International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Real Time Monitoring of Respiratory Abnormality Using IOT

[1]Mrs.W.SHERINMARY,[2]KIRUBAKARAN M,[3]MATHIVADHANI A,[4]RAMYA P, [5]KRITHIGA SREE R

[1]Asst.Professor, Department of ECE, Adithya Institute Of Technology, Coimbatore ,India, sherinmary_w@gmail.com
[2]UG Scholar, Department of ECE, Adithya Institute Of Technology, Coimbatore ,India, karankiruba8289@gmail.com
[3]UG Scholar, Department of ECE, Adithya Institute Of Technology, Coimbatore ,India, mathivadhani1830@gmail.com
[4]UG Scholar, Department of ECE, Adithya Institute Of Technology, Coimbatore ,India, ramya.p11620009@gmail.com
[5]UG Scholar, Department of ECE, Adithya Institute Of Technology, Coimbatore ,India, krithigajai0231@gmail.com

A B S T R A C T

Our final project is a respiratory monitoring system. The device calculates a patient's breathing rate by detecting changes in temperature when the patient breathes through a mask. Features of the device include a sensor which goes off when the patient stops breathing, when a low battery indicator signal when the battery powering the device reaches the threshold voltage. We use analog to digital conversions to sample readings from both the thermistor and battery.

Keywords— IOT (Internet of things); PPM (Parts per million); GSM (Global system for mobile communication); LORA(long range); IOT (Internet of things); Health Monitoring system, Bluetooth; Environment and physiological;

1 INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARSCoV- 2), the seventh human coronavirus, was discovered in Wuhan, Hubei province, China, during the recent epidemic of pneumonia in January 2020. Since then, the virus has spread all over the world, and as of 20May 2020, it has infected 4,806,299 people, and caused 318,599 deaths. SARS-CoV-2 as well as SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV) cause severe pneumonia with a fatality rate of 2.9%, 9.6% and 36%, respectively. In order to avoid this human intervention and cumbersome process, we have fully automated using a smart medical mask embedded with sensors, ESP-32 board enabled with WiFi connectivity and a battery pack. This smart medical mask when worn by employees or working group people in organization, sense and sends their temperature and breathing rate to web server connected through internet.

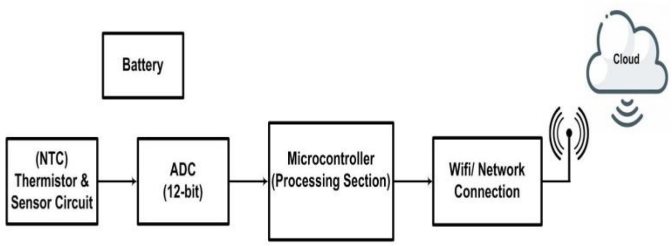
2 PROJECT OBJETIVE

Wearing masks can help communities slow the spread of COVID-19 when worn consistently and correctly by a majority of people in public settings and when masks are used along with other preventive measures, including social distancing, frequent handwashing, and cleaning and disinfecting.The information about how wearing masks can help reduce spread of COVID-19, for whom wearing a mask is or is not recommended, and considerations regarding implementation of mask-wearing as a COVID-19 community mitigation strategy.

3 PROPOSED SYSTEM

The mask is integrated with sensor which acquire the breathing rate of the person

- **BLOCK DIAGRAM**

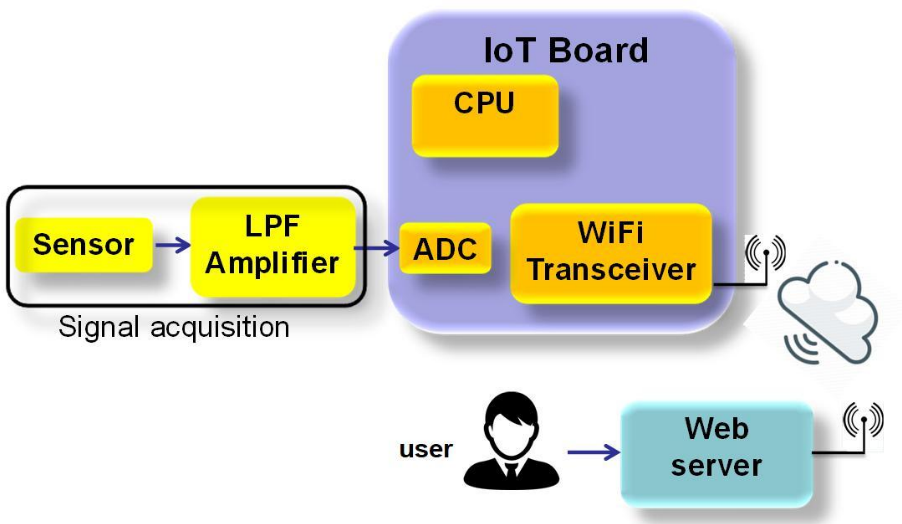


Architecture of signal acquisition in Smart Medical mask

4 HARDWARE IMPLEMENTATION

This section provides the detailed design of the hardware used for prototyping. The complete hardware prototype is developed and implemented using ESP-32 development board. A Hardware prototype was built using ESP-32 Development board (shown in Figure-4.2), Sensor and Operational Amplifier (LM324) as shown in Figure. The data received from the senor is filtered an amplified by signal acquisition system.

Further it is processed and sent to the cloud through wifi communication module



Internal Architecture Of Our Proposed System

THERMISTOR

Thermistor placed inside maskA thermistor is a resistor whose resistance is dependent on temperature. NTC thermistor, when the temperature increases, resistance decreases.Very sensitive and react to very small changes in temperatureWhile the principle use of thermistor is as resistive temperature sensors, they can also be connected in series with another component or device to control an electrical current flowing through them.

In other words, they can be used as thermally sensitive current-limiting devices.Thermistor are available in a whole range of types, materials and sizes characterised by their response time and operating temperature. Also, hermetically sealed thermistor eliminate errors in resistance readings due to moisture penetration while still offering high operating temperatures and a compact size.

The three most common types are: Bead thermistors, Disk thermistor, and Glass encapsulated thermistor.These heat-dependent resistors can operate in one of two ways, either by increasing or decreasing their resistive value with changes in temperature.

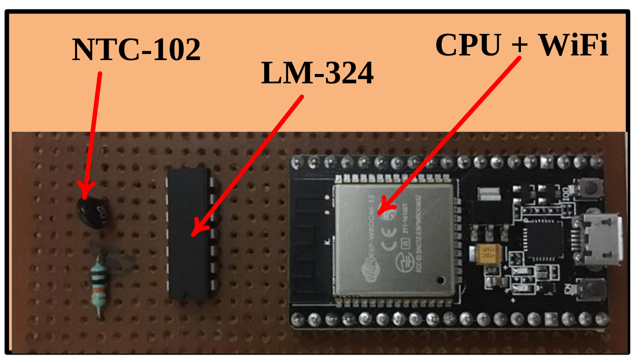
Then there are two types of thermistor available: negative temperature coefficient (NTC) of resistance and positive temperature coefficient (PTC) of resistance.Negative temperature coefficient of resistance thermistors, or *NTC thermistors* for short, reduce or decrease their resistive value as the operating temperature around them increases.

Both the temperature points of T1 and T2 are calculated in the temperature units of Kelvin where 0^0C = 273.15 Kelvin. Thus a value of 25^oC is equal to 25^o + 273.15 = 298.15K, and 100^oC is equal to 100^o + 273.15 = 373.15K, etc

THERMISTOR

OUR MEDICAL MASK PROTOTYPE

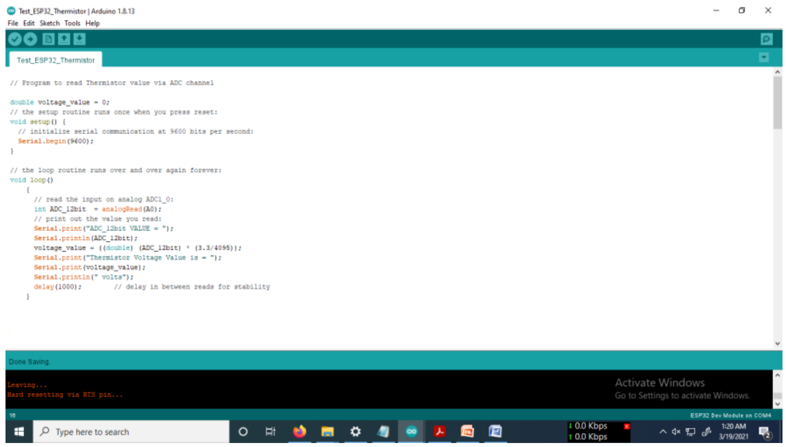
The developed hardware prototype using ESP-32 board, sensor (thermistor) and signal acquisition circuit is shown in Figure-4.11. This embedded sensor based prototype is placed inside the medical.



Prototype developed for medical mask using ESP-32 board

5 SOFTWARE IMPLEMENTATION

The developed hardware prototype was programmed using C/C++ Language. The Software implementation of this framework includes libraries, which provide building blocks for the design. The work-flow details of the software implementation are discussed in the following sections use a software development kit (SDK) provided by Espressif or one of the platforms listed on WiKiPedia. Fortunately, the amazing ESP32 community recently took the IDE selection a step further by creating an Arduino add-on. The complete program for the proposed architecture was written using C/C++ languageArduino is fundamentally a C/C++ environment, while Processing's underlying language is Java.TheArduino Integrated Development Environment - or Arduino Software (IDE) contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and ESP-32 hardware to upload programs and communicate with them.



Thermistor Sampling

Samples from the thermistor are taken through PINA0. First, the ADMUX register is set to turn on the left adjust result and external reference. The MCU then waits for a conversion to occur, and then sets the variable sample_old to the current sample and the sample variable to the high bits from the ADC. The absolute value of the difference between sample_old and sample is used to determine if the patient has stopped breathing. If this difference is less than or equal to 8, then this is considered a "no breath". If the MCU detects 10 consecutive "no breaths", a PWM signal is generated to produce a sound from the speaker. If the difference is above the tolerance, then the "no breath" counter variable c is reset to 0 and the PWM signal is set to be turned off.

Battery Sampling

To take a sample from the battery, ADC channel 1 on PINA1 is turned on by setting the ADMUX register. The MCU waits for a conversion to occur and then sets the variable bat_samp to the high bits from the ADC. The sample is then compared to the ADC value that was found to correspond to a voltage of 7.6 V. During testing it was found that device operation becomes unstable at 7.5 V. Therefore, we decided to warn the user when the voltage of the battery becomes 7.6 VIf the battery sample is found to be less than or equal to the tolerance, then a PWM signal is generated, left on for about 1 second, and then is turned off. The PWM channel which produces a tone for a low-battery warning has a larger prescalar than the PWM channel to produce the alarm for when a patient is not breathing, making the low-battery tone lower in pitch.

6 CONCLUSION

One of the best ways to prevent the spread of the coronovirus is to isolate anyone who might be carrying the virus. Unfortunately, unless the person is tested for the 2019-nCoV, he/she does no know that he/she is infected before getting sick. Therefore, detecting COVID-19 symptoms in the early stages plays a vital role. Our proposed IoT based medical mask is aimed to detect the most common symptoms of the disease. When any symptom is detected, the person is warned to get self-isolation; moreover, the health conditions of the patient transfer to the cloud database via the mobile application, so the healthcare specialist is informed about the employee's current situation.

REFERENCES

1. Noori Kim, Joslyn Lim Jun Wei, John Ying; Haining Zhang, Seung Ki Moon, Joonphil Choi "A Customized Smart Medical Mask For Healthcare Personnel", 2020 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)
2. M. Ippolito, F. Vitale, G. Accurso, P. Iozzo, C. Gregoretti, A. Giarratano, et al., "Medical masks and Respirators for the Protection of Healthcare Workers from SARS-CoV-2 and other viruses", Pulmonology, 2020.
3. A. Basra, B. Mukhopadhayay and S. Kar, "Temperature Sensor Based Ultra Low Cost Respiration Monitoring System", 9th International Conference on Communication Systems and Networks (COMSNETS), 2017.
4. S. Khan, S. Ali and A. Bermak, "Recent Developments in Printing Flexible and Wearable Sensing Electronics for Healthcare Applications", Sensors, vol. 19, no. 5, pp. 1230, 2019.
5. S. P. Sreenilayam, I. U. Ahad, V. Nicolosi, V. Acinas Garzon and D. Brabazon, "Advanced materials of printed wearables for physiological parameter monitoring" Materials Today, vol. 32, pp. 147-177, 2020

6. https://www.electro-tech-online.com/tools/thermistor-resistance-calculator.php
7. https://www.electronics-tutorials.ws/io/thermistors.html
8. https://people.ece.cornell.edu/land/courses/ece4760/FinalProjects/f2012/htq2_mg573/htq2_mg573/index.htm
9. https://maker.pro/arduino/tutorial/how-to-clean-up-noisy-sensor-data-with-a-moving-average-filter
10. https://forum.arduino.cc/index.php?topic=622546.0
11. https://forum.arduino.cc/index.php?topic=60292.0
12. https://www.norwegiancreations.com/2016/03/arduino-tutorial-simple-high-pass-band-pass-and-band-stop-filtering/
13. https://elvistkf.wordpress.com/2016/04/19/arduino-implementation-of-filters/
14. https://www.norwegiancreations.com/2016/03/arduino-tutorial-simple-high-pass-band-pass-and-band-stop-filtering/