Unsupervised Temperature Sensor at Common Places

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ABSTRACT
Considering the need for social distancing due to COVID-2019 and other viral flues, it is important to avoid meeting or getting in proximity with people who are sick. Therefore, this paper describes the construction and mechanism for an unsupervised temperature detector to avoid people with high temperatures to enter or attend a social gathering. The temperature detector uses an infrared thermal sensor to identify the person's body temperature and can be used to control the mechanism of the doors of entry to public places etc.

Author Keywords
COVID 2019; Thermal Sensor; Infrared sensor; Ultrasonic Sensor.

INTRODUCTION
The pandemic of 2019, also known as COVID 19 is caused by the coronavirus called SARS-CoV-2. This pandemic has affected the lives of more than 73,800,00 people across the world [1]. This virus when infected shows many symptoms and is not necessary that everyone has same symptoms. Symptoms usually take 2-14 days after the exposure to the virus [2]. This is one such reason that this contagious virus is a fast spreader as the person would feel just fine but might be infected and therefore can be a carrier for the virus to spread.

As suggested by the CDC, it is important to maintain social distancing, to avoid close contact with people. Although after long lockdowns the business have started to operate but impose a certain strictness like a temperature check, headcount check before allowing people to go into public places. This brings importance to unsupervised temperature detectors to stop people with body temperature greater than 100.4 ^{O}F [2]. This device is meant to be placed at doors or entrance of places such that when the person walks in front of the device the device detects the person's body temperature and thereby decides to allow the person based on the detected temperature.

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This device also has a variable range of height to detect temperature of people when they enter using an ultrasonic sensor to detect contact with a person and then triggers the temperature sensor.

COMPONENT REVIEW
To build an unsupervised temperature detector there are a few sensors and hardware needed like an MLX90614 sensor, Ultrasonic Sensor, a 9g Servo and a power supply of 5V-9V. Apart from the major components, wires, LEDs, and gear mechanism parts are also required.

Infrared thermal Sensor MLX90614
MLX90614 is an infrared thermometer which is used for non-contact temperature detection usually used in devices that have temperature control like air conditioners etc. This is a small size and a low-cost sensor with a medical accuracy of 0.5^{O}C. This sensor is available for both 3V and 5V [3].

Figure 1. MLX90614 Sensor [4]

Ultrasonic Sensor HCSRO4
HCSRO4 uses sonar which is an ultrasonic pulse that is transmitted, and an echo is received and using the time for the echo the distance to the object is calculated. It can be used for ranges up to 2cm to 80cm. The operating voltage for the sensor is +5V.

Figure 2. HC-SRO4 Ultrasonic Sensor [4]

Servo Motor SG-90
It is a micro servo motor that operates form 4.8 V to 6.5V. Just like most of the hobby servo motors, SG-90 also rotates

from 0^{O} to 180^{O}. Although the servo weighs about 9 grams it has a torque of up to 2.5kg/cm which is very ideal for the current model.

Figure 3. Servo-Motor SG-90

MECHANISM

The system is constructed such that, when the Arduino Nano, is powdered the power supply flows though the pins D13 to light the LED and indicate the start of the process. Once started the servo gear is powered to rotate for every 1 degree such that the servo rotates and moves infrared sensor down.

The extension keeps moving downwards until the ultrasonic gets an echo signal sent by the trigger. It then uses distance to compare with a stand distance of 10-20 cm checks if the person is standing close by the distance sensor. Once a person is detected then the infrared sensor is called such that the package methods form the **adafruit** are used to access the object temperature in Celsius or Fahrenheit.

Then the temperature is checked with the standard temperature for a symptomatic COVID patient (100.4^{O} F) [2]. And then based on the result the LED either blinks to turn off or to stay on. If the red LED is on, then the person could be infected and therefore the doors remain locked, else the doors can be opened.

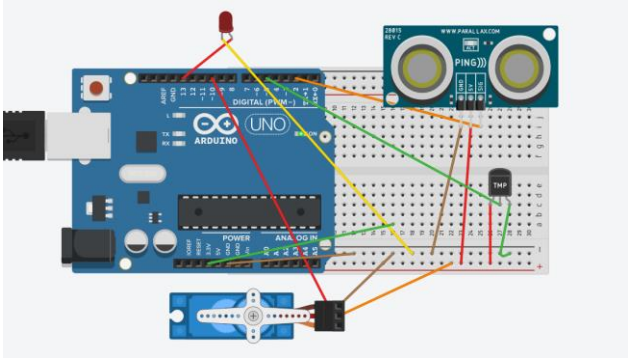

Figure 4. Sample Circuit Connection (generated via tinkercad)

Circuit Connections

The circuit is connected using a breadboard like shown in the figure 4. The ultrasonic sensor and the servo are connected to the 5V channel and the infrared sensor is connected to the 3.3V channel. Unlike the figure shown the ultrasonic sensor has 4 pins where instead of 1 signal pin it has a trigger pin and an echo pin, each of them connected to A2 and A3, respectively. Similarly, the temperature sensor shown is TMP36 and is only used to show the connection but for the paper the model used is MLX90614 which also has 4 pins Vcc, GND, SD, SL. The SD and SL are connected to A4 and A5, respectively.

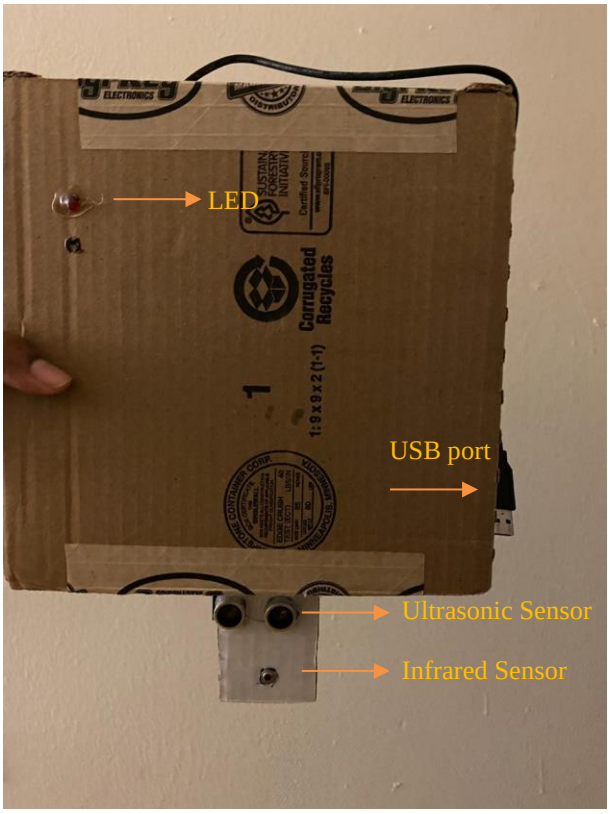

Figure 5. Front view of the unsupervised temperature sensor

RESULTS

The system was tested to see if it works in all different cases, although the system behaved as expected when each component was tested but after the integration of the design failed. This could be due to the lack of proper support in the servo mechanism and the communication delay between the ultrasonic sensor and the infrared sensor. Although this system could help the businesses by avoiding having a dedicated person to risk their life by scanning the foreheads of other people, but people can still tailgate or hide their forehead to avoid being detected by the system.

FUTURE WORK

The system needs to have a better mechanism to hold the moving in a stronger manner. Using the sleep mode for the infrared sensor can help avoid wastage of battery. Although the device has a very low human interface, a digital display such that the person can see their body temperature and be confirm their body temperature can be more useful. This can also raise self-awareness and enlighten the person to avoid further social gathering.

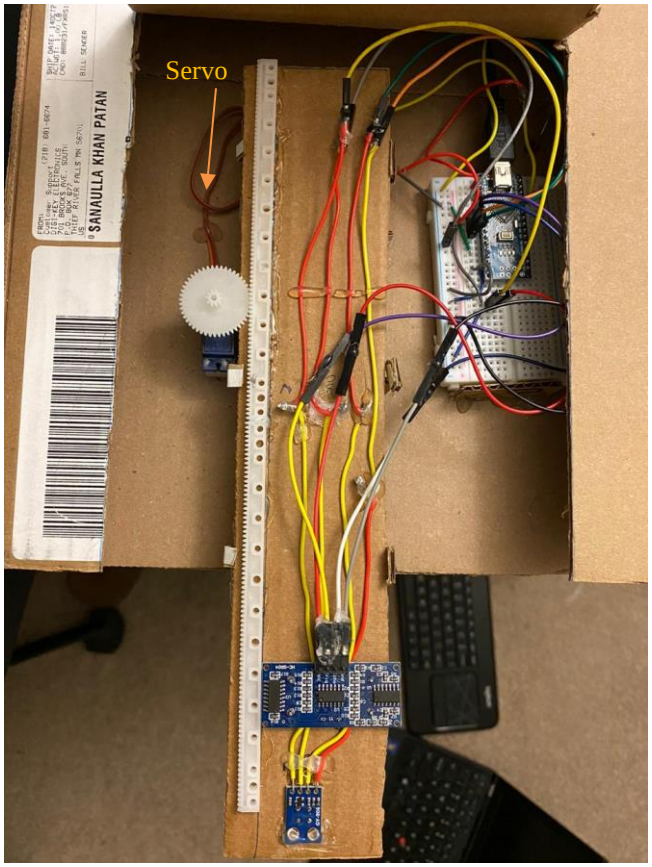

Figure 6. Internal wiring of components in unsupervised temperature detection system.

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