

# Development of Visitor Monitoring System Used Arduino Microcontroller Based on Internet of Things Technology

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**Abstract:** In the modern era, many shopping complexes or modern markets are built for convenience to buy and sell products and central market. The visitor monitoring system needs to check and know how many visitors in a time for safety reasons in case of an emergency evacuation. Current conventional visitor monitoring systems often still use manual methods or mechanical counting devices that are inaccurate. This research aims to design a monitoring system and focuses on the development of a visitor monitoring system using Arduino-based Internet of Things (IoT). The system is designed to improve the accuracy and efficiency of measuring the number of visitors in a place in real-time. The use of IoT technology in the field of monitoring is becoming increasingly important, especially in measuring the success and effectiveness of a place. Arduino is used to design a more advanced and accurate monitoring system, as it can control various types of sensors and is easy to connect to the internet. By utilizing IoT technology, the visitor monitoring system can be developed to be more effective and efficient in monitoring the number of visitors in a place in real time. This research aims to design and develop a monitoring system that can accurately measure the number of visitors and is integrated with IoT technology. The results achieved that system can count and monitor in a specific place or kiosk in a shopping complex as built prototype. The proposed system can assist and improve the effectiveness and efficiency of management to monitoring visitors in a place.

**Keywords:** Ultrasonic, Arduino, Microcontroller, Database, Sensor, IoT

## 1. INTRODUCTION

The increasing importance of using IoT technology in various fields, including the field of monitoring. Monitoring the number of visitors to a place, such as a museum, art gallery, shopping center, or tourist spot is important in measuring the level of success and effectiveness of that place. However, often the use of conventional visitor monitoring systems still uses manual methods, such as manual counting by officers or using mechanical counters that are less effective and inaccurate. Therefore, it is necessary to develop a monitoring system that is more sophisticated and accurate, which can measure the number of visitors in real time and is integrated with IoT technology. Arduino, a very popular microcontroller platform, can be used to design this monitoring system, because Arduino can control various types of sensors and actuators, and is easily connected to the internet via wireless fidelity (Wi-Fi) or Ethernet modules. By utilizing Arduino and IoT technology, a visitor monitoring system can be developed to be more effective and efficient in monitoring

the number of visitors in a place in real time. Thus, this research will focus on the development and design of a monitoring system for monitoring the number of visitors using Arduino based on the IoT, to increase accuracy and effectiveness in measuring the number of visitors in a place in real time. The IoT is a concept whereby an object can transfer data over a network without human-to-human or human-to-computer interaction. For example, a car equipped with a built-in sensor can warn the driver when the tire pressure is low. IoT is widely used in machine-to-machine (M2M) communications in manufacturing, power, oil, and gas. Products built with M2M communication capabilities are often referred to as "smart" systems. IoT infrastructure consists of electronic hardware, software, sensors, and connectivity, which interoperate in an infrastructure network such as the Internet. IoT can be described as a global information service that connects physical and virtual objects based on the technology they have. This research aims to develop and build a system ability to monitor visitor in a place

and track the location in a real-time. Several sensors installed at the strategic places to achieve better detection of visitor.

## 2. LITERATURE REVIEW

When compiling this thesis report, the authors were inspired by several references from previous studies related to or related to this thesis report. Some of these studies are as follows. the journal entitled Design and Implementation of a Visitor Detection System for Arduino-based Stores by [1-3]. In this study the visitor detection and visitor counter tools made are tools that make it easier or relieve shopkeepers directly. This research designed a visitor detection tool and visitor counter tool automatically. The visitor detector and visitor counter have two sensors, namely the PIR sensor and the photodiode sensor as detectors and visitor counters based on Arduino with the C programming language.

In a journal entitled Design and Development of an Internet of Things-based Automatic Visitor Counter Information System by [4-7] in this study the parameters used were to detect passing objects. This study also used the HC-SR04 infrared sensor to count the number of people above the infrared sensor at the front door. The classification method is very simple and easy to understand. Therefore, the accuracy of the system is obtained. In this case, the door dimensions are 200 cm long and 190 cm high. Journal entitled RestoCrowd Development: Crowdsourcing-based Restaurant Visitor Android Application with Extrapolation by [8-12] in this study, called Resto Crowd was developed to test a simple method that can estimate the number of restaurant visitors with fewer data and efficient power usage. The RestoCrowd system consists of an Android-based application and a web service for aggregating crowdsourcing data. The results of the Black-box test state that the system application has met the system requirements. The results of the power usage test stated that the RestoCrowd application only consumed a maximum of 0.6668 mAh of power to run 1 detection procedure in the background (2 mAh in 1 hour). The results of the accuracy test stated that the average accuracy was 80.63% from 83 training data and 12 test data.

In a journal entitled Design of a Visitor Counting Tool at the Tangerang Unis Library Using the Internet of Things-based Pir Sensor by [13-15] in this study using a library visitor recording system that is used to count visitors passing through the entrance and exit. The parameters in this study use the detection of passing objects. The sensor used is a Passive Infrared (PIR) sensor which will detect human objects passing through the entrance and exit. If the human object passes through the entrance the number of visitors will be added by one, and if the exit will be reduced. In the journal entitled Development of an Arduino-based Eremerasa Bathing Tourism Counter Tool Development by [176-18] in this study, the aim is to develop a tool to count the number of tourist visitors and to find out the response of counter staff about visitor counters Arduino-based bath tour. These methods have 7 stages, namely potential and problems, data collection,

product design, product trials, product revisions, usage trials, product revisions.

## 3. METHODOLOGY

The research methodology used in this final project includes three stages. The first stage is to conduct a literature review. In the literature review, various theories are studied by analysis of books obtained from lecture notes, library books, and studying related internet media. with this research, as well as analyzing previous research references related to this final project. The second stage is conducting laboratory studies, in laboratory studies research and testing are carried out on several electronic components and other supporting components that will be involved in the final project based on the specification data. The last stage is the discussion method, in this method consultations are carried out with the supervisor, and asking questions from colleagues related to this final assignment.

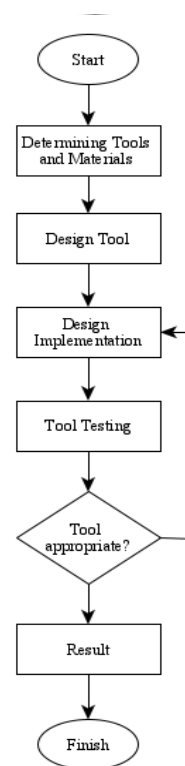


Figure 1. Flowchart The concept of tool design

This research began by conducting a literature review, namely looking for references to previous studies related to this research. After conducting a literature review, the authors calculated the distance between the sensor and the object (person). This aims to find out when the sensor detects an object that passes through it. The next step is to determine the components and tools needed to carry out the research to match the required specifications. After all the tools are obtained, hardware and software design is carried out. The hardware design includes block diagrams and tool design,

while the software design includes making system flowcharts and programming them. After planning is implemented, the testing phase is carried out which includes tool testing, sensor testing, LCD testing, and buzzer and LED testing. Tests continue to be carried out until the research results are obtained following the objectives, then data collection is carried out as evaluation material.

Running system analysis is carried out to find out which system or process is currently running. In this system, the process of calculating the number of visitors is still using the manual method, namely by the way the user counts or writes it in a book. Following the system approach method used the depiction or modeling of the running system will be presented using UML notation, namely Activity diagrams.

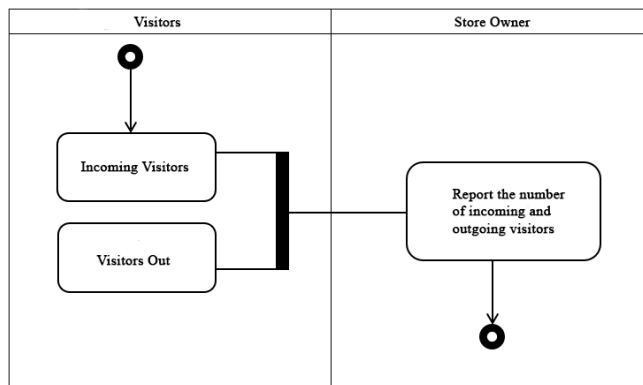


Figure 2. Current system analysis

The proposed analysis is carried out to find out the process of calculating the number of incoming and outgoing visitors. This system is designed to determine the access of the number of visitors in the shop or in the room where every visitor who comes (IN) will be processed in visitor data using an ultrasonic sensor and display the output results of visitors who come to the LCD, as well as visitors who leave (OUT) will be counted in visitor data and will be censored using an ultrasonic sensor, then the output will be displayed on the LCD and stored in the database. The below is Figure 3.3 the proposed system design.

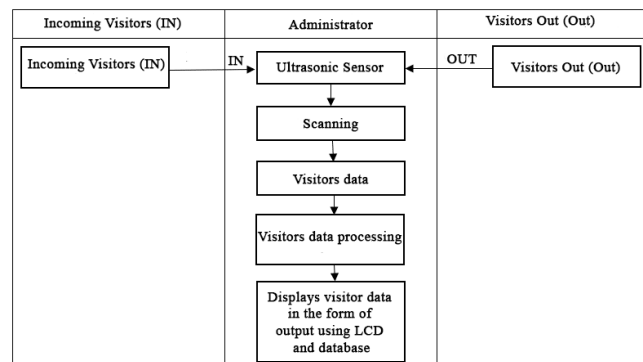


Figure 3. Proposed system analysis

Design is the next stage after analysis. The design is carried out to reduce errors and determine the characteristics

of the components before making the tool. The design phase is divided into 2 parts, namely the hardware and software sections. To explain the design of the system carried out in realizing the design research of the monitoring system for the number of visitors. First, it is generally described by a block diagram. The block diagram design for the number of visitors monitoring system that will be made is as follows as shown in Figure 3.4.

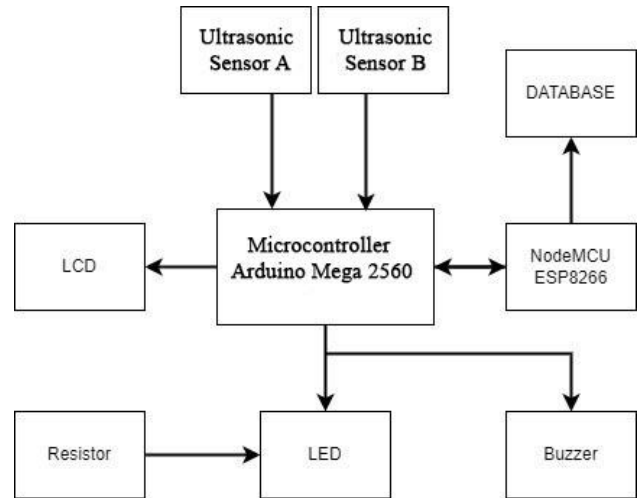


Figure 4. Proposed system diagram block

In the tool design scheme above, the ultrasonic sensor functions as a detector for the movement of visitors entering and leaving, and the ultrasonic sensor data is sent directly to the Arduino Mega 2560 Microcontroller. The Arduino Mega 2560 microcontroller will give commands to the LED to light up and the buzzer to sound. Resistors function to hold the voltage and electric current on the LED used. Then the ultrasonic sensor data will be displayed on the LCD. The LCD will display the visitor count according to what is received on the microcontroller. After the data is entered into the microcontroller, then the data will be sent to the NodeMCU ESP8266. After the data is entered in Nodemcu, it will be forwarded and stored in the database. The flowchart of how the tool to be designed works can be seen in the following figure.

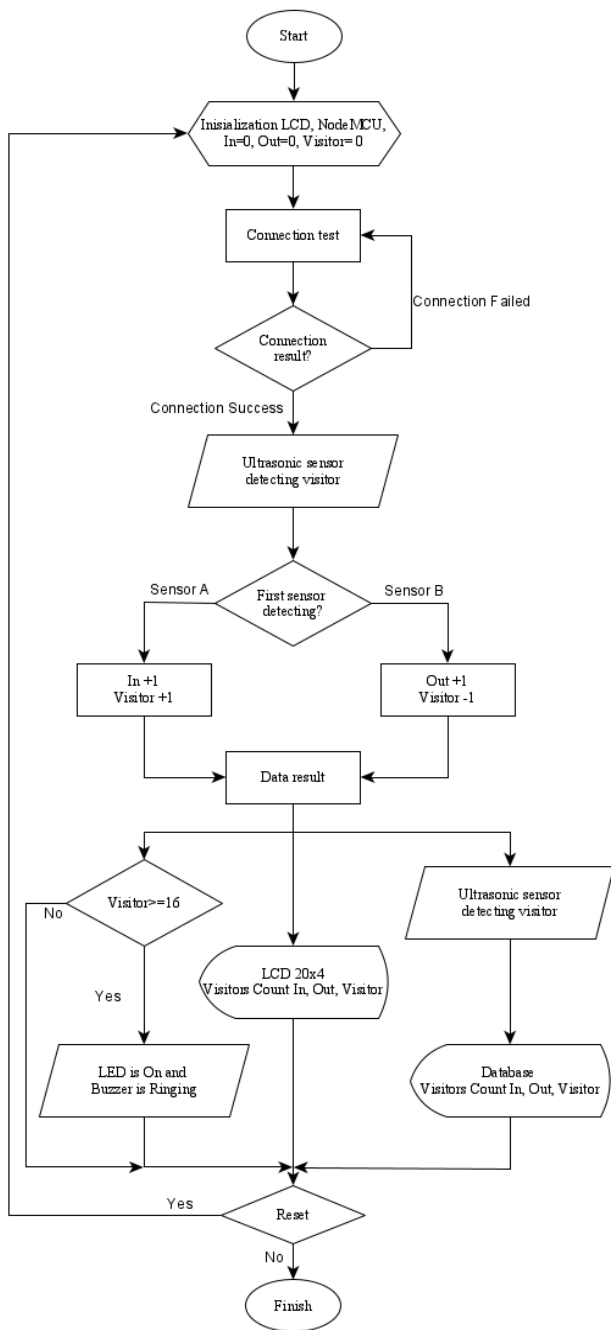


Figure 5. Flowchart How the Monitoring System Work Amounts

The process starts with initializing the LCD, and all the ports in the electronics circuit, followed by connecting to WiFi on the esp8266 Node MCU, followed by detecting visitors who pass through the sensors. If the sensor detects a visitor, the LED will light up and the buzzer will sound. After the sensor detects, the data results will be displayed on the 20x4 LCD and sent to the database.

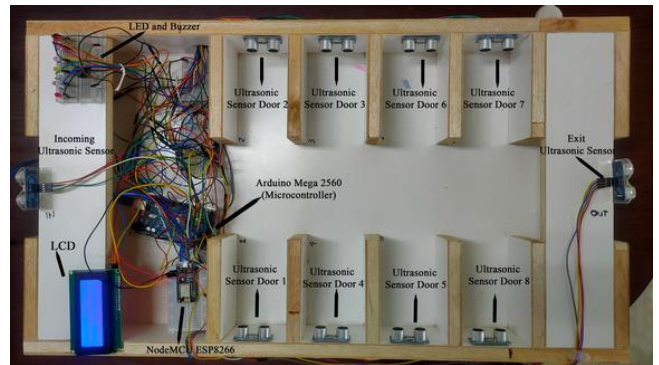


Figure 6. Design of Model visitor in a mall

#### 4. RESULTS AND DISCUSSION

The following shows the results of the hardware design of the monitoring system for the number of visitors using an Arduino microcontroller based on the IoT. From Figure 4.1 it can be seen that the physical form of the design results of the system. The author uses 1 Arduino Mega 2560 module, 1 NodeMCU ESP8266 module, 10 ultrasonic sensors, 1 20x4 i2c LCD module, 1 buzzer, and 6 LEDs.

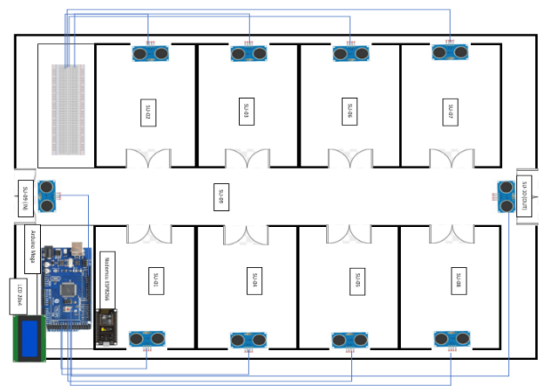


Figure 7. Prototype proposed visitor system

At this stage, after the monitoring system for the number of visitors has been successfully run, the sensor can detect people passing through the sensor, an example of the sensor used can be seen in Figure 4.4 below.

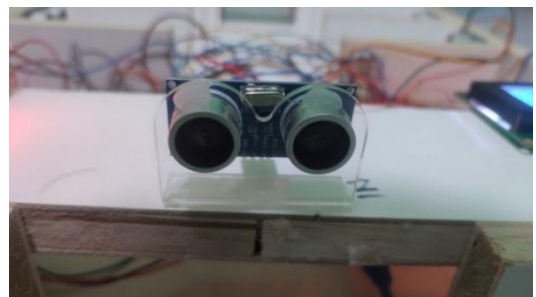
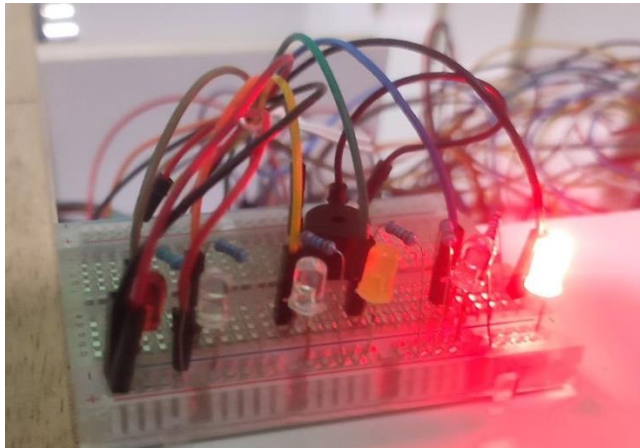


Figure 8. Ultrasonic sensor in system

At this stage, when the sensor detects people entering or leaving, the buzzer will sound and the LED will light up. An example of when the LED lights up can be seen in the following figure 4.6.



(a)



(b)

Figure 9. Testing of visitor system

At this stage, when the sensor detects people entering or leaving, the buzzer will sound and the LED will light up. An example of when the LED lights up can be seen in the following figure 4.6.

## 5. CONCLUSION

Based on the results of the research, design and testing described previously it can be concluded that:

1. This tool can be designed to make it easier to calculate the number of visitors in a room/building with microcontroller technology, so that the calculations are accurate and clear.
2. In this series of visitor counters, the microcontroller has the main role to process the working system of the ultrasonic sensor and then processed by the microcontroller which is then sent to the LCD and database to become output in the form of calculation results.
3. The final conclusion is that the results of designing a tool to count the number of visitors using an Internet of Things-based Arduino microcontroller can work well and as expected.

## ACKNOWLEDGMENT

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