International Journal of Computer Sciences and Engineering Open Access
Survey Paper Volume-4, Special Issue-6, Aug 2016 E-ISSN: 2347-2693

# A study of a Visitor Counter with automated entry and exit

Adriza Chattopadhyay[1], Belonia Mukherjee[2], Pritha Rudra[3], Debraj Chakraborty[4]

[1]*Electronics and Communication, Pailan College of Management and Technology, MAKAUT(WB), India*
[2]*Electronics and Communication, Pailan College of Management and Technology, MAKAUT(WB), India*
[3]*Electronics and Communication, Pailan College of Management and Technology, MAKAUT(WB), India*
[4]*Electronics and Communication, Pailan College of Management and Technology, MAKAUT(WB), India*

**Available online at: www.ijcseonline.org**

Received: Jun/30/2016 Revised: July/11/2016 Accepted: July/26/2016 Published: Aug/12/2016

***Abstract*—** The model discussed here is a bidirectional visitor counter .The key features described in the model are i) counting number of people entering and exiting a room using an embedded system ii) using the concept of Infra Red sensor modules (TSOP sensor) and servo motors.[1]The embedded system used here is an Arduino Uno board. It is a microcontroller (Atmega328) based board having 14 digital pins (out of which some are PWM pins) and 6 analog pins. The Arduino have been programmed using EMBEDDED C. The detection of people entering or leaving is done by the IR modules. The concept of servo motor has been used for the opening and closing of the gates at the entrance and exit. Finally the entire counting process is done by the arduino and the final number of people inside the room at a particular instant of time is displayed in the serial monitor of the Arduino IDE (Arduino programming Interface) and can be seen using a laptop or personal computer.

***Keywords*—**Arduino UNO; TSOP IR sensor module; Servo motors; Embedded C Programming

## I. INTRODUCTION

The model mainly focuses on the security maintaining aspect in our lives. In our model we have prepared a model of a huge room using scrap metal. It consists of two doors like openings, one for entrance and the other for exit. Two combinations of a thin scale outline package[2](TSOP) infra red sensor module and a micro servo motor (SG90-9 gram) are each placed at the entry and the exit door. The output pins, ground and positive pins of the components are connected to the Arduino board. When a person enters or exits, the sensor modules detects obstruction and sends the signal to the system, which then analyses it and opens the required door, entry or the exit using the servo motor automatically. The program of the arduino board is such that it counts the number of people entering and exiting the room and calculates the number of people present in the room at any given instance of time. The corresponding output is obtained in the serial monitor of the arduino programming interface.

## II. METHODOLOGY

The functioning of our model can be explained by dividing it into three parts according to the three components used- the arduino UNO board, the TSOP sensor module and the micro servo motor.

Corresponding Author: *Adriza Chattopadhyay,*
*Department of Electronics and communication, University of West Bengal , India*

### *A) Arduino UNO board*

Arduino UNO is a microcontroller based board, which can be used independently without any further components for a large number of models. Using only a microcontroller is a very difficult work as it requires a burner kit to burn the program in it. Also the program needs to be written in machine language, which is very complicate. Along with this peripheral devices and other components need to be connected to the microcontroller whereas the arduino UNO comes with all the required components embedded in a single board. The programming interface, Arduino Integrated Development Environment (IDE) is available freely in the internet. Program can be written in Embedded C language and can be uploaded directly to the board through USB port. The Arduino Uno [24] is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins, of which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller. It simply needs to be connected to the computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.[7]In our model the arduino UNO controls all the other components. The program in the arduino programming interface reads the reading of the TSOP sensor module and processes it to determine whether to open the gate and also which gate to open. The opening and closing of the gates (servo motor) is also controlled by the arduino. Also counters are set in the program to count the number of people entering and leaving and

correspondingly compared to give the real time count of people present in the room. Hence the Arduino UNO is the complete processing unit of our model.

*B) TSOP Sensor Module*

We have used two TSOP-OBSD single or thin scale outline package – obstruction detection modules. One of the modules is placed at the entrance and the other is placed at the exit. The module consists of a TSOP receiver and an IR LED emitter pair. The TSOP receiver always detects a signal of fixed frequency so error due to false detection of ambient light is negligible. The module consists of a 555 IC, working as an astable multivibrator. There is also a potentiometer in the module which is used to control the range of obstruction detection. The output of the module is high whenever it receives a fixed frequency otherwise it is low. Hence whenever there is an obstruction the output of the sensor module is high. This output is further processed by the arduino UNO board.

*C) SG90-9 gram Micro Servo Motor*

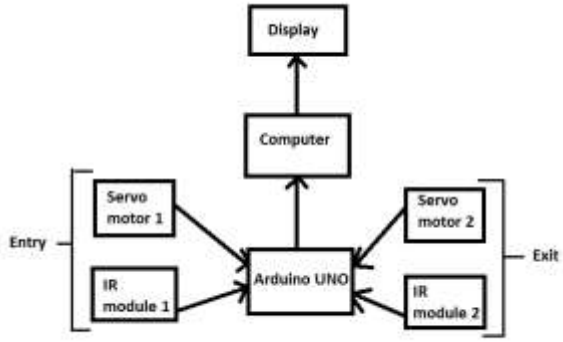
[3]A servo motor is an electronic motor consisting of a Dc motor, gears, a potentiometer and a circuit. The circuit along with the potentiometer makes the servo to rotate as required. The gear mechanism present inside the servo motor takes high input speed of the Dc motor (fast) and at the output, a slower speed is produced as required, which can be used practically throughout. We have used SG90-9 gram micro servo which is a position rotation control servo motor. It is tiny and weighs 9gram and has high output power. This Servo motor can rotate approximately 180 degrees (90 in each direction).[6]We can use any servo code, hardware or library to control these servo motors. We do not have to make a gear and motor arrangement manually for our model purpose. It comes with a 3 horns (arms) and hardware. In our model we have used two such servo motors, one for the entry gate and the other for the exit gate. A metal latch is attached to each of the servo motors. When a person enters and the entry sensor value goes high the angle of the entry latch changes to 90 degree i.e. it opens. Similarly when the exit gate sensor value goes high, the exit gate servo latch's angle becomes 180 degree (since in the opposite direction). The output of the servo motors are attached to PWM pins of the arduino.

## III. IMPLEMENTATION

The basic idea behind the making of this bidirectional visitor counter is to count the number of people entering and leaving a room and finally give a count for the people remaining inside. For achieving this goal we have made use of the following equipments for our model:

- Two IR (infra red) modules.
- Two servo motors.
- Vero board.
- Arduino Uno microcontroller.
- Wires.

Connections made between the different components of our model are shown in the Fig.1 and the set up has been described later.




[8]FIG 1: The block diagram showing the connections between the different components

In fig 1, the arrows are the connections made between the different components. The above is the block diagram of our complete model. In our model the power supply is coming from the computer. We can make the model independent by using batteries to provide power to the arduino board, from which the other components will get the power. The ground connection of the components is also provided by the arduino. The ground of all the components are taken common and connected to the ground of arduino. Finally the outputs of the components are connected to the digital pins of the arduino. The complete detailed circuit of the model is given in fig 2. In fig 1, IR module 1 and Servo motor 1 are at the entry gate and IR module 2 and Servo motor 2 are at the exit gate. The display is the serial monitor of the arduino programming interface. In the Vero board of fig 2, we have made two distinct lines by soldering. [4]One line is the POWER line which is connected to the 5V pin of the Arduino Uno and the other line is the GROUND line connected to the ground pin of the Arduino Uno. The respective ground pin of the two servo motors and the IR modules are connected to the ground line. The VCC connections are made in a similar way through the power line. The output of SERVO MOTOR1 is through the digital pin number 9 of the Arduino Uno. The output of SERVO MOTOR2 is through the digital pin number 11 of the Arduino Uno. The output of the IR MODULE1 is through digital pin number 2 and the output of the IR MODULE2 is through digital pin number 4 of the Arduino. Corresponding to the two IR modules there are two servo motors whose movement control the movement of the gates at the entry

and exit point.IR sensing mechanism is used to sense the presence of visitors and the whole counting process is done by the microcontroller. When constant light falls on the IR sensors (that is in absence of any interruptions) the output from the sensors would be a logic low signal in this case. In case of any interruption (due to a person crossing the path), the light would cease to fall on the module and the output from the sensor would be a logic high signal. [5]This transition from lo to hi for each IR module is detected by the microcontroller and accordingly the count is incremented at the entry module, similarly the count is decremented at the exit module. The entire setup model has been made to look an open top room with two doors (one entry point and the other is the exit point). This model has been made using metal welded to bring the desired shape. The required program is fed to the Arduino via a laptop. Now one IR module is placed at the entry point, when it detects a person entering , it blinks showing it has detected an obstacle, the servo motor corresponding to entry point rotates 90 degrees, the person goes in as the gate opens, count is incremented by one. Now at the exit point, when a person is leaving, the exit point IR module blinks indicating a hindrance, likewise count is decremented. The second servo motor rotates 90 degrees and the gate opens, the person leaves. The calculation is done by the microcontroller, and after subtracting, we see the final output that is total no. of people in the room = people entered – people exited.

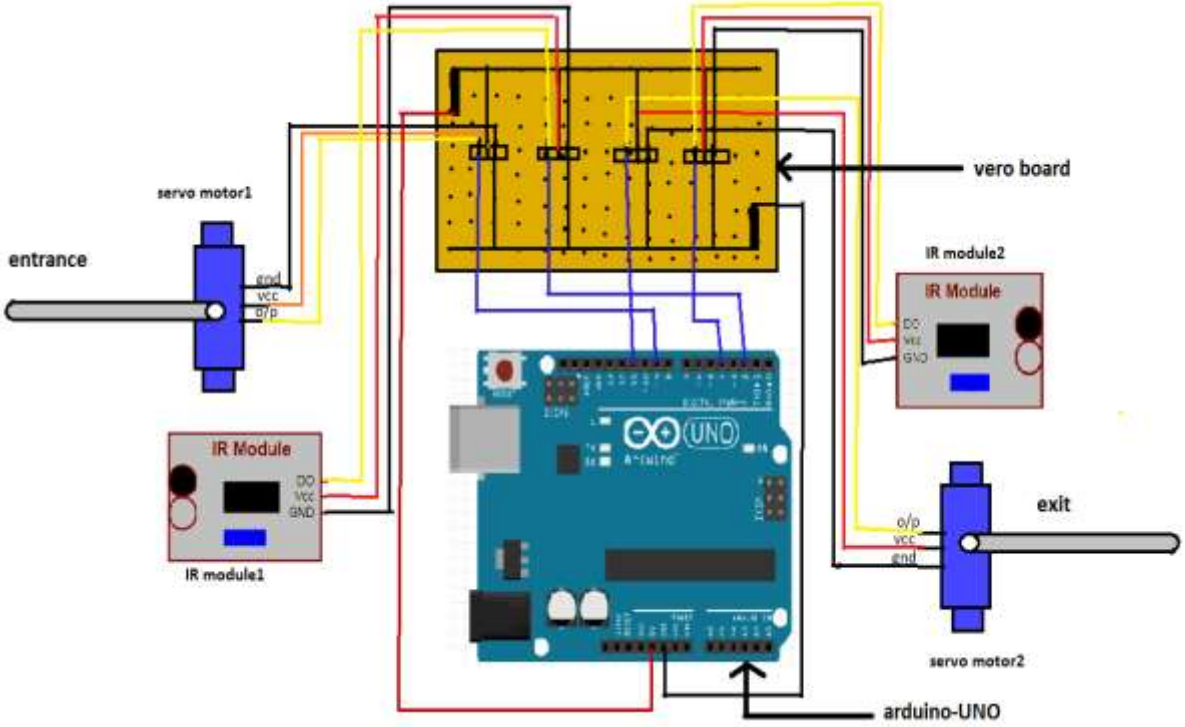



FIG 2: Complete circuit design of our model

## IV. PROGRAM

Fig 3, is the complete flowchart of the program used in our model. The code for this model has been developed after facing a lot of challenges. The objective was to develop an error free code that can calculate and give the number of people present in a room at every instance of time. In a huge hall where hundreds of people are present it is not humanly possible to determine the number of people entering and exiting constantly. So our code will serve the purpose and will accurately determine the number of people entering, exiting as well as the number present at a given instance of time. In our model we have prepared two automated doors, one for entrance and the other for exit. The opening and closing of the doors are done with the help of servo motors. We have connected a latch to each of the motor which would only open when a person will want to pass through them. Two sensors are placed, one in front of the entry servo latch and the other in front of the exit servo latch. The advantage of using this combination of servo latch and sensors is that no person will be able to exit through the entry gate or enter through the exit gate. Since the entire system is controlled by Arduino-UNO, the code is prepared in the open source Arduino IDE software which is available freely. [9]The code is written in Embedded C programming language. For using servo motors, first we have to include

the servo motor function in our code, #<include servo.h> is the code line for this purpose. After this, since there are two servo motors, two objects one for each of the motors are created. Then the variables are declared and initialized. Record of all the variables is given below. These are done in outside the setup() method because these are global type variables and are needed throughout the code in both the setup() and loop() method.

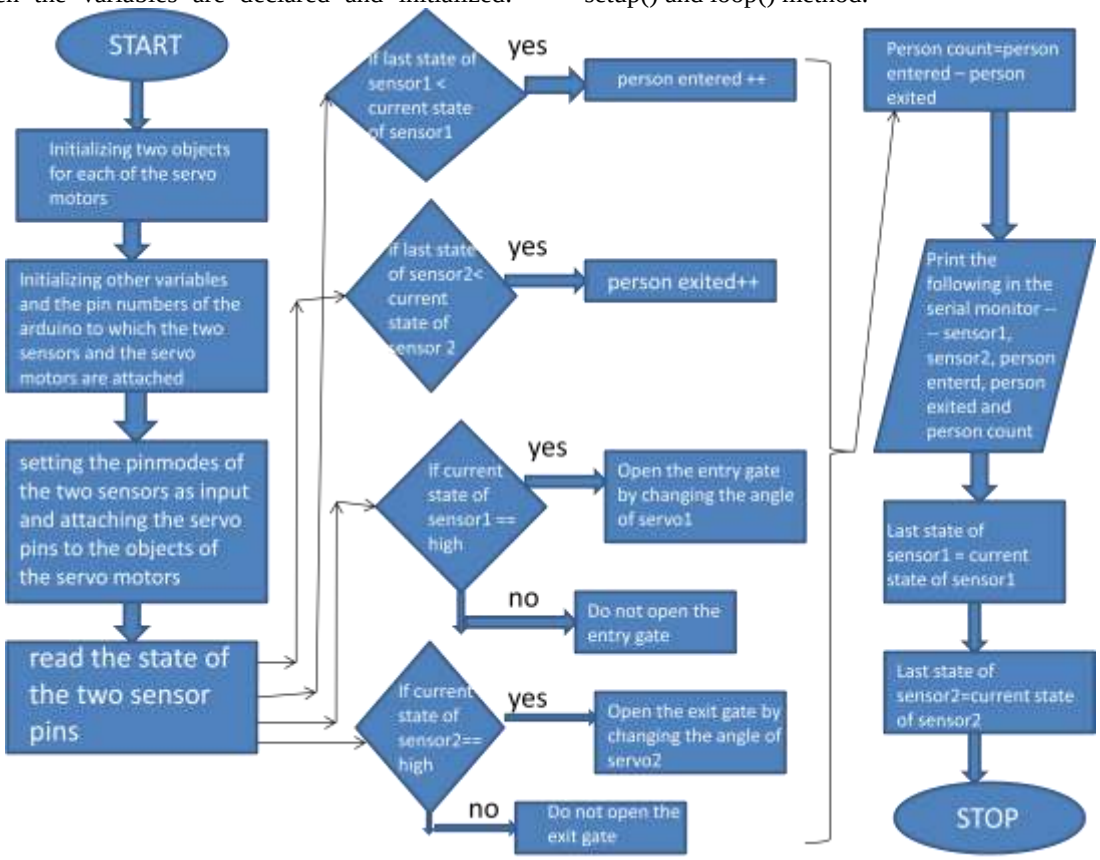



FIG 3: Complete flowchart of the program

**TABLE 1: list of variables and their description used in our program**

| SL.NO | NAME | TYPE | PURPOSE |
|---|---|---|---|
| 1. | Myservo1 | object | Object of entry servo motor |
| 2. | Myservo2 | object | Object of exit servo motor |
| 3. | Laststate1 | integer | Last state of entry sensor |
| 4. | Laststate2 | integer | Last state of exit sensor |
| 5. | personentered | Integer(counter) | Increasing by 1 every time a person enters |
| 6. | personexited | Integer(counter) | Increasing by 1 every time a person exits |
| 7. | personcount | Integer | Number of person present in the room at a time (personentered - personexited) |
| 8. | TSOPin1 | integer | Storing the pin number of arduino to which output of sensor 1 is connected |
| 9. | TSOPin2 | integer | storing the pin number of arduino to which output of sensor 2 is connected |
| 10. | ServoPin1 | integer | Storing the pin number of the arduino to which output of entry servo motor is connected |

| | | | |
|---|---|---|---|
| 11. | ServoPin2 | integer | Storing the pin number of the arduino to which output of exit servo motor is connected |
| 12. | Sensorbit1 | integer | Reading and storing the state of sensor 1 |
| 13. | Sensorbit2 | integer | Reading and storing the state of sensor 2 |

## V. RESULTS

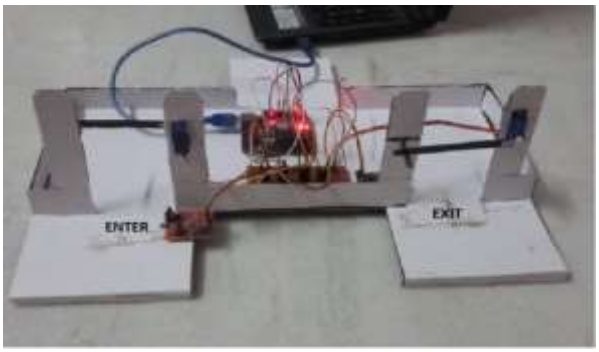



**FIG 4: the complete model of our model**

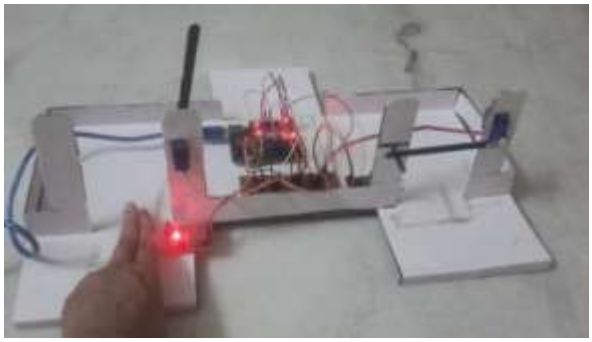


**FIG 5: The entry gate sensor detects obstruction shown by glowing of red LED and the gate opens**

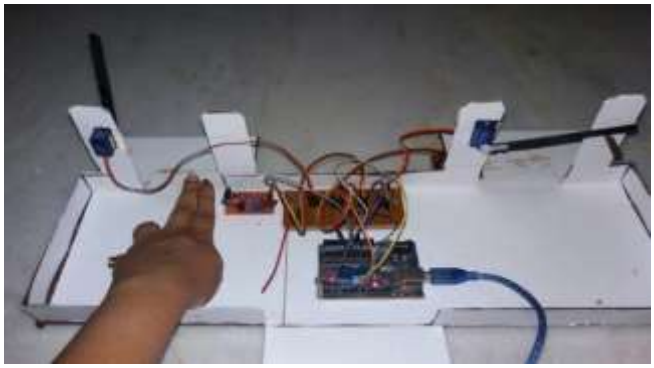


**FIG 6: Opening of exit gate when the sensor detects obstruction**

## VI. CONCLUSION

After several rounds of intense trial and error the model was finally complete. Bidirectional visitor counter is a very small portion of a massive technological model regarding security systems. Experiments for further development on security management are being carried out.[10]However technology is not always error-free and it is due to the presence of these errors scientists are taking the initiative to bring about more advancement so that a country can boast of its skills in the field of science. The most challenging part was the execution of the entire program that needed to be uploaded to the arduino board in order to make the mechanism work. The hardware part basically consisted of sensor boards, servo motors and the arduino connected by wires and jumpers where we faced the problem of faulty and loose connections but ultimately managed to overcome such obstacles as well. Basically we came up with the idea of visitor counter with the sole intention of drawing attention to that technology which may sound quite simple but requires an immense of concept of both hardware and software in order to put up a proper security system. After doing a bit more of study we came to know that this model can be further made advanced if an Optical Character Recognition (OCR) program is included which will read the number plate of a vehicle and create a database for the entry and the exit of the same. This model not only helped us in acquiring knowledge of the future scope of this concept but also increased our hardware handling and coding skills which will prove to be of ample help for our career purposes.

## ACKNOWLEDGMENT

We would like to thank our college, Pailan College of Management and Technology, for giving us the opportunity to write this paper. We would like to extend our gratitude to all the faculty members of the department of Electronics and Communication for helping us in every step.

## REFERENCES

[1] Kadam Shah, Prakash Savaliya and Mitesh Patel, "Automated roomlight controller with bidirectional visitor counter", IJICTRD – International Journal of ICT Research and Development | Vol-1 Issue-4 | ISSN: 2395-4841

[2] Bader M. O. Al-thobaiti, Iman I. M. Abosolaiman, Mahdi H. M. Alzahrani, Sami H. A. Almalki, Mohamed S. Soliman, "Design and Implementation of a Reliable Wireless Real-Time Home Automation System Based on Arduino Uno Single-Board Microcontroller", international journal of

control, automation and systems vol.3 no.3 july 2014 issn 2165-8277 (print) issn 2165-8285 (online)

[3] Alicia M. Gibb, "New Media art, Design, and The Arduino Microcontroller a Malleable Tool", A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science, February 2010, unpublished.

[4] Chinmay Kulkarni, Suhas Grama, Pramod Gubbi Suresh, Chaitanya Krishna, Joseph Antony, "Surveillance Robot Using Arduino Microcontroller, Android apis and the Internet", 2014 First International Conference on Systems Informatics, Modelling and Simulation.

[5] Drew Newell "Method for Powering Arduino Microcontroller and Shield using a Battery", unpublished.

[6] Pavel Vařacha , Nicos Mastorakis , Roman Jašek , Martin Pospíšilík, Bronislav Chramcov , David Sámek, "Technical Devices for Supervising of a Household via Interned Based on Arduino Microcontroller", unpublished.

[7] Mejdl Safran and Steven Haar, "Arduino and Android Powered Object Tracking Robot", unpublished

[8] Deepti Malviya, Suman Sharma, "Design And Development Of Walking Bipedal Robot With The Help Of Arduino Controller", Issn: 2277-9655 (I2or), Publication Impact Factor: 3.785 (ISRA), Impact Factor: 2.114

[9] Rodriguez, K., Crespo, J, Barber, R.,"An android interface for an arduino based robot for teaching in robotics", The 6th international conference of education, research and innovation, at sevilla.

[10] Justus Beyer, Richard Varbelow, Jan-Niklas Antons , Steffen Zander ,"A Method For Feedback Delay Measurement Using a Low-cost Arduino Microcontroller", unpublished.

**AUTHORS PROFILE**

Adriza Chattopadhyay , completed schooling from Nava Nalanda High School, Kolkata and pursuing B.Tech from Pailan College of Management and Technology(MAKAUT, WB)

Belonia Mukherjee, completed schooling from M.P.Birla Foundation Higher Secondary School, Kolkata and pursuing B.Tech from Pailan College of Management and Technology(MAKAUT, WB)

Pritha Rudra, completed schooling from Carmel High School, Kolkata and pursuing B.Tech from Pailan College of Management and Technology(MAKAUT, WB)

Debraj Chakraborty, completed his Master of Technology in Radio Physics & Electronics from University of Calcutta in the year 2010. Before that he had completed M.Sc. in Electronic Science from the same University in 2008.He has publications in the field of MM wave. Presently he is involved as an Assistant Professor in ECE of Pailan College of Management & Technology under Maulana Abul kalam Azad University of Technology-West Bengal since 2012.