

PEOPLE COUNTER USING ARDUINO BASED ULTRASONIC SENSOR

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ABSTRACT

Church is one of places where the number of people visiting is increasing day by day. For that reason, the church manager has to think about how to accommodate the entire congregation in attendance or whether to add worship sessions. Therefore the owner of the church hired people to count the number of people attending. However, errors often happen in the counts. Therefore, the authors designed a tool that serves to count the number of congregations in attendance, and aims to minimize errors in counting. The sensor used is the ultrasonic sensor HC-SR04, where the way it works is to capture movement that passes through the sensor and will be processed by the Aduino Uno.

Keywords: Church, people counter, microcontroller, Arduino Uno, Ultrasonic Sensor HC-SR04.

1. INTRODUCTION

Nowadays, places of worship are becoming one of the places whose number is increasing. Because of this increase, it's important to find out how many congregations are growing in order to accommodate it. To find out how many congregations are growing, we need a system that can count the number of people.

This person counting system works automatically, so that later this system (M. I. Hanafri, 2018) will be placed in one of the places of worship (R. Silitonga. 2020). The tool for counting the number of people can be used as a new system that will be used in places of worship. From the existing problems, the system for calculating the number of congregations (R. G. Paramananda, 2018) can provide information to the manager of the place of worship.

Because at places of worship there is no electronic device used to count the number of congregations in attendance, so the count is still manual, namely by using a hand tally counter, then the result is informed to the manager of the place of worship.

Arduino is one of the alternatives that can be used as a tool that can count the number of people who enter the place of worship quickly and actually (Rahmat Tullah, 2019). The price is relatively affordable, and the programming language that is fairly open source (A. N. Putra. 2016) can be the right alternative to help count the number of people who enter a place of worship. Arduino is a microcontroller (A. D. Darusman, 2018) that can make various kinds of electronic projects that can help people's daily activities in this modern era.

In its application, the authors use Arduino Uno which is a place to accommodate coding. Then there is an ultrasonic sensor that functions as a movement detector. The ultrasonic sensor works by the reflection of ultrasonic waves (aizal Nulul Handoyo Ady. 2018), and will be explained in more detail in the discussion below. Then the authors use a notification when someone is detected by the sensor,

which is a red LED. The authors use LEDs because using a buzzer would disturb the solemnity in worship. And then the authors also use the 800L SIM Module (R. Fahyurisandi. 2019) which is used to give the results obtained from the ultrasonic sensor, namely the number of people who attend the worship.

2. RESEARCH METODOLOGY

A. Methods of data collecting

1. Observation Method.

The authors conducted a direct observation process at the case study sites, namely GBI Curug, in order to see and find solutions to existing problems.

2. Literature Study

The authors collected data from guide books and data references related to the project to be made.

B. Development Method or Analysis and Design Method

1. Analysis Method

In this method, the authors will analyze the current system based on data obtained from the process of observation and literature study. By analyzing the current system, it is hoped that the author can help meet the needs and improve the facilities in GBI Curug.

2. Design Method

In designing the author used the Flowchart method, where the manufacture of "People Counter using Arduino UNO (Case Study on GBI Curug)" step by step is described.

C. Problems Faced

The problems faced by the existing system system are:

1. The church congregation count is still manual, so there may be errors in the calculation.
2. No electronic media devices are used to count the congregations present at the GBI Curug Worship.

D. Troubleshooting

To overcome the problems mentioned above, the authors provide solutions as follows:

1. To design a technology system that can count the number of people quickly and accurately and notify the number to the manager of the place of worship.

E. Needs Identification

This People Counter using Arduino UNO consists of two parts, namely:

1. Hardware, including:

Arduino Uno R3, LED, 2x16 LCD, resistor, Stepdown module, ultrasonic sensor, SIM800L, power supply, PCB and connecting cable.

2. Software, including:

Arduino IDE software and Arduino libraries.

3. RESULTS AND DISCUSSION

A. New Proposed Procedure

Based on the identification of the problem, the writers propose that this automatic counting system can help reduce counting errors in counting the congregation. In addition, this system is useful for limiting the number of congregations during these conditions.

The proposed new system is a breakthrough in developing the existing work system, therefore this system is expected to increase the accuracy in counting the number of congregations. This project consists of several electronic components including:

1. Arduino uno which serves as a placeholder for commands that will run according to what commands are entered.
2. The ultrasonic sensor will be installed on the top of the door which serves as a detector if someone passes through the door.
3. The LED functions to give notifications when someone is detected.
4. The 800L SIM module functions to SMS to the owner of a place of worship containing the number of congregations.
5. The stepdown module serves as a support for the 800L SIM which is useful for lowering the voltage that goes to the 800L SIM
6. The power supply is in charge of changing the high AC voltage into a lower DC voltage.

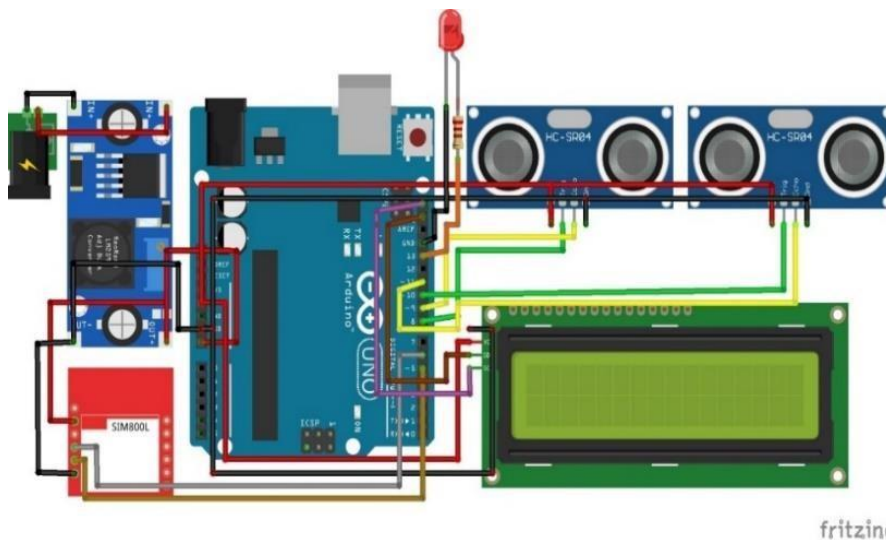


Figure 1. Hardware Architecture and Cable Connection in General Proposed System

B. System Design Flowchart

The following is a system design that will be made, where the design describes the system created. In making and designing programs, it can be described in the form of flowcharts so that it can make it easier to carry out and design steps or processes correctly. The form of the overall flowchart of the system created can be seen in Figure 2, as follows:

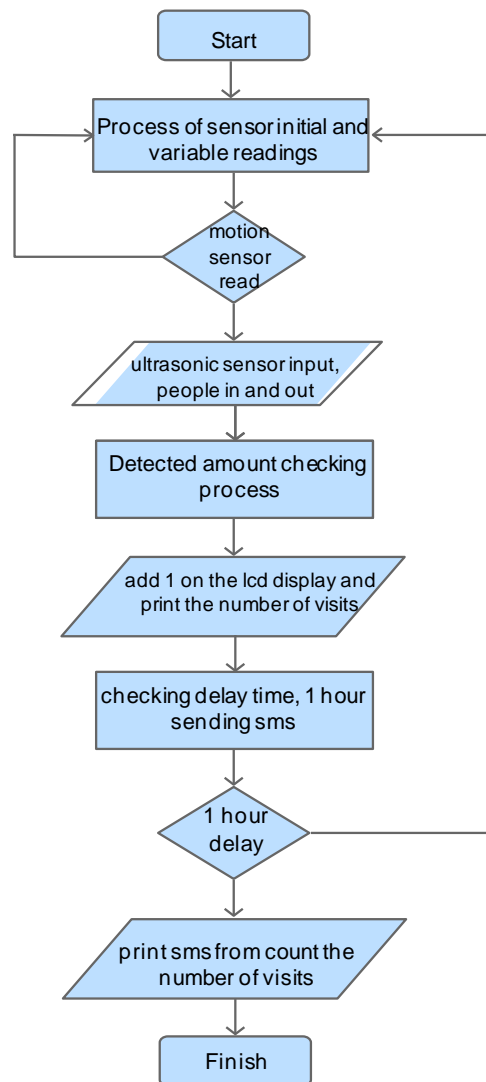


Figure 2. Flowchart Diagram

The flowchart in Figure 2 describes the work process of an automatic people counting system using an ultrasonic sensor with an Arduino UNO-based SMS notification. Here is the workflow:

1. User Starts.
2. The ultrasonic sensor starts to read the movement.
3. If the motion is detected by the sensor, the input from the ultrasonic sensor will detect people entering and leaving the building.
4. Otherwise the sensor starts reading again
5. The process of checking the number of people entering and leaving last on the same day.
6. The number of entries and visits increased by 1.
7. The process of checking the delay whether it is 1 hour or not.
8. If it has been 1 hour, the 800L SIM Module will send an SMS to the destination number containing the number of visitors.
9. If it has not been 1 hour the process will return when the sensor reads the movement.

C. Tool Design Prototype

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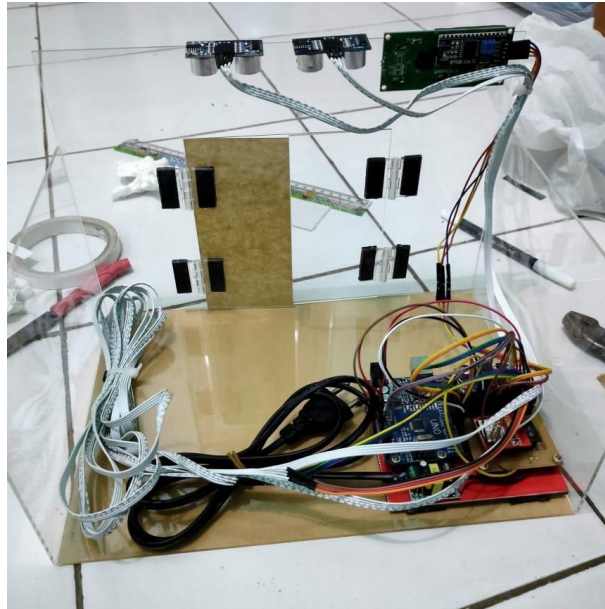


Figure 3. The Design of the Tools

The devices were mounted on the PCB board.

The following table details the tools:

Table 1. Table of Tools Details to be Used Based on the picture

No.	Information
1.	Power cable to electricity (supply voltage)
2.	Arduino data cable
3.	Power supply
4.	Resistor + red LED
5.	Arduino Uno
6.	LCD 2x16
7.	Ultrasonic Sensor 1
8.	Ultrasonic Sensor 2
9.	800L SIM Modul
10.	<i>Stepdown</i>
11.	<i>Jumper Cable</i>
12.	ON/OFF Button

After all the tools have been assembled, the coding is ready to be inputted on the Arduino. Here the authors use the Arduino IDE application.

C. System and Tool Testing

After conducting a system analysis and design on a series of tools, the authors conducted testing on the tool to determine the performance and results of the

design of the tools, and evaluate if an error occurred in the series of tools. The following is an experiment of the tool:

1. Determination of the point where the sensor is located. Before we test the tool, the sensor will be placed behind the door of the worship room, here is a map of the sensor point determination.

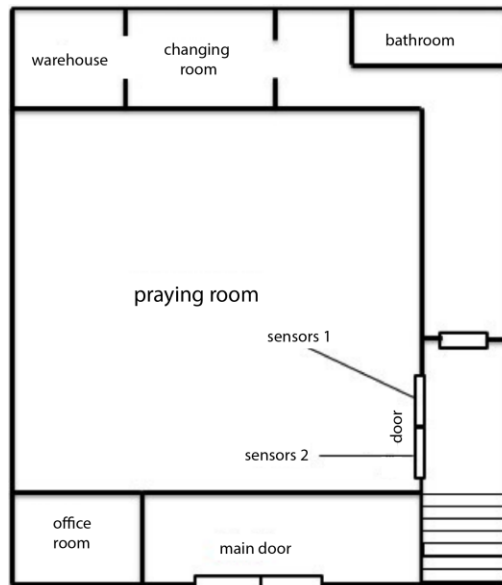


Figure 4. Determination of the Point of Sensor Placement

2. LCD Testing

At this point, the author conducted a test on a 2x16 LCD, whether or not the coding typed was successfully uploaded to the device.

```
Serial.begin(9600);  
lcd.begin();  
lcd.print("PENGHITUNG JUMLAH");  
lcd.setCursor(0, 1);  
lcd.print(" JEMAAT");  
delay(1000);  
  
lcd.clear();  
lcd.print("In=0 Out=0");  
lcd.setCursor(0, 1);  
lcd.print("Visitor=0");  
  
pinMode(ECHO1, INPUT);  
pinMode(TRIG1, OUTPUT);  
pinMode(ECHO2, INPUT);  
pinMode(TRIG2, OUTPUT);  
pinMode(ledPin, OUTPUT);
```

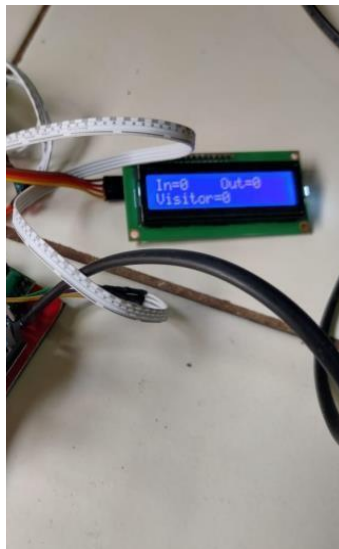


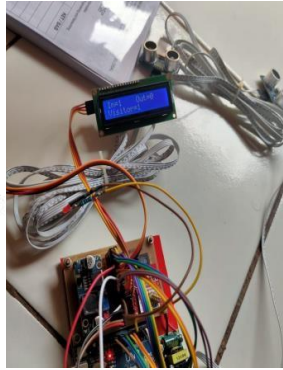
Figure 5. 2x16 LCD Testing Process

3. Ultrasonic Sensor Testing HC SR-04

Furthermore, the authors conducted experiments on ultrasonic sensors. Here, the author uses 2 sensors, namely incoming sensors and outgoing sensors. Here is the test:

a. Entry and Exit Sensor

```
ukur_jarak1();  
if (jarak1 < 20){  
  jarak1 = 100;  
  jarak2 = 100;  
  
  pengunjung++;  
  masuk++;  
  digitalWrite(ledPin, HIGH);  
  lcd.setCursor(3, 0);  
  lcd.print(masuk);  
  lcd.setCursor(8, 1);  
  lcd.print(pengunjung);  
  delay(500);  
  digitalWrite(ledPin, LOW);  
}
```



```
ukur_jarak2();  
if (jarak2 < 20 && masuk > 0){  
  jarak1 = 100;  
  jarak2 = 100;  
  
  keluar++;  
  masuk--;  
  pengunjung--;  
  lcd.setCursor(3, 0);  
  lcd.print(" ");  
  lcd.setCursor(3, 0);  
  lcd.print(masuk);  
  lcd.setCursor(12, 0);  
  lcd.print(" ");  
  lcd.setCursor(12, 0);  
  lcd.print(keluar);  
  lcd.setCursor(8, 1);  
  lcd.print(pengunjung);  
  delay(500);  
}
```



Figure 6. Incoming Sensor Test

The picture above shows the sensor readings are indicated by the increasing number of IN and VISITORS, and also the LED lights up.

4. Testing the 800L SIM Module

D. Implementation of the Proposed System

After testing each tool, the authors conducted testing at the case study site, namely at GBI Curug. The test results of the tool can be seen in Figure 9.

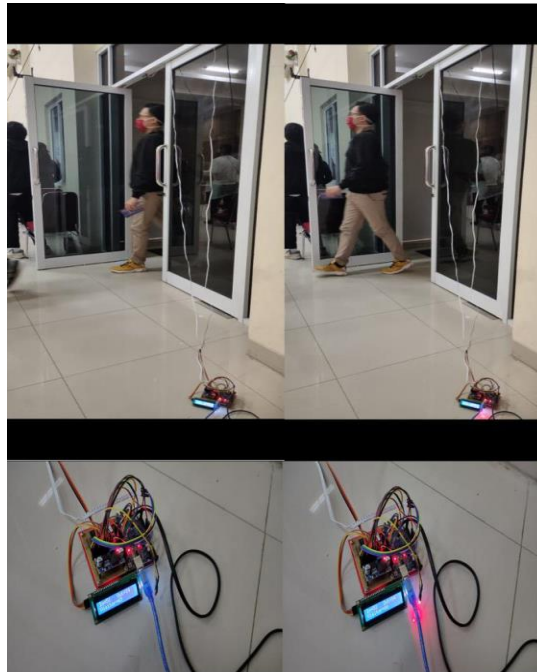


Figure 9. Implementation of Research Results in the Study Case (GBI Curug)

4. CONCLUSION

1. The Arduino is set by placing the sensor on the church door. When the sensor reads if someone passes, Arduino will process and display the amount read by the sensor, and will be informed to the church manager via SMS.
2. This system is made to make it easier to count the number of congregations and minimizing the difference between the real number and the count.

5. RECOMMENDATION

- a. This system needs a battery as a backup power supply to anticipate when the power goes out.
- b. This system needs development so that the count data becomes online, and stored in a database.
- c. This system needs for more specialized sensors to detect humans, so that those detected are actually detected as humans.
- d. This system needs notification when the visitor quota is almost full.

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