&Amp;Ots=Hjrheus_

[13] E. Sorongan, Q. Hidayati, And K. Priyono, "Thingspeak As An Internet Of Things-Based Gas Station Tank Monitoring System," Jtera (Journal Of Engineering Technol. Engineering), Vol. 3, No. 2, P. 219, 2018, Doi: 10.31544/Jtera.V3.I2.2018.219-224.

[14] Renita, "Referensisiswa.My.Id," Https://Www.Referensisiswa.My.Id/.Https://Www.Referensisiswa.My.Id/2020/10/Pengertian-Pompa-Meliputi- Function.Html (Accessed Jul. 26, 2023).

[15] Meilinaeka, "It.Telkomuniversity.Ac.Id," Https://It.Telkomuniversity.Ac.Id/. Https://It.Telkomuniversity.Ac.Id/Pengertian-Power-Supply-Dan- Function/#:~:Text=Simple%2c Definition Of Power Supply, To Chemical Into Electrical Energy. (Accessed Jul. 26, 2023).

[16] Dickson Kho, "Components Of Electronics,"Teknikelektronika.Com,2022. Https://Teknikelektronika.Com/Pengertian-Seven-Segment-Display-Layar-Tujuh- Segment/ (Accessed Jul. 27, 2023).

[17] Function.Co.Id, "Seven Segment Display," Function.Co.Id. Https://Fungsi.Co.Id/Seven-Segment-Display/