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# Smart Home Automation with Bi-Directional Visitor Counter

**Mohamad Afiq Aiman bdul Rahim[1], Izanoordina Ahmad[1]**
[1]Section of Electronics Technology
Universiti Kuala Lumpur British Malaysian Institute

Corresponding email: afiq.abful@s.unikl.edu.my

**Abstract:** Many people are seeking out autonomous gadgets in today's world. There is a compelling need to develop circuits that ease daily life's burden with rising living standards. To avoid crowding, knowing how many people are in the room is an advantage, and this project can also help with that. Electricity is a crucial resource in the 21st century. Electrical power needs to be saved at all costs. Although this idea was motivated by the problem that customers have always experienced, people commonly forget to turn off the lights or the fan when leaving the room, resulting in unnecessary electricity use. This circuit is a dedicated circuit that takes over the task of regulating the power appliances in the house and correctly calculating the number of visitors in the region to solve this problem. The system detects when a person enters and leaves the room and automatically turns the light and fan on and off according to the number of people. The outcome of this system is that the light and fan are turned on when there is a person in the room. The fan speed is adjusted automatically depending on how many people are in the room. In the end, the light and fan go off when the room is empty. In conclusion, this project will design a monitoring system and construct a prototype of Smart Home Automation with Bidirectional Visitor Counter to help users prevent electricity waste. This project should be executed in natural settings to prove the theoretical and research findings. This project also evaluates and validates Smart Home Automation with Bidirectional Visitor Counter to assure its usefulness.

**Keywords:** Smart Home Automation, Visitor Counter, ESP32, Infrared Sensor (IR Sensor)

## 1.0 INTRODUCTION

Automatic appliances are prevalent now. The creation of easier-to-use circuits is vital due to rising living standards, and this project, The Smart Home Automation with Bidirectional Visitor Counter. One of the most reliable circuits in Smart Home Automation with a Bidirectional Visitor Counter is to manage an electrical appliance and correctly count visitors. Electricity is one of the century's most vital resources. Our invention was inspired by an issue consumers always have: they always forget to turn off the lights or fan when they leave the room, leading to energy waste. The Smart Home Automation with Bidirectional Visitor Counter is a reliable circuit that controls the electrical appliances in the house and calculates the number of visitors in the area to solve this problem. This project counts and displays the number of people who enter a lecture hall or conference room. The electricity goes out when there are no more people in the room.

Some people forget to turn off appliances when they leave the room, which can cause wasting electricity. This problem always occurs when they are rushing. Users must pay extra for the unused electricity. Also, not everyone can turn on and off appliances manually. Disabled people in wheelchairs will have trouble accessing the wall-mounted switches. In a classroom or hall, it's difficult to know if it's empty because the light may be on, but no one is there, leading some to believe it's empty. This will hinder class use by others. This project's scope is to create a system that can count and display the total number of visitors inside a space using a bi-directional counter and LCD. Once the counter has been detected and increased by one number, this project can also turn on the power appliances. It may also regulate the air conditioner's temperature or the fan's speed, dependent on the number of people in the room. But there are some limitations to the project, such as the requirement for a strong network connection to monitor data because the system was connected to the Internet of Things (IoT). Additionally, the system is only meant to be used for monitoring. If users want to turn OFF the light or the fan, they need to do it manually using the power switches.

The primary objective of this Smart Home Automation with Bi-Directional Visitor Counter project is to design and develop a system and prototype that can count visitors entering and exiting the space in both directions and show the total number of occupants on an LCD screen.

Additionally, this concept might be utilized to automate the operation of electrical household equipment in response to the number of individuals present in the space. Also, this project is to evaluate and validate the system of Smart Home Automation with Bi-Directional Visitor Counter. As a result, one of the primary benefits of this project is developing a system that may reduce the amount of wasted energy caused by electric power consumption.

## 2.0 LITERATURE REVIEW

This paper research by K.Mohana Prasad, P. Dhar, and Naseem displays the plan of Industrial Automation utilizing Arduino. This project aims to ease the industry work by reducing the consumption of electricity and providing the safety features that will not lead to a dangerous situation. Additionally, this circuit is also necessary to monitor the visitor for better human traffic management. Next, this paper also aims to construct a visitor counter that will count and calculate the number of guests in the room and turn ON and OFF electrical appliances accordingly. The method used in this system is that when a person passes through the first sensor, the Arduino will search for the second sensor interruption. When the detection has been complete, the counter will go to 1, and at that time, the electrical devices will be turned ON. The system detection needs to be vice versa from the entry to the exiting. Also, when the number of visitors exceeds the maximum number of visitors, the buzzer will start beeping. [1]

This paper is research by Teddy Surya Gunawanet all displays the Prototype Design of Smart Home System using Internet of Things. This project aims to enable users to manage the energy consumed and increase savings by controlling the appliances through smartphones. Also, this project's purpose is to increase interest among users in controlling their appliances through a smartphone. This project provides a solution for assistive technology, especially for disabled and older adults, using mobile remote control apps. The system works when the microprocessor interprets the command and sends a HIGH and LOW signal to the relay. Then, it will be monitored and controlled by using the Graphical User Interface, GUI. The users can utilize the GUI to control the home appliances. Also, the current and gas reading will be displayed on the website. The system will also notify when the PIR sensor detects human motion in the room, and the Ultrasonic sensor detects an automobile at the main gate. As the project outcome, the Smart Home Control System can reduce the need for human intervention, increase security, and also energy efficiency. This system allows users to monitor and control house appliances by using the Internet of Things (IoT). [2]

This paper was research by Dr.S.Deepa1et all. display a Bi-Directional Visitor Counter with an Automatic Room Light Controller system. This system aims to count the visitor entering and leaving the room. Next, the system identifies the visitor's entry and exit based on the interruption of the sensors. Also, this system is created to automatically turn ON and OFF the light, depending on the number of visitors. The system works by detecting the person that passes through the sensor. At the initial conditions, when a person enters the room, the counter will increment by value one, and it will automatically turn ON the light. Then, when the person leaves the room, the counter will be decremented by value one on each sensor's detection. The light will goes OFF when the number of visitors is zero. The total number of visitors will be displayed on the Liquid Crystal Device (LCD). [3]

This paper research by A S F Rahman1et all. displays the Post COVID-19 Implementation of a Bi-directional Counter with Reduced Complexity for People Counting Application. This project aims to develop a system for counting people through infrared detection. Next, create a system that can prevent crowded areas during this pandemic. Lastly, the system tallies the count and updates based on people moving in/out through the supervised premise/area. The systems work when the transmitted IR (Infrared) signal has been blocked, enabling obstacle detection. Detection from the Infrared sensor one or two will activate the counter. The detection sequence coming from Infrared sensor 1 to Infrared sensor two will cause the counter to count up and vice versa for the opposite direction. As a result of the system, whenever a customer passes through a sensor, the system will begin counting them as a customer. The display will show the overall number of people in the establishment. If the establishment reaches the maximum number of people allowed, the display will indicate that the establishment is full and that any additional customers will have to wait. [4]

This paper research by Suleimanet all. displays the Bidirectional Visitors' Counter with Automatic Room Light Controller. The main objective of this project is to prevent congestion in a room by indicating the number of people present in the room. Next, this project is to do a controller-based module that counts the number of the person visiting a particular room, hall, mall, etc. This project aims to control the light automatically according to the number of visitors. The whole mechanism is based on the interference of infrared waves. As a light source, an infrared beam is used. Each port on the bidirectional visitor counter contains an automatic room light controller and a microcontroller as a master controller. Additionally, the infrared sensor is used as a transmitter. As a result, this system will count the number of visitors passing through a single door, and it will

also turn the room light on when there is a minimal number of people in the room and turn it off when the room is empty. [5]

## 3.0 MATERIALS AND METHODS

The project contains a few experiments based on the objectives that need to be done, as in the following list.

### 3.1 Design a Monitoring System of Smart Home Automation with Bidirectional Visitor Counter

The system needs to be designed to monitor the number of visitors in the room by using an IoT application, counting the visitor entering and leaving the room bi-directionally, and automatically turning ON and OFF the appliances based on the number of visitors.

### 3.2 Developing a Prototype of Smart Home Automation with Bidirectional Visitor Counter

The prototype needs to be developed to allow the users to monitor the number of visitors in the room and reduce the electricity waste by automatically turning OFF the appliances when the room is empty.

### 3.3 Evaluate and Validate the System of Smart Home Automation with Bidirectional Visitor Counter

The system needs to be evaluated and validated by installing the prototype at a suitable place and starting to run the system and record the data.

### 3.4 Block Diagram

The purpose of this block diagram is to assist readers in understanding the home automation monitoring and bidirectional visitor counter system process and to ensure that readers get a glimpse of the project's hardware process flow. Ensure that the device can be turned on when all of its components have been discovered. A 5V power supply and an Infrared Sensor module make up the system. Relay modules for connection to AC appliances, an LCD, and the Blynk App are its outputs. Cloud database Blynk will hold the information. The NodeMCU ESP32 DEV KIT 1 processor controls the system's input and output.

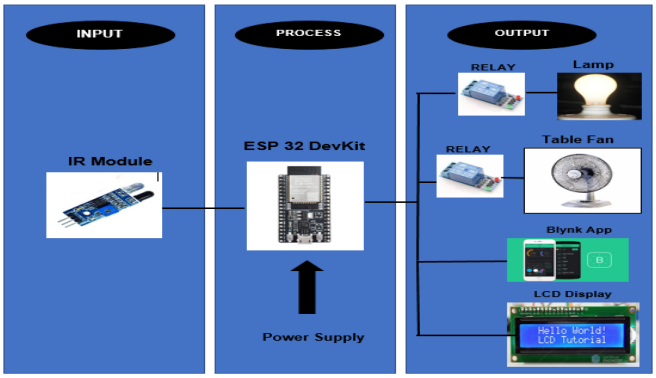


Figure 1: Block Diagram of the System

### 3.5 Flow Chart

The flowchart for the entrance phase of the Smart Home Automation with Bi-Directional Visitor Counter detection is shown in the figure below. A person entering the room must first pass through sensor IR 1 before they may proceed. Once the microcontroller has finished reading the data, it will increase its count and activate the light and fan. Fan speed one will be engaged when more people are present than zero. People passing across sensors will cause a detection cycle to repeat itself. Speed 2 of the fan is activated when more than five people are in the room. A fan set to speed three will begin to run when more than ten people are in the room.

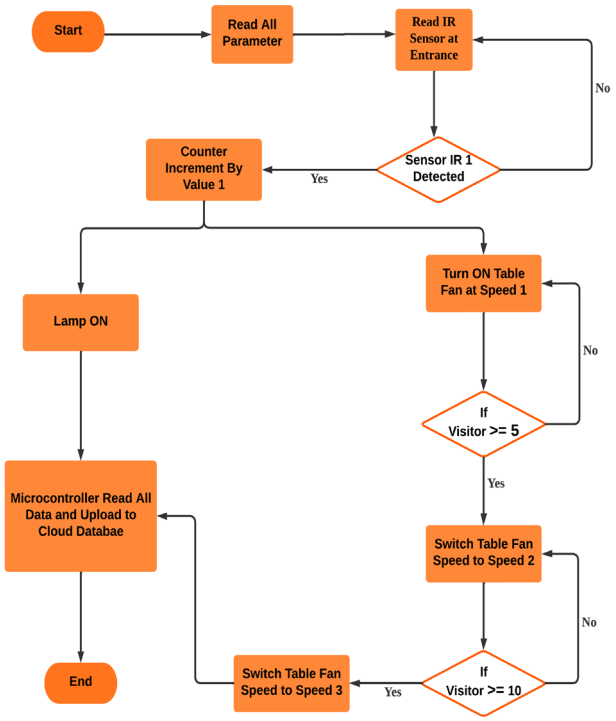


Figure 2: Process Flow Chart at the Entrance

The flowchart for the exit phase of the Smart Home Automation with Bi-Directional Visitor Counter detection is shown in the figure below. A person leaving the room must first pass through sensor IR 2 before they may proceed. As soon as the microcontroller has finished reading the data, it will decrement its count by one and deactivate the light and fan when there is no person in the room. Fan speed three will be set when more than ten people are in the room. People passing across sensors will cause a detection cycle to repeat itself. Speed two of the fan will be switched when less than ten people are in the room. A fan set to speed one will begin to run when less than five people are in the room. When there is no person in the room, the light and fan will automatically turn OFF.

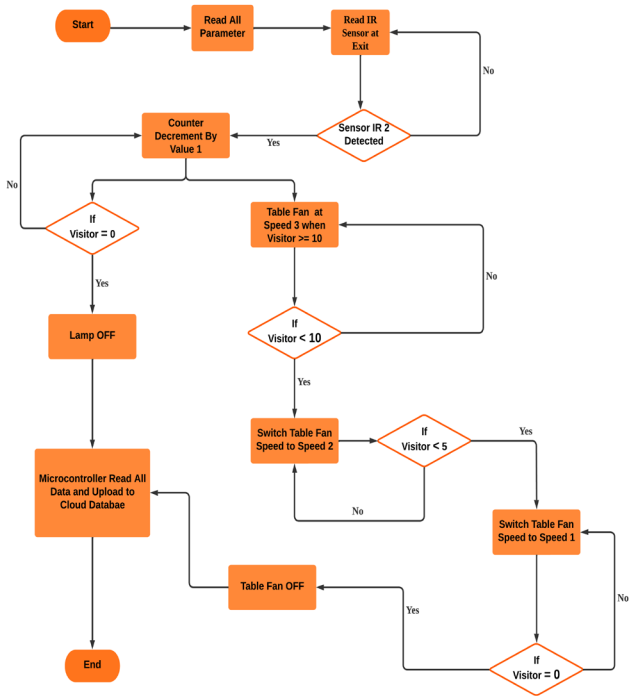


Figure 3: Process Flow Chart at the Exit

## 4.0 RESULTS

### 4.1 PROJECT MODEL

Figure 4 below shows the Project Model. This project consists of ESP32 DEV KIT 1 as the controller, lamp and table fan as the output, an Infrared sensor as the input, and Blynk Applications as the monitoring platform.

Figure 4: Project Model

### 4.2 RESULT FOR EXPERIMENT 1

Based on Figure 5 below, the Smart Home Automation with Bi-Directional Visitor Counter system will be monitored by the Blynk application. When there is no visitor in the room, the light and fan are OFF at the initial condition. The indicator in the Blynk will also indicate nothing.

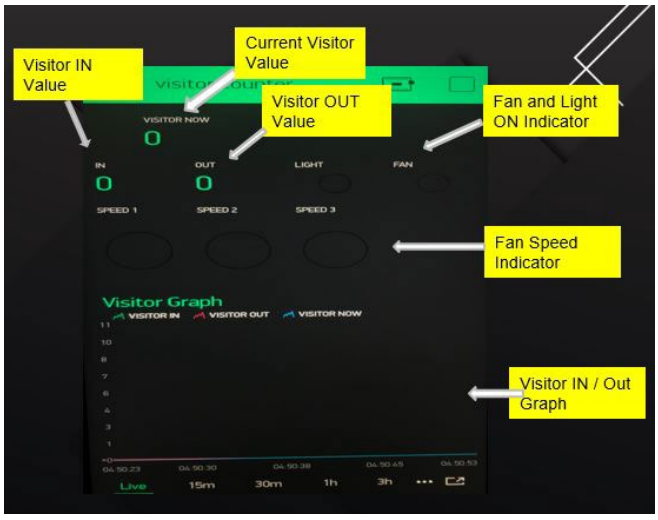


Figure 5: Blynk Apps Interface

For the entry detection, from figure 6, when the visitor in the room is one or more, the light will be turned ON, and the fan will also turn ON at speed 1. From figure 7, when the visitor in the room is five and above, the fan speed will switch to speed 2. From figure 8, when the visitor in the room is ten and above, the fan speed will switch to speed 3.


Figure 6: When visitors >= 1


Figure 7: When visitors >= 5

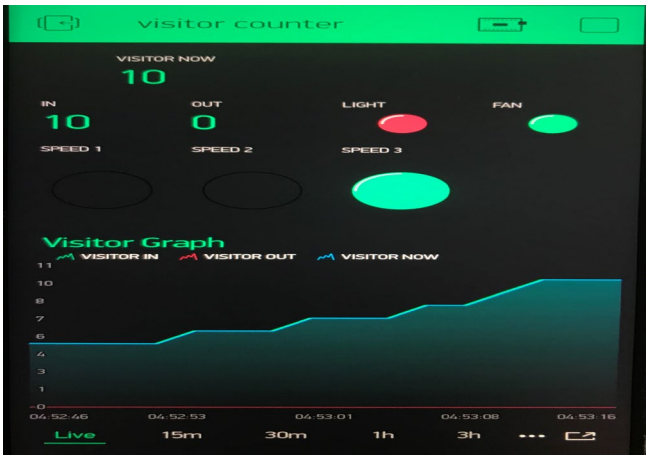


Figure 8: When visitors >= 10

For the leaving detection, from figure 9, when the visitor in the room is less than ten, the fan speed will switch from speed 3 to speed 2. From figure 10, when the visitor in the room is less than five, the fan speed will switch to speed 1. From figure 11, when the total visitor in the room reaches zero, the light and the fan will automatically turn OFF.

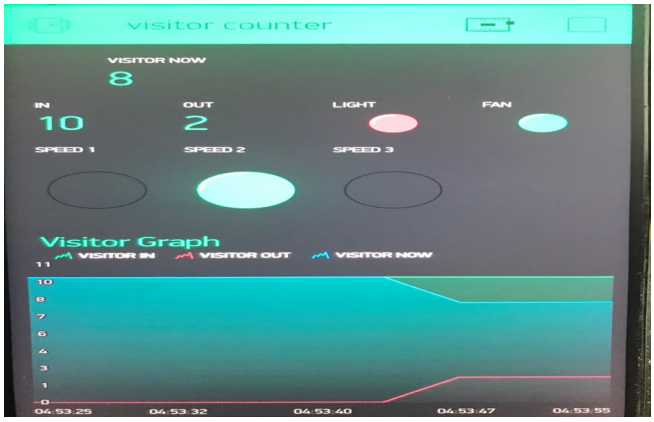


Figure 9: When visitors < 10


Figure 10: When visitors < 5


Figure 11: When visitors = 0

### 4.3 RESULT FOR EXPERIMENT 2

Based on figure 12, this is the prototype of the Smart Home Automation with Bi-Directional Visitor Counter developed. The prototype consists of NodeMCU ESP32 as a microcontroller that controls the system. Next, the infrared sensor detects the visitor entering and leaving the room. The 5V relay module is also included to control the light, fan, and fan speed. Lastly, the prototype also consists I2C LCD to display the numbers of the visitor.

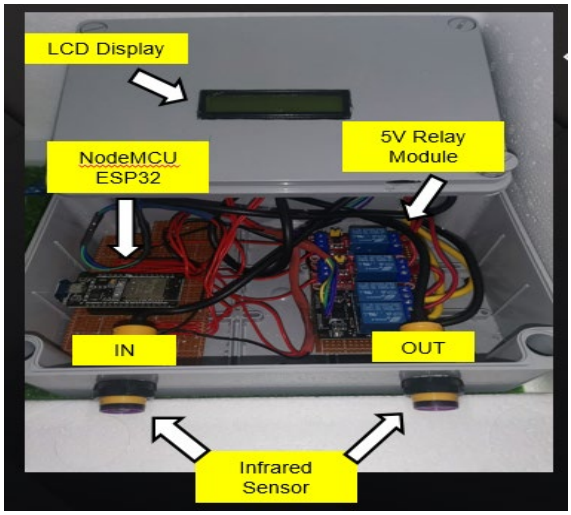


Figure 12: Prototype of the project

### 4.4 RESULT FOR EXPERIMENT 3

Figure 13 below shows the outcome of the prototype tested when a person is entering the room. The lamp and table fan will automatically turn ON.

Figure 13: When there is a person in the room.

The table below shows the data collected from the project during the testing. Table 1 shows the data collected during the entrance, and Table 2 shows the data collected during the exit.

Table 1: Data collected during the entrance

| NUMBER OF VISITORS | RESULT | | |
|---|---|---|---|
| | LIGHT | FAN | SPEED |
| 0 | OFF | OFF | 0 |
| 1 | ON | ON | 1 |
| 2 | ON | ON | 1 |
| 3 | ON | ON | 1 |
| 4 | ON | ON | 1 |
| 5 | ON | ON | 2 |
| 6 | ON | ON | 2 |
| 7 | ON | ON | 2 |
| 8 | ON | ON | 2 |
| 9 | ON | ON | 2 |
| 10 | ON | ON | 3 |
| 11 | ON | ON | 3 |
| 12 | ON | ON | 3 |
| 13 | ON | ON | 3 |
| 14 | ON | ON | 3 |
| 15 | ON | ON | 3 |

Table 2: Data collected during exit

| NUMBER OF VISITORS | RESULT | | |
|---|---|---|---|
| | LIGHT | FAN | SPEED |
| 15 | ON | ON | 3 |
| 14 | ON | ON | 3 |
| 13 | ON | ON | 3 |
| 12 | ON | ON | 3 |
| 11 | ON | ON | 3 |
| 10 | ON | ON | 3 |
| 9 | ON | ON | 2 |
| 8 | ON | ON | 2 |
| 7 | ON | ON | 2 |
| 6 | ON | ON | 2 |
| 5 | ON | ON | 2 |
| 4 | ON | ON | 1 |
| 3 | ON | ON | 1 |
| 2 | ON | ON | 1 |
| 1 | ON | ON | 1 |
| 0 | OFF | OFF | 0 |

## 5.0 DISCUSSION

This section identifies some limitations that need to be improved in the future. For this prototype, the IR Sensor has a bit of delay during detection and gives time to the microcontroller to process the data. However, the system is always capable of working according to the flowchart.

## 6.0 CONCLUSION

In conclusion, this project will provide an efficient method by designing a monitoring system and developing a prototype of Smart Home Automation with Bidirectional Visitor Counter to ease users to prevent electricity wastage. This project's implementation should be done in real situations to prove the theoretical and research findings. This project also helps to evaluate and validate the system of Smart Home Automation with Bidirectional Visitor Counter to ensure that the system is useful and could help the users. In addition, this project was a success as the system ran along with the flowchart.

For the future improvement of this project, a controlling system could be added to this project so that users can also control the appliances by using smartphones. Also, the monitoring features for energy usage to this project could be added.

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