Person count detention to keep everyone safe during the pandemic using Embedded Systems.

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in Electronics and Communication Engineering

by

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

DECEMBER- 2021

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of RUTH BALAJI (39130382) and SUBHARAJA CHELLAM (39130443) who carried out the project entitled **"Person count detention to keep everyone safe during the pandemic using Embedded Systems"** under my supervision from September 2021 to October 2021.

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Submitted for Viva voce Examination held on_____

Internal Examiner External Examiner

DECLARATION

We, Ruth Balaji (39130382) and Subharaja Chellam.A (39130443) hereby declare that the Mini project Report entitled **"People count detection to keep everyone safe during pandemic using Embedded systems"** done by us under the guidance of **"Dr. E. ANNA DEVI** "is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering / Technology degree in **Electronics and Communication.**

DATE: **1.**

PLACE: CHENNAI **2.**

SIGNATURE OF THE CANDIDATE

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We would like to express our sincere and deep sense of gratitude to my Project Guide **Dr. E. ANNA DEVI** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of Electronics and Communication Engineering who were helpful in many ways for the completion of the project.

Ruth Balaji

Subharaja Chellam

PROJECT DETAILS

PROJECT TOPIC: Person count detection to keep everyone safe during pandemic using Embedded System

PROJECT GUIDE: DR. E. Anna Devi

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ABSTRACT

- According to the data obtained by the World Health Organization, the global pandemic of COVID-19 has severely impacted the world and has now infected more than eight million people worldwide.

- The rise of COVID-19 pandemic has had a lasting impact in many countries worldwide since 2019.

- The proposed approach in this project is developed to avoid more people from entering the desired places (i.e., Mall, University, Office.. etc) by detecting people count using Arduino and Sensors to count the number of people while entering and exiting.

- This helps to maintain the social distancing inside those places and limit the total number of persons.

- If the total number of people count increased, the Arduino microcontroller will give the buzzer alarm to notify the person.

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INTRODUCTION

1.1. Introduction to Embedded Systems:

An embedded system is an electronic system that has software and is embedded in computer hardware. It is programmable or nonprogrammable depending on the application. An embedded system is defined as a way of working, organizing, performing single or multiple tasks according to a set of rules. In an embedded system, all the units assemble and work together according to the program. Examples of embedded systems include numerous products such as microwave ovens, washing machine, printers, automobiles, cameras, etc. These systems use microprocessors, microcontrollers as well as processors like DSPs. The important characteristics of an embedded system are speed, size, power, reliability, accuracy, adaptability. Therefore, when the embedded system performs the operations at high speed, then it can be used for real -time applications. The Size of the system and power consumption should be very low and then the system can be easily adaptable for different situations. An Embedded system is a combination of computer hardware and software. As with any electronic system, this system requires a hardware platform and that is built with a microprocessor or microcontroller. The Embedded system hardware includes elements like user interface, Input/output interfaces, display and memory, etc. Generally, an embedded system comprises power supply, processor, memory, timers, serial communication ports and system application specific circuits.

1.2. Dealing with Embedded circuits:

Processor is the heart of an embedded system. It is the basic unit that takes inputs and produces an output after processing the data. For an embedded system designer, it is necessary to have the knowledge of both microprocessors and microcontrollers.

Sensor − It measures the physical quantity and converts it to an electrical signal which can be read by an observer or by any electronic instrument like an A2D converter. A sensor stores the measured quantity to the memory.

A-D Converter − An analog-to-digital converter converts the analog signal sent by the sensor into a digital signal.

Processor & ASICs − Processors process the data to measure the output and store it to the memory.

D-A Converter − A digital-to-analog converter converts the digital data fed by the processor to analog data.

Actuator − An actuator compares the output given by the D-A Converter to the actual (expected) output stored in it and stores the approved output.

1.3. Requirements:

The requirements of embedded systems are different from the requirements of the traditional computer based system. To develop and adopt embedded systems, software such as C++, C, ADA, etc, are used and some systems which have to specialized use operating systems such as Linux, OSE, Nucleus RTOS, Windows CE, and ThreadX. Usually, with application development, there is a consideration to external factors such as temperature and other environmental factors which may affect performance, however with embedded software development this is not the case.

1.4. Programming languages:

Programming of an embedded system in assembly language (input) and converting it into the machine-level language (output) using an assembler can be explained using the following example, where we perform the addition of two numeric's using two separate registers and store the result in an output register.

C Programming- C language is a structure-oriented language, developed by Dennis Ritchie. It provides less memory access using the simple compiler and delivers the data efficiently according to machine instructions. They are applicable in wide ranges from embedded systems to supercomputers.

Embedded C- Embedded C is an extension of the C language, which is used for developing an embedded system. The syntax is similar to C language (like the main function, functions declaration, data type's declaration, loops, etc). The main difference between embedded C and standard C language are input-output addressing of hardware, fixed-point operations, and processing address spaces. The use of C in the embedded system due to the following advantages

- It is small and easy to learn, understand and debug the program.
- All the C compilers are compatible with all embedded devices
- It is a processor-independent (that is, it is not specific to a particular microprocessor or microcontroller).
- C language uses the combination of assembly language and features of the high-level language
- It is fairly efficient, more reliable, more flexible, more portable between different platforms..

Compare to other high-level language C offers more flexibility because it is a relatively small structure-oriented language and supports low-level bitwise data manipulations.

C++ - Object-oriented language like C++ is not optional for developing an efficient program in research constraint environments like embedded devices. Virtual functions and exception handling of C++ are some specific features that are not efficient in terms of space and speed of the system.

JAVA - An embedded system can be programmed in JAVA language, using JAVA virtual machine (JVM) which accesses lots of resources. It primarily finds usage in high-end applications (like mobile phones) and offers portability across systems to process the applications. It is not preferred for smaller embedded devices.

CHAPTER-2

LITERATURE SURVEY

This chapter provides a literature review on the innovations and challenges of the visitor counter system with smart power management. A summary of past and present research was provided for this reason in three sections: early innovations, modern trends, and future challenges.

2.1 Early Developments:

Counting of visitors passing through a location was previously performed manually using of finger or tally methods which was time consuming and inaccurate. Other room appliances such as light switches are still mainly operated manually in most regions of the world invariably leading; to power waste of personal incompetence, human recourses, and time. With technological innovations, many electronic technologies such as bidirectional visitors' counters and automatic appliance controllers, have been created as a result of technological advancements to keep count of the number of visitors entering a hall and control the lighting in that environment. These technological developments led to the development of counters using an 8051 microcontroller (AT89C51) [6].

2.1.1 8051 Microcontroller (AT89C51) :

The AT89C51 is an 8-bit microcontroller from the Atmel family that has been around for a long time. It uses the famous 8051 architecture, which is why most beginners have used it to date. This is a 40-pin IC kit with a 4-kilobyte flash memory. It has four ports and a total of 32 programmable GPIO pins. It is devoid of an ADC module and only supports connectivity through USART. It can be paired with an external ADC IC, such as the ADC084 or the ADC080808 [1]. The AT89C51 is no longer in production, and Atmel no longer supports the current design. Instead, the new AT89S51 is recommended for new applications. However, if your goal is to learn encode, the AT89C51 has a strong community behind it. The AT89C51 may still be a viable option.

2.2 Modern Trends:

Earlier attempts of counter Systems were harder to program and larger complex circuits. These designs were not completely automated as a user is required to manually increase or decrease the values by pressing the buttons, and this serve as a great limitation to the system. 7 Recent counter systems using Arduino and Raspberry Pi are equipped with improved architecture which includes; smart sensors and more advanced distributed control technology [3].

2.2.1 Arduino:

Arduino is simply an open hardware development board used by tinkerers, software developers, innovators, and inventors to design and build devices that communicate with the real-time situations. It was originally developed in Ivrea, Italy [1]. Arduino boards can convert inputs like light on a sensor or a finger on a button and convert them to outputs like triggering an engine or turning on an LED. Boards are programmed by giving a series of commands to the board's microcontroller [6].

2.2.2 Advantages of Using Arduino:

• This model can be implemented as an automated switch to increase energy efficiency. The counter detects zero people in a room and automatically put off the power supply. Thus, promoting electricity and energy conservation.

• Easily operated and not complex like micro-controller.

• Compared to microcontrollers which are limited to Windows, while Arduino is supported with all operating systems, including Linux, Macintosh, and Windows.

• Arduino boards are inexpensive when compared to other microcontrollers available on the market. For as little as 5,000 naira, you can get a pre-assembled Arduino board.

• Easy to program

Researcher	Technology used	Key benefits	Limitations
Bruno F. Carvalho	ultrasonic sensor	Identifies objects and determines the distance between the sensor and the objects with precision.	This technique was unable to detect over one individual at a time. If multiple individuals go through the system at the same time, only one of them will be detected.
Jeong W. Choi	IR-UWB radar sensors using ARM Cortex-M4 and Raspberry Pi 2 modules	The system is capable of detecting several individuals at a time.	As the sensors on the market are highly expensive, the system is not cost-effective.
Jothibasu M and Aakash B	IR sensors	This method is a bi-directional counter whilst possessing the ability to regulate home appliances and helps in consuming less electricity.	This technique is only capable of detecting one person at a time.

Figure : Researchers

CHAPTER-3

AIM & SCOPE

3.1. Aim:

The Main aim of this project, to develop a project to avoid more people from entering the desired places (i.e., Mall, University, Office, …etc.) by detecting People counts.

3.2. Purpose:

- According to data obtained by the World Health Organization, the global pandemic of COVID-19 has severely impacted the world and has now infected more than eight million people worldwide.
- The rise of COVID-19 pandemic has had a lasting impact in many countries worldwide since 2019.
- The proposed approach in this project is developed to avoid more people from entering the desired places (i.e., Mall, University, Office, …etc.) by detecting People count using Arduino.
- In Proposed System, we develop a project to avoid more people from entering the desired places (i.e., Mall, University, Office, …etc.) by detecting People count using Arduino and sensors to counts the peoples while entering and exiting.
- This helps to maintain the social distancing inside those places and limit the Total number of persons.
- If the total number of people count increased, the Arduino microcontroller will give the buzzer alarm to notify the person.

CHAPTER-4

MATERIALS & METHOD

4.1. Hardware materials:

The physical components that a system requires to function**:**

- Arduino Nano
- IR Sensor
- Liquid Crystal Display Base
- Liquid Crystal Display
- Buzzer
- Cable
- Connecting wire

Arduino Nano:- Arduino Nano is a small, complete, flexible and breadboard-friendly Microcontroller board, based on ATmega328p**,** developed by Arduino.cc in Italy in 2008 and contains 30 male I/O headers, configured in a DIP30 style**.** Arduino Nano Pin out contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins. It is programmed using Arduino IDE, which can be downloaded from Arduino Official site. Arduino Nano is simply a smaller version of Arduino UNO, thus both have almost the same functionalities. It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V.Arduino Nano's maximum current rating is 40mA, so the load attached to its pins shouldn't draw current more than that. Each of these Digital & Analog Pins is assigned with multiple functions but their main function is to be configured as Input/Output. Arduino Pins are acted as Input Pins when they are interfaced with sensors, but if you are driving some load then we need to use them as an Output Pin. Functions like pin Mode () and digital Write () are used to control the operations of digital pins while analog Read () is used to control analog pins. The analog pins come with a total resolution of 10-bits which measures the value from 0 to 5V.No prior arrangements are required to run the board. All you need is a board, mini USB cable and Arduino IDE software installed on the computer.USB cable is used to transfer the program from the computer to the board. No separate burner is required to compile and burn the program as this board comes with a built-in boot-loader.

Microcontroller	Atmega328p/Atmega 168
Operating Voltage	5V
Input Voltage	7 – 12 V
Digital I/O Pins	14
PWM	6 out of 14 digital pins
Max. Current Rating	40mA
USB	Mini
Analog Pins	8
Flash Memory	16KB or 32KB
SRAM	1KB or 2KB
Crystal Oscillator	16 MHz
EEPROM	512bytes or 1KB
USART	Yes

Arduino Nano Specifications

www.TheEngineeringProjects.com

Figure : Specifications of Arduino Nano

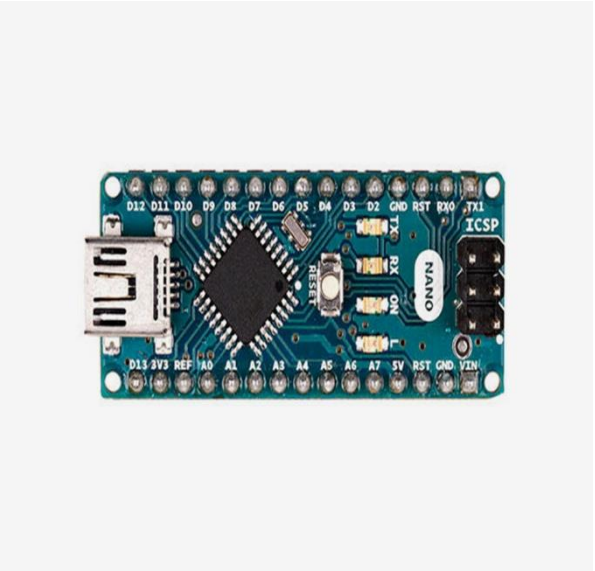


Figure : Arduino Nano

The following figure shows the pin out of the Arduino Nano Board:

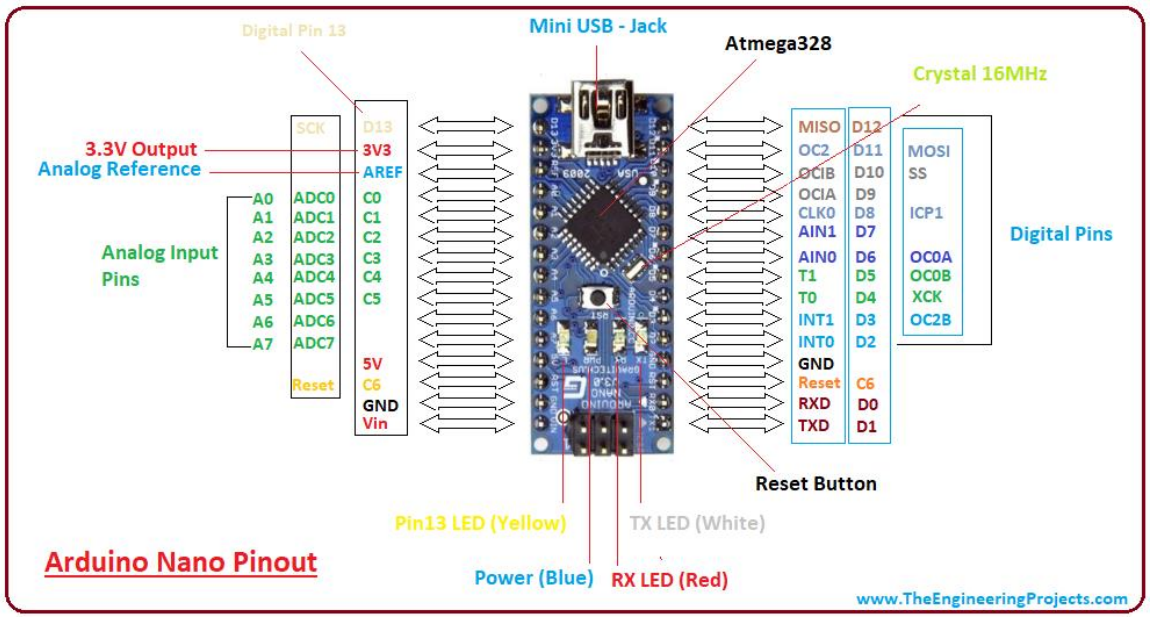


Figure : Arduino Nano pin out

Each pin on the Nano board comes with a specific function associated with it. We can see the analog pins that can be used as an analog to a digital converter, where A4 and A5 pins can also be used for I2C communication. Similarly, there are 14 digital pins, out of which 6 pins are used for generating PWM.

Vin: It is input power supply voltage to the board when using an external power source of 7 to 12 V.

5V: It is a regulated power supply voltage of the board that is used to power the controller and other components placed on the board.

3V3: This is a minimum voltage generated by the voltage regulator on the nano board.

GND Pin: These are the ground pins on the board. There are multiple ground pins on the board that can be interfaced accordingly when more than one ground pin is required.

Reset Pin: Arduino Nano has 2 reset pins incorporated on the board, making any of these Reset pins LOW will reset the microcontroller.

Pin#13: A built-in LED is connected to pin#13 of nano board. This LED is used to check the board i.e. it's working fine or not.

AREF: This pin is used as a reference voltage for the input voltage.

Analog Pins: There are 8 analog pins on the board marked as A0 – A7.These pins are used to measure the analog voltage ranging between 0 to 5V.

Digital Pins: Arduino Nano has 14 digital pins starting from D0 to D13. These digital pins are used for interfacing third-party digital sensors and modules with Nano board.

PWM Pins: Arduino Nano has 6 PWM pins, which are Pin#3, 5, 6, 9, 10 and 11. (All are digital pins)

These pins are used to generate an 8-bit PWM (Pulse Width Modulation) signal.

External Interrupts: Pin#2 and 3 are used for generating external interrupts normally used in case of emergency, when we need to stop the main program and call important instructions.The main program resumes once interrupt instruction is called and executed.

Serial Pins: These pins are used for serial communication where:

1. Pin#0 is RX used for receiving serial data.
2. Pin#1 is Tx used for transmitting serial data.

SPI Protocol: Four pins 10(SS->Slave Select), 11(MOSI -> Master Out Slave In), 12(MISO -> Master In Slave Out) and 13(SCK -> Serial Clock) are used for SPI (Serial Peripheral Interface) Protocol.SPI is an interface bus and is mainly used to transfer data between microcontrollers and other peripherals like sensors, registers, and SD cards.

I2C Protocol: I2C communication is developed using A4 and A5 pins, where A4 represents the serial data line (SDA) which carries the data and A5 represents the serial clock line (SCL) which is a clock signal, generated by the master device, used for data synchronization between the devices on an I2C bus.

IR-Sensor:- The sensor module adaptable to ambient light, having a pair of infrared emitting and receiving tubes, transmitting tubes emit infrared certain frequency, when the direction of an obstacle is detected (reflection surface), the infrared reflected is received by the reception tube, After a comparator circuit processing, the green light is on, but the signal output interface output digital signal (a low-level signal), you can adjust the detection distance knob potentiometer, the effective distance range of 2 ~ 30cm, the working voltage of 3.3V- 5V.

Detection range of the sensor can be obtained by adjusting potentiometer, with little interference, easy to assemble, easy to use features, can be widely used in robot obstacle avoidance, avoidance car, line count, and black and white line tracking and many other occasions.

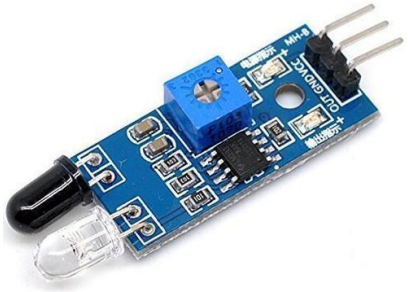


Figure : IR Sensor

Specification:-

1. When the module detects an obstacle in front of the signal, the green indicator lights on the board level, while the OUT port sustained low signal output, the module detects the distance 2 ~ 30cm, detection angle 35 °, the distance can detect potential is adjusted clockwise adjustment potentiometer, detects the distance increases; counter clockwise adjustment potentiometer, reducing detection distance.
2. The sensor active infrared reflection detection, target reflectivity and therefore the shape is critical detection distance. Where the minimum detection distance black, white, maximum; small objects away from a small area, a large area from the Grand.
3. The sensor module output port OUT port can be directly connected to the microcontroller IO can also be directly drive a 5V relay; Connection: VCC-VCC; GND-GND; OUT-IO
4. Comparators LM393, stable;
5The module can be 3-5V DC power supply. When the power is turned on, the red power indicator lights;
6. With the screw holes 3mm, easy fixed installation;
7. Board size: 3.2CM * 1.4CM
8. Each module has been shipped threshold comparator voltage adjusted by potentiometer good, non-special case, do not adjustable potentiometer.

Module Interface Description:-

1. VCC : 3.3V-5V external voltage (can be directly connected to 5v and 3.3v MCU)
2. GND : GND External
3. OUT : small board digital output interface (0 and 1)

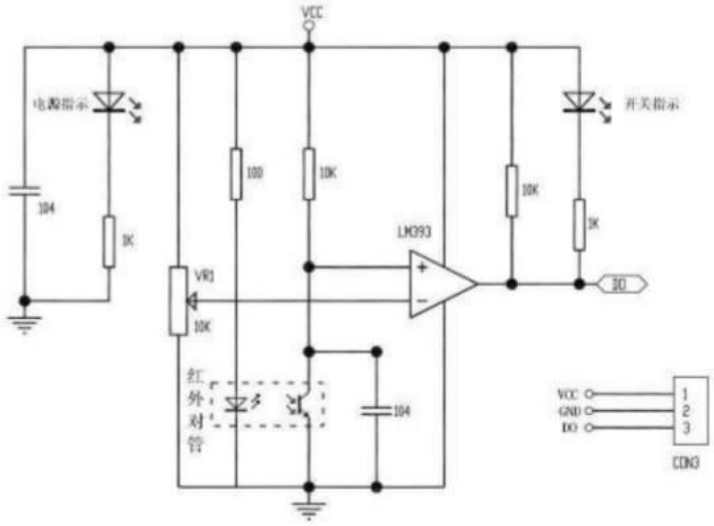


Figure : IR Sensor circuit

Liquid crystal display: - Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material

sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to

maintain a defined orientation angle. One each polarizer's are pasted outside the two glass panels. These polarizer's would rotate the light rays passing through them to a definite angle, in a particular direction.

When the LCD is in the off state, light rays are rotated by the two polarizer's and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent.

When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarizer's, which would result in activating / highlighting the desired characters. The LCD's are lightweight with only a few millimeters thickness. Since the LCD's consume less power, they are compatible with low power

electronic circuits, and can be powered for long durations. The LCD's don't generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range. Changing the display size or the layout size is relatively simple which makes the LCD's more customer friendly. The LCDs used exclusively in watches, calculators and

measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in

Telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications.

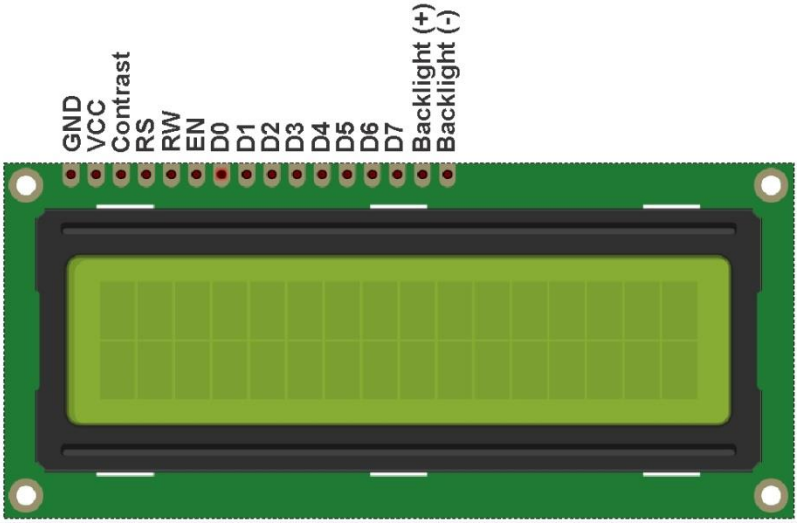


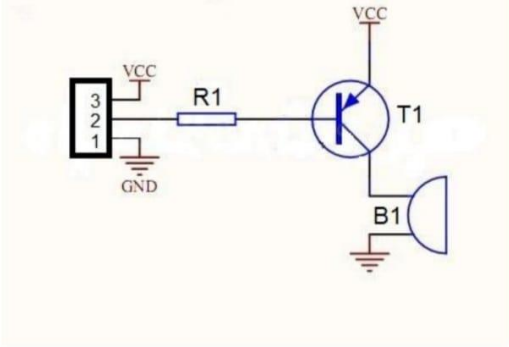
Figure : Liquid Crystal Display

Buzzer:- A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play." Specifications:

- On-board passive buzzer
- On-board 8550 triode drive
- Can control with single-chip microcontroller IO directly
- Working voltage: 5V
- Board size: 22 (mm) x12 (mm)

Pin Configuration:

- VCC
- Input
- Ground



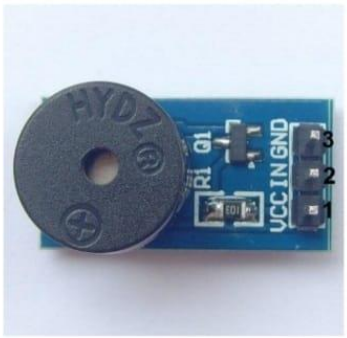


Figure : Schematic Diagram of a Buzzer

Figure : Buzzer

Cable:- Power cable types are power cord, extension cable, twisted, shielded, extensible, communication cable, and many more. These cables can be used overhead or buried underground. Types of Computer Cables: Types of computer cables are power cable and data cable. A cable should have the following three components,

1.Conductor: The conducting part is used to transmit electricity. Extensively used conductors are copper and aluminum.

2.Insulator: To keep the conductors separated from each other and prevent unintended paths for current flow (e.g. short circuit), the wires are shielded with insulating materials. Various synthetic polymers are used for this purpose.

3.Sheath: It is yet another layer to give protection to the wires from chemical reactions with the atmosphere. A common material for the sheath is PVC (polyvinyl chloride).

Figure : Cable

Connecting wires:- Wires are used for establishing electrical conductivity between two devices of an electrical circuit. Connecting wires allows an electrical current to travel from one point on a circuit to another because electricity needs a medium through which it can move. Most of the connecting wires are made up of copper or aluminum.

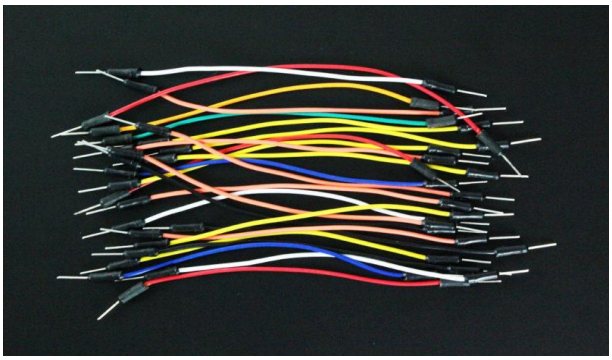


Figure : Connecting wires

4.2. Software Materials:

- Arduino IDE

Arduino IDE:- Arduino IDE is an open-source software, designed by Arduino.cc and mainly used for writing, compiling & uploading code to almost all Arduino Modules. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is available for all operating systems i.e. MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling the code. A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more. Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

4.3. Programming Language:

- Embedded C

Embedded C- programming:- It is an extension to the traditional C programming language, that is used in embedded systems. The embedded C programming language uses the same syntax and semantics as the C programming language. The only extension in the Embedded C language from normal C Programming Language is the I/O Hardware Addressing, fixed-point arithmetic operations, accessing address spaces, etc.

4.4. Working Method:

- In this project the arduino microcontroller has been programmed in such a way to detect the number of people entering a desired place.
- There are two IR sensors in which are for the input and the other is for output.
- A buzzer is present.
- The Liquid Crystal Display, displays the people count of entry and exit.
- When a person enters, the Input IR senor senses the number of people entering inside a desired place (Super markets, classrooms etc.).
- Once the maximum number of people count is reached then the buzzer begins to beep denoting the “please wait, not allowed” in LCD display.
- When a person is standing near the IR sensor input then another person inside the desired place (Super market, classroom etc.) Cannot exit.
- Only when the person moves away from the IR sensor input, the person inside can exit.
- The IR sensor output detects the number of people exiting from the desired place and then allows the people to enter the place.
- When the IR sensor detects the people count it gets displayed on the LCD display

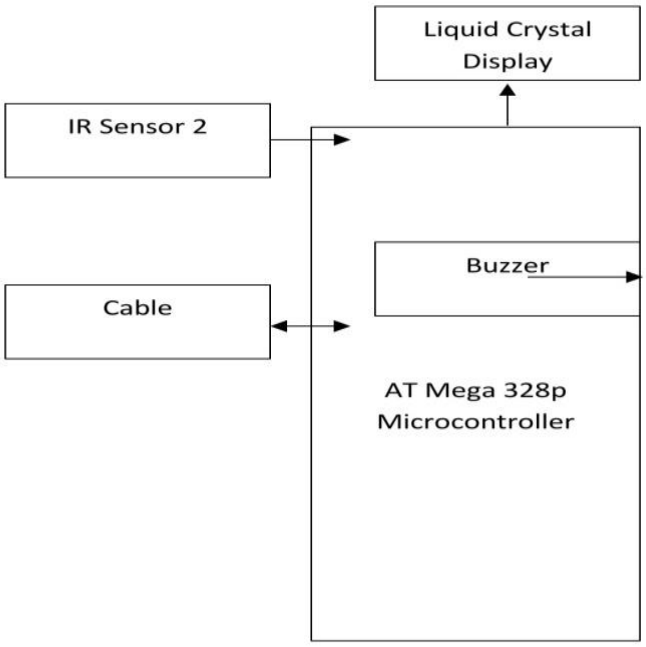


Figure : Block diagram

CHAPTER-5

RESULT

- In this project the arduino in which the program is programmed gives an information to the buzzer when the IR sensor detects the Number of people entering inside is maximum.
- This project is very much helpful in protecting the people from the spread of covid-19 and helps the owners to follow the 50% occupancy rule given by the government.
- There the project is designed in such a way to maintain social distance and minimize the spread of the virus.

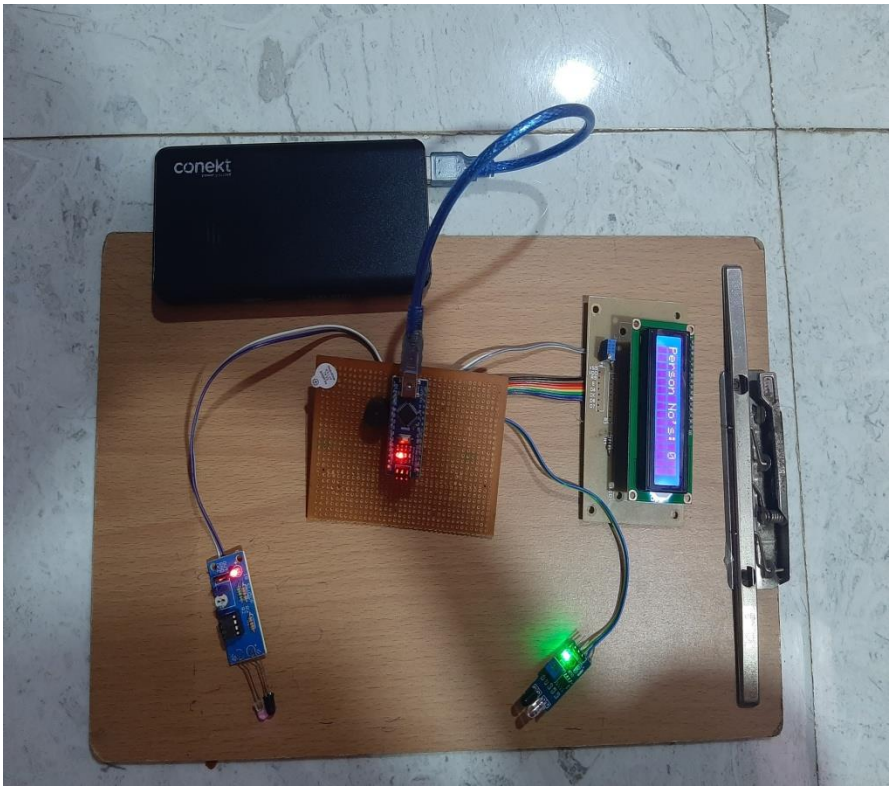


Figure : Project

CHAPTER- 6

SUMMARY AND CONCLUSION

- This project is very helpful in the most crucial times due to the COVID-19.
- It helps in making sure that social distance is maintained and places are not crowded avoiding the spread of the virus.
- The IR sensor used makes sure that the number of people allowed in and out is restricted correctly to number of people inputted in.
- This project will be very much helpful for many shops and places during these times so that the spread of virus never increases.

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