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Automatic Digital Wireless Temperature Detecting Smart Door

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Abstract: Due to the successful emergence of the internet of things, sensor-based smart door using Temperature Sensor and Oximeter. A usable non-contact IR temperature sensor that can measure the body temperature without any physical contact is implemented. This paper describes a working prototype of Smart Door using Temperature Sensor and Oximeter system using MLX90614 temperature sensor, DIY Arduino with Oximeter MAX30100 where Ultrasonic Sensor is used for the distance measuring. In this prototype sensor, data is acquired and analysed to give proper feedback to the person with its temperature and oxygen level. The sensor vitals are collected and sent to the Arduino using shielded cable i.e., through wired communication, respectively. Analysis of a person's vitals based on ambient Temperature and Pulse gives a person's real-time temperature and Pulse condition so that if the condition is not normal, then the buzzer and red LED will flash so that preventive measures can be taken to avoid further complication. Per user, data can be saved in the system database for further reference.

Keywords: DIY Arduino, LED, Oximeter, prototype, Smart Door, Temperature Sensor.

I. INTRODUCTION

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

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 a 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.

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.

Need: Safety: The process of checking temperature of any person entering premises became common due the covid 19 pandemic. It's usually done by a person using a thermometer and even though the thermometer is contactless the person taking the temperature in close enough to get infected. Since that person is in contact with everyone entering and leaving the premise it’s possible that everyone can get infected.

Spread of the virus: The problem with this is the fact that the person in charge of doing the checks and allowing access of the building is also in danger of being infected. Since this person also interacts with everyone who enters and leaves the premises. It puts everyone in danger of contracting the virus hence defeating the original purpose of the process. Also, the chances of human error exist, the checker might misread the readings or allow people entry despite high temperature for personal reasons.

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Design Procedure:

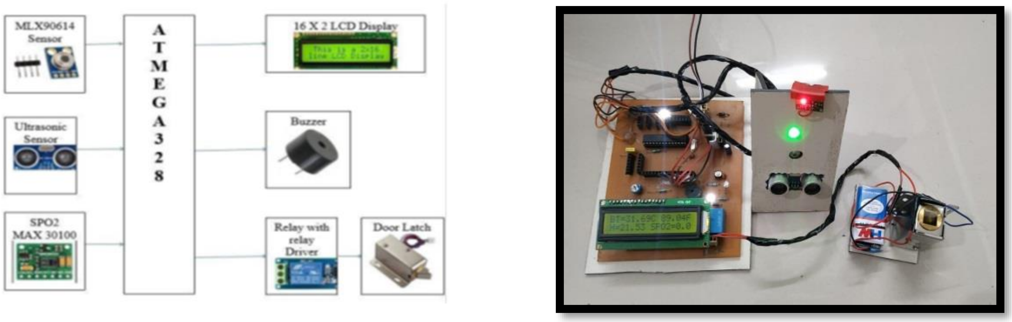

Fig. 1 block diagram, Actual picture of project

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

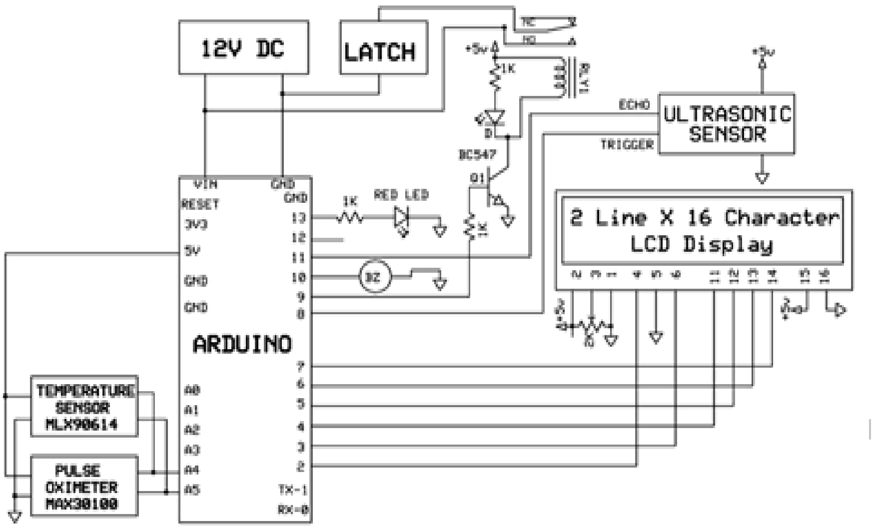

Fig. 2 Circuit diagram of project

• When power is given to system, system becomes ON. The power is given to the sensors i.e., IR sensor which an infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion. Then signal is given to relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current.
• MLX90614 sensor is manufactured by Melexis Microelectronics Integrated system, it has two devices embedded in it, one is the infrared thermopile detector (sensing unit) and the other is a signal conditioning DSP device (computational unit). It works based 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.
• A contactless temperature measurement can be done by the MLX90614 sensor. It has two devices embedded in it, one is the infrared thermopile detector (sensing unit) and another is a signal conditioning DSP device (computational unit). The system measures the forehead temperature of the person and sends it to the microcontroller through the SDA pin of

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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.
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 a counter will be incremented by one (+1), if counter is up to five (+5) then you are allowed otherwise door will not open.' 'If Temp. is Abnormal – red light and buzzer turns ON and starts ringing and door will not open.'

Fig. 3 HC-SR04 distance sensor

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e., the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).
In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is D = ½ T x C (Where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second). For example, if a scientist set up an ultrasonic sensor aimed at a box and it took 0.025 seconds for the sound to bounce back, the distance between the ultrasonic sensor and the box would be: D = 0.5 x 0.025 x 343 / or about 4.2875 meters.

Ultrasonic sensors are used primarily as proximity sensors. They can be found in automobile self-parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems, as well as manufacturing technology
Ultrasonic sensors are also used as level sensors to detect, monitor, and regulate liquid levels in closed containers (such as vats in chemical factories). Most notably, ultrasonic technology has enabled the medical industry to produce images of internal organs, identify tumours, and ensure the health of babies in the womb.
HC-SR04 distance sensor: Power the Sensor using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.
The amount of time during which the Echo pin stays high is measured by the MCU/MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information, the distance is measured as explained in the above heading.

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MLX90614 Sensor:

Fig. 4 MLX90614 Sensor

- 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.)

MAX30100 SPO2 Sensor:

- Operating Voltage: 1.8v – 5.5v
- Interface Type: I2C Serial Interface
- s
- Module Weight: 1.2g (Header + module)

Fig. 5 MAX30100 SPO2

Flowchart: Flow of project working is as follows.

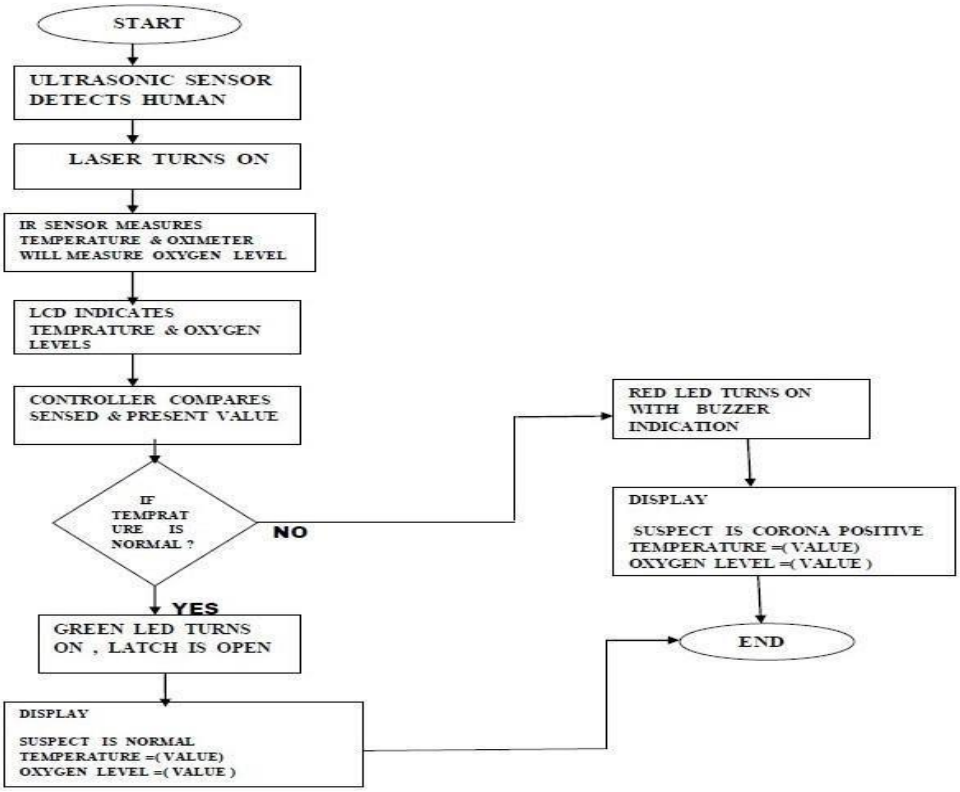

Fig. 6 Flow chart

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RESULT AND CONCLUSION

The following figures show the result of the project.

When Normal temperature | When High Temperature | SpO2 Result

Fig. 7 Result

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