

Chapter 1

INTRODUCTION

1.1 INTRODUCTION

With the growing demand in the field of public safety and crowd management, crowd monitoring system has become an essential necessity of recent times.

One of the most recent examples of crowd mismanagement occurred in India during the Kumbh mela, where a huge rush took place as devotees tried to board a train. The number of devotees far exceed the station's holding capacity this led to a crowd crush. This tragic incident led to the death of at least 30 individuals, while at least 90 individuals injured in this stampede, if proper and efficient crowd control system were install this massacre could have been avoided.

Incidents like this and several other such tragedies across the word highlight the urgent need for automated, reliable crowd monitor systems, this system was developed with careful consideration of the past crowd disaster and their devastating impact.

The primary goal of the project is to design a solution that not only tacks the number of person but also integration it with the ventilation system and also include automated responses to prevent overcrowding and to ensure safety. This is achieved by incorporation sensor like Passive Infrared Sensors(PIR) and WIFI connectivity module (esp8266), and ThingSpeak cloud-based services to collect, store, analysis data, and send response via email in real time .

This project can then be scaled up to be implemented in environments such as train station, crowded event, public places where the possibility of crowd mismanagement is high. By developing a system that automatically tracks people stores the data, managing it and communicated it to the cloud platforms, authorities can make use of this information to prevent accidents and mishaps before they occur.

Chapter 2

PROBLEM STATEMENT & OBJECTIVE

2.1 Problem Statement

Crowd mismanagement in public places can lead to accident, injuries and various fatalities due to lack of real time monitoring, there is a need for automated system that can track crowd count, respond to overcrowding and send real time data to authorities.

2.2 Objective

The main objective of the project is to develop a IoT-based crowd control. System which can:

- 1)control the count correct without any issues like double counting
- 2) send real time data to cloud and use a cloud service website to store it .
- 3)analyses the stored data using the cloud server website and send an email alert to authorities based on it.
- 4) control the ventilation based on the count

2.3 Specific Aims

Aim 1: To make an efficient enter and exit system based on PIR system and create a variable count and display it in lcd

Aim 2: to control the ventilation using servo motors the motors should rotate to certain angle based on the crowd count

Aim 3: To send the data to Thing Speak channel using esp8266

Aim 4: To send an email alert based on if count exceeds a certain threshold

Chapter 3

METHODOLOGY

3.1 Methodology

The system is designed to monitor the number of people occupying a room in real time.

the following are the major steps which outlines the technical implementations-

1)Sensing and detection: -

- Two PIR sensors are implemented in the entry and exit gate which read, when motion is detected by the entry PIR the system registers this as a new person entering by incrementing the count , similarly when motion is detected by the exit PIR the system registers this as a person leaving by decrementing the count
- This is displayed in the lcd module; to avoid double count and to facilitate the resetting of the PIR there is a delay time which is shown in the lcd as x(no entry) y(entry allowed) in both the entry PIR as well as the exit PIR
- A servo motor is established which rotates to certain angle based on the count this act as a fan control i.e., a ventilation system

3.2 Block Diagram

The figure (3.1) given below shows the block diagram of the project .it schematically represent the working of the real time crowd monitoring system. The key component of the project is the Arduino uno which handles counting based on the input from PIR sensors for sensing the entry/ exit of individuals, servo motor for count-based angle control. The lcd displays the count along with the entry/ exit permissions(“y”or”x”) and alert messaged when the threshold is exceeded.

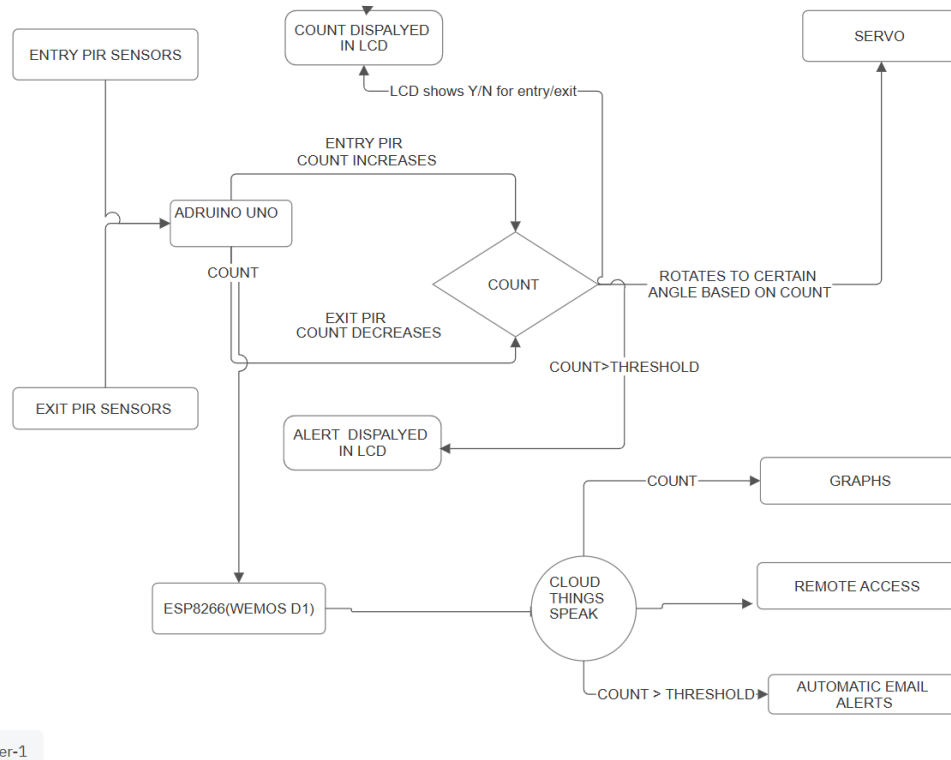


Fig. 3.1 Block diagram of the proposed work.

3.2 Circuit

The overview of the project circuit is as follows shown in fig3.2:-

1)PIR to Arduino UNO:-

Two PIR sensor are attached to the Arduino to detect motion and send it back the Arduino

2) Arduino uno to LOLIN(WEMOS)D1:-

The Arduino uno is connected to the lolin(wemos)d1 esp8266 module using TX and RX pin used for serial communication / transfer of data between uno and esp.

3)Uno to servo:-

The servo is connected to uno , the uno control the servo by making it rotate to certain angle based on the crowd count(automatic fan control a novelty in this project)

4)Uno to LCD:-

A lcd is also connected to uno to show the live information:-

- Number of people inside
- "Entry Allowed(y)"/"Entry Denied(n)" status
- Alert messages(if count> threshold)

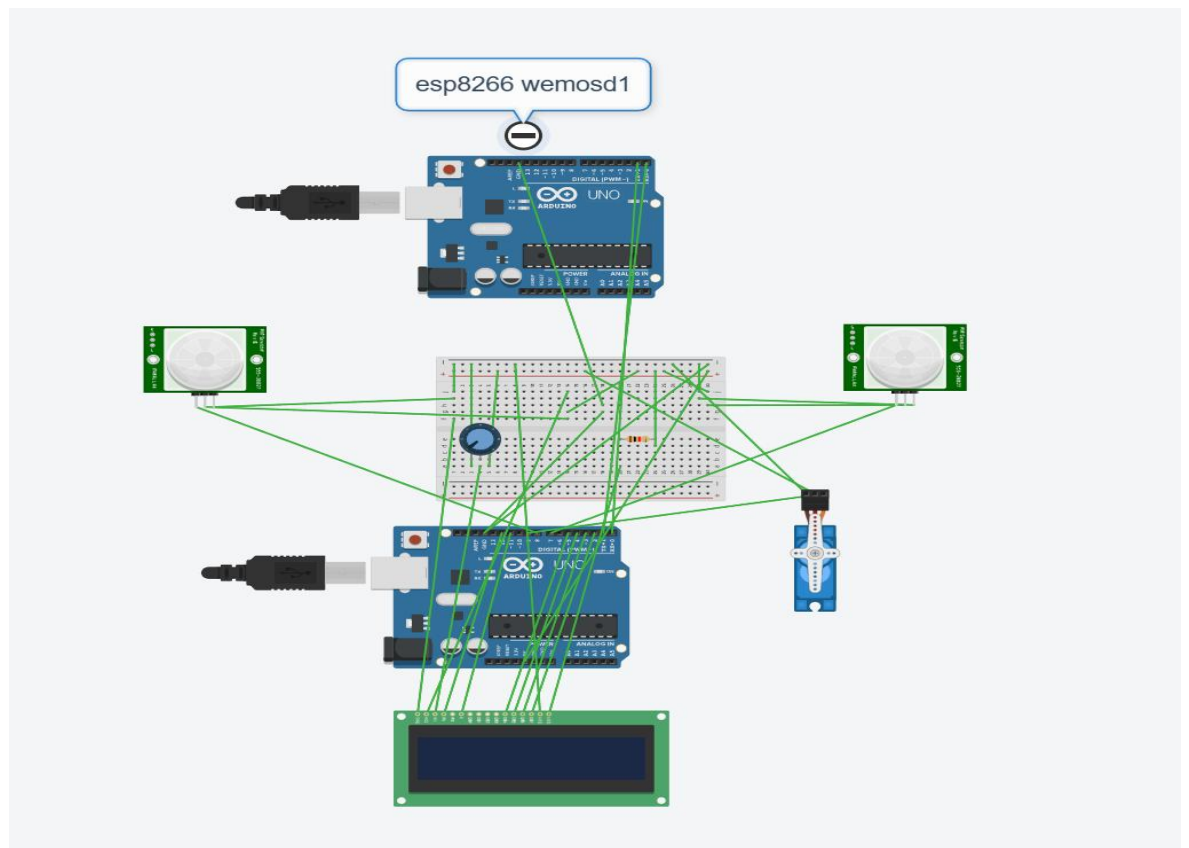


Fig. 3.2 Circuit diagram of the proposed work.

3.3 Hardware Components and Connections

The components used in the project involves 2 PIR sensors, servo motors, LCD(I2C), LOLIN (WEMOS) D1 (ESP8266), breadboard, connecting wires.

S.No	Components	Specifications	Purpose
1)	PIR sensors	HC-SR505 Mini Infrared PIR	To detected motion at entry and exit points
2)	Servo motors	SG90 micro servo	To adjust to certain angle based on the crowd count

3)	LCD(I2C)	16X2 display with i2c interference	To display crowd count, entry and exit status and alerts
4)	Arduino uno	ATmega328P microcontroller	Main controller to process and analyze sensor inputs
5)	LOLIN (WEMOS) D1	ESP8266 Wi-Fi Module	To send crowd data to Things speak via cloud wifi
6)	Breadboard	830 Tie-points (standard)	For interconnecting components
7)	Connecting Wires	Male-to-Male, Male-to-Female	To connect all components (sensors, LCD, servo, etc.) on the breadboard

The connections of the project are as follows :-

1. PIR Sensor Connections (2 units: Entry & Exit)

PIR Pin	Connect To
VCC	5V Arduino UNO
GND	GND Arduino UNO
OUT	Digital Pin

2. LCD (I2C) Connections (16x2 Display)

LCD I2C Pin	Connect To
GND	GND on Arduino UNO
VCC	5V on Arduino UNO
SDA	Analog pin on Arduino UNO
SCL	Analog pin on Arduino UNO

3. Servo Motor (for fan control)

Servo Wire	Connect To
Signal	Digital Pin 9 on Arduino UNO
VCC	5V on Arduino UNO (or external 5V supply if needed)
GND	GND on Arduino UNO

4. Arduino UNO to WEMOS D1 (ESP8266)

WEMOS D1	Connect To
TX	RX on Arduino UNO (Pin 0)
RX	TX on Arduino UNO
GND	GND on Arduino UNO

3.3 WEBPORTAL DESIGN

In this project the web portal used is thing speak its is used as a cloud platform for data storage, the graphs in things speak can be initialized after making a channel. Once the channel is setup, names can be set for these channels. The values send by the esp8266 is stored in Thing Speak and plotted.

For the alert automation mechanism, the projects use Thingspeak's built in MATLAB analysis tool which send email notification when the crowd count exceeds a defined threshold. This is achieved by creating a React in ThingSpeak, the react automatically checks the count value for every single data input and If the reacts finds that

the count surpasses the threshold, the React function executes the MATLAB code to send a Gmail alert.

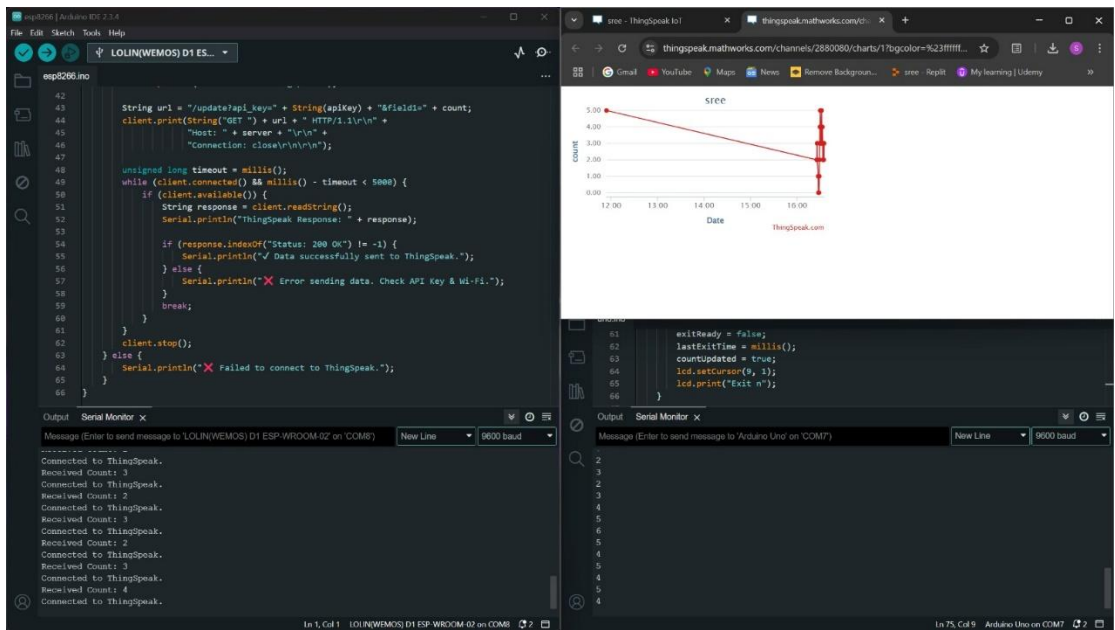


Fig 3.3(1)-Arduino ide with things speak



Fig 3.3(2)-Gmail alert

Chapter 4

RESULTS, DISCUSSIONS & DEMONSTRATION

The project successfully implements a IoT based crowd monitoring system which efficient counts the number of people entering and exiting a room and then sends it to things speak and store it and then graphs it, the project does have its own limitation due the project using a PIR sensor the delay time of the sensor is taking into account and additional delay is given to prevent missed counting or double counting this is displayed in the lcd .Another limiting of the project is the upload time limit of thinks speak the things speak graph takes a time of 15 seconds per every data input .Inspite of all this the project works perfectly and accurately providing satisfactory output.

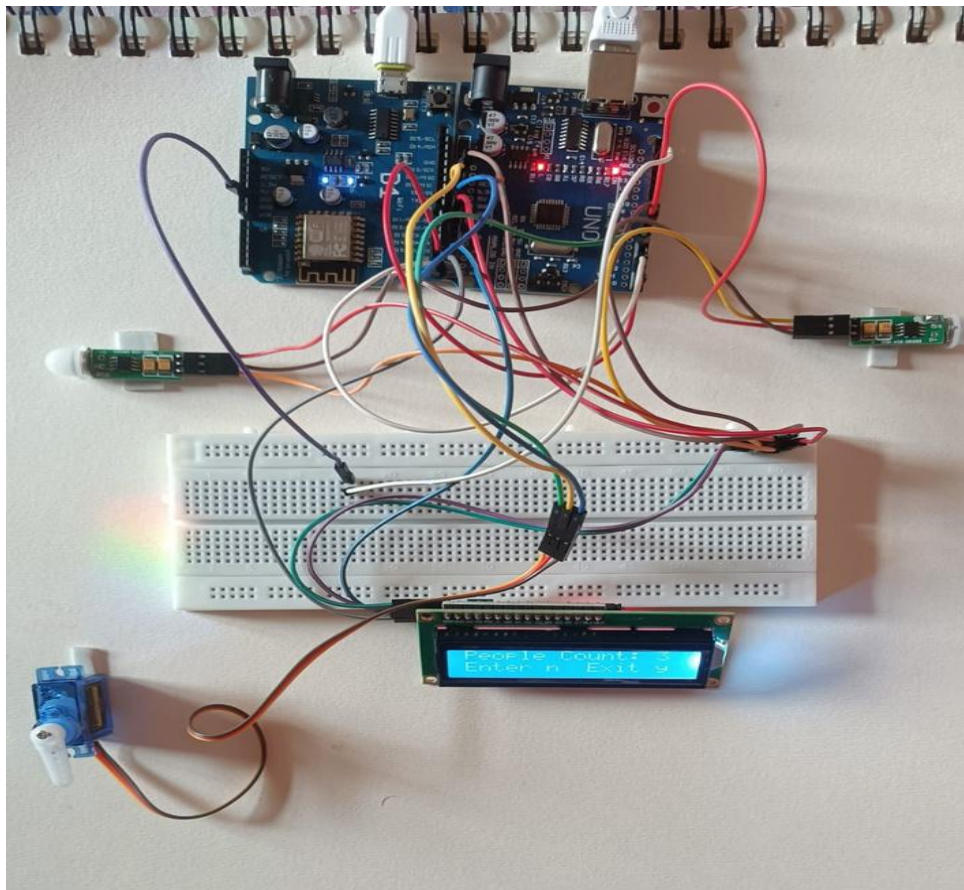


Fig. 4.1 Photograph of the designed model.

Chapter 5

SUMMARY & FUTURE TRENDS

- This project showcase a cost efficient, effective and reliable Iot based crowd monitoring system using Arduino UNO ,ESP8266(WEMOS D1), Thingspeak.
- This project act effectively count number of people entering and exiting a space and updates this data in real–time to the cloud data and an LCD display provides the current feedback to the users, While a Motor adjusts itself based on current crowd count showcasing as a automatic fan control system as an value added feature to this project.
- This project is suitable for small scale monitoring in a controlled places such as rooms, labs or offices

The future trends include:-

- Replacing Sensor from PIR sensor to Camera based systems to improve accuracy and minimize false detections
- Adding security features like RFID or QR code scanning for Entry and detailed Access to an environment
- Advanced cloud platform for increasing frequency of updating real time data
Expanding the system for controlling more entry and exit points
Development of mobile application for real time data for everyone

Chapter 6

REFERENCES & RESOURCES

<https://circuitdigest.com/microcontroller-projects/iot-based-crowd-monitoring-system>

<https://iotprojectsideas.om/iot-visitor-counter-using-esp32-ultrasonic-sensor/>

<https://www.electronicclinic.com/bidirectional-visitor-counter-using-arduino-and-ultrasonic-sensors-counting-visitors/>