NEW HORIZON
COLLEGE OF ENGINEERING
New Horizon Knowledge Park, Ring Road, Marathalli
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

Arduino Based Bidirectional Counter And Temperature Reader System

In partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

A MINI PROJECT

REPORT

Submitted by

NAME OF THE STUDENTS

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Bonafide Certificate

This is to Bonafide that the mini project report entitled "**Arduino Based Bidirectional Counter And Temperature Reader System**" submitted by **Pranav R Naik, Rahul Vijay Lingadhal, S Nahush, Vishal Suresh**, Department of Electrical Engineering, New Horizon College of Engineering, Bangalore in partial fulfilment for the award of the degree of Bachelor of Engineering , is a record of bonafide work carried out by him/her under my supervision, as per the NHCE code of academic and research ethics.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university. The project report fulfils the requirements and regulations of the institution and in my opinion meets the necessary standards for submission.

Guide Name — Dr. Mahesh M

Dr.Joshua Daniel Raj — HoD

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I express my sincere thanks to **Dr. Mahesh M** HoD, Department of Electrical Engineering, New Horizon College of Engineering for his kind words of support and encouragement.

I wish to extend my profound sense of gratitude to my parents for all the sacrifices they made during my project and providing me with moral support and encouragement whenever required.

Date:

Place:

Pranav R Naik

S Nahush

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Vishal Suresh

Abstract

Looking at the current situation, getting back to normal can be only done by following the guidelines and norms during routine activity. This project will help in manitaing social distancing and even in temperature screening. The device is installed with a IR sensor which help in counting the no. of entry in a place, and then the MLX90614 infrared sensor the sensor will record and display your temperature. Considering the government norms during this pandemic we have built this device keeping public safety as our priority. Our first priority being public safety we need to just fix it at entry, the device works contactless and displays the results on lcd screen. The device has no manual work or operation required there fore the person kept for temperature screening is not required. The works on 5v battery, hence cheap and affordable if manufactured in large quantity.

This project will give us knowledge on Arduino uno and its working. The different ways we can use it different utilization. The work on Infrared sensor and and its uses in different prospects. This project works on coding, hence we will be working with c language. There fore an advancement to our knowledge.

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Introduction

As we all know the current situation in our country is extremely dangerous. This pandemic has put everybody's lives at risk and has threatened to cause a major issue in our country. Therefore in this critical situation the government has set certain rules and policies in order to curb the mass gathering of people at public places and other locations. The MHA has initiated unlock 5.0 phase one by opening malls, cinema theatres, gyms, etc. with a seating arrangnement of only 60% of the seats to be filled, and no more allowed. According to the rules laid for this pandemic situation, a limit has been set for the number of people that can be present in a particular area/location. Thus counting the number of people present has become mandatory, but doing this procedure manually can be gruesome task.

So to make this count easier with all the necessary precautions taken we have tried to implement a system which will help in both counting and keeping everyone safe. Our counter and temperature reader system will not only count the number of people present but also give their temperature as well. Therefore no one with high temperatures will be able to gather in public and put other lives at risk.

In this project we have used an Arduino UNO, a LCD display, a contactless temperature sensor and a counter system as well. The function of each of the equipment depends on each other. The project consists of two different systems working in tandem at the same time. The counter system and the temperature reader system in our venture gather the respective information at the same time and present the data to the Arduino, which in turn displays the particular information on the display panel.

Therefore the fundamental principle of out circuit is to count the number of people allowed at a particular venue whilst recording their temperatures at the same time. At this sensitive stage in our country we need such a system to avoid risking lives.

Theory

An infrared thermometer is a thermometer which infers temperature from a portion of the thermal radiation sometimes called black-body radiation emitted by the object being measured. They are sometimes called laser thermometers as a laser is used to help aim the thermometer, or non-contact thermometers or temperature guns, to describe the device's ability to measure temperature from a distance. By knowing the amount of infrared energy emitted by the object and its emissivity, the object's temperature can often be determined within a certain range of its actual temperature. Infrared thermometers are a subset of devices known as "thermal radiation thermometers".

Sometimes, especially near ambient temperatures, readings may be subject to error due to the reflection of radiation from a hotter body—even the person holding the instrument—rather than radiated by the object being measured, and to an incorrectly assumed emissivity.

The design essentially consists of a lens to focus the infrared thermal radiation on to a detector, which converts the radiant power to an electrical signal that can be displayed in units of temperature after being compensated for ambient temperature. This permits temperature measurement from a distance without contact with the object to be measured.

A non-contact infrared thermometer is useful for measuring temperature under Circumstances where thermocouples or other probe-type sensors cannot be used or do not produce accurate data for a variety of reasons.

Some typical circumstances are where the object to be measured is moving; where the object is surrounded by an electromagnetic field, as in induction heating; where the object is contained in a vacuum or another controlled atmosphere; or in applications where a fast response is required, the accurate surface temperature is desired or the object temperature is above the recommended use point for contact sensors, or contact with a sensor would mar the object or the sensor, or introduce a significant temperature gradient on the object's surface.

Infrared thermometers can be used to serve a wide variety of temperature monitoring functions. A few examples provided include detecting clouds for remote telescope operation, checking mechanical or electrical equipment for temperature and hot spots, measuring the

temperature of patients in a hospital without touching them, checking heater or oven temperature, for calibration and control, checking for hot spots in fire-fighting, monitoring materials in processes involving heating or cooling, and measuring the temperature of volcanoes. At times of epidemics of diseases causing fever, such as SARS coronavirus and Ebola virus disease, infrared thermometers have been used to check arriving travelers for fever without causing harmful transmissions among the tested.

In 2020 when COVID-19 pandemic hit the world, infrared thermometers were used to measure people's temperature and deny them entry to potential transmission sites if they showed signs of fever. Public health authorities such as the FDA in United States published rules to assure accuracy and consistency among the infrared thermometers.

There are many varieties of infrared temperature-sensing devices, both for portable and handheld use and as fixed installation. Infrared radiation, that portion of the electromagnetic spectrum that extends from the long wavelength, or red, end of the visible-light range to the microwave range. Invisible to the eye, it can be detected as a sensation of warmth on the skin. The infrared range is usually divided into three regions: near infrared (nearest the visible spectrum), with wavelengths 0.78 to about 2.5 micrometres (a micrometre, or micron, is 10^{-6} metre); middle infrared, with wavelengths 2.5 to about 50 micrometres; and far infrared, with wavelengths 50 to 1,000 micrometres. Most of the radiation emitted by a moderately heated surface is infrared; it forms a continuous spectrum. Molecular excitation also produces copious infrared radiation but in a discrete spectrum of lines or bands. Infrared radiation (IR), or infrared light, is a type of radiant energy that's invisible to human eyes but that we can feel as heat. All objects in the universe emit some level of IR radiation, but two of the most obvious sources are the sun and fire IR is a type of electromagnetic radiation, a continuum of frequencies produced when atoms absorb and then release energy. From highest to lowest frequency, electromagnetic radiation includes gamma-rays, X-rays, ultraviolet radiation, visible light, infrared radiation, microwaves and radio waves. Together, these types of radiation make up the electromagnetic spectrum.

British astronomer William Herschel discovered infrared light in 1800, as per NASA. In an experiment to measure the difference in temperature between the colors in the visible spectrum, he placed thermometers in the path of light within each color of the visible spectrum. Herschel observed an increase in temperature from blue to red, and he found an

even warmer temperature measurement just beyond the red end of the visible spectrum.Within the electromagnetic spectrum, infrared waves occur at frequencies above those of μwaves and just below those of red visible light, hence the name "infrared." Waves of infrared radiation are longer than those of visible light, according to the California Institute of Technology. IR frequencies range from about 300 gigahertz (GHz) up to about 400 terahertz (THz), and wavelengths are estimated to range between 1,000 micrometers (μm) and 760 nanometers (2.9921 inches), although these values are not definitive, as per calculations done in NASA.

One of the most useful applications of the IR spectrum is in sensing and detection. All objects on Earth emit IR radiation in the form of heat. This can be detected by electronic sensors, such as those used in night vision goggles and infrared cameras. Night vision cameras use a more sophisticated version of a bolometer. These cameras typically contain charge-coupled device (CCD) imaging chips that are sensitive to IR light. The image formed by the CCD can then be reproduced in visible light. These systems can be made small enough to be used in hand-held devices or wearable night-vision goggles. The cameras can also be used for gun sights with or without the addition of an IR laser for targeting.Infrared spectroscopy measures IR emissions from materials at specific wavelengths. The IR spectrum of a substance will show characteristic dips and peaks as photons (particles of light) are absorbed or emitted by electrons in molecules as the electrons transition between orbits, or energy levels. This spectroscopic information can then be used to identify substances and monitor chemical reactions.

Robert Mayanovic, professor of physics at Missouri State University said that, infrared spectroscopy, such as Fourier transform infrared (FTIR) spectroscopy, is highly useful for numerous scientific applications. These include the study of molecular systems and 2D materials, such as graphene. infrared astronomy as "the detection and study of the infrared radiation (heat energy) emitted from objects in the universe." Advances in IR CCD imaging systems have allowed for detailed observation of the distribution of IR sources in space, revealing complex structures in nebulas, galaxies and the large-scale structure of the universe.One of the advantages of IR observation is that it can detect objects that are too cool to emit visible light. This has led to the discovery of previously unknown objects, including comets, asteroids and wispy interstellar dust clouds that seem to be prevalent

throughout the galaxy.IR astronomy is particularly useful for observing cold molecules of gas and for determining the chemical makeup of dust particles in the interstellar medium, said Robert Patterson,professor of astronomy at Missouri State University. These observations areconducted using specialized CCD detectors that are sensitive to IR photons.

Testing must be done using FLIR infrared cameras. Social distancing requirements must be strictly observed by the screening personnel using the FLIR infrared cameras. A minimum distance of 2 metres must be maintained. Temperature screening of employees, contractors and visitors to prevent the entry of people with elevated temperatures must be conducted daily & at each and every mobilisation/personnel change location prior to entry to a plant location or working site (mines/energy/services). After testing is conducted, each inspected employee test must be marked as “completed” and, if applicable, have a temperature recorded. Temperature screening will be conducted at the entrance to any location or at the point of distribution (airports/waterways/road) by an approved tester. The testing process will be conducted using thermal scanners requiring no skin contact. For ease of screening, consider reducing the number of access and entry points to the location. 24-hour screening must be in place where necessary. If the scanner’s reading result is within the normal range of body temperature (equal to or less than 37.3°C) then it is considered safe to allow access to the location. If a person’s temperature is equal to or in excess of 37.4°C, the designated screener must follow the procedure to manage a person with symptoms and the person will not be allowed to enter the location to commence work. The person shall be placed in an approved location until reassessment occurs. Re-testing time frames

• Temperature reading equal to or >37.4°C shall be subject to further testing after a period of 1 hour

• Temperature reading after 1 hour equal to or >37.4°C will require a further 24- hour isolation

• Temperature reading equal to or >37.4°C for more than 24 continuous hours will be subject to further testing and the site-specific emergency response shall be enacted, and quarantine actioned for a period of 14 days.

Guidelines: COVID-19 Temperature Screening 12 In case of visitors or contractors, access to a location will not be allowed if the thermal scanner shows a temperature equal to or higher

than 37.4°C. Assistance if required will be provided by an approved site management team. Note: Where national or local authorities recommend action to be taken on detection of a lower temperature than 37.4°C, this shall be complied with.

Components

- Arduino UNO 1
- IR sensors 2
- Relay 1
- 10k Potentiometer 1
- Jumpers male to male, male to female
- Bread board 1
- MLX90614 Infrared sensor 1
- LCD display screen 16X2 1
- USB cable 1
- Battery 1
- Resistors 2

Components description

ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a

AC-to-DC adapter or battery to get started.The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features an ATmega16U2 programmed as a USB-to-serial converter. This auxiliary microcontroller has its own USB bootloader, which allows advanced users to reprogram it.

IR SENSOR

The infrared sensors are the sensors that detect/measure infrared radiation or change in the radiation from outer source source or inbuilt source.Also sensors that uses the property of infrared radiations to detect the changes in surrounding are termed as infrared sensors.

TYPES OF IR SENSORS

here are two types of infrared sensor based on its function:

- Thermal Infrared sensor

* Quantum infrared sensor

-These are the types of infrared sensors based on the working mechanism:

* Active Infrared Sensors

* Passive Infrared sensors

RELAY

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Potentiometer

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider.[1] If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name.

Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly

control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load.

BREAD BOARD

A breadboard is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used for slicing bread.[1] In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these.Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. Older breadboard types did not have this property. A stripboard (Veroboard) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs).

MLX90614 INFRARED SENSOR

The MLX90614 is a Contactless Infrared (IR) Digital Temperature Sensor that can be used to measure the temperature of a particular object ranging from -70° C to 382.2°C. The sensor

uses IR rays to measure the temperature of the object without any physical contact and communicates to the microcontroller using the I2C protocol.

MLX90614 Temperature Sensor Specifications

- Operating Voltage: 3.6V to 5V (available in 3V and 5V version)
- Supply Current: 1.5mA
- Object Temperature Range: -70° C to 382.2°C
- Ambient Temperature Range: -40° C to 125°C
- Accuracy: 0.02°C
- Field of View: 80°
- Distance between object and sensor: 2cm-5cm (approx.)

The key feature of MLX90614 is that it is a contactless IR temperature sensor with high accuracy. So it can be used in industries to measure the temperature of moving objects like a rotating motor shaft. Due to its high accuracy and precision, it is also used in a wide range of commercial, health care, and household applications like room temperature monitoring, body temperature measurement

The MLX90614 Temperature sensor is manufactured by a company called Melexis. The sensor is factory calibrated and hence it acts like a plug and play sensor module for speeding up development processes.

The MLX90614 consists of two devices embedded as a single sensor, one device acts as a sensing unit and the other device acts as a processing unit. The sensing unit an Infrared Thermopile Detector called MLX81101 which senses the temperature and the processing unit is a Single Conditioning ASSP called MLX90302 which converts the signal from the sensor to digital value and communicates using I2C protocol. The MLX90302 has a low noise amplifier, 17-bit ADC and a powerful DSP which helps the sensor to have high accuracy and resolution.

As mentioned earlier, the MLX90614 sensor can measure the temperature of an object without any physical contact with it. This is made possible with a law called Stefan-Boltzmann Law, which states that all objects and living beings emit IR Energy and the intensity of this

emitted IR energy will be directly proportional to the temperature of that object or living being. So the MLX90614 sensor calculates the temperature of an object by measuring the amount of IR energy emitted from it.

Applications of MLX90614

Temperature Measurement of moving objects

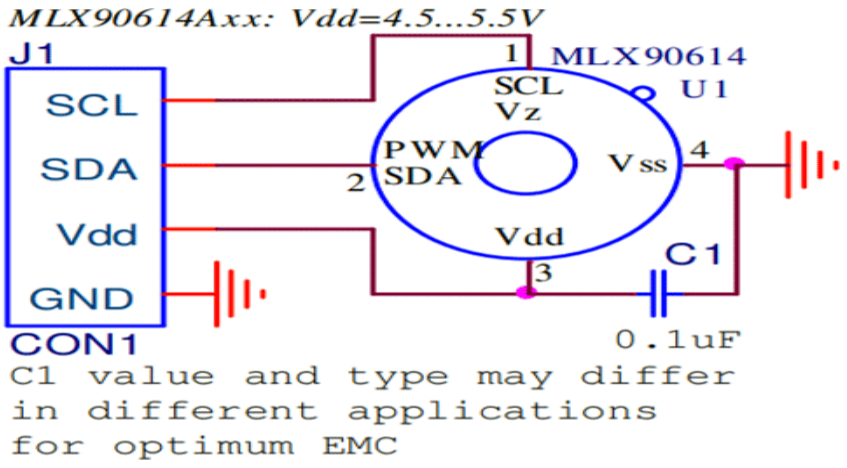
Industrial Thermal Gun

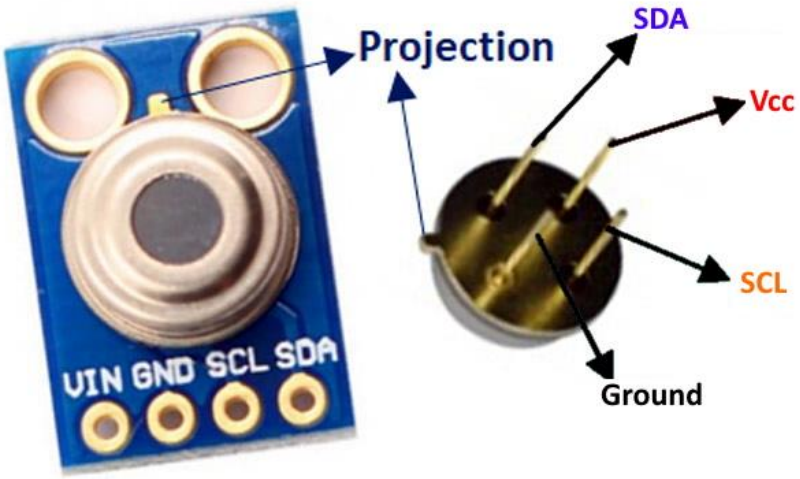
Human Body Temperature Measurement

Home/Office Temperature Control

Livestock Monitoring

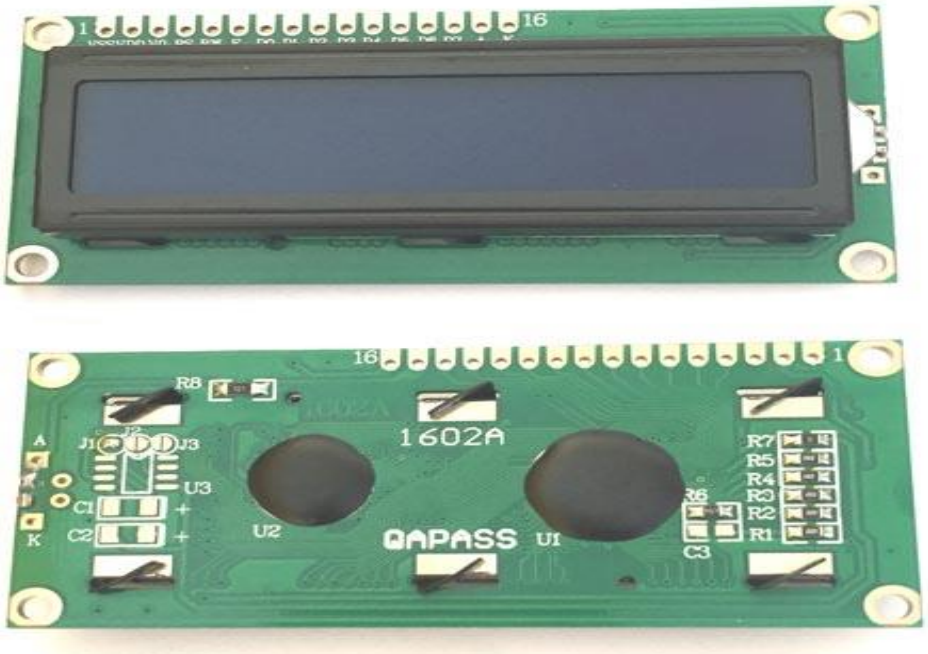
Movement Detection





LCD DISPLAY

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.



USB

The term **USB** stands for "Universal Serial Bus". **USB cable** assemblies are some of the most popular **cable** types available, used mostly to connect computers to peripheral devices such as cameras, camcorders, printers, scanners, and more.

Battery

The battery is the main power source used in the device to operate the device. We use resistor to drop the voltage of 9v battey to 5v. this is done using the technique of voltage divider rule.

Resistors

Resistors are used to resist thecpower supply given to device to bring it to its limit range.

Tables

S.no	Name	Type	Pins used in connections
1	**Arduino UNO**	Embedded system	A0-A5 input pins D8-D13 output pins Gnd pin -7 Vcc pin -5
2	**IR sensors**	Sensor	Gnd to ground Vs to 5v Output -1 to input of the arduino
3	**Mlx90614**	IR temperature sensor	Scl connected to A5 Sda connected to A5 Vdd-5v Gnd to ground
4	**16x2 display**	Lcd	Db7-db11 input pins Vss, K-gnd pin of Arduino Vdd,Vee pin to 5v Vo – 10k pot

Working of Project

The device has 3 major components IR sensor, Arduino UNO, and MLX90614 temperature sensor. Assume a person entering a room, the device setup is in such a way that the ir sensor 1 is placed first and the comes the temperature sensor and then the ir sensor 2.

The person's presence is sensed by the Ir sensor as a count n increments each time a person enter. There a transmitter fixed Ir sensor sends infrared radiation which is reverted back to the receiver and this signal is sent to the Arduino in the form of analog signal. The ir sensor thus declares presence of a person.

Once the person passes to Ir sensor 1 then he/she has move their wrist infront of the temperature sensor MLX90614 is a infrared temperature sensor which need not be bought in contact with the person for reading their body temperature. it is a contactless temperature sensor and can read the temperature from a distance of 1 meter. This temperature sensor also sends the signals in analog form. There are special slots for this components in Arduino as scl/sda for their conecctions. Hence within 5 minutes the temperature of the body is measured.

After this the person moves to the second IR sensor 2 which is placed after the temperature sensor. The IR sensor do not count. And the person moves if his temperature is normal and if there is space in to fit according to the government norms.

Now, during exit Ir sensor 2 comes into picture. The tramitter transmits ir radiations and reciever recieves reverted back if there is presence of body it detects it and sends the analog signals to the Arduino UNO, the Arduino processes the data and reduces the count by one. Each time a person approaches the IR sensor 2 it reduces the count by one. The whole device works in this manner. This device is mainly built to help people to maintain social distancing in the public places, even try and keep them safe in this pandemic situation. The result is displayed on lcd screen.

Every component of the operates on 5v dc supply. The relay used is to separate the two different power supply. The potentiometer is used to the contrast of the lcd display. The

temperature sensor is connected to the Arduino in analog slots of scl/sda pins. The ir sensors ouput pins are connected to the A0 and A1 pins. Ground pins of all components are given to the pin no. 7 of the Arduino. The vcc pins of all components is given to pin no. 5 of the Arduino. Lcd display pins db4 to db 7 are connected the Arduino pins d8 to d11. The Arduino UNO converts the analog signal to the digital before transmitting it to lcd screen for display. The lcd screen displays the no. of counts i.e. no. of people entering and the temperature of each person entering.

During this pandemic situation this device can be used in many public places. The Arduino UNO used here is programmed on Arduino IDE. The USB cable is used for connectivity for programming the device. There are many IDE to performs programming the Arduino. The lcd screen displays :

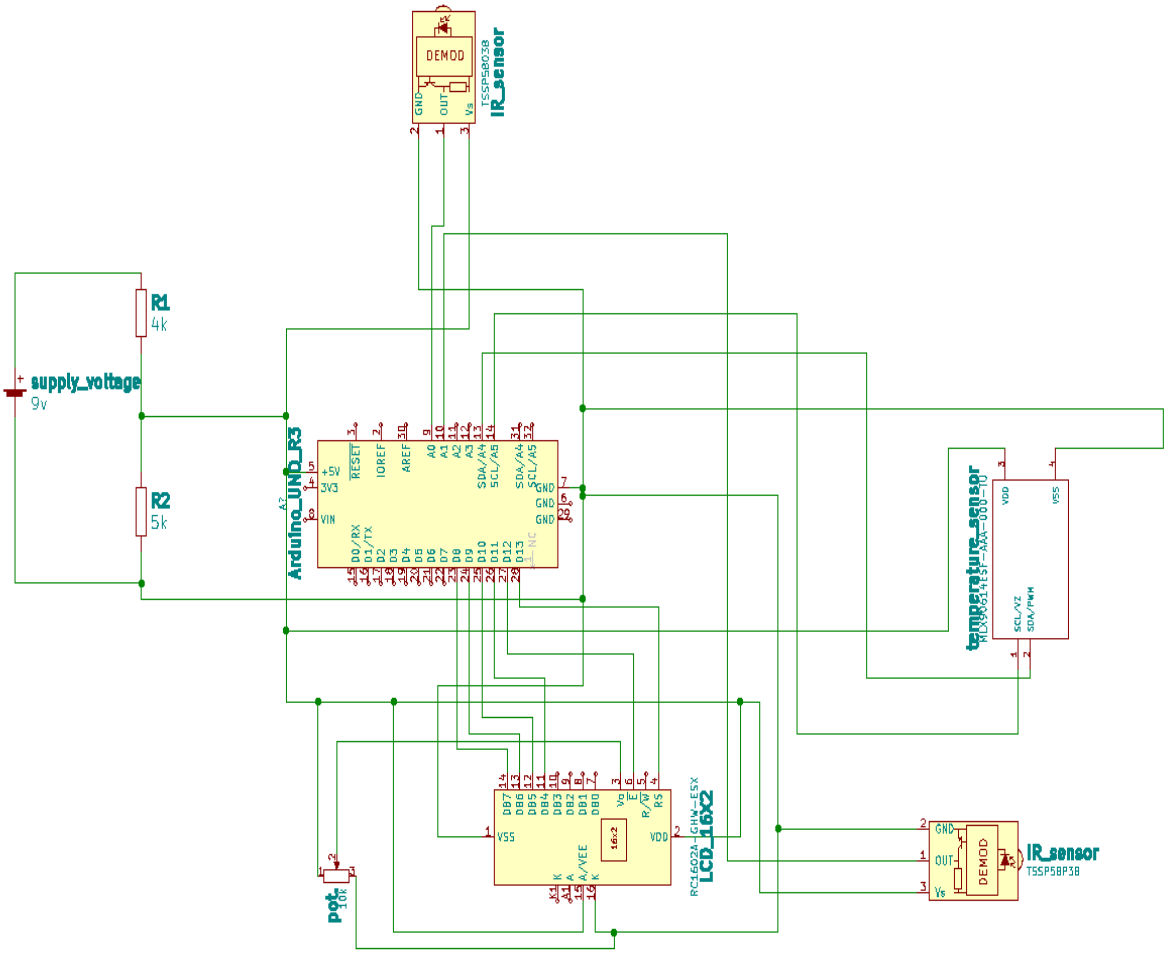
- No. of people entering
- Temperature of that person
- Whether he is fit to enter
- No. of people exiting from the place.

This all thing can be concluded from the device output. Finally the device ensures the safety of the people entering the place.

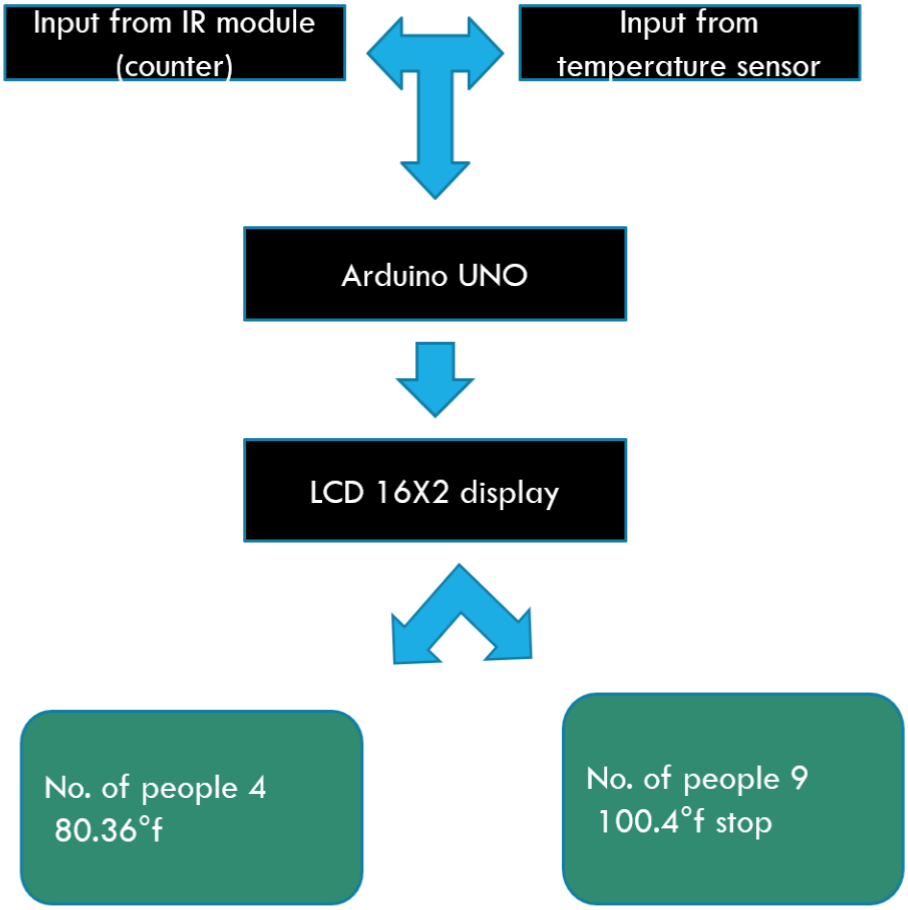
Mathemactical calculations: for the power supply bascically the voltage divider rule has been applied i.e., V2=V*R2/(R1+R2)

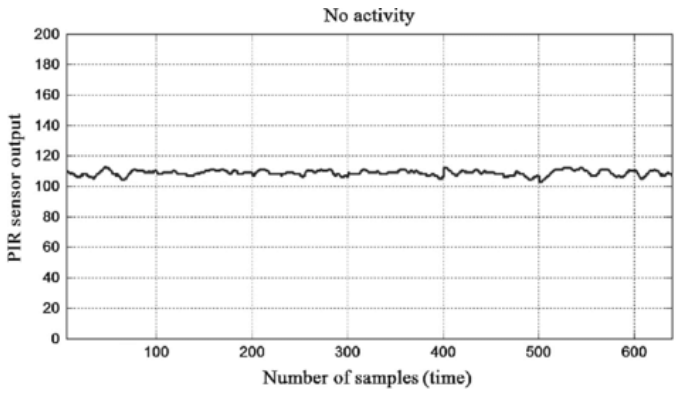
For temperature sensors range provided for operation is <=100.4˚F no problem >100.4˚f the lcd displays "**STOP".**

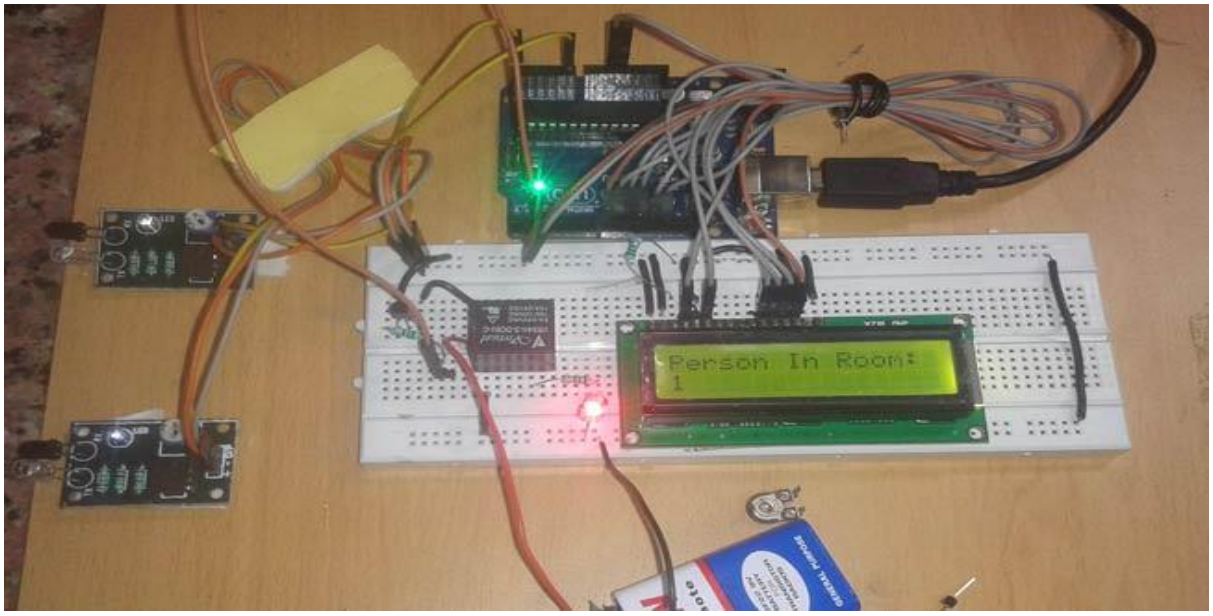
Circuit Diagram

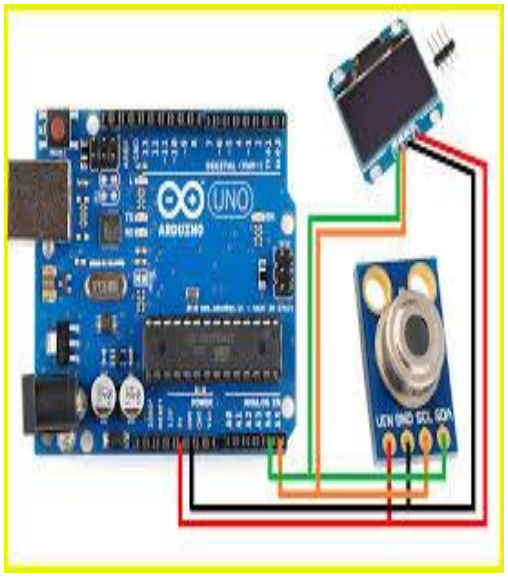


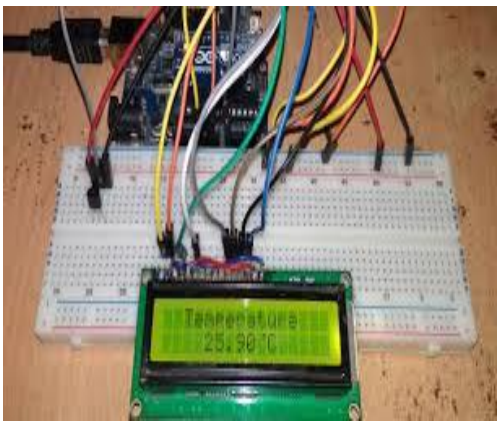
Hardware pictures

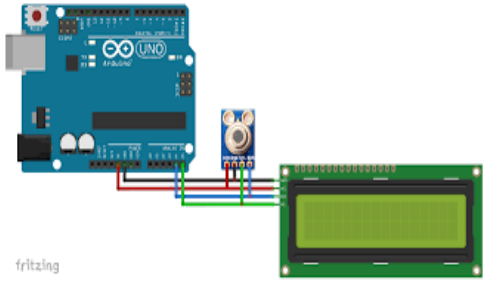


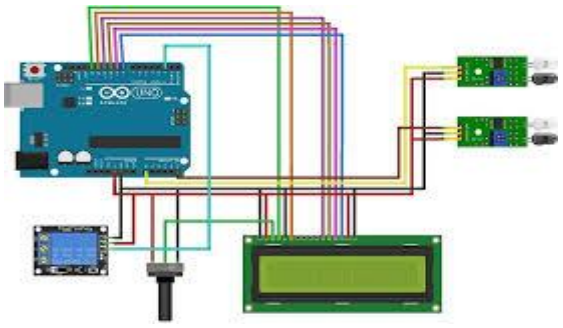



Person In Room:
1


UNO
ARDUINO
VCC GND SCL SDA


Temperature
25.90°C


UNO
fritzing



Conclusion

The system was successful in counting no.of entries, exits and read body temperature within an acceptable range of error, and sending that information at higher update rate than similar projects have done. Moving time expensive floating point calculations of the Arduino and performing them on base station to increase the speed of execution time.The project was a valuable experience in designing, programming, implementation, and testing of the system with several discrete hardware and software components.

Ultimately the system accomplished its goal of maintaining social distancing and safety to the user and people around him in a safe way. Every individual could read the no.of entries and their temeperature during this pandemic time. And avoid close contacts with people and over crowedness in public areas. Now, installing this project public places will allow the people entering there are safe and how many can fit in accordance with guidelines laid by the government. The whole project works in favor of the government in maintaining public safety and social distancing. And should be installed in many public places.

Applications

- It can be used in public transport system.
- It can be used cinema halls, theatres, restaurants, etc.
- It can be used in schools, colleges, if anytime government think of starting them.
- It can be used in offices, factories, industries, hospitals etc. where people go in bulk.
- And many more places where crowd is more like temples, and people are in constant touch of each other.

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- **Automated Room Light Controller with Visitor Counter** Gaurav Waradkar1 , Hitesh Ramina2 , Vinay Maitry3 , Tejasvi Ansurkar4 , Asha Rawat5 , Parth Das6 UG Scholar1,2,3,4 , Assistant Professor5,6 Department Of Computer Engineering PVPPCOE Sion, Mumbai, India.
- **Voice Controlled Digital Thermometer for Medical Application** Shwetlana Sinha1 , Sreya Chattopadhyay1, Arunava Mukhopadhyay1 Electronics and Communication Engineering Institute of Engineering & Management, Kolkata, India
- **Digital Thermometer: Design & Implementation using Arduino UNO Based Microcontroller** Bhavin Changela1 Krunal Parmar2 Bhautik Daxini3 Krushi Sanghani4 Kruti Shah5 1,2,3,4,5Department of Biomedical Engineering 1,2,3,4,5A V Parekh Technical Institute, Rajkot, Gujarat, India
- **A Non-Contact Integrated Body-Ambient Temperature Sensors Platform to Contrast COVID-19** Sandra Costanzo 1,2,3,4,* and Alexandra Flores 1 1 Dipartimento di Ingegneria Informatica, Modellistica, Elettronica e Sistemistica, Università della Calabria, 87036 Rende, Italy; flrlnd93d56z605o@studenti.unical.it 2 ICEmB (Inter-University National Research Center on Interactions between Electromagnetic Fields and Biosystems), 16145 Genoa, Italy 3 National Research Council of Italy (CNR), Institute for Electromagnetic Sensing of the Environment (IREA), 80124 Naples, Italy 4 CNIT (Consorzio Nazionale Interuniversitario per le Telecomunicazioni), 43124 Parma, Italy * Correspondence: costanzo@dimes.unical.it; Tel.: +39-0984-494652 Received: 5 September 2020; Accepted: 3 October 2020; Published: 12 October 2020