JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Pedestrian flow Counter Using Arduino

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Abstract : This paper presents a novel pedestrian flow counter system designed to accurately track visitor traffic in various settings. The proposed system utilizes advanced infrared sensors and a buzzer alarm to provide real-time counting and alerts. Unlike existing visitor counting methods, our system offers improved accuracy, reliability, and scalability. The system's performance is evaluated through experiments, demonstrating its effectiveness in tracking visitor movements. This research contributes to the development of intelligent visitor management systems, enabling organizations to optimize their operations, enhance security, and improve customer experience.

KEYWORDS: Arduino, IR Sensor, I2C Module, LCD Interface

1. INTRODUCTION:

This cutting-edge system is designed to accurately track the number of visitors entering and exiting a premises, providing real-time updates and alerts. Equipped with advanced infrared sensors and a buzzer alarm, this counter ensures seamless and efficient visitor management. The system's user-friendly interface and clear display make it easy to monitor visitor traffic, while the buzzer introduction provides an audible alert for each visitor. Whether you're managing a busy office building, a popular retail store, or a secure facility, our bidirectional visitor counter is the perfect solution for streamlining your visitor management process.

The rapid growth of urbanization and technological advancements has led to an increased demand for efficient visitor management systems. Traditional visitor counters often rely on manual data entry or unidirectional counting methods, which can lead to inaccuracies and inefficiencies. This paper proposes a novel bidirectional visitor counter system that utilizes advanced infrared sensors and a buzzer alarm to provide accurate and real-time visitor tracking.

This bidirectional visitor counter offers a cost-effective, efficient, and easy-to-implement solution for tracking and managing visitor traffic in various environments such as retail stores, offices, museums, and event venues. The simplicity and functionality of this system make it a valuable tool for improving operational efficiency and gaining insights into foot traffic patterns.

2. LITERATURE SURVEY:

In this, includes all the discussions on research done prior to take up the project and understand the various methods that were used previously. A detailed analysis of the existing systems was performed. This study

helped in identifying the benefits and also the drawbacks of existing systems. Pedestrain flow counter with home automation In this paper The aim of our project is to make a controller based model to count the number of person entering into the room and it lights up the room based on the light intensity of the room and turn on fan automatically where the persons are sitting inside the room. It is made to prevent unwanted electric power waste in schools, colleges, houses and other working places. The buzzer is designed to alert individuals when the room has reached full capacity. Upon hearing the alarm, people will instinctively recognize the situation and leave the room. And by doing this project we can save the time for counting the people and we can control the people in crowed areas.

3. PROBLEM STATEMENT:

Effective visitor management is crucial for maintaining security, safety, and efficiency in various settings, including offices, retail stores, and secure facilities. However, traditional visitor counting methods often suffer from inaccuracies, leading to potential security breaches, overcrowding, and inefficient resource allocation. This paper addresses these challenges by presenting a bidirectional visitor counter system that provides accurate and reliable visitor tracking.

This project utilizes the Arduino platform along with sensors (e.g., infrared sensors, ultrasonic sensors, or light sensors) to detect movement in both directions. The system will update a counter every time a person crosses the threshold, whether entering or exiting. Additionally, a buzzer will sound each time a person is detected, providing an audible cue for monitoring or alerting staff to the movement.

4. EXISTING SYSTEM:

The existing system, known as the Pedestrian Flow Counter, is an innovative solution designed to count and monitor the number of individuals entering and exiting a particular space in real-time. This system operates by utilizing two strategically placed infrared (IR) sensors at the entrance, which detect the direction of movement. When a person enters, the count is incremented, and when a person exits, the count is decremented. This data is then processed by an Arduino Uno microcontroller, which ensures precise calculations and accuracy through the implementation of debouncing techniques to avoid errors such as double counting or negative counts.

5. PROPOSED SYSTEM:

He proposed bidirectional visitor counter system utilizes Arduino, infrared sensors, and a buzzer to accurately track visitor entry and exit. The system features real-time updates, alerts, and calibration for ensured accuracy.

- Advanced infrared sensors for accurate detection
- Arduino board for efficient data processing
- Buzzer alarm for instant alerts
- LCD display for real-time visitor count
- User-friendly interface for easy calibration and maintenance

6. COMPONENTS REQUIRED:

(A) Hardware Components

- Arduino UNO
- Infrared (IR) Sensors (2-3)
- Buzzer
- I2c module
- LCD Display (16X2)
- Breadboard

- Jumper Wires
- Power Supply

(B) Software Components

- Arduino
- C++
- Arduino Library

7. BLOCK DIAGRAM

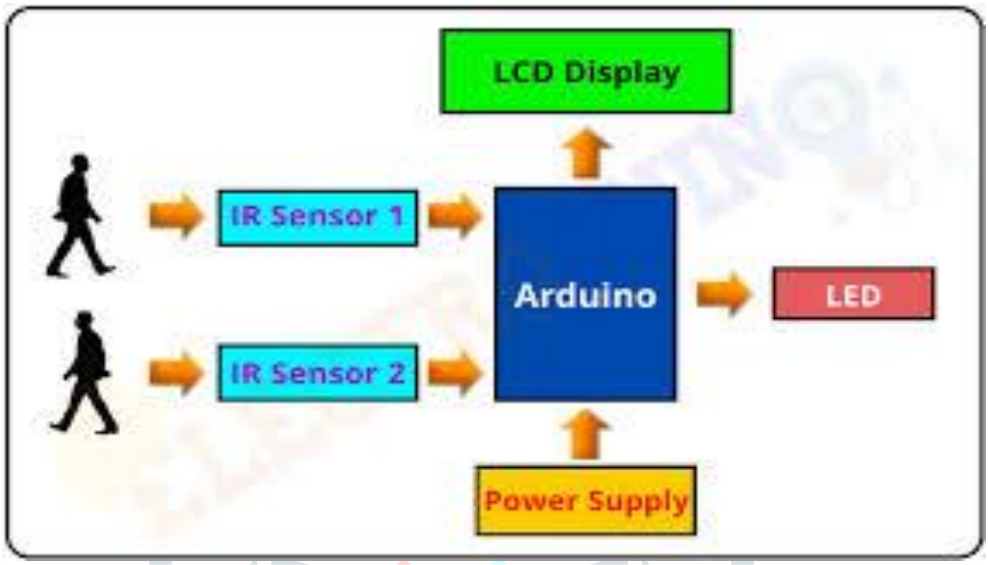
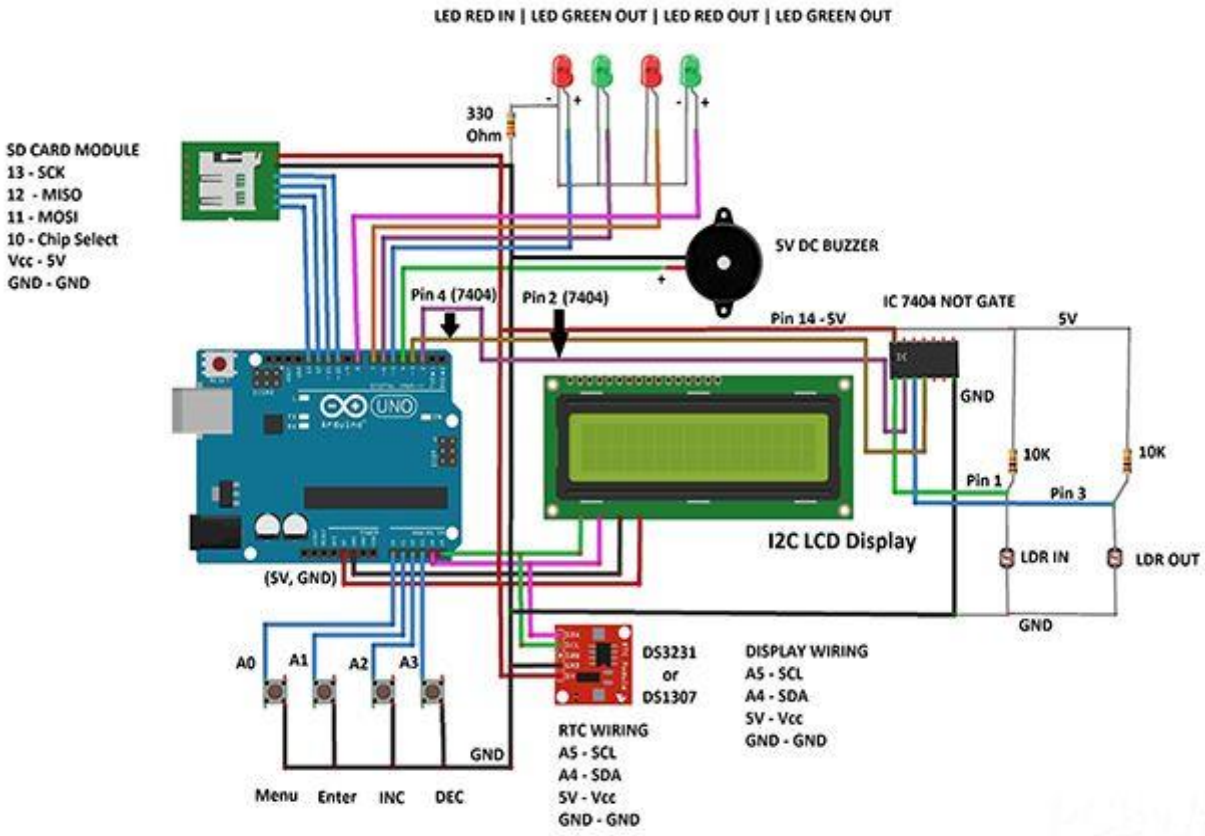


Fig : Proposed block diagram

8. SCHEMATIC DIAGRAM:



9. COMPONENTS DESCRIPTION:

9.1 Arduino UNO:

There are several ways to power the Arduino Uno board. The first is as simple as utilizing a USB cable, which you often get when you acquire an Arduino board, to connect your board to your computer.

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, and a USB connection for programming. Arduino Uno is a popular choice for DIY electronics projects and prototyping. Arduino UNO is a microcontroller board based on the ATmega328P. 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.

There is a Vin pin on the circuit now if you look at the power pins. This pin may be used to supply your board with 7–12 volts. incredibly useful for situations in which you must attach an external power supply straight to your board. It goes without saying that in order to properly use the ground while using the Vin, you must connect it to the ground of the external power supply. Keep in mind that the earth is already included into the USB and DC power jacks and connects to everything you put them in. Actually, the metal portion of the USB connection that you can touch is connected to the ground directly.

9.2 I2C MODULE:

I2C (Inter-Integrated Circuit) is a simple and widely used communication protocol for connecting multiple electronic devices. It uses just two wires (SDA and SCL) to transfer data between a master device (which initiates communication) and one or more slave devices. I2C employs start and stop conditions to frame data exchanges, has built- in addressing to select specific devices, and relies on clock synchronization. It's commonly used in sensors, memory chips, displays, and other components in various electronic systems. The 16x2 I2C LCD display module combines both the LCD screen and an I2C backpack module into one unit. This backpack simplifies the wiring and control of the LCD. • The SDA and SCL pins are used for I2C communication. The SDA line carries data between the microcontroller and the LCD module, while the SCL line provides clock pulses for synchronization.

The VCC pin supplies power (typically 5V) to the display, and the GND pin establishes a common ground reference between the microcontroller and the LCD. • This setup allows you to control the content displayed on the 16x2 LCD easily using standard I2C libraries and functions, making it more convenient and space-efficient compared to directly connecting and managing all the individual pins of a non-I2C LCD module.

You can then use your microcontroller to send text and commands to the I2C LCD display, enabling you to display messages, sensor data, or any other information on the screen with minimal wiring and hassle.

9.3 IR Sensor:

Infrared (IR) sensors are electronic devices that detect infrared radiation, typically emitted by objects in the form of heat or reflected light. In the context of the bidirectional visitor counter, *IR sensors* are used for detecting the presence of individuals passing through a specific area, such as an entry or exit point.

Active and Passive IR Sensors:

1. Active IR Sensors (AIR): These sensors emit their own infrared light, which is then reflected back from objects (e.g., a person passing through). The sensor detects this reflection to register an object’s presence.

2, Passive IR Sensors (PIR): These detect infrared radiation emitted from warm bodies (like humans). These sensors only detect changes in the heat signature of a body entering their field of view, and they do not rely

on reflected light from an external source. However, for this specific project, *active IR sensors* are more suitable for accurate detection of movements in a bidirectional counter system.

9.4 Buzzer:

A buzzer is an electronic device that produces a beep or buzzing sound. It is commonly used as an alarm or alerting device in various applications, including security systems, timers, and electronic circuits. A buzzer is an electronic component that produces an audible sound (or "buzz") when powered. It is commonly used in electronic circuits to indicate a notification, alert, warning, or simply provide sound feedback in a project. Buzzers are often used in devices like alarms, timers, and toys, as well as in microcontroller-based projects like Arduino and the buzzer which consists of active buzzer and passive buzzer.

9.5 LCD display:

Liquid Crystal display or LCD is a flat panel display which uses back light reflector to produce the monochrome or coloured images. In our project it is used to display the count of number of person in the room. A 16x2 LCD (Liquid Crystal Display) is another common option for displaying information. It has a grid of 16 characters (columns) and 2 lines (rows), allowing it to display more detailed information than a 7-segment display. With an LCD display, you can show both the current visitor count and additional information, such as "Visitors Entered: 5" or "Visitors Exited: 3," in a more descriptive format. The display is controlled by the Arduino using a simple interface, typically utilizing an I2C (Inter-Integrated Circuit) module for easier wiring and communication.

9.6 Arduino IDE: A Software in which the programming is done to run the hardware. Programming is written in embedded C language.Arduino programs are run inside Arduino Integrated Development Environment. He Arduino IDE is a software platform designed for writing, compiling, and uploading code to Arduino microcontroller boards. It is an essential tool for developing Arduino-based projects, including the bidirectional visitor counter system

9.7 Arduino Libraries:

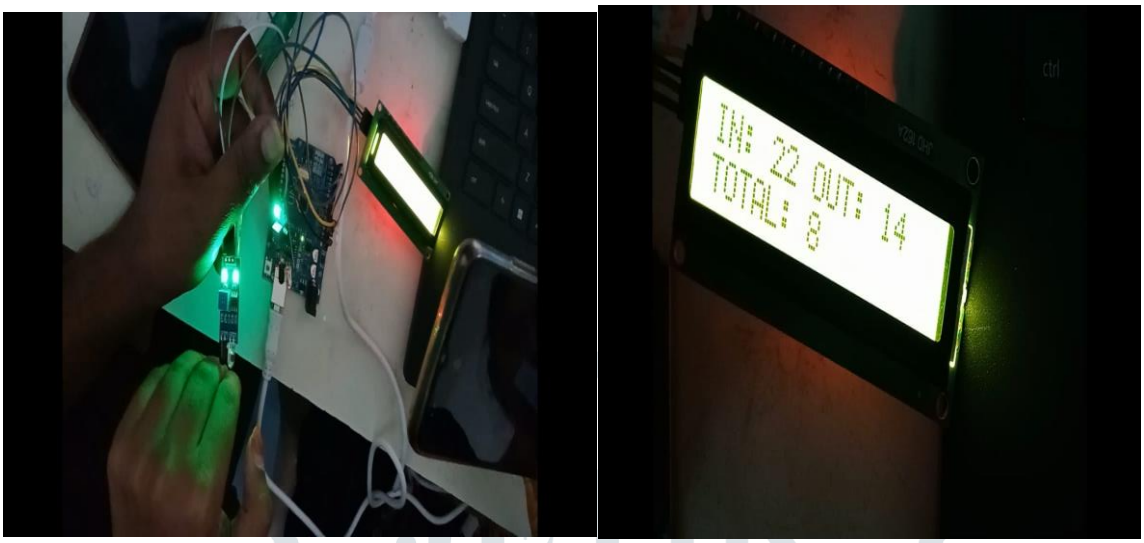
- Simplify complex tasks
- Provide easy-to-use functions for specific hardware components
- Enable communication with external devices and sensors
- Implement complex algorithms and protocols

10. SCOPE OF THE PROJECT:

- Counting visitors entering and exiting a premises
- Displaying the total count on an LCD display.
- Providing audio feedback using a buzzer.
- Automatic detection of visitor movement using IR sensors.
- Real-time updating of visitor count

The project aims to create a simple, efficient, and cost-effective visitor counting system.

I. RESULT:



The Bidirectional Visitor Counter project was successfully implemented using Arduino Uno, IR sensors, LCD display, and a buzzer. The system accurately counts visitors entering and exiting a premises, displaying the total count on the LCD display.

II. CONCLUSION:

The pedestrian flow counter system is a practical and innovative solution to monitor and manage foot traffic effectively in real-time. Utilizing sensor-based technologies and microcontroller integration, the system delivers reliable and accurate counts of visitors entering and exiting a specific area. Its automated design eliminates the need for manual counting, enhancing efficiency and reducing errors. Useful for managing large events, conferences, or exhibitions by monitoring attendee flow and ensuring a smooth experience.

III. FURTURE SCOPE:

- Integration with IoT for remote monitoring via Wi-Fi or Bluetooth.
- Real-time data logging and analytics for trend analysis and optimization.
- Automation of lighting, air conditioning, and access control systems.
- Enhanced accuracy with ultrasonic or AI-powered sensors.
- Scalability for multi-entry and multi-exit monitoring in large facilities.
- Improved user interface with touchscreens and customization options.
- Applications in health and safety for crowd management and alerts.
- Energy optimization using renewable energy sources like solar panels.
- Accessibility features like multi-language support and voice guidance.
- Modular designs and customization for various industries and setups.

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