

A Wireless System for Body Temperature Measurement

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Abstract—With the development of mobile communication technology , mobile phones have not only call functions , but has telephone, dial up recording, call recording and other strong features, and send and receive text messages and email and other functions. There is no function to measure body temperature. Body temperature is a basic parameter for monitoring and diagnosing human health. Phone is a portable communication tool, its style increasingly small and ideal to carry. Therefore, the need for frequent monitoring of body temperature can be easily equipped as an application in cell phone. A temperature sensing unit can be included as an integral part of the mobile phone, resulting in an additional feature (body temperature measurement) provided with mobile phone. It is a very reasonable design for day to day body temperature measurement function but has yet to see this products or reports.

I. INTRODUCTION

Measuring body temperature is considerably important to physiological studies as well as clinical investigations. In recent years, numerous observations have been reported and various methods of measurement have been employed. Measurement of human body temperature is significant in the early detection of diseases, timely diagnosis, and treatment. Conventional body temperature measurement includes the use of a clinical thermometer and now a day's digital thermometer. A digital thermometer is hold by the patient at desired location and it shows the temperature on the display connected to it. The aim of this paper is to implement a system that sense the body temperature in a similar manner but the reading is shown on the screen of a cell phone.

The system consists of a hardware module to measure the body temperature. This temperature is then sent over wireless personal area network like Bluetooth to a cell phone. The emphasis is on various methods of measuring human body temperature that will provide accurate results and the most appropriate device according to our application. Once the temperature is sensed, it is stored. Then the reading is sent to the cell phone via Bluetooth. Even any other mode of transmission to cell can be used but the reason behind using a wireless personal network between cell phone and transmitter through Bluetooth enables further advancement to include "temperature sensing" as one of the features of modern cell phones. Also the link between transmitter of sensing unit and cell phone's Bluetooth is made permanent so that the data is not sent to any other device. Moreover it even provides protection against other network problems like unavailability of network for some time as in case of GSM. Also the range of Bluetooth is good enough in relation to this application.

The sensing part includes holding the sensor between the fore finger and thumb for a definite period. The body's actual temperature is determined by making corrections in measured temperature. The correction will be decided on the basis of difference between actual body temperature and the measured temperature by practically comparing the reports of at least 50 individuals. A lookup table consisting of the obtained voltages from sensor and the equivalent temperature is made.

At the receiving end, the change to be made in cell phone is to include an application (a program) that facilitate to accept data from Bluetooth. Thus this paper introduces a system that includes an entire temperature sensing unit with a Bluetooth transmitter and an application (program) to display the temperature on cell phone. The system finds application in hospitals where a doctor can download the application and temperature readings from various patients will be displayed on his cell phone.

II. TECHNIQUES FOR DETECTING TEMPERATURE

There are various sensors available for determining the body temperature as:

1. Infrared non contact sensor
2. Medical digital thermometer
3. Thermistor

These sensors can be used to detect the core body temperature in practical applications. The first sensor in above mentioned list gives the temperature of that part of skin on which it is pointing. It actually gives the skin temperature and not the actual body temperature. Skin temperature is not same as the core body temperature because it acts as a bridge to maintain the body temperature with outside atmospheric temperature. Medical digital thermometer gives the exact temperature but it is a whole unit with display so using the same for sensing and interfacing it in order to connect it with cell phone will hardly provide any worth.

Pertaining to above factors the best method suiting the need of this invention is to use a Thermistor. A Thermistor is a variable resistor whose resistance varies with the change in temperature. A Thermistor is hold between the fore finger and thumb for a definite period in order to change its resistance according to the core body temperature. This change in resistance is converted into an equivalent change in voltage by employing thermistor in one of the branches of a wheatstone bridge.

This voltage change can be used to determine the exact temperature. A mathematical relation is established between the change in voltage and the equivalent change in temperature and a lookup table consisting of various practical values of temperature in the range of 28 deg C to 45 deg C.

III. REQUIREMENTS OF THE SYSTEM

1. A detecting system to accurately measure body temperature.
2. Storage device to store the reading and perform necessary calculations on it.
3. A transmitter and receiver unit to send data to cell phone via wireless personal area network.

IV. METHODS

The method includes sensing temperature and storing it. Necessary calculations are performed on the reading to find the temperature. This data is sent through a wireless network viz. Bluetooth to a cell phone. Prior to sending, a permanent link is established between the transmitter attached to the sensing unit and the receiver of cell phone. The concept of using Bluetooth lies here only. Bluetooth is a wireless network and is almost available in all mobile phones in present scenario. Moreover Bluetooth is a wireless personal area network hence it becomes the ideal choice for the said invention.

The software change needs an application to accept the data sent through the sensing unit and display the same on cell phone when that application is launched. Also the application makes use of Bluetooth connectivity when this application is launched.

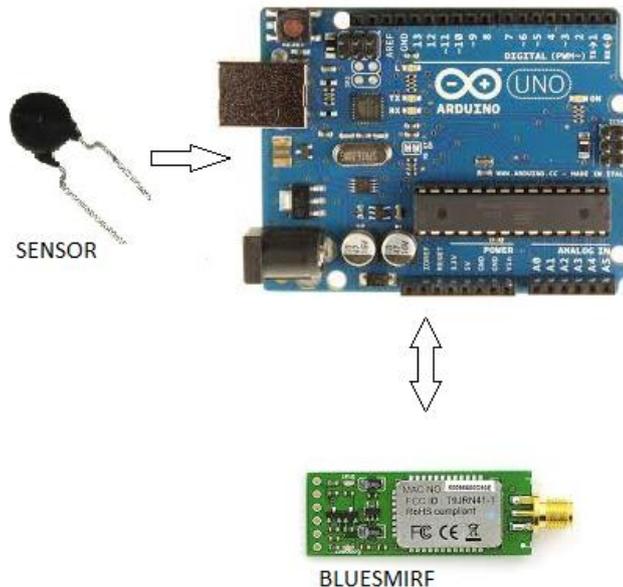


Fig 1

The sensor is connected to an Arduino board. The arduino board used is Arduino UNO R3. Even other boards like Arduino Mega 2560 or Arduino AOK can be used. These boards are stackable in order to connect Bluetooth shield with them.

The Bluetooth shield used is Bluesmirk. To establish serial communication between Arduino board and Bluetooth Shield, the baud rate should be set at 9600 in place of 115200. As this Bluetooth shield is communicating with Bluetooth of cell phone so setting the baud rate to 9600 is necessary.

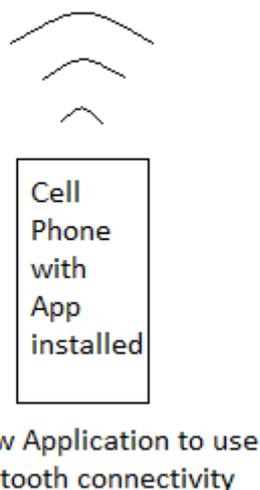


Fig 2

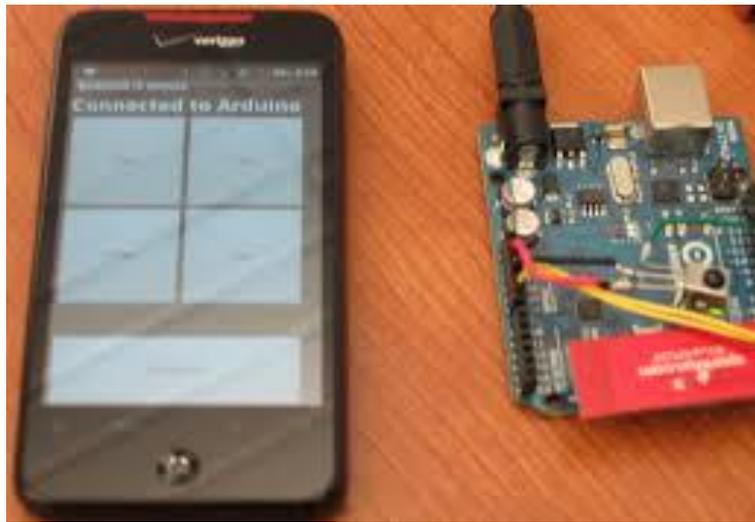


Fig 3

V. EXPERIMENTAL SET-UP

The final system consists of a body temperature sensor unit assembled with a microcontroller, storage unit and transmitter that supports transmission through Bluetooth technology. At the reception, we need a cell phone with Bluetooth enabled and an application to accept the reading and display the same.

The sensor is interfaced to Arduino UNO and a Bluesirf silver mate board is interfaced with Arduino. Program is uploaded in Arduino to communicate via Bluetooth. As Arduino is an open source platform the program are readily available from the official site. The application necessary at the receiving end (cell phone in our case) is also available from Google play store if the cell phone is an Android phone. For a java based cell phone, an application is developed using the platform of Nokia developer J2ME Application. It includes the connection manager and the connection interface in order to receive incoming messages, error notifications and about device connection accomplishment.

The Arduino code contains the “SoftwareSerial.h” library for communicating serially with Bluetooth.

Source list

- The J2ME code(for java based cellphone)
- Arduino code

VI. FLOWCHART OF THE PROJECT

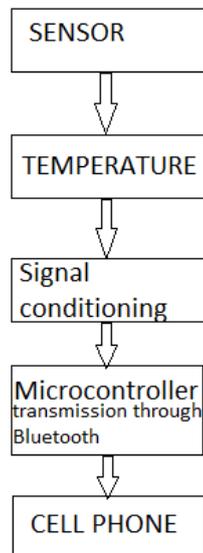


Fig 4

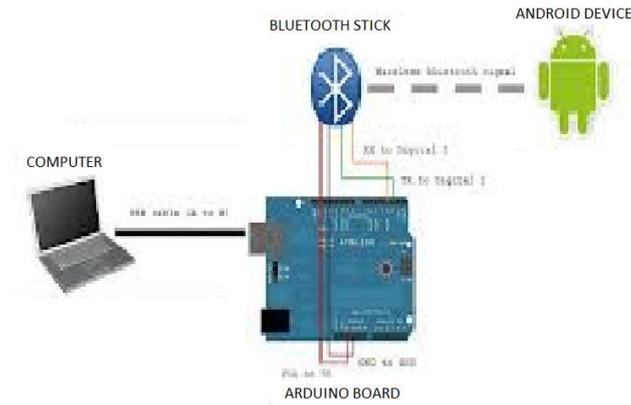


Fig 5

VII. CONCLUSION

A system that measures the body temperature and stores the value. Then send the reading to the cell phone to which the transmitter of sensing unit is paired.

ACKNOWLEDGMENT

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