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Contactless Body Temperature Sensor with Kodular

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ABSTRACT: Commercial thermal infrared gun, a non-contact forehead Infrared thermometer, is designed for simple, expedient and accurate initial fever screening of group by aiming the thermometer at areas of the face such as forehead. In order to measure such person, you need to be close to the target and may result to being infected. The purpose of this device is to wirelessly scan and view the temperature form a distance. Person who's in charge for measuring temperature before entering the building is safe from being infected and can do more task instead of standing close and measuring others. "Touch less and do more." Here, we will develop a smart Bluetooth -based contactless thermometer with thermal screening capability added to our phones. To transform our phones into a contactless thermometer, first we need to connect our phones to a sensor over Bluetooth for giving us the temperature reading in an app.

KEYWORDS: Contactless thermometer, temperature sensor

I. INTRODUCTION

Body temperature is the basic and vital indicator of life. Measuring body temperature plays an important role in daily care. However, in the face of people's pursuit of a fast and safe lifestyle nowadays, the traditional mercury thermometer needs to measure about 5 minutes under the armpits and needs to be read by human eyes. Therefore, there are many drawbacks. With the development of infrared technology, infrared thermometers have also been recognized by the public due their safety and rapidity.

Basic design of Infrared thermometer consists of a lens to focus the infrared energy on to a detector, which converts the energy to an electrical signal that can be displayed in units of temperature after being compensated for ambient temperature variation. Infrared thermometer is mainly based on the principles of black body radiation to measure the human bodies infrared radiation wavelength, followed by the measurement of body temperature, infrared sensors used by it only to absorb the infrared radiation of human body without any emission, which uses a passive non- contact measurement method and can effectively prevent cross-infection of the human body, it is safe and convenient, so the infrared thermometer does not cause harm to the human body.

Compared with the traditional thermometer, the infrared thermometer is safe to use and has convenient measurement and short measuring time. It facilitates temperature measurement from a distance without contact with the object to be measured. As such, the infrared thermometer is useful for measuring the temperature under circumstances where thermocouples or other probe type sensors cannot be used or to do not produce accurate data for a variety of reasons. Therefore, the research on infrared thermometer designed has important theoretical and practical significance.

Infrared pyrometers allow users to measure temperature in applications where convectional sensors cannot be employed. Specifically, in cases dealing with moving objects, or where non-contact measurements are required because of contamination or hazardous reasons, where distances are too great, or where the temperature to be measured are too high for thermocouples or other contact sensors.

As day by day variants of COVID-19 are being increasing, it has become essential to regularly monitor the human body temperature without coming into contact with the measuring device so that an infected person can be immediately detected without further spreading the disease (due to contact). As per the need of time, a contactless temperature measuring device such as a thermometer is required everywhere.

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So, we are developing a smart Bluetooth-based contactless thermometer with thermal screening capability added to our phones. To transform our phones into a contactless thermometer, first we need to connect our phones to a sensor over Bluetooth for giving us the temperature reading in an app. We can also get the data from the sensor to our phone using the USB.

Contactless thermometer can achieve temperature on display by using Arduino Nano as the main control device as well as MLX90614 as the infrared (IR) thermometer sensor. Here, Bluetooth HC-05 used to transform the data to the mobile phone so that we can see the temperature using our phones as shown in Fig 1. As result, compared with the traditional thermometer, it shows strong points such as convenient reading, wide range of temperature measurement and accuracy where temperature output is displayed digitally. Besides, it would be used everywhere because of its easy-handling.

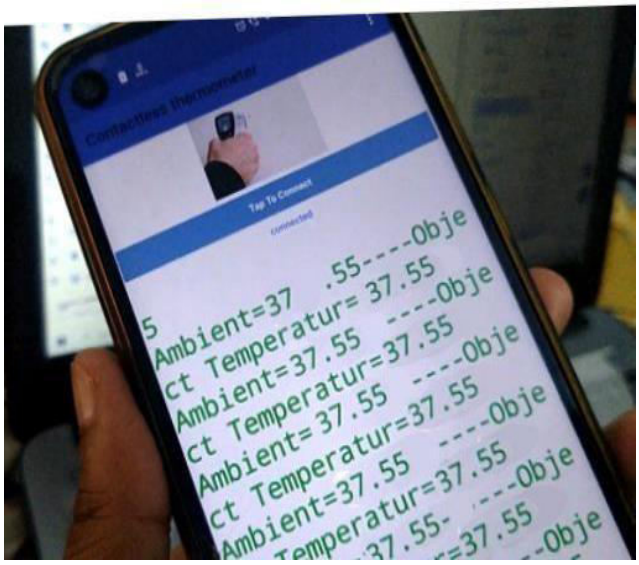

Fig 1: General image of displaying temperature

II. RELATED WORK

A total of fifteen studies were identified that evaluated the accuracy of tympanic thermometers. Of these publications, four were systematic reviews and eleven were non- randomized studies. Among these publications, tympanic temperature was used as the reference in four studies where results did not focus on the tympanic measurements.

Devices used to measure tympanic temperature varied across studies. The Braun Thermo Scan and the First Temp Genius were those used most often, whereas one study did not report the model of the device. The number of measurements and the mode of the device may have been different between studies, but were not always specified. The years of publication ranged from 2009 to 2014.

Seven studies evaluated the accuracy of handheld infrared skin thermometers. Of these publications, one was a systematic review and six were non-randomized studies.

Devices used to measure skin temperature varied across studies. The Thermo focus and the Emergent thermometers were those used in the non-randomized studies, whereas one study did not report the model of the device[3] and the SR included studies with other kinds of devices. The number of measurements and the mode of the device (i.e. the algorithm transforming the actual reading into the predicted body temperature) were different or not reported between studies.

The accuracy of handheld infrared skin thermometers was compared with rectal temperature in two studies, with pulmonary artery catheter temperature in one study, with tympanic thermometers in one study, with auxiliary temperature in one study, with nasopharyngeal temperature in one study, and with a reference that could be either oral, rectal or auxiliary temperatures in one study. The years of publication ranged from 2009 to 2013.

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III. PROPOSED ALGORITHM

A. *Description of the Proposed Algorithm:*

The temperature of a human body is sensed using temperature sensor MLX90614. For coding, first should install the MLX90614 Library in the Arduino IDE and then include it in the coding.

Loop function is created and it will run repeatedly. In the loop function, the sensor reading is checked and then it passes the reading to serial using Serial println(). This ensures that when we connect the Bluetooth to the serial pin of Arduino, the readings are transferred to the Bluetooth module.

Create the android application using Kodular website. Power the device and switch on the Bluetooth of the phone. Then select “connect” and select the Bluetooth module i.e., HC-05. The readings which are transferred from the Arduino will appear in the Bluetooth.

Android Application

Android application is designed by using Kodular website which is software compatible with all the android devices and other hardware components. Using this there is no need of coding the designing tools and only main code is edited for the working of design. This website is best known and good working software at any condition for application development.

Kodular is faster and production ready apps. It has simple and intuitive interference and offers many design possibilities even for complex applications. It does not require any expert consultation to make an app on Kodular but it has a set of limitations.

Creating the application, Login to kodular Account and then a New Project in kodular then give the name to the application. In this project naming the application as “temperature sensor” . As shown in the below figure 2 make the app layout and add the following components to the layout.

- Bluetooth client
- File
- List picker
- Clock
- Image

There are three sections in the kodular platform: Assets, Designer and Blocks. Open the blocks section and start coding by joining various blocks as in Fig 3. Next, export the project as Temperature Sensor.apk files and install it in your Android phone.

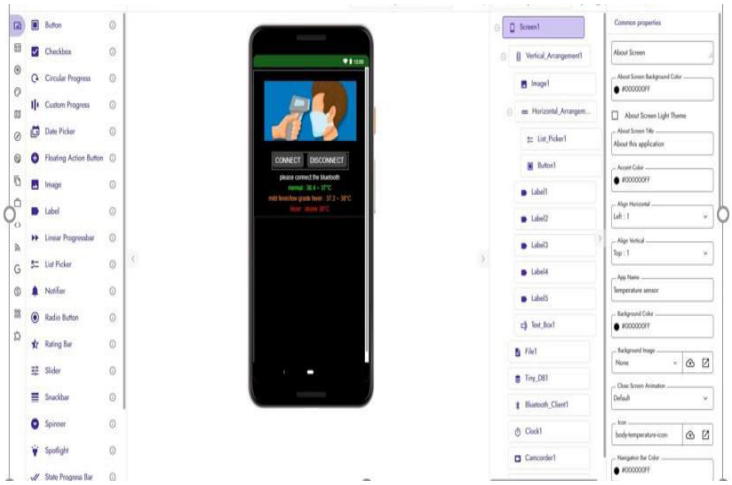

Fig 2: Application layout in kodular platform

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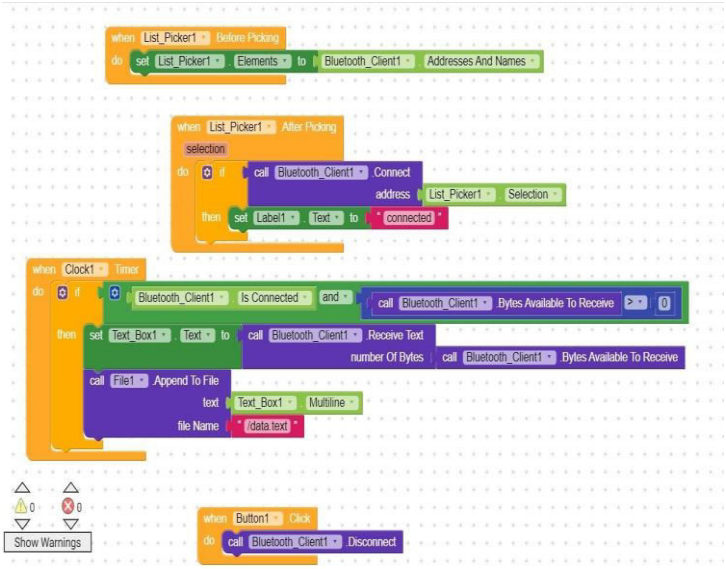

Fig 3: Coding in blocks section

When the clock fires we will check if the data is available in the Bluetooth. If the data greater than 0 then it will check for the available data. The data will take all them in bytes and load them in ascii format to label. Then we send to the textbox. The list picker contains all the paired devices to the android phone.

After making the connections and installation of the application on your phone, turn on the Bluetooth on your phone, open the application, and click on the 'CONNECT' button. Select HC- 05 to connect it. After the connection, you can see the temperature readings on the application as shown in the below figure 4.

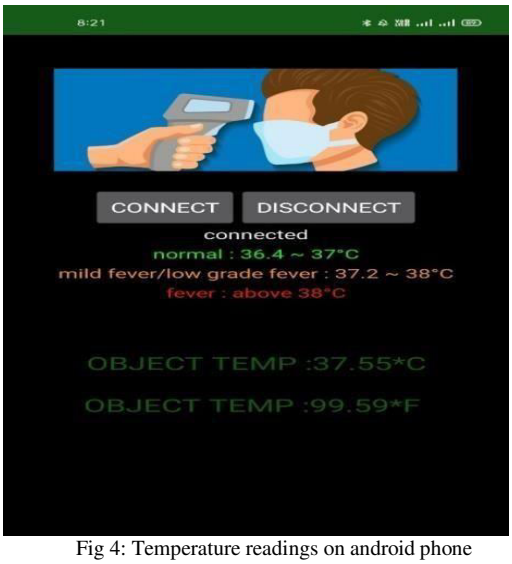

Fig 4: Temperature readings on android phone

IV. PSEUDO CODE

Step 1: Terminal Sensor acting as input
Step 2: Input to Arduino Nano
Step 3: Based on the code in the Program input is given to Nano
Step 4: Arduino Nano sends input to Bluetooth
Step 5: Bluetooth connects to Android application and displays desired result
Step 6: End.

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V. SIMULATION RESULTS

After implementing the project, it is important to check the results and verify it. Checking the results of intermediate steps are also important to proper analyses the whole project. It helps us to find the mistakes and to correct them, observing the results gives us lot of knowledge about the theoretical calculations and real world working differs and results shows the performance andcharacteristics of the final project.

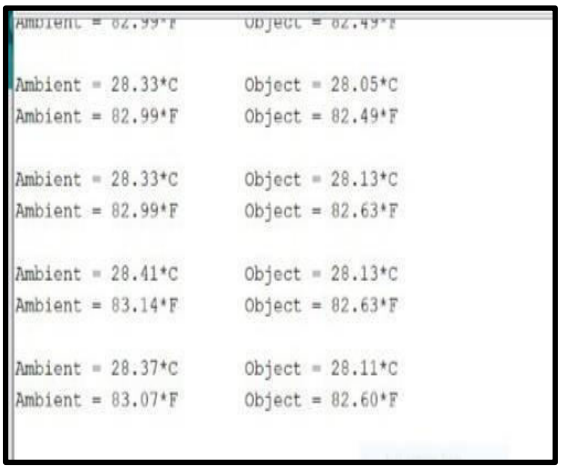

Fig 5: Output of the First step

Testing is done in each step. First step result is obtained by testing the sensor i.e., MLX90614 temperature sensor which only sensor used in the whole model. The coding the sensor is done through Arduino IDE. The output of the first stage is shown in Fig 5, where the temperature of the object is displayed on computer screen.

After installing the application in the phone, power the device and then switch on the Bluetooth of the phone. Then opening the application, select 'connect' and then select the Bluetooth module 'HC-05'. After successful connection, the temperature readings will be able to see in phone screen. As shown in Fig 6. The app will also save the temperature reading and temperature data in the text file and it will be available in file manager.

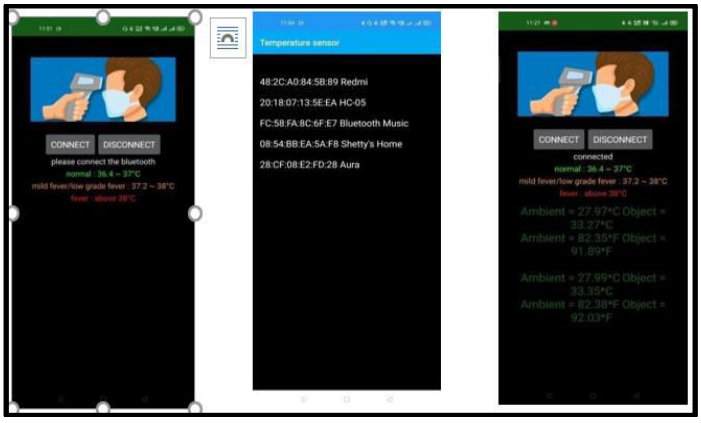

Fig 6: Output of the project

VI. CONCLUSION AND FUTURE WORK

The hand-held, non-contact thermometer has emerged as a good high-tech choice for detecting fever quickly. This device is easy to use non-invasive, accurate, infection-free and relatively inexpensive. Use this infrared thermometer at home for checking fever in children or very old seniors at home without toughing them or distracting them. Measuring the body temperature in public screening applications is not a good method for detecting increase in body temperature in individuals potentially infected with corona virus. By using this wireless infrared temperature sensor we can easily

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maintain the social distance, there is no contact between the sensor and the body hence the spread of the virus can be minimized. Since we are using the Bluetooth to measure the temperature in our smart phone it is very easy and handy to use this device.

Since this corona virus outbreak it is very essential to measure the temperature of the body regularly without making a contact with any devices which may spread the viruses. These Bluetooth based IR temperature sensing has made the thermal screening very easy using our smart phone.

These contactless temperature sensors are mostly used for the detection of body temperature at a gap of 2 to 5 cm between the sensor and the body. World Health Organization has specified that the distance between the two persons should be 1 meter during checking the body temperature to avoid the spread of the corona virus. Hence researches are going on to increase the range of the wireless infrared sensor. Fluke 568 is one of the example for the IR temperature sensor which has the range of 6ft. This distance can increased in the future for safe measurement of the temperature.

The wireless temperature sensor is becoming more and more accurate day by day. These sensors can also use in different applications such as in industries, HVAC, agriculture, aerospace and automotive. Instrumentation companies have pioneered advances in IR thermometers, line scanners, and imaging systems, addressing a host of application challenges. The new breed of IR sensor technology provides better accuracy, higher reliability, and greater ease of use.

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