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TEMPERATURE MONITORING SMART BAND

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Abstract: An outbreak of 2019 coronavirus pandemic (COVID-19) in Wuhan, China has spread quickly nationwide. There is a lack of human resource for monitoring the symptoms of COVID-19 patients or suspected person. Also human available for the monitorization of the symptoms are endangered as the COVID-19 can affect those too. This paper consists of an idea of inventing the Temperature Monitoring Smart Band which measures the temperature of a person without any human intervantion and alerts the user and nearby Covid Care Center (CCC) if the temperature exceeds the pre-defined COVID-19 conditions. This band also helps the Covid Care Center's Team to detect the live location of the suspected person. This band is the best example of maintaining social distancing in the society.

Keywords— *COVID-19, Temperature, Infrared, Arduino, GPS, GSM.*

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I INTRODUCTION

Temperature monitoring smart band measures temperature using the infrared light to measure the temperature. The temperature range is pre-defined by the manufacturer according to the COVID-19 conditions. If the temperature measured by the band exceeds the maximum temperature limit, the band will immediately notify the user. The smart band also includes a GSM and GPS module which sends the exceeded temperature alert to the nearest COVID Care Center (CCC) and also sends the accurate location of that person, so that their team will locate that person and make their test for COVID-19. This band helps in maintaining social distancing as there is no need of a physical person to measure the temperature of the suspected person. By using this band, we can detect suspicious person and stay away from them.

Fig. 1 Temperature Monitoring Smart Band

II. LITERATURE SURVEY

This paper presents a wearable human health-monitoring band. The band consists of a body temperature detector (BTD) and a hearrate detector (HRD). The BTD and HRD are realized using an inkjet-printed flexible temperature sensor and a commercial heart ratesensor module, respectively. The sensitivity of the fabricated BTD was found to be -31/°C with a linearity of 99.82%. The HRD usingthe commercial heart rate sensor module has a good performance with a standard deviation of 0.85 between the data of a commercial smart watch and the fabricated HRD [1].

In this paper, a user-friendly and cost-effective wireless health monitoring system that measures human body temperature from the back of the human body for monitoring the core body temperature of the human body is proposed. To measure body temperature accurately and precisely, a semiconductor-based micro temperature sensor with a max. accuracy of ±0.3°C was chosen and controlled by a high-performance/low-power consumption Acorn-Reduced Instruction Set Computing Machine (ARM) architecture microcontroller to build the temperature measuring/monitoring device. Depending on a 2.4 GHz multi-channel Gaussian frequency shift keying (GFSK) RF communication technology, upto 100 proposed temperature measuring devices can transmit/send the data to one receiver at the same time. E-shell of the proposed wireless temperature measuring device was manufactured using a 3D printer, and the device was assembled to conduct the performance tests and in vivo experiments. E-performance test was conducted with a K-type temperature sensor in a temperature chamber to observe temperature measurement performance. E-results showed an error value between two devices was less than 0.1°C from 25 to 40°C. For the in-vivo experiments, the device was attached on the back of 10 younger male people to measure skin temperature to investigate the relationship with ear temperature. According to the experimental results, an algorithm based on the curve-fitting method was implemented in the proposed device to estimate the core body temperature by the measured skin temperature value. E-algorithm was established as a linear model and set as a quadratic formula with an inter-polant and with each co-efficient for the equation set with 95% confidence bounds. For evaluating the goodness of fit, the sum of squares due to error (SSE), R-square, adjusted R-square, and root mean square error (RMSE) values were 33.0874, 0.0212, 0.0117, and 0.3998, respectively. As the experimental results have shown, the mean value for an error between ear temperature and estimated core temperature of the body is about ±0.19°C, and the mean bias is 0.05 ±0.14°C when the subjects are in steady status [2].

Wearable devices have recently received considerable interest due to their great promise for a plethora of applications in day-to-day life. An increase in the research efforts are oriented towards a non-invasive monitoring of human health as well as activity parameters. A wide range of wearable sensors are being developed for real-time non-invasive monitoring of heath and activity parameters. This paper provides a review of sensors used in various wrist-wearable devices, methods used for the visualization of parameters measured as well as methods used for intelligent analysis of data obtained from various wrist-wearable devices. As a result of this review, a taxonomy of sensors, functionalities, and methods used in non-invasive wrist-wearable devices was assembled and presented [3].

As smart bands develop gradually, their functions are also diversifying. Among these functions, body temperature should be accurate, but in reality it is not. Therefore, this paper proposes a method of converting the skin temperature measured with infrared sensor to the body temperature using a neural network. The proposed method can be applied to hardware modules in smart bands and will also increase medical confidence as it provides more accurate body temperature [4].

III. METHODOLOGY

Infrared Temperature Monitoring Smart band works on a phenomenon called black body radiation. Anything at a temperature above the absolute zero has molecules inside of it moving around. The higher is the temperature, the faster the movement of the molecules. As the molecules move, the molecules emits infrared (IR) radiation- which is a type of electromagnetic radiation below the visible spectrum of light. As the molecules get hotter, they emit more infrared (IR), and even start to emit visible light. That is why heated metals can glow red or even white. Infrared Temperature Monitoring Smart Band detects this radiation.

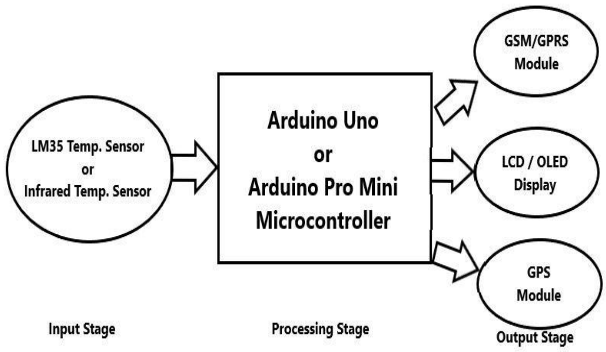

Fig. 2 Block Diagram of the Temperature Monitoring Smart Band

IV PRODUCT SPECIFICATIONS

Infrared Temperature Sensor: The MLX90614 is a contactless infrared digital temperature sensor that can be used to measure the temperature of a particular object ranging from -70℃ to 382.2℃. 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.

Fig. 3 MLX90614 IR Temperature Sensor

Arduino Pro Mini microcontroller: The Arduino Pro Mini microcontroller board is based on the ATMEGA328P microcontroller IC. It has 14 digital I/O pins (of which 6 can be used as PWM outputs), 6 analog I/O pins, an on-board resonator, a reset button and holes for mounting pin headers. A six pins header can be connected to an FTDI cable or sparkfun breakout board to provide an USB power and communicate to the board.

Fig. 4 Arduino Pro Mini microcontroller

OLED Display Screen: An Organic Light Emitting Diode (OLED) is a LED in which an emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current. An OLED display works in the absence of a backlight because it emits visible light. So it can display deep black levels and can be thinner as well as lighter than a Liquid Crystal Display (LCD).

Fig. 5 OLED Display Screen

GPS Module: Global Positioning System (GPS) is a satellite based system that uses sattelites and ground stations to measure and compute it's position on earth. GPS receiver module gives output in standard NMEA (National Marine Electronics Association) string format. It provides output serially on transmitter pin with default 9600 baud rate. This NMEA output in the form of string from GPS receiver contains different parameters separated by commas (,) like latitude, longitude, altitude, time etc.

GPRS GSM Module: SIM800L GSM/GPRS module is a miniature GSM module, which can be integrated into a

Fig. 6 Neo 6M GPS Module

great number of IoT and electronic projects. You can use this module to perform like almost anything a normal cell phone can: send SMS text messages, make / receive phone calls, connecting to the internet through GPRS, TCP / IP and more. Also, this module supports quadband GSM / GPRS network, meaning it works pretty much anywhere in the world.

Fig. 7 SIM800L GPRS GSM Module

V CONCLUSION

The estimated cost of the product / band is Rs. 2000 per band. This cost will get reduced as we will require these bands in bulk for the current pandemic situation. We can also use a LM35 Temperature Sensor instead of an Infrared Temperature Sensor. Doing so will reduce the cost of the band, but simultaneously the accuracy will also be reduced.

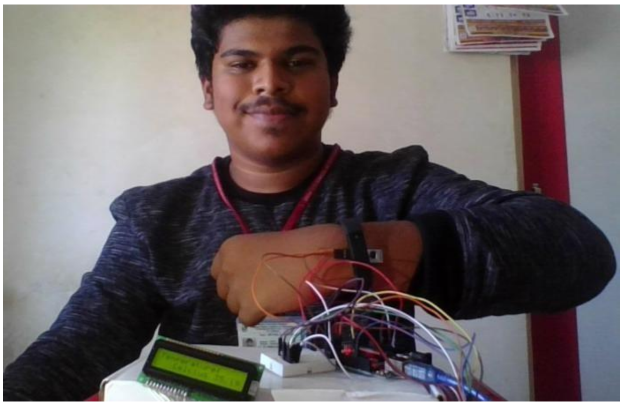

Fig. 8 Sample Band using LM35 Temperature Sensor

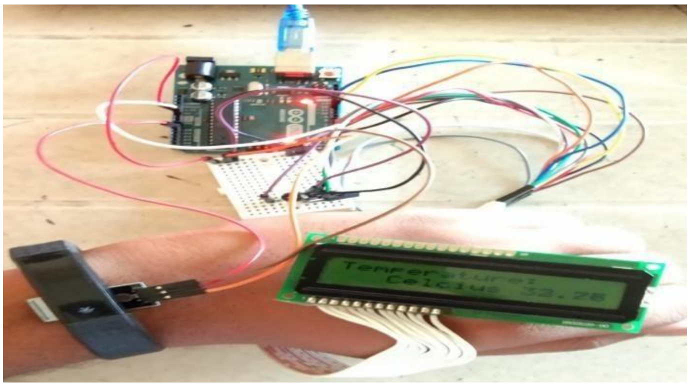

Fig. 9 Sample Band using LM35 Temperature Sensor

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