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To study the bidirectional digital visitor counter with applications

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Abstract
The "Digital Visitor Counter" project relies on the connecting of many parts with an Arduino microcontroller, including sensors, motors, and logic gates etc. Both ways can be counted using this counter. Depending on where the sensor is placed in the mall or hall, this circuit can be used to count the number of people entering a hall, mall, home, or workplace at the entrance gate and to count the number of people leaving the hall by decrementing the count at the same gate or exit gate. Additionally, it can be used at entrances to parking lots and other public spaces. The main objective of this study article is to count and display the number of individuals entering any location, like a conference room, lecture hall, or hospitals.

Keywords: Digital visitor counter, Arduino microcontroller, including sensors, motors

Introduction
Automatic appliances are always needed in the modern society. There is a sense of urgency for the development of circuits that would simplify life's complexity given the rise in living standards. We frequently need to keep an eye on the individuals entering places like shopping centers and hospitals. We will undertake a research paper entitled "To Study Bidirectional Digital Visitor Counter with Applications" with automated room light management to address this issue. There is a visitor counter for this project. The number of people within the hospital is shown on an LCD. The number of visitors entering any conference room, lecture hall, hospital, retail mall, and hospital etc. It may be counted and shown using this paper. This has a two-way effect. This indicates that the counter will be increased whenever a person enters the room and decremented if they depart. It will also automatically regulate the lighting in the room. The primary goal of this research paper is to count and display the number of people entering any space, such as a conference room or lecture hall or hospitals as well as malls and industries.

Components Required
- Arduino UNO R3
- 16*2 LCD Display
- IR sensor
- Relay module
- LM358
- LED
- Resistors
- Potentiometer
- PCB
- Connecting wire

Arduino UNO
An open-source microcontroller development board is called an Arduino UNO. The Arduino platform consists of a hardware programmable circuit board (often known as a microcontroller) and software called the IDE (Integrated Development Environment), which is used to create and upload computer code to the physical board.

A 5V Atmel ATmega328 microprocessor with 2 Kb of RAM, 32 Kb of flash memory for programming, and 1 Kb of EEPROM for parameter storage is featured on the board. With a clock speed of 16 MHz, 300 000 lines of C source code may be executed every second
The board features 6 analog input pins and 14 digital I/O pins.

Power Supply
The UNO board may be operated using a USB connection or an external power source. An AC-to-DC connection (divider wart) or battery can provide external (non-USB) force. The board may operate with an external source of 6 to 20 volts.

Memory of Arduino UNO
The ATmega328 has 32KB (with 0.5 KB involved by the boot-loader). It likewise has 2 KB of SRAM and 1 Kb of EEPROM (which can be perused and composed with the EEPROM library).

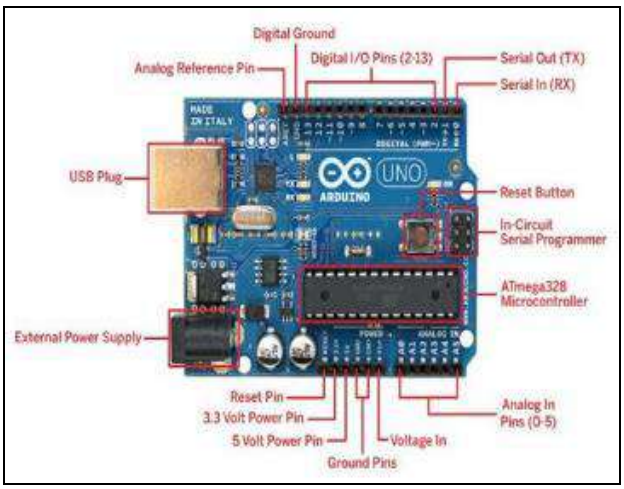

Fig 1: Schematic Diagram of Arduino UNO

Input and Output of Arduino UNO
Digital pins on Arduino total 14. They operate on 5 volts. Each pin includes an inner draw up resistor of 20–50k ohm and may provide or receive 20 mA under specified operating conditions. The maximum current that should not be exceeded on any I/O pin is 40mA in order to prevent permanent damage to the microcontroller. Furthermore, a few pins have specific capacities:

- **Serial:** 0 (RX) and 1 (TX), which is used to get (RX) and transmit (TX) TTL serial information.
- **Outside interrupts:** 2 and 3. These pins can be designed to trigger a hinder on a low esteem, a rising or falling edge, or an adjustment in worth.
- **PWM:** 3, 5, 6, 9, 10, and 11. Give 8-bit PWM yield with the along Write capacity.
- **SPI:** 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins bolster SPI correspondence utilizing the SPI library.
- **Driven:** 13. There is an implicit LED driven by advanced pin 13. At the point, when the pin is HIGH esteem, the LED is on, when the pin is LOW esteem, it's off.
- **TWI:** A4 or SDA pin and A5 or SCL pin. Support TWI correspondence utilizing the Wire library.

The UNO has 6 simple Analog inputs, named A0 through A5, each of which give 10 bits of determination (i.e. 1024 unique qualities).
There are a few different pins on the board

- **AREF:** Reference voltage for the simple inputs. Utilized with analog Reference.
- Reset Convey this LOW to reset the microcontroller. Normally used to add a reset catch to shield, which obstruct the one on the board.

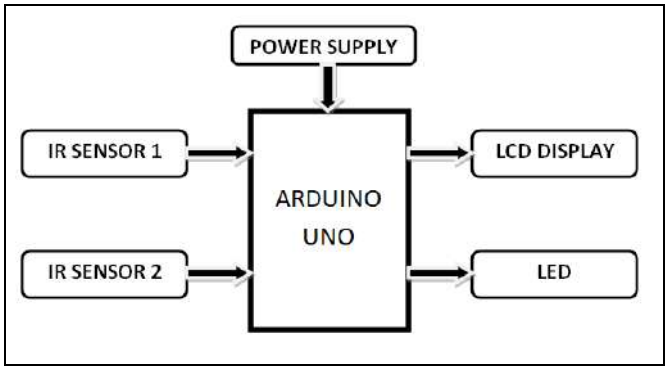

Fig 2: Block Diagram of Arduino UNO Based Counter System

16×2 LCD Display
The word LCD (Liquid Crystal Display) refers to a particular type of electronic display module used in a wide range of circuits and devices, including TV sets, calculators, computers, and mobile phones. Seven segments and multi-segment LED displays are the most popular. The primary advantages of adopting this module are its low cost, ease of programming, animations, and unlimited ability to show bespoke characters, unique animations, etc. The explanations are that LCDs are inexpensive, easily programmable, and have no restrictions on showing unusual and even customised characters, animations, and other content. A 162 LCD display can show 16 characters per line on each of its two lines. Each character on this LCD is presented using a 5 by 7 pixel matrix.

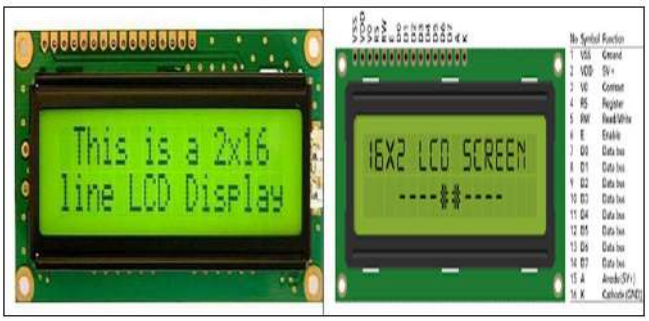

Fig 3: 16*2 LCD Screen Display

There are two registers on this LCD
Command and Data. The command instructions sent to the LCD are stored in the command register. A command is a directive issued to an LCD device to carry out a certain operation, such as initialising it, clearing its screen, adjusting the cursor, managing the display, etc. The data that will be shown on the LCD is kept in the data register. The character's ASCII value, which will be shown on the LCD, is the data.

Infra-Red Sensor

The widely utilized IR sensor is used in a wide range of electronic devices, including line follower robots, alarm systems, motion detectors, and product counters. An IR sensor's essential components are an IR LED and a photodiode; these two components are sometimes referred to as an IR pair or photo coupler. IR sensors operate on the theory that an IR LED generates IR radiation, which a photodiode detects. When IR radiation is applied to a photodiode, its resistance varies. As a result, the voltage drop across the photodiode also changes (like LM358). We are able to detect voltage changes and provide the output appropriately. There are two ways to install IR LEDs and photodiodes: directly and indirectly. IR LED and photodiode are kept in front of one another in direct incidence so that IR radiation can fall directly on the photodiode. Any item placed in between them will prohibit IR light from landing onto the photodiode.

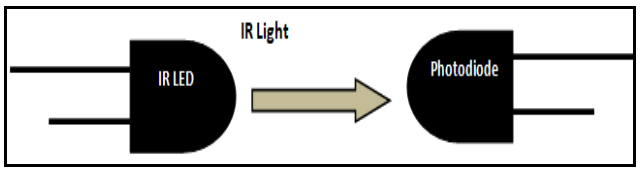

Fig 4: Infra-Red LED

Both the IR LED and the photo diode are positioned in paral lel (side by side) and pointed in the same direction in an indi rect incidence. In this way, an item placed in front of an IR pair will reflect IR light, which will then be picked up by a p hotodiode. Notably, a black object will absorb all infrared li ght rather than reflecting it. In an IR sensor module, the IR p air is typically arranged in this way. The basic components f or creating an IR module are an IR pair (IR LED and Photod iode) and an LM358 with a resistor and an LED.

Photodiode

It is regarded as a light-dependent resistor (LDR), which implies that when light shines on it, its resistance decreases dramatically from its extremely high level when there is no light. A photodiode is a semiconductor with a P-N junction that conducts current in the opposite direction when light strikes it; the quantity of current flow is proportional to the amount of light. It is operated under reverse bias. It may be used for IR detection thanks to this characteristic. A back-color coating on the outside of the photodiode gives it an LED-like appearance.

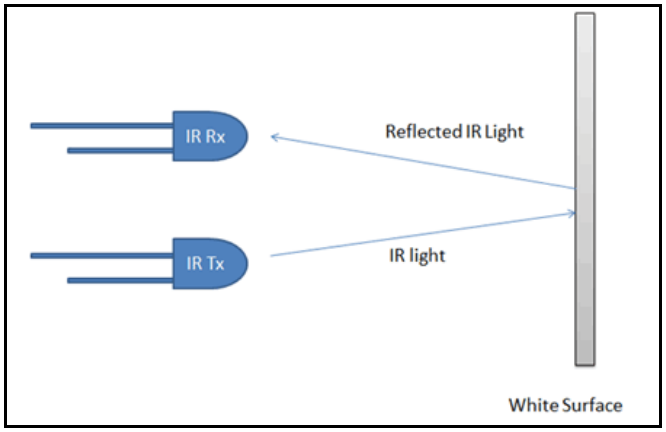

Fig 5: IR Sensor Circuit

LM358

It is an operational amplifier (Op-Amp) and in this circuit we are using it as a voltage comparator. LM358 has two independent voltage comparators inside it, which can be powered by single PIN, so we can use the single IC to build two IR sensor modules. We have used only one comparator here, which have inputs at PIN 2 & 3 and output at PIN 1. Voltage comparator has two inputs; one is inverting input and second is non-inverting input (PIN 2 and 3 in LM358). When voltage at non-inverting input (+) is higher than the voltage at inverting input (-), then the output of comparator (PIN 1) is HIGH, and if the voltage of inverting input (-) is higher than non-inverting end (+), then the output is LOW.

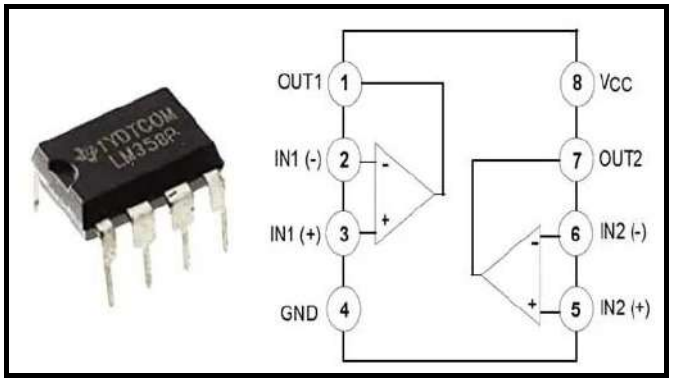

Fig 6: LM358

IR Sensor Module Components

- IR pair (IR LED and Photodiode)
- IC LM358
- Resistor 100, 10k, 330 ohm
- Variable resistor- 10k
- LED (Light Emitting Diode)
- Potentiometer
- Capacitors (Electrolyte and Ceramic)

Working Process

Four components make up this project: sensors, controller, counter display, and gate. The sensor would detect a pause and send a signal to the controller, which would then run the counter either higher or lower depending on whether someone was entering or leaving. The controller also shows counting on a 16x2 LCD screen. When someone enters the room, the IR sensor will be interrupted by the object, and because we introduced a delay, the other sensors won't function either. You can see the all connections in the IR sensor circuit diagram. Photodiode is connected in reverse bias, inverting end of LM358 (PIN 2) is connected to the variable resistor, to adjust the sensitivity of the sensor and non-inverting end (PIN 3) is connected to the junction of photodiode and a resistor. When we turn ON the circuit there is no IR radiation towards photodiode and the output of the comparator is LOW. When we take some object (not Black) in front of IR pair, then IR emitted by IR LED is reflected by the object and absorbed by the photodiode. Now when reflected IR falls on the photodiode, the voltage across photodiode drops, and the voltage across series resistor R2 increases. When the voltage at resistor R2 (which is connected to the non-inverting end of comparator) gets higher than the voltage end, then the output becomes HIGH and LED turns ON. Voltage at inverting end, which

is also called Threshold voltage, can be set by rotating the variable resistor's knob. Higher the voltage at inverting end (-), less sensitive the sensor and lower the voltage at inverting end (-), more sensitive the sensor. This whole circuit can placed on PCB to build a proper professional IR sensor Module.

Circuit Explanation

There are some sections of whole visitor counter circuit that are sensor section, control section, display section, and driver section.

Sensor section

In the section, we have used two IR sensor modules, which contain IR diode, potentiometer, comparator (OP Amp) and LED's Potentiometer is used for setting reference voltage at comparator's one terminal and IR sensor the object or person and provide a change in voltage at comparator's second terminal then comparator compares both the voltage and generate a signal at output. Here in this circuit we have used comparator for two sensors. LM358 is used as a comparator. LM358 has inbuilt two noise Op-amp.

Control Section

Arduino UNO is used for controlling whole process of this visitor counter. The output of comparators is connected to digital pin number 14 and 19 of Arduino. Arduino read these signals and send command to relay driver circuit to drive the relay for light bulb controlling.

Display Section

Display section contains a 16×2 LCD. This section will display the counted number of people in hospital and light status when no one will in the room.

Relay Driver Section

Relay driver consist a BC547 transistor and a 5 volt relay for controlling the light bulb. Transistor is well utilized to drive the relay because Arduino does not supply voltage and current to drive relay. So we added a relay driver circuit to get enough voltage and current for relay. Arduino sends commands to this relay driver transistor and then light bulb will turn on/off accordingly.

Schematic Diagram

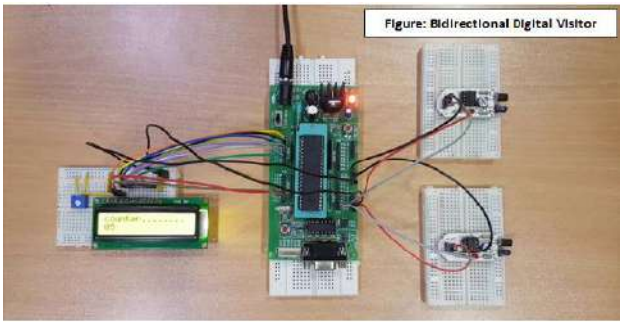

Fig 7: Bidirectional Digital Visitor Counter

Counter

A counter is a device that keeps (and occasionally shows) the number of times a specific operation has occurred in digital logic and computing, frequently in connection to a clock. The most typical kind is a sequential digital logic circuit, which has several output lines and a clock-input line. The binary or BCD number system is represented by the values on the output lines as a number. The value in the counter is increased or decreased with each pulse delivered to the clock input. The usage of counters in digital circuits is fairly widespread. They can be produced as standalone integrated circuits or as a component of larger integrated circuits.

Fig 8: Options in file menu

Program Code

PROGRAM CODE

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(13,12,11,10,9,8);

#define in 14
#define out 19
#define relay 2

int count=0;

void IN()
{
  count++;
  lcd.clear();
  lcd.print("Person In Room:");
  lcd.setCursor(0,1);
  lcd.print(count);
  delay(1000);
}

void OUT()
{
 count--;
  lcd.clear();
  lcd.print("Person In Room:");
  lcd.setCursor(0,1);
  lcd.print(count);
  delay(1000);
}

void setup()
{
 lcd.begin(16,2);
 lcd.print("Visitor Counter");
```

Applications

- This circuit can be used domestically to get an indication of number of persons entering parity.
- It can also be used as home automation system to ensure energy saving by switching on the loads and fans only when needed.

Limitations

- It is ineffective when two or more people cross the door at once since only one person can block the sensor's

light beams.
- We must manually turn off the electricity if someone needs to when they are inside the room. As a result, in this instance, we are unable to automatically regulate the light.

Future Expansion
- By using this circuit and proper power supply we can implement various applications, such as fans, tube lights, etc.
- By modifying this circuit and using two relays we can achieve a task of opening and closing the door.

Conclusion
In today world, there is continuous need automatic appliance will be increase in standard. There is sense of urgency for developing circuit that would ease the complexity of life. Also if someone wants to know the number of person presents in a hospital, so as not to have congestion, the circuit proves to be helpful. The theme of this project when merged with certain established technologies can be quite effective in number of countries like Germany, France & Japan etc, which control the train. This project in developing countries and it has a bright future. This project helps us to control the light the light of a room automatically and counts the number of person/visitor entering and leaving the room. By using this circuit and proper power supply, we can implement various application such as fans, tube lights etc.

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Conflict of Interest
The authors declare that no conflict or any economic interest that exists in our present research work.

Authors Contribution
Both authors contributed to the completion of this work. Author Dr. Shashank Sharma undertakes the manuscript designed and conducted the entire studies, collected and analyzed the research data, and prepared the entire manuscript draft as well as supervised the results-discussion. Similarly, author Dr. Sanjay Kumar Dubey has properly checked the spelling mistake, punctuation, grammatical error, conceptualization, writing, review, editing and helped in computer programming. Both authors read and approved the final manuscript.

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