# Design and Application of Low-Cost Health Monitoring System

Lakshmi B N[1] and S. Selvakanmani[2]

[1]*Assistant Professor, Department of Computer Science and Engineering, BMSIT and M Bangalore-560065, Karnataka, India.*
[2]*Associate Professor, Department of Computer Science and Engineering, Velammal Institute of Technology, Chennai - 601204. Tamil Nadu, India.*
[1]*lakshmibn@bmsit.in*, [2]*sskanmani6@yahoo.com*.

**Abstract.** Researchers designed a limited health monitoring system that could detect cardiac output, pulse rate, as well as skin temperature in addition to checking physiological parameters routinely at the house. The last study aims to design as well as construct a useful diagnostic that uses an expandable shackle to detect cardiac output, pulse rate, as well as skin temperature, and afterward displays the information to the network display. Electronics, analog system, the engine as well as valves' functional status, as well as Raspberry Pi 3 seem to be the four primary components of the gadget. The idea was to connect all of the circuit's pieces such that the software could monitor all of the health statuses.

**Keywords:** health monitor; computer screen; Raspberry Pi 3.

## 1. Introduction

A person's health can be a top priority. Advanced people's rights, on the other hand, were constantly hampered by a variety of potentially hazardous variables, like as excessive fluid temperature as well as an irregular heartbeat. High cholesterol, often known as hypertension, raises the heart's workload in increasing the blood flow through the circulatory arteries [1]. Attack, myocardial, heart problems, atherosclerosis, as well as blood pressure problems are all linked to pressure. It was also one of the factors that contribute to chronic renal failure [2]. An individual's normal respiratory rate was 60 to 100 beats per minute. Even though there is a huge spectrum of health, a pulse rate that is excessively positive or negative could suggest an issue. The resultant level was 10 mg/°C, as well as the operating voltage was directly proportionate to the Degree Celsius [3-4]. Then, slowly valve was opened to let the gas out of the cuffs. During this point, the physician must hear with the stethoscope while also checking the blood pressure monitor. The pounding noise occurs whenever the pressure changes approach the client's pressure gradient. Whenever the banging noise stops, the associated force seems to be the pressure in the arteries of the client. Throughout this work, many compromises were established between the physical devices. Firstly, utilize the MCP3008 as the ADC for the overall project. Furthermore, whenever the temperature satellite's behavior was evaluated, the ADC measurement was extremely incorrect as well as inconsistent. During this time, you should abandon the MCP3008 in favor of a more accurate ADC, such as the ADS1115 with a 16-bit range [5]. Another technological compromise seems to be the manner of pulse rate monitoring. Originally, an ultraviolet transmitter, as well as a sensor, was used to create an ultraviolet cardiac current sensor. However, the reflecting off the fingernail is extremely small, which has a significant impact on accurateness. Furthermore, if the client continues to utilize these cardiac current sensors, the transmitter, as well as detection, must be completely covered.

The calculated and results would be greatly diminished if the transmitter, as well as detection, really isn't fully covered. As a consequence, abandon this concept as well as demand a new alternative, as described in section [6] of the pulse rate measuring device. Create the program to display the EKG while receiving information from the pressure transducer. Secretly planning a genuine ECG, on the other hand, was difficult as well as limiting the system throughput dramatically. The amount of information gathering has been lowered from 0.05s each test to about 0.8s each test. Heartbeat identification was extremely imprecise with the low sample rate, as well as the output suffers the consequences [7]. As a result, opt to perform the assessment firstly and save the information in a word document. Receive information from the word document after the assessment step as well as graph the ECG with the information from the word document.

## 2. Materials and Methods

TMP36 would be a precise Celsius thermometer with low power. It produces an electrical result concerning the Degree of Celsius and also has a 10 mg/°C outputting range [8]. That temperature controller has the benefit of not requiring any accurate measurement to achieve usual precision. Stress detector MPX2050GP for measuring oxygen levels in handcuffs [9]. Adaptive band-pass filtering was being used, to give a high voltage gain while screening out sounds to increase the resultant power of the signal. Because the output voltage from the pressure gauge was enough, it must be amplified before any more analysis. The high-precision monitoring oscillator only with single outer loop for volume adjustment. The Raspberry Pi GPIO pin [10] is used to drive the voltage. Have used an opt isolator to remove Raspberry Pi from the engine, as well as the opt isolator permits, everyone, to preserve the integrity of the transmission line from the unwanted side of the engine. Engines were also generally loud, large voltage pushed, and might end up causing explorative surges to delete out the circuitry in Raspberry Pi, just use an opt isolator to remove Raspberry Pi from the engine, as well as the opt isolator means allowing us to help the property of the loop from the undesirable side of the engine.

## 3. Proposed Technique

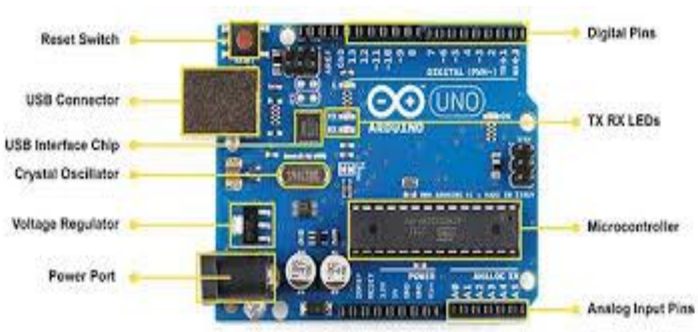


**Figure 1:** Hardware diagram.

Raspberry Pi would be used to operate both engines as well as the gate. They're wired a maximum of 2 NPN transistors, with the transistors' bottom pins linked to GPIO 21 as well as 16. Whenever the GPIO was set too high, the machine is switched on and the valve is opened. Each issue with our pressure regulator is that it does have two components: opening or closing, making it impossible to modulate circulation. When the valves were configured to release throughout condition 2, all of the gas in the handcuff was discharged in a microsecond. Because the procedure has become so rapid, the pressure gauge or Raspberry Pi will miss the cardiac beat information. Adding additional coding to with us an application to allow the pump to flow oxygen every 4 seconds, with a period of 0.05 sec every time, to tackle the issues. The shackle gently brings down as a result of something like this. One issue with compressing the handcuff would be that the temperature inside of the shackle was affected. As a result, the temperature within the pipe appears unpredictable in the first seconds after someone quit expelling gas, resulting in large data sets that mask the true heart sound wave. As a result, put the application to rest for 1 second to permit the temperature inside of the cuff to stabilize before receiving information from the ADC. Figure 1 shows the Hardware diagram.

## 4. Health Measurement

The cardiac beat comes following systolic pressure as well as vanishes before diastolic pressure even during the test. The temperature inside of the cuff oscillates when the heart rate increases, forcing the information received from the ADC to pause as well. The modified AC output power reflecting the cardiac beats captured by the force sensor was seen in the diagram below. However, the strength of the cardiac beat changes with periods. Since the pressure from the handcuffs could still completely cover the arteries, blocking blood circulation, the indication might fluctuate whenever the cardiac beat first occurs. As a result, certain faint pulse rates might even go undetected. Many heart rates were powerful enough to still be recognized once the tension inside the cuff drops to a certain value, as well as they're transmitted filter using ADC could achieve a level of above 25000. Following 15 seconds of testing, the steady-state was usually reached. Choose the period in the program where another waveforms fluctuation seems to be the greatest. It specifies that the period begins after the detection of 10 pulse rates. After counting the pulse rate for thirty seconds, multiply 2 by the number of heart rhythms observed to get the pulse rate. Because not all pulses could be recognized in actuality, researchers discovered that multiplying 2.2 seems to be an acceptable way to produce a fairly precise pulse rate report after calibration. The essential principle of pulse rate monitoring can be seen in the coding below. The systolic temperature was recorded when the very first pulse emerges, as well as diastolic stress was calculated after the pulse cannot be identified entirely, as indicated in the preceding paragraph. The idea was straightforward, but it must manage with noise. Since this sensing element has become so strong, even a tiny motion by the client could cause a loud hissing noise like a pulse, reducing the reliability of the positive test significantly. To reduce the impact of imbalanced datasets, our application produces pressure gradient after counting three pulse rates as well as diastolic after counting 40 nonplused pieces of information, which would be comparable to 400.05 seconds = 2 seconds. Initially, I attempted to visualize cardiac beat in live time. However, I have been unable to locate a suitable Python library that could fully handle that method. Polly, a premium representation for making charts, including scientific charts, was one of the tools humans tested. Polly could detect information in real-time, but because it is an internet application, the chart could only be viewed on a computer. Then I continued to matplotib, which is a graphing toolkit for Python as well as its quantitative mathematics expansion Jumpy. The movement of the cardiac beat could be created using the animation method; however, this feature halts the project's operation. Humans have exhausted all feasible solutions and have been unable to tackle the issues. Then I discovered that using to display information on the screen seems to be a massive amount of work.

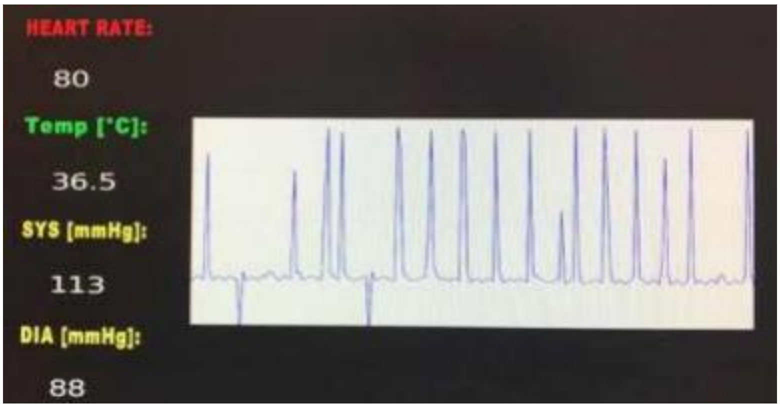


**Figure 2:** Output graph

Humans construct a perfectly functioning widely used diagnostic with skin temperature, pulse rate, including cardiac monitoring algorithms, as well as a graphical user interface to show the measurements. Comparing the OMRON item testing findings to actual data measured as well as estimated outcomes during the testing phase. Humans discovered that their measured values are very similar to those of

OMRON. Humans produce stringent reliability requirements. The wellness monitoring was depicted in the graphics as well as the movie below. Figure 2 shows the Output graph

## 5. Conclusion

Each last project has been completed effectively in the end. Humans effectively applied the quantification of skin temperature in degrees Centigrade, pulse rate in beats per minute, as well as pulse rate in millimeters of mercury, as well as all 3 measured values, were also extremely reliable compared to certain other consider the following products available at pharmacies, supermarkets, as well as other locations. In addition, researchers create a graphical interface to show consumers all of the measuring findings as well as an ECG that precisely recovers the pressure information taken during the observation made. During implementing those methods, researchers made many choices in terms of improving the information as well as computation correctness. Designers ran into a few issues, but we were able to work through them and eventually resolve all of the issues as well as glitches. Humans received a lot of knowledge as a result of the study. Everything humans learn and practice from such research was significant as well as important for possible future research of existing software systems.

## References


1. Nedungadi, P., Jayakumar, A., & Raman, R. (2018). Personalized health monitoring system for managing well-being in rural areas. *Journal of medical systems*, *42*(1), 1-11.
2. Swartz, R. A., Jung, D., Lynch, J. P., Wang, Y., Shi, D., & Flynn, M. P. (2005, September). Design of a wireless sensor for scalable distributed in-network computation in a structural health monitoring system. In *Proceedings of the 5th International Workshop on Structural Health Monitoring* (pp. 12-14).
3. Islam, A. J., Farhad, M. M., Alam, S. S., Chakraborty, S., Hasan, M. M., & Nesar, M. S. B. (2018, October). Design, Development, and Performance Analysis of a Low-Cost Health-Care Monitoring System using an Android Application. In *2018 International Conference on Innovations in Science, Engineering, and Technology (ICISET)* (pp. 401-406). IEEE.
4. Kale, S., & Khandelwal, C. S. (2013, March). Design and implementation of the real-time embedded telehealth monitoring system. In *2013 International Conference on Circuits, Power and Computing Technologies (ICCPCT)* (pp. 771-774). IEEE.
5. Girolami, A., Brunelli, D., & Benini, L. (2017, July). Low-cost and distributed health monitoring system for critical buildings. In *2017 IEEE Workshop on Environmental, Energy, and Structural Monitoring Systems (EESMS)* (pp. 1-6). IEEE.
6. Lynch, J. P. (2007). An overview of wireless structural health monitoring for civil structures. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *365*(1851), 345-372.
7. Federici, F., Alesii, R., Colarieti, A., Faccio, M., Graziosi, F., Gattulli, V., & Potenza, F. (2014). Design of wireless sensor nodes for structural health monitoring applications. *Procedia Engineering*, *87*, 1298-1301.
8. Tang, T., Yang, D. H., Wang, L., Zhang, J. R., & Yi, T. H. (2019). Design and application of structural health monitoring system in the long-span cable-membrane structure. *Earthquake Engineering & Engineering Vibration*, *18*(2).
9. Kumar, K. M., & Venkatesan, R. S. (2014, May). A design approach to smart health monitoring using android mobile devices. In *2014 IEEE International Conference on advanced communications, control and computing technologies* (pp. 1740-1744). IEEE.
10. Ganesh, G. R. D., Jaidurgamohan, K., Srinu, V., Kancharla, C. R., & Suresh, S. V. (2016, December). Design of a low-cost smart chair for telemedicine and IoT-based health monitoring: An open-source technology to facilitate better healthcare. In *2016 11th International Conference on Industrial and Information Systems (ICIIS)* (pp. 89-94). IEEE.