

Study on

**Bi-directional counter system**



**Submitted by:**

**NAME: SANDEEP PRADEEP**

**BATCH: 1**

**ROLL NO: CSE-048**

**GROUP: 3**

Under the Guidance of

# DR. HARINATH AIREDDY

REPORT

***ON***

***PROJECT…***



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# ABSTRACT

The main intention of a Bidirectional counter system is to design a system wherein the number of persons entering or leaving a Food Court, or any enclosed area is kept track of and displayed on a LCD.

This circuit will count the number of people entering and exiting the Food Court. This count will be very accurate as an Arduino Board is utilized and it will beep a warning using a buzzer if the total number of people exceed the limit. The Arduino will get signals from the IR Sensors and the underlying programming code will help in determining the count. The Infrared Sensors will continuously check for any person passing through the door, entering or exiting.

The system is designed to use at places like food courts or even laboratories and classrooms where the intensity of crowd is intermediate, and the data maybe stored to cloud for future use and maybe monitored live as well.



# INTRODUCTION

We are in a world of digital transformation. In every aspect technology is one common thing people depend upon. If we look back in the 1970s, people used to count visitors manually by counting them or they used a manual tally counter. The human counter was unreliable as it was inaccurate most of the times, plus it came at great costs. It may be confusing for a person to tally and keep track of total number of people entering and leaving at the same time.

But today we can see that numerous methods have been introduced to count people without the need of any human presence. In our system we use an Arduino Board which is an open source microcontroller board enhanced with Infrared Sensors which provides much better results than traditional systems with less complexity and better efficiency.



# OBJECTIVE

The main objective of our system is to count and keep a track of total number of people entering or exiting an enclosed area. Since the onset of the Pandemic, Social Distancing has become an utmost priority. This device will help us count and limit the number of people in enclosed areas to ensure their safety.

The sensors used in the circuit are very efficient and can be installed in various kinds of places such as classrooms, auditoriums, libraries, malls, banks, seminar halls, stadiums, lifts etc. where monitoring the number of visitors become an essential need. With this device we can ensure that the total number of people present do not exceed the prescribed limit.

This information would not only help to limit the number of people but also help rescue teams to ensure that all the people have been retrieved during any mishap such as the collapse of a building or a fire incident.



# METHODOLOGY

The micro-controller-based visitor counter is designed to respond to the flaws in the operations of the existing counters. The design in its sense has three main sections and circuits. These include detection section (IR sensor circuit), microcontroller section, alerting section. The main component of our system is the Arduino Board along with Infrared Sensors and Buzzer.

* ARDUINO: Arduino is an open-source microcontroller board based on ATmega328p microcontroller. It is one of the popular development boards used for experimental purposes and it serves as an intermediate to Internet of Things (IoT). The board consists of other components such as serial communication, crystal oscillator, voltage regulator etc. It consists of 2 KB of RAM, 1 KB of ROM, flash memory of 32 KB and can be easily programmed with the open-source software Arduino IDE. It also includes 14 digital I/O pins for both reading and writing data, and 6 analog pins for reading input.
  + GND (3 pins): Abbreviation for Ground. The board consists of 3 pins and is used as the negative terminal of any sensor or circuit connected to the Arduino.
  + 5V & 3.3V: These pins supply 5volts and 3.3 volts of power to the circuit respectively. Most sensors are designed to be compatible with these 2 voltages.
  + Most sensors are designed to be compatible with these 2 voltages.
  + Power: All Arduino boards require a power source to run on. There are two ways to power the board. The first is by using a USB cable connected to a computer. The board can be powered by connecting it directly to a wall power supply using the barrel jack given. But the voltage of the power source should be in the range of 6-12V.
  + The sensor consists of three pins namely,
    - VCC: The VCC pin is connected to a 5 volts DC supply to power up the sensor.
    - Ground: The Ground pin is connected to ground.
    - Vin: The Vin pin is connected to one of the digital input/outputs (I/O) pins of Arduino.

Once powered up, the sensor transmits IR rays. Whenever there is an obstacle in front of the sensor, the ray will get reflected which is detected by the IR receiver.

* IR SENSORS: An infrared (IR) sensor emits and detects infrared rays. It is used to detect obstacles. An IR sensor consists of IR transmitter, receiver, operational amplifier, variable resistor and a light emitting diode (LED). IR transmitter is an IR LED which emits ray in the range of infrared frequency. IR ray is invisible to us because the wavelength of IR rays (700 nm 1mm) is much higher than visible light.

Our system uses two IR sensors to determine entry or exit depending upon which gives a higher input first.

* BUZZER: A buzzer is used that beeps when the number of people in the enclosed area exceeds the prescribed value.

**WORKING**

The IR sensors are connected to the Arduino board. The system is placed at the entrance point and the power is switched on. The microcontroller continuously monitors the Infrared Receivers. When any object passes through the IR Receivers then the IR Rays falling on the receivers are obstructed. The obstruction occurs under two circumstances. When the first sensor is obstructed before the second sensor it indicates that the person is entering the building and the buzzer beeps to reflect the same. Similarly, the second sensor is obstructed before the first 1 to indicate an exit movement. This obstruction is sensed by the Microcontroller, computed and displayed on system.

The output of the receiver circuit sends high or low signals to the microcontroller. The programmed microcontroller follows the set of instructions written on it. The tally computation (addition and subtraction) is done when it receives low signals from the two IR receivers. It is after this command, which the microcontroller is made to send control signals to the other I/O device.



# RESULTS AND DISCUSSIONS

In our project we have designed and implemented a Bidirectional counter system using the concept of Embedded Systems. The target users of the project can be any one right from a common man to any organization. Let’s say if anyone uses our project for Seminar Purpose then the track record of the persons attending the seminar will give the exact idea about the number of candidates attending and leaving the seminar.

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We are convinced, from the above results, that the bidirectional counter system is highly efficient and economical. There is no time lag in the operation of the system. The system offers most favorable operation since it functions continuously without errors. Its program can also be modified to take additional input depending on the function desired by the programmer. There is no need for human auditor services.



# SCOPE OF THE WORK

The Bidirectional counter system counts the number of people entering and exiting, efficiently and accurately.

* This system can be enhanced in near future by including and implementing a cloud service where in the data from the microcontroller would be stored in cloud. Thus, making the data even more secured and easily accessible to the user or organization.
* A camera may also be implemented in this system for face recognition and body movement tracking
* Powerful industrial IR sensors may also be used for higher accuracy and efficiency
* A notification or SMS system may be added to keep track of visitors on the spot without being present near the device.
* A smaller and a more handier version of this same device can be made so that it can be carried to places where it is required and instantly installed within seconds and completely controlled through a mobile application.



# CONCLUSION

We conclude and make recommendations in this section based on our results.

We re-iterate the following as noted from our discussions of the results in the above section:

* In demonstration of the project, the infrared sensing part used to detect the passage of visitors worked.
* Microcontroller was very efficient in its task performance, thus computation of counts and controlling I/O devices.
* Also, the buzzer was effective in alerting and notifications.

Hence the whole purpose of the bidirectional counter system was successfully achieved and is applicable in the wider scope. Finally, we conclude that the proposed system will count visitors effectively and efficiently by reducing the rate at which error occurs when counting visitors.

As the project was to design and construct a device that would count the exact number of people in a building, the following recommendation however should be considered to ensure effective operation of the digital bidirectional counter system:

* The sensors should be positioned at the entrance in a way not to attract visitor’s attention.
* The device should be installed at a narrow entrance suitable for only one person to pass through at a given time.
* An uninterruptible power supply should be introduced to the system to serve as a backup power supply. In near future, some institutions that deem it necessary to monitor their crowd may no longer rely solely on human auditors and unsophisticated counter systems to tally the number of visitors.



# REFERENCE

The following resources and references were used for the completion of this project:

1. YouTube videos
2. NPTEL course.
3. SWAYAM.GOV.IN



# ACKNOWLEDGEMENT

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