

IOT BASED MEASUREMENT OF BODY TEMPERATURE USING MAX30205

Dr. Sudha S.¹, P. Shruthi², M. Sharanya³

¹Professor, ECE Department, Easwari Engineering College, Tamil Nadu, India

^{2,3}B.E - ECE Department, Easwari Engineering College, Tamil Nadu, India

Abstract - Temperature is a vital parameter in determining a person's health condition and plays a primary role in diagnosing the problem. Using the Fever Click MAX30205 sensor, a person can measure his body temperature easily. In cases where the patient is unable to meet the doctor or requires frequent monitoring, he could send his body temperature to the doctor anytime using the mobile application based on Firebase platform. To obtain values from the sensor and send it to Firebase, ESP8266 Wi-Fi Module is being utilized.

Key Words: Fever Click, MAX30205 sensor, Android application, IoT (Internet of Things), ESP8266 Wi-Fi Module, Firebase

1. INTRODUCTION

Human body temperature is of great interest in medical practice and diagnosis. The normal human body temperature range is usually between 36.5 °C and 37.5 °C (97.7 °F – 99.5 °F). A person's body temperature depends on his/her age, exertion, infection, the time of day, the subject's state of consciousness, activity level, and emotional state of the subject. Fluctuations in the human body temperature indicate a variety of diseases such as hypothermia, hyperthermia and cardiac arrhythmias.

Human body temperature changes are usually a reaction of our body's immune system; a fever indicates that the immune system is fighting off an infection. Body temperature is one of four significant signs that indicate the detection and diagnosis of almost all diseases and disorders, the other three being blood pressure, pulse rate, and respiration rate.

1.1 IMPORTANCE OF A PERSON'S TEMPERATURE

When an individual becomes unwell, one of the first things that should be done is to determine what disease, injury, or other factor is its cause. Few problems, such as heatstroke and pneumonia, cause the body to become higher than usual.

Some problems, such as hypothermia and some kinds of shock, cause the body to become colder than usual. The problem with the patient can be found by determining the body temperature. Change in the person's body temperature indicates that the treatment being used is effective.

1.2 VARIOUS BODY TEMPERATURES AND THEIR EFFECTS:

Table -1: List of different body temperatures along with their corresponding effects

BODY TEMPERATURE	EFFECTS ON BODY
44 °C (111.2 °F) or greater	Death will occur almost certainly.
43 °C (109.4 °F)	Usually death, serious brain damage, Cardio-respiratory collapse, continuous convulsions, and shock
42 °C (107.6 °F)	The person might turn pale or remain flushed and red. One might become comatose, be in severe delirium, vomiting, and convulsions could occur. Blood pressure (BP) might be high or low. Heart rate would be very fast.
41 °C (105.8 °F)	Dizziness, fainting, severe headache, hallucinations, vomiting, delirium and drowsiness might occur. Palpitations and breathlessness could occur too.
40 °C (104.0 °F)	Begins to be life-threatening. Fainting, headache, breathlessness, dehydration, weakness feeling, vomiting, and dizziness along with profuse sweating.
39 °C (102.2 °F)	Profuse sweating, flushed and red. Exhaustion, fast heartbeat rate, and breathlessness.
38 °C (100.4 °F)	Thirsty, uncomfortable, sweating, feeling of hunger, chillness feeling too.
36.5–37.5 °C (97.7–99.5 °F)	Normal body temperature.
36 °C (97 °F)	Temperature becomes this low while sleeping may be normal.
35 °C (95 °F)	Shivering, numbness and grey/bluish colouring of the skin. Heart irritability may occur.
34 °C (93 °F)	Disablement of finger movement, shivering.
33 °C (91 °F)	Lot of confusion, drowsiness, lessening of reflexes, slow heart rate, breathing is shallow.
32 °C (90 °F)	Hallucinations could occur, delirium, a lot of confusion, extreme drowsiness progressively becoming comatose. Absence of shivering.
31 °C (88 °F)	Comatose, conscious rarely. Very fewer reflexes. Shallow breathing and slow heartbeat. Serious heart rhythm problems may occur.
28 °C (82 °F)	Heart rhythm disturbances to be severe, breathing might stop anytime. The person might appear dead.
24–26 °C (75–79 °F) or less	Irregular heartbeat or respiratory arrest usually causes death.

2. PROPOSED METHOD

Fever Click senses and measures the human body temperature. The Wi-Fi module transmits the data to the cloud database, which stores the data. The ESP Wi-Fi module was chosen because it allows making simple IP connections. According to this buffered data, the results are displayed in the Android application which was created by us, "Temperature Monitor". The dynamic updates are provided with the help of the Firebase and the sensor. These updates could be viewed by the doctor by using the mobile application. This is depicted in Figure 1.

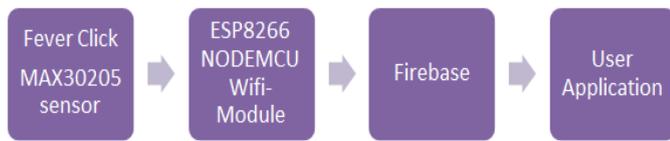


Fig -1: Block Diagram

3. SETUP

Fever Click measures the temperature of our body with an accuracy of 0.1°C. The click contains MAX30205 human body temperature sensor, having a 16-Bit (0.00390625°C) temperature resolution. This device converts the analog temperature measurements to the corresponding digital form with the help of a high resolution, sigma-delta, an analog-to-digital converter (ADC). Fever click reads the body temperature, and the results could be shown on the mikromedia PIC32, which is a high quality, compact smart display.

The data from the sensor will be segregated by the NodeMCUESP8266-12E Wi-Fi Module. The firmware NodeMCU is an open source IoT platform and is equipped with an integrated TCP/IP protocol stack, which can provide access to the Wi-Fi network.

The Wi-Fi module transmits the data collected to the Firebase, which is a mobile and web application development platform developed by Firebase, Inc. It offers many services such as analytics, storage, hosting, real-time database, different APIs, multiple authentication types and hosting platform.

The Android application shows the temperature of the patient. When the information button is clicked, the temperature along with the time of measurement would be displayed. The developed application receives the required data from the cloud database. The values will be updated periodically. The pictures of the application with the information button as well as the display of temperature are being shown below.

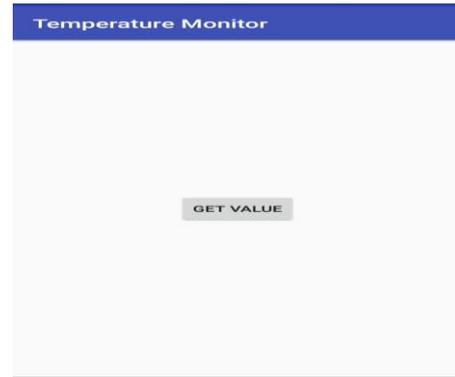


Fig -2: The Get Value button

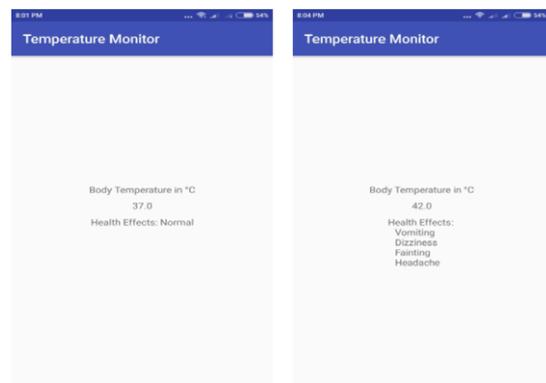


Fig -2: Different temperatures and their effects displayed in App

4. FIELD SETUP

The Fever Click MAX30205 sensor should be in contact with the patient's skin to make measurements. Since this is the only basic requirement, patients of any age group, whether bedridden or not, at any time of the day, can measure their body temperature. Then, the microcontroller is used to send the value to the cloud database which sends the same to the user's interface. The photos of Fever Click along with MAX 30205, as well as the sensor with mikromedia PIC32 smart display are shown below.

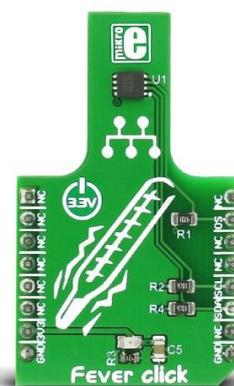


Fig -2: Fever Click

5. RESULT

The temperature of a patient's body can be measured with just contact of the skin with the sensor. The above experiment has been implemented on 5 patients of different age groups with body temperatures and has been validated with accurate results. This method provides an efficient and better way to communicate to a doctor, especially for patients who are bedridden or require frequent medical check-ups. ☐

6. CONCLUSION

We have successfully developed a system that would monitor the temperature of the patient and continuously send the temperature values to the doctor. In this way, any abnormalities in the body's thermoregulation mechanism are found and hence several disorders can be prevented. ☐

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