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Low-Cost Arduino-Based Counter System

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Abstract

A useful tool for counting the number of persons entering or exiting a room is an automated counter system. The goal of this research is to present a novel approach that can count people automatically. With the aid of ATmega328P internal code, it intelligently determines and counts the number of individuals. The number of obstacles that pass in front of the IR sensor in a single direction is counted in this project. A 16x2 LCD display module shows the count number or the total counts value. The module consists of an IR LED emitter and an IR photodiode detector. In this project, we are utilizing an active infrared sensor. It produces a high output when it detects an object inside its detection range, and a low output otherwise. Rotating the built-in trim pot will also change the sensor's range. When something moves in front of it, the count starts at zero and increases by one.

Keywords: ATmega328P, IR Sensor, 16x2 LCD Display Module.

1.Introduction

Our world is changing rapidly due to digitalization. People rely on technology in all aspects of their lives. When the 1970s rolled around, many still counted visits by hand or with the aid of a manual tally counter. However, as we can see today, a variety of techniques have been developed to count people without requiring human presence. The cameras and sensors will make it easier for us to count the people. All we have to do is program them to complete the necessary work. Hiring someone to stand and manually count the number of visitors or employees who enter or leave the event or place is the main technique of visitor counting. Even the tally counters lack features and are not very user- friendly. Not even the tally counters are very user-friendly or offer many benefits. Consequently, these approaches show to be costly and unreliable. For those who work in customer-facing industries, measuring visits has become a crucial responsibility in recent years. Administrators use the number as a measure to gauge client happiness. So, people started looking into ways to count people without any problems and effectively. Many techniques have been developed since then and are currently employed globally in a variety of industries. Every approach has certain drawbacks, too, so the administrators must choose the most effective way to tally visitors. Even though one approach might be very costly, it might be effective. Another may be more affordable and practical, but it may not be as effective. In this project we have used Arduino UNO which detects the movement by the help of infrared wave which is being transmitted by the IR emitter continuously. Whenever any object comes in front of the infrared wave then the wave is reflected back to the IR receiver which gives a signal to the Arduino UNO by the help of coding and the LCD screen shows the counting.

2.Literature Review

Martins Adekanmbi et. al has proposed in their work a production line counter was designed, and also applies CAD approach to ensure minimal errors during construction [1]. J. Singh et. al have proposed model which describe how to minimize the road accident on the curve roads by using a model which uses IR sensors that will sense elements for the vehicles coming from either side of the road using IR sensor connected with Arduino Uno software to alert drivers about the vehicles coming from either side of the road [2]. M.C.Krishna attempts to provide a unique solution which can automatically count the number of people. It intelligently discovers and counts the number of people with the help of internal code from the Arduino UNO [3]. Norsahida Kamal and Norlela Ishak have proposed a system comprises two (2) Infrared (IR) sensors that are connected to Arduino UNO for entrance detection. It will capture the total number of customers or shoppers in and out of the premises [4]. S.A Ajayi et. al have suggested a design, which was fabricated with Infrared transmitter and receiver, Microcontroller, LCD (Liquid Crystal Display), Oscillator, Connecting Wires, Mother board, Batteries, Capacitor, Resistor, and Pyrex plastic and test an infrared traffic counter on the selected major dual carriageways in Akure

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metropolis [5]. This design is complicated, and the cost of this design is high. The use of infrared sensors was another strategy put out by Jothibasu M et.al [6]. Infrared sensors are essential for item identification. This approach uses two infrared sensors positioned next to each other to detect visitors. "The counting process's logic is straightforward: it detects an increase in the count when a person crosses the sensor close to the door and then moves the sensor away. "This technology is not only a bi-directional counter, but it can also be used to control household appliances and reduce electricity consumption. More than one individual cannot be detected at once with this method. Only one person will be detected by the system if two people go through it simultaneously. In our project we have used a microcontroller, 12C module, LCD, IR sensor and connecting wire thus the cost of the system is low, and the circuit is less complicated.

3. Methodology and Model Specifications

3.1. Methodology

The emitter is an IR LED, and the detector is an IR photodiode. The IR photodiode is sensitive to the IR light emitter by an IR LED. The IR transmitter continuously emits the IR light, and the IR receiver keeps on checking for the reflected light. If the light gets reflected back after hitting an object in front of it the IR receiver receives this light. This way the object is detected in the case of the IR sensor and the number of objects is displayed on the LCD screen.
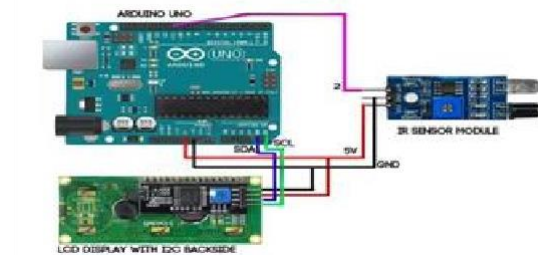
3.2. Circuit Diagram

Fig-1 Circuit Diagram of Mini IR Counter

3.3. Construction

Arduino UNO:

An ATmega328P-based microcontroller board is the Arduino UNO. It features six analog inputs, a 16 MHz ceramic resonator, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a set button. It has everything required to support the microcontroller; all you have to do to get it going is use a USB cable to connect it to a computer or an AC-to-DC adapter or battery to power it.

Fig 2: Arduino UNO board

12CModule:

Two lines—the Serial Data Line (SDA) and the Serial Clock Line (SCL)—can be used by two devices to communicate with one another utilizing a bidirectional protocol thanks to an I2C module. With as few I/O pins as feasible, this communication is fast, reliable, and stable. Via the serial data line, the controller device can establish a connection with any target device by sending a distinct I2C address. A built-in I2C chip in certain I2C modules, such as those used with 16x2 character LCD displays, transforms serial data into parallel data for the display, there are two default I2C addresses that these modules normally have by looking at the black I2C adaptor board located on the module's underside: 0x27 or 0x3F.
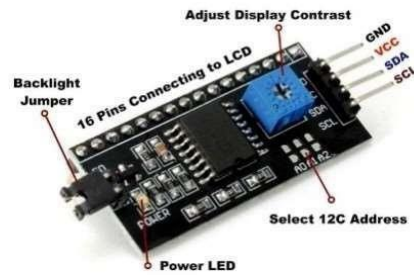
Fig 3: 12C Module board.

16X2 LCD:

A 16-character, 2-line display on a 16x2 LCD module is described in the document. It can be connected to development devices such as the elab628 or elab40 and display outputs. In order to create characters and timing for the display, the LCD module includes its own controller and memory. It can communicate using four or eight bits, and it needs to be setup by sending commands to set up parameters including data bus width, character font, and on/off settings. To transfer information and commands between the controller and data bus, it makes use of three control lines: Enable, Register Select and Read/Write. The LCD module connects to electronics goods via a ten-pin header and can be altered for various uses.

Fig 4: LCD screen.

IR Sensor Module:

A specialized LED that emits infrared light with a wavelength of between 700 nm and 1 mm is called an infrared light-emitting diode, or IR LED. Similar to how different LEDs produce light with different colors, different infrared LEDs may produce infrared light with varying wavelengths .A gadget known as an IR sensor makes use of infrared technology to identify objects or environmental changes. Many different physical characteristics, including closeness, motion, and temperature, can be detected by infrared sensors. Gallium arsenide or aluminum gallium arsenide are typically used to make infrared LEDs. In addition to infrared receivers, these are frequently employed as sensors. An infrared LED has the same appearance as a regular LED. It is impossible for a person to see infrared radiation since the human eye cannot detect it.

Jumper Wires

Simply put, jumper wires are wires having connector pins on either end that can be used to join two places together without the need for solder. Typically, jumpers are used in conjunction with breadboards and other prototype equipment to facilitate the easy modification of circuits as needed.

Fig 6: Connecting wire.

3.4. Project Budget

Sl.No	Required Equipments	Specification	Budget(Rs)
I	Arduine UNO	ATmega3282	759
2	12CModule	COGLCD 16x2 Chance LCD 5 x 8 dots includes CHISE IC: ST7032 Power Supply 3V/5V 1/16 day cycle	140
3	16x2 LCD	Operating Voltage 4.7V to 5.3V Operating Current ImA (without backlight) Can display (16x2) 32 Alphanumeric Characters Works in both 8-bit and 4-bit Mode	220
4	IR Sensor Module	Board Size:32"1 4cm Working Voltage 3. Vto5V Operating Voltage 3v. 23mL 5v:-33mA	139
5	Jumper Wires	As per required	100
	Total		**1348**

3.5. Hardware Model

Fig-7 Hardware Model Structure

4.Result

Mini IR counter is designed to count the number of persons crossing it. This counter can be placed in front of a door so that it can count the number of people entering or exiting the room. The infrared transmitter emits light continuously, while the infrared receiver never stops looking for reflected light. The light is detected by the infrared receiver if it is reflected back by an item in front of it. In the case of the IR sensor, the item is detected in this manner.The LCD screen shows the number of people crossing the door.

5.Conclusion

The counter circuit is designed using a microcontroller, 12C module, LCD screen, IR sensor, and connecting wire to count the number of people crossing the circuit where we have achieved almost 90% accuracy, and the counting is shown on the LCD screen.

6.Future Scope

- By modifying this circuit and using two relays we can achieve a task of opening and closing the door .

- We are also trying to modify the system by incorporating the traffic signaling system which can detect some special vehicles like ambulance and the IR detector receives the signals and turn the traffic signal into green automatically.

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