International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 05 | May-2021 ISSN: 2582-3930

Contactless Temperature Measurement with Door Mechanism

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Abstract –

Abstract: In response to COVID19 pandemic outbreak, there is a need for a temperature check-up of the visitors to detect fever before they enter the city via the airports, railway stations and even at the highway tolls. There is a need for thermal screening in shopping malls, multiplex, supermarket and various other places before granting access to the visitors. There is a risk of cross infection in manual testing. The MLX90614 is a high-performance Infrared Temperature Sensor that can be used to automatically make a temperature check-up and decide whether to grant the door access. This paper is comprised of mainly the three subsystems: namely Human Presence Detection System, Temperature Measurement System and automatic door access control with display.

Key Words:MLX90614, HC-SR04, microcontroller, I2C protocol, COVID19.

1.INTRODUCTION

The COVID -19 pandemic has changed the human life. This paper refers to building a smart device which helps to perform a contact less temperature sensing door opening system. This reduces the dependency of people on the guard and ensures the safety of the guards and also speed up the process. This paper aims to provide the detail explanation of contact less door opening mechanism and the benefits of using the same.

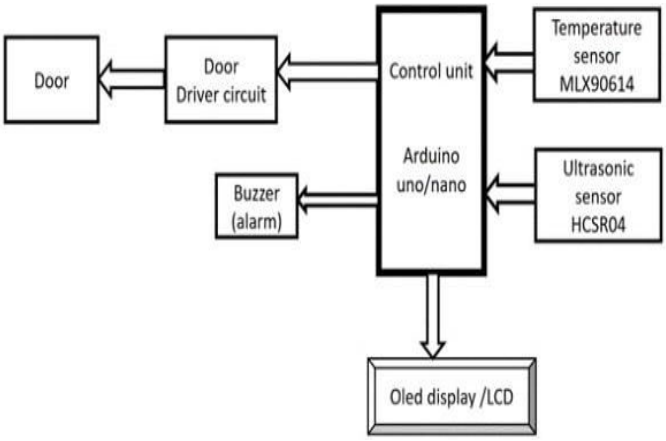
2. Problem Statement

Ever since the lockdown has been lifted, people have started travelling and measures have been taken to stop the spreading of the infection. Social distancing and thermal screening are being adopted everywhere. The thermal screening is currently being done manually and there is a high chance of cross infection. In places where large number of people travel the manual system cannot be managed easily and it is a burden. Moreover, manual thermal screening requires human power and there is also a risk that the person conducting the thermal screening might get infected.

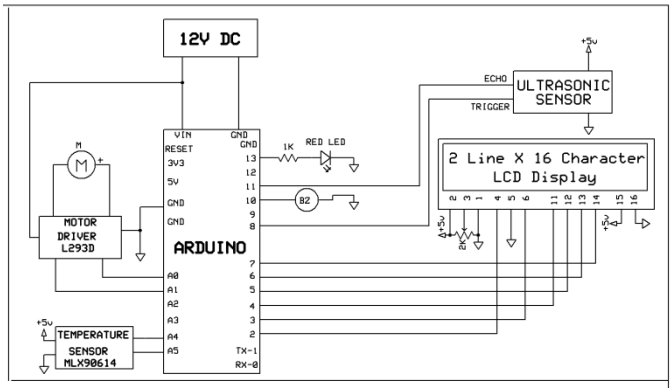
3. PROPOSED SOLUTION

A contact less temperature measuring and door (gate) access system using the MLX90614 sensor along with Arduino. Hence minimizing the risks of spread of virus is employed in the current methods of screening. The MLX90614 sensor uses IR energy to detect the temperature of an object. The system is user friendly. Implementing this system in airports, railway stations, shopping malls and other places helps the user to restrict the entry of the person having fever and avoiding the possible spread of infection.

4. BLOCK DIAGRAM



5. CIRCUIT DIAGRAM



6. METHODOLOGY

A. Human Presence Detection System:

This subsystem consists of a HC-SR04 ultrasonic sensor which is used here to measures distance. HC-SR04 Ultrasonic sensor is a 4pin module, whose pin names are VCC, trigger, echo and ground respectively. The module has two eyes projecting in the front which forms the Ultrasonic Transmitter and Receiver. By the help of this sensor we can measure the distance of the object placed in the range of the sensor. The transmitter transmits an ultrasonic wave of known speed, this wave travels in air and when it gets objected it is reflected back towards the sensor which is received by the echo of the sensor. The microcontroller keeps sending a pulse to the trigger pin of the sensor. On the falling edge of the pulse the sensor starts emitting the ultrasonic sound waves. These sound waves bounce back when they hit the object and is sensed by the echo (receiver) of the sensor. The echo pin of the sensor sends back a pulse signal to the microcontroller which has a ON time equal to the time taken by the waves to travel and

bounce back. By measuring the pulse on time, we can calculate object distance. Further by detecting the change in the distance we can sense an entry of the person. So, whenever a person enters the microcontroller turns on the temperature sensor for further operation by displaying a message asking the person to face towards the temperature sensor. When no entry is sensed the temperature sensor (MLX90614) is set to power saving mode by the microcontroller.

B.Temperature Measurement System:

A contactless temperature measurement can be done by the MLX90614 sensor. It has two devises embedded in it, one is the infrared thermopile detector (sensing unit) and another is a signal conditioning DSP device (computational unit). It works bases on Stefan-Boltzmann law which states that all objects emit IR energy and the intensity of this energy will be directly proportional to the temperature of that object. The sensing unit measures how much IR energy is emitted by a target object and the computational unit converts it into temperature value using a built in ADC and outputs the data through I2C communication protocol. With the integration of on chip ADC, it requires minimal external circuitry and occupy minimal PCB area. The sensor uses both the object temperature and the ambient temperature to calibrate the object temperature value. It operates with a 5V supply. It can measure object temperatures in the range -70○Ċ to 380○Ċ and the ambient temperature in the range -40○Ċ to 125○Ċ with an accuracy of 0.5○ ˚C and a resolution of 0.02○Ċ. The system measures the forehead temperature of the person and sends it to the microcontroller through SDA pin of the sensor using I2C protocol. The MLX90614 has an on-chip RAM where the measured value is stored and it has EEPROM whose bits can be altered to set the mode of the sensor.

C.I2C Protocol:

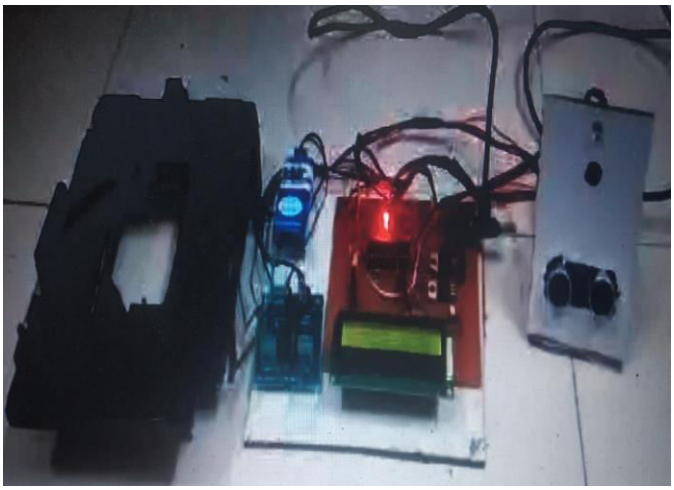
This protocol uses two-line SDL and SCL, one for the clock and another for data transmission whenever the microcontroller sends the clock signal through SCL. To identify the devices connected it sends the address bits to the particular device which is required. The address is 7 bit long and the last 8th bit is used to indicate read or write operation. The microcontroller sends a write command to start a temperature reading of the person in front of the sensor. The sensor stores the measured value in the RAM. The RAM address can only be read and cannot be altered by the user. Then the microcontroller sends a read signal to read the measured value. The EEPROM addresses can be written by the microcontroller to choose the operating mode of MLX90614.

D.Automatic Door Access:

The microcontroller performs calculations on the temperature measured by sending appropriate signal to the door circuitry, and access by displaying a message ‘if Temp. is Normal – green light turns ON and door will be automatically open and close an counter will incremented by one (+1), if counter is upto five (+5) then you are allowed otherwise door will not open.’ ‘if Temp. is Abnormal – red light and buzzer turns ON an starts ringing and door will be not open.’

7. RESULT.

A. Project Setup:



B. Result when Normal temperature detected.

C. Result when abnormal temperature detected.

8. CONCLUSIONS

The COVID-19 pandemic is considered as the most crucial global health calamity of the century and the greatest challenge that the humankind faced since the 2nd world war. The common symptoms of infection are Fever and if a thermal screening is done the possible spread of the virus can be controlled to a certain extent. This system enables a fully automatic contactless thermal screening for a door(gate) access. Currently the thermal screening is done manually and it not only becomes very difficult when it comes to large scale but there can be negligence of the guards too. In places like airports, railway stations and metro stations thousands of people arrive and depart which are hotspots for spreading of virus. If the automated thermal screening process is used in such place, it not only makes the screening process fast but also stops the possible spread of infection to a great extent. This system can also be implemented in the shopping malls, cinema, supermarket etc. This system can be embedded into already existing automatic doors (glass doors) with a very less modifications. The manual system in which monitoring was required, needed lots of money to maintain and were expensive, using the above system the users can cut the cost and dependency on the manual system.

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