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DESIGN AND DEVELOPMENT OF TANK/VOLUME LEVEL AUTOMATION SYSTEM USING TOF (TIME OF FLIGHT) SENSOR BASED ON ARDUINO

Yohan Wibisono[1], Bambang Setiawan[2], Noor Sulistiyono[2], Dadang Abdul Aziz[2], Firmansyah Abdullah[2]
[1]Politeknik Pelayaran Malahayati, Aceh besar, Indonesia
[2]Politeknik Transportasi SDP, Palembang, Indonesia

ABSTRACT

Fuel oil is a primary need for the community to assist mobility activities in daily life. The role of fuel oil until now is an energy source that has become the main choice for use in various sectors, especially in shipping, it is a must as a transportation operator to monitor the availability of fuel oil on ships so that shipping traffic runs smoothly between lands. With the rapid development of technology in the current era of globalization, it has provided many benefits in progress in various aspects. The use of technology by humans in helping to complete work is a must in life. The development of this technology must also be followed by developments in Human Resources (HR). Humans as technology users must be able to take advantage of current technology, as well as subsequent technological developments. Human adaptation to new technologies that have developed must be done through innovation. The Time of Flight sensor is an electronic component that functions to measure the distance between the sensor and the object. In this study, use this for the purposes of measuring the level of the fuel tank on the ship. Thus, it can determine the level of the fuel level in the tank so that there is no oil spill, so that it can be monitored using Arduino.

Keywords: Fuel,Technology,Time Of Flight

1. Introduction

Fuel oil is a primary need for the community to assist mobility activities in everyday life. Until now, the role of fuel oil is an energy source which is the main choice for use in various sectors. One of the needs for fuel oil is for transportation modes in Indonesia. Various types of fuel are available on the market, one of which is HSD oil (High Speed Diesel) or often referred to as diesel. When compared with other fuels, HSD is the most widely used fuel. Almost all modes of transportation that use diesel engines use this type of fuel. Diesel motors have rotation above 1000 rpm, thus HSD fuel will burn completely in the combustion chamber.

Based on Marpol Annex I, prevention of oil spills or oil spills from ships and to keep the sea safer from oil pollution is the responsibility of the crew. One of the negative impacts resulting from an oil spill is damage to marine biota and ecosystems. With the rapid development of technology and a positive impact on education. In this study, the design and construction of an HSD (High Speed Diesel) level automation tool system for the fuel tank on the SDP Palembang Polytechnic training ship uses an Arduino-based Time of Flight (TOF) sensor.

Time of Flight sensor is an electronic component that functions to measure the distance between the sensor and an object. In this study, it is used for the purposes of measuring the level of the fuel tank on the SDP Palembang Poltektrans training ship. In this way, you can find out the level of fuel in the tank so that no oil spills occur, so that it can be monitored using Arduino.

1.1 Problem Formulation

Based on the background explanation above, the problem that arises when designing the system is how to design an HSD (High Speed Diesel) level automation tool system for fuel tanks on the training ship Poltektrans SDP Palembang using an Arduino-based TOF (Time of Flight) sensor

1.2 Problem Limitation

In order for the research to be completed, it is necessary to have the boundaries of the problem.

The limitations of the problem in this study are as follows:
1. The system is simulated on a ship's fuel tank in the form of a box measuring 30x25x25.
2. Ship level readings using the TOF (Time of Flight) sensor.

3. Data processing from the TOF (Time of Flight) sensor uses the Arduino Uno microcontroller.
4. The results of the ship's HSD (High Speed Diesel) level automation are displayed on the 16 x 4 LCD
5. Notification using buzzer.

2. Research Methods

The research method "Design of an HSD (High Speed Diesel) Level Automation Tool System for Fuel Tanks on Training Ships of Poltektrans SDP Palembang Using an Arduino-Based TOF (Time of Flight) Sensor" is implemented using an Arduino Uno microcontroller to read the TOF (Time of Flight) sensor) and processes it so that it can be displayed on the LCD in the form of HSD (High Speed Diesel) level data and notifications in the form of sounds using a buzzer. The steps taken to complete the research were conducting a literature study, making a system design, designing a TOF (Time of Flight) sensor circuit, designing an inter-integrated circuit (I2C) to display on the LCD and notifications on the buzzer.

2.1. Study of literature

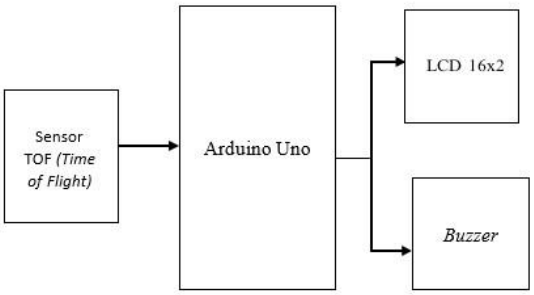
Literature study is learning from the material – Supporting materials for completing this research in the form of books, papers from previous studies, as well as related materials via the internet. The supporting materials used to complete this book are knowledge of TOF (Time of Flight) sensor readings, Arduino Uno microcontroller programming, displays on the LCD and notifications on the buzzer.

2.2. Literature review

A. System Concept

The system concept from the research “Design Build an HSD (High Speed Diesel) Level Automation Tool System in Material Tanks

Fuel on the SDP Palembang Polytechnic Training Ship Using Arduino-Based TOF (Time of Flight) Sensors” is depicted in the block diagram in Figure 1. The TOF (Time of Flight) sensor will send fuel tank HSD level data to the Arduino microcontroller. HSD level data from the TOF sensor is processed by the Arduino microcontroller to become HSD level data. Then the HSD level data on the ship's tank will be displayed via the LCD and buzzer as a notification.



B. ToF sensors

The TOF (Time of Flight) sensor is ToF cameras use infrared light red (a laser invisible to the human eye) to determine depth information - such as how bats perceive their surroundings. The sensor emits a light signal, which hits the subject and returns to the sensor. The time it takes to revive is then measured and provides depth mapping capabilities. This provides a major advantage over other technologies, as it can accurately measure distances.

C. Arduino

Microcontroller is a computer system that has one or several very specific tasks (Chamim, 2012). A microcontroller is a computer system in which all or most of its elements are packaged in a single IC (Integrated Circuit) chip, so it is often called a single chip microcomputer. There are several types of microcontrollers that can be used as a tool to monitor water pH, one of which is the Arduino Uno. Arduino Uno is a minimum board for an open source microcontroller system.

D. LCD (Liquid Crystal Display)

According to Kho, Dickson (2021) Understanding LCD (Liquid Crystal Display) is a type of display media that uses liquid crystals to produce visible images. Liquid Crystal Display (LCD) technology has been widely used in products such as Laptop screens, Cellphone screens, Calculator screens, Digital Watch screens, Multimeter screens, Computer Monitors, Televisions, Portable Game screens, Digital Thermometer screens and electronic products. other.

E. Buzzer

Buzzer is an electronic component that functions to convert electrical vibrations into vibrations the working principle of the buzzer is almost the same as that of a loudspeaker, so the buzzer also consists of a coil attached to a diaphragm. (Sulistyowati, 2012). The active buzzer has two positive and negative legs the

buzzer is often used in Arduino programs as an alarm. The buzzer will sound long when the HSD (High Speed Diesel) level in the fuel tank is full and will ring intermittently when it is about to run out.

3. Results and Discussion

3.1. LCD testing

Liquid Crystal Display testing is done by testing the device by connecting the LCD with I2C and then connecting it to the pins on the Arduino uno.

Figure 1. LCD testing

3.2. Buzzer Testing

Testing the buzzer lamp is carried out by connecting the anode and cathode to the buzzer pin attached to ground and a voltage of 5 Volts

Figure 2. Buzzer Testing

3.3. Time of Flight Sensor Testing

Testing the time of flight sensor is done by connecting the pin on the sensor with Arduino uno and by looking at the status on the serial on the Arduino application.

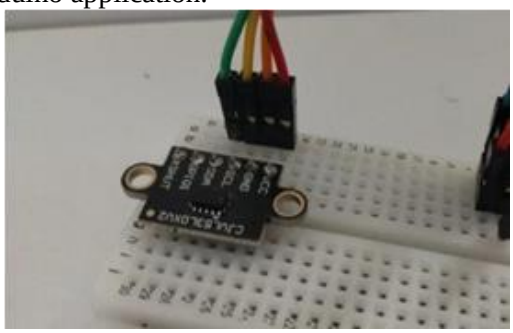


Figure 3. Time of flight sensor testing

3.4. Overall System Testing

Overall system testing is testing carried out using all hardware and software equipment used such as Arduino Uno, LCD, buzzer, and time of light sensor. This test ensures that the data sent by the website to Arduino via the internet network can communicate with each other then the data can move the module according to voice commands made on the website.

Figure 4. Overall System Testing

Table 1. Overall System Testing

Testing	Function	Test results
Arduino uno	a complete microprocessor system contained on a chip.	Can be used
Lcd	as a display of data, letters, characters or graphics	Can be used
buzzer	to convert electrical vibrations into sound vibrations	Can be used
Sensor Tof	As a sensor that can send data to the microcontroller	Can be used

In overall testing, it can be seen in Figure 4 and Table 1 that the data shows that all components can run smoothly as they should.

3.5. Level Measurement Analysis

Data analysis is a process for classifying, seeing relationships, making comparisons, similarities and differences on data that is ready to be studied, and creating data models with the intention of finding useful information so that it can provide instructions for making decisions.

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Sending data to the Time Of flight sensor which is transferred to the Arduino Uno which is placed on a miniature tank measuring 30 x 25 x 25 shows the results of real level measurements by carrying out 10 experiments at different height sizes

Table 2. Level Measurement Analysis

No	Ukuran (cm)	Sensor (cm)	Selisih	Volume
1	10	10	0	6.250 L
2	12	12	0	7.500 L
3	14	14	0	8.750 L
4	16	16	0	10.000 L
5	18	18	0	11.250 L
6	20	20	0	12.500 L
7	22	22	0	13.750 L
8	24	24	0	15.000 L
9	26	26	0	16.250 L
10	28	28	0	17.500 L

The test results are shown in Table 2 with 10 times the experiment shows that measurements using a ruler and data received by the sensor in centimeters have no difference and precision.

4. Conclusion

Based on the results of the tests and analyzes that have been carried out in the previous chapter, it can be concluded that:

1. The control system can receive data by the time of flight sensor properly
2. The control system can work independently

Realtime and with a level of accuracy of measurement in centimeters, it is very accurate with a difference of 0 cm.

Suggestions from researchers

This system can still be developed, because technological developments are increasingly advanced with microcontrollers and networks more sophisticated. In addition, programming can also be developed so that monitoring of the system can be carried out on a large scale.

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