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REVIEW PAPER ON AUTOMATED HEALTH MONITORING AND SMART VENTILATOR SYSTEM USING IOT

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Abstract: Internet of Things (IoT) based smart health monitoring system is a patient monitoring system in which a patient can be monitored 24 hours. In the present world, IoT is changing the infrastructure of technologies. By facilitating effortless interaction among various modules, IoT has enabled us to implement various complex systems such as smart home appliances, smart traffic control systems, smart office systems, smart environment, smart vehicles and smart temperature control systems and so on in very little space. Health monitoring systems are one of the most notable applications of IoT. Many types of designs and patterns have already been implemented to monitor a patient's health condition through IoT. In this paper, a review of IoT based smart health monitoring systems is presented. The latest innovative technologies developed for IoT based smart health monitoring system with their merits and demerits have been discussed.

This review aims to highlight the common design and implementation patterns of intelligent IoT based smart health monitoring devices for patients. The common symptom of COVID-19 that can be easily identified is fever or Body Temperature, blood oxygen level(Spo2) and heart rate all are playing a vital role in the covid-19 pandemic, this is the primary symptom that we have to check to identify the covid-19 virus also in day to day life this parameter determining a person's health conditions. Hence this paper can help in case if the patient or person is unable to meet the doctor or requires frequent monitoring to solve all problems we are going to develop this system which can be monitor anytime and all monitor data can be stored at a cloud. Also, this system can be used at entrance of various shop, D-Marts, Clinics to monitor customers health conditions and stored their records. The result shows that the proposed system can be more efficient than the normal manually system.

Index Terms **-Intelligent smart health monitoring, internet of things, temperature sensor, pulse sensor, humidity sensor, motion sensor, Oximeter sensor**

I. INTRODUCTION

Internet of Things (IoT) is now a reliable technological standard and a heavily researched field. Sensors are being used almost everywhere in the present time, from everyday products to industrial monitoring systems. The use of IoT and sensor-based intensive health care systems are increasing rapidly. IoT makes our life smarter, more efficient and easier. Using a smartphone as the data computing platform, the prototype model provides user-friendly voice recognition and alert functionalities.

Several life-threatening diseases can be easily monitored by IoT based systems. Cardiovascular Disease (CVD) is a common disease which is the cause behind most of the deaths in the world. At present, with the revolution of information and technology, smartphone-based health monitoring systems are becoming more popular. These systems can be used to collect real-time health information and give feedback to patients and medical specialists. Allowing every single person to examine their health, and advising them to find immediate treatment in case of emergencies, can result in saving that person's life. The use of these monitoring systems can decrease medical fees for the nation in the long run. Nowadays, due to widespread mobile internet access, the combination of mobile internet with a health service system using android open-source design has become very easy.

In recent years, Electrocardiography (ECG) has become an easily accessible service for everyone. By recognizing the small difference in voltage generated by the cardiac muscle, an ECG can properly determine the heart's functionality. Using a smart device, doctors and patients can continuously observe the heart rate and can get important data and take proper steps to prevent severe damages. Heart rate and body temperature are some of the most important traits of the human body which are major contributors to determining a patient's health condition. The number of heart bits per minute is denoted as the heart rate of the patient.

It is also referred to as the pulse rate of the body. The normal pulse rate of a healthy adult is 60 to 100 beats per minute. The average human pulse rate is 70 beats per minute for males and 75 beats per minute are for females. Females aged 12 and older have faster heart rates than males. The rate changes with illness, due to damage to body, heart, and exercise. Hence heart rate is essential in determining one's health condition. Diabetes is a very common disease throughout the world. According to the World Health

Organization (WHO), there are about 422 million people in the world suffering from diabetes and the amount is increasing day by day. Smart health monitoring devices determine the health condition i.e. rate of the pulse, body temperature, respiratory rate, blood glucose rate, the position of the body, ECG, EEG, and other things by using sensors. The sensors are connected and controlled through various microcontroller-based systems such as Arduino, raspberry pi, etc.

The microcontroller collects the data using sensors. The collected biomedical data is usually stored in servers. From the stored data, the device can decide whether the patient's condition is normal or abnormal. This device provides real-time health care observation for doctors and medical assistants where they can use the data anytime. Here the main advantage is that the device has low power consumption, better performance, high sensitivity and easy set up.

It is assumed that by 2020 there will be about 26 to 50 billion network-connected devices and 100 billion by 2030. Raspberry pi is the most common platform for IoT. It is a Linux-based low-cost device. Raspberry Pi and IoT have collectively ushered a new era in the field of healthcare systems. With the combination of sensors such as pulse rate sensor, temperature sensor, accelerometer, and respiration sensor, a Raspberry Pi can be transformed into a mini-clinic. These systems are being used in many parts of the world. Microcontroller units (MCU) are being used as the main controller of the systems but they do not support parallel data handling.

Handling multisensory data in a parallel way can reduce time. A field-programmable gate array (FPGA) is such a circuit that has a real-time performance and unique hardware logic control system. Hence, FPGA has now become more famous than MCU in multisensor data handling in the IoT environment. For these reasons, new advancements have been made using FPGA rather than MCU. A general architecture of a smart health monitoring system has been illustrated in Figure 1. Different types of sensors have been used in different types of health monitoring systems. In Figure 1, the sensors collect data from the patient and send those data to the processing unit. The processing unit compares those data with previously-stored cloud data and detects the health condition of patients. The system provides feedback after determining the condition of the patient.

In this paper, we are going to focus on IoT based healthcare systems that employ sensors, smartphones, and microcontroller unit based approaches, working procedures of the reviewed systems, the limitation and the working capability of each system.

II. LITERATURE REVIEW

Sr. No	Paper Title	Author	Aiming for
1)	IoT in healthcare sector-covid-19 patient monitoring system pressure & volume controlled mechanical ventilation for covid19 patient with ards	Mrs.Shweta suryawanshi, abhijit pise, bhavika sathe, farhan parwez	Proposed a project which can be monitor anytime and all monitor data can be stored at a cloud. Also, this project can be used at entrance of various shop, d-marts, clinic to monitor customers health conditions and stored their records. The result shows that the proposed system can be more efficient than the normal manually system
2)	Design and development of lowcost positive pressure portable mechanical ventilator	Rakshit P. Bhagat rohit P. Shende yash S. Mahan	Research shows the development of a low-cost, open- source mechanical ventilator. Constructing a low-cost, open- source mechanical ventilator aims to mitigate the consequences of this shortage on those regions
3)	On Off Controller for COVID 19 Management	Shajil Anthr	A control system design with on off strategy to control two parameters that influences the number of Covid patients and predictive planning for COVID management based on this strategy are the highlights
4)	Low-Cost, Open-Source Mechanical Ventilator with Pulmonary Monitoring for COVID-19 Patients	Leonardo Acho, Alessandro N. Vargas	Proposed a numerical method for monitoring the patients' pulmonary condition. The method considers pressure measurements from the inspiratory limb and alerts clinicians in real-time whether the patient is under a healthy or unhealthy situation. Experiments carried out in the laboratory that had emulated healthy and unhealthy patients illustrate the potential benefits of the derived mechanical ventilator

III. METHODOLOGY

In this paper, we propose an automatic system to monitor Patient's body temperature, heart rate, body movements and Blood pressure. Further we extend the existing system to Predict if the patient is suffering from any chronic disorder or Disease using the various health parameter and various other Symptoms that are obtained by the system. General ventilator just controlling oxygen we monitor oxygen, heart beats, temperature, humidity etc. Then they can be all Send to cloud and then doctor will monitor patient remotely. .

In our system we are measuring patient's parameters (ECG, temperature, heart rate, pulse, etc) different available sensors. These sensors collected data i.e. biometric information is given to raspberry pi and then it is transferred to server. The data stored in a database and can be displayed in a website that can be accessed only by authorized person. The doctors, RMOs, patient or his family members can be given authorization. The system even facilitates the doctor to view the patient's previous history from the data in memory.

Remote health monitoring can provide useful physiological information in the home. This monitoring is useful for elderly or chronically ill patients who would like to avoid a long hospital stay. Wireless sensors are used to collect and transmit

signals of interest and a processor is programmed to receive and automatically analyze the sensor signals. In this project, you are to choose appropriate sensors according to what you would like t o detect and design algorithms to realize your detection. Examples are the detection of a fall, monitoring cardiac signals. Using a single parameter monitoring system an approach to a remote health monitoring system was designed that extends healthcare fr om the traditional clinic or hospital setting to the patient's home. The system was to collect a heartbeat detection system data, fall detection system data, temperature data and few other parameters. The data from the single parameter monitoring systems w as then availed for remote detection. During design the following characteristics of the future medical applications adhered: a) Integration with current trends in medical practices and technology, b) Real-time, long designed device. Term, remote monitoring, miniature, wearable sensors and long battery life of a c) Assistance to the elderly and chronic patients. The device should be easy to use with minimal buttons.

IV. SYSTEM DESIGN

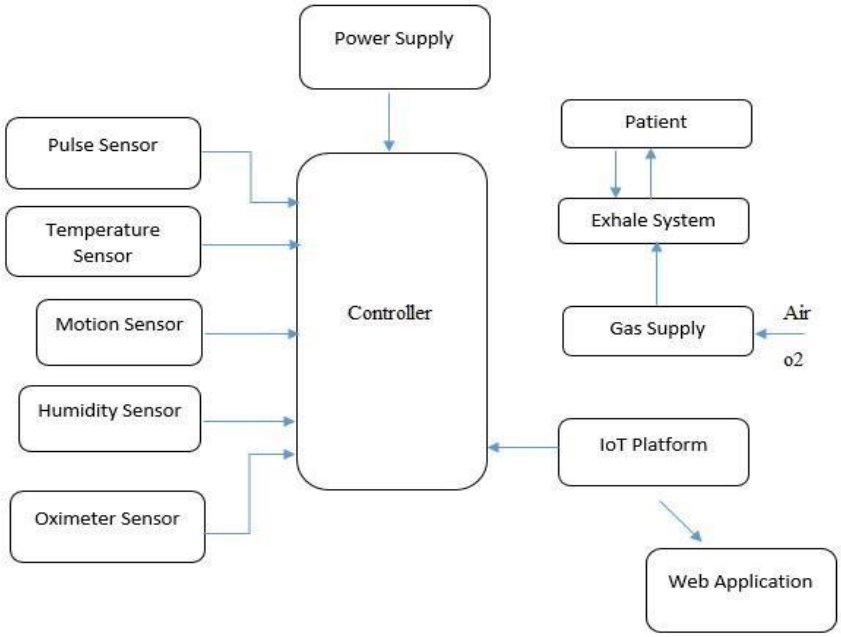

Figure 1. System architecture diagram

The automatic health monitoring system consists of controller i.e Raspberry Pi, and sensor that are pulse sensor, temperature sensor, motion sensor, humidity sensor, Oximeter sensor etc. The interconnection between different components is explained using the architecture of system. Architecture diagram is shown in figure 1. This project is very useful since the doctor can monitor patient health parameters just by visiting website or URL. And nowadays many IOT apps are also being developed. So now the doctor or family members can monitor or track the patient health through the Android application. Wide variety of sensors are used in the devices to monitor the patient vitals ranging from heart rate, body temperature, ECG, Respiration, Non invasive blood pressure, oxygen saturation etc. The deployment of wireless health monitoring removes the geographical barriers in getting specialist care.

The core objective of this project is the design and implementation of a smart patient health tracking system. Fig.1 shows the overview of the proposed system. The sensors are embedded on the patient body to sense the temperature and heartbeat of the patient.

Two more sensors are place at home to sense the humidity and the temperature of the room where the patient is staying. These sensors are connected to a control unit, which calculates the values of all the four sensors. These calculated values are then transmitted through a IoT cloud to the base station. From the base station the values are then accessed by the doctor at any other location. Thus based on the temperature and heart beat values and the room sensor values, the doctor can decide the state of the patient and appropriate measures can be taken. So that doctor can handle multiple patients at one time.

V. BACKGROUND WORK

1. HARDWARE COMPONENTS DETAILS

Raspberry Pi module

The Raspberry Pi is a series of low-cost, programmable computers that include a set of GPIO, or 'General Purpose Input Output', pins that can be used to connect and control external electronic devices, and to create Internet of Things (IoT) solutions. It is act as controller.

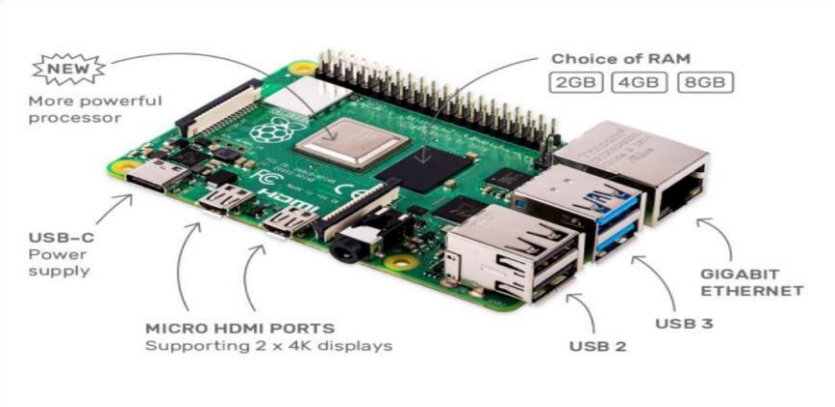

Figure 2. Raspberry Pi

Pulse Sensor

An optical heart rate sensor measures pulse waves, which are changes in the volume of a blood vessel that occur when the heart pumps blood. Pulse waves are detected by measuring the change in volume using an optical sensor and green LED

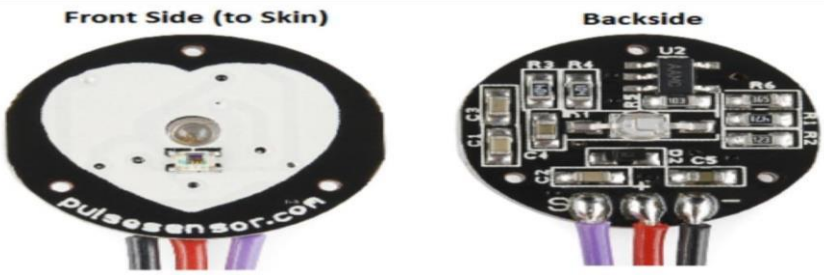

Figure 3. Pulse sensor

Temperature sensor

The LM35 series are accurate optimized temperature circuits with output voltage, which is linearly relative to the temperature in centigrade. The lm35 has a vantage point over kelvin's linear temperature sensors, as a realistic centigrade scaling does not allow the consumer to delete the huge constant voltage from the display

Figure 4. Temperature sensor

Motion sensor

A motion sensor, or motion detector, is an electronic device that uses a sensor to detect nearby people or objects. Motion sensors are an important component of any security system. When a sensor detects motion, it will send an alert to your security system, and with newer systems, right to your mobile phone.

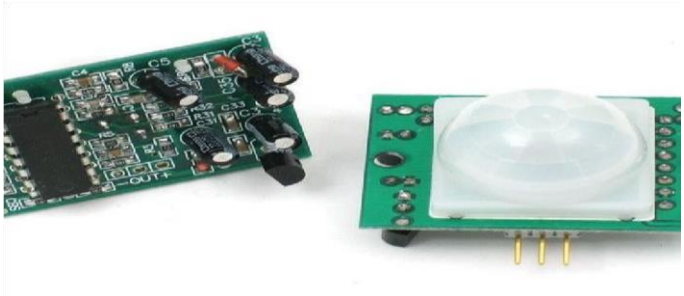

Figure 5. Motion Sensor

Humidity sensor Humidity sensors work by detecting changes that alter electrical currents or temperature in the air. … Two thermal sensors conduct electricity based upon the humidity of the surrounding air. One sensor is encased in dry nitrogen while the other measures ambient air. The difference between the two measures the humidity.	 Figure 6. Humidity sensor
Oximeter sensor Conventional pulse oximeters noninvasively measure human pulse rate and arterial blood oxygen saturation with an optoelectronic sensor composed of two inorganic light-emitting diodes (leds) with different peak emission wavelengths and a single inorganic photodiode.	 Figure 7. Oximeter sensor

2. SOFTWARE REQUIREMENT DETAILS

A) Python

Python is a widely used general-purpose, high-level programming language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. The language provides constructs intended to enable clear programs on both a small and large scale. Python supports multiple programming paradigms, including object-oriented, imperative and functional programming or procedural styles .It features a dynamic type system and automatic memory management and has a large and comprehensive standard library. Here , we use **3.9.7 python** version.

B) PHP

PHP (Hypertext Preprocessor) is known as a general-purpose scripting language that can be used to develop dynamic and interactive websites. It was among the first server-side languages that could be embedded into HTML, making it easier to add functionality to web pages without needing to call external files for data. MySQL is a Relational Database Management System (RDBMS) that uses Structured Query Language (SQL). Here we use 6.0 php version.

VI. DETAIL SYSTEM OVERVIEW

In figure 1, The automatic health monitoring system consists of controller and sensor. This all sensor are used to sense the patients parameters. The Raspberry Pi is work as controller. Pulse sensor used to sense the pulse wave of patient and this signal gives to controller. Temperature sensor is used to detect temperature in patient body and this information gives to Raspberry pi. The motion sensor detect the nearby or object. When it detect motion it will send an alert to your security system. Humidity sensor work by detecting changes that alter electrical currents or temperature in the air and gives the result to controller . Oximeter sensor is used to measure human pulse and arterial blood oxygen saturation with optoelectronics. These all sensor's parameter are provided to Raspberry Pi for the processing. The Raspberry Pi is a series low cost programmable computer that includes a set of GPIO(general purpose input output) pins that can be used to connect and control electronic device and to create IOT solutions. The output of controller is provided to Iot platform that is information send to server and this all info is display on mobile or computer and doctor can see condition of patient without physical contact. In this system we use ventilator this is integrated with all sensor. If oxygen level is low then the then ventilator is automatically on, if oxygen level is normal then ventilator is automatically off.

This all information can be accessed by the doctor on his phone or a computer And get the information. If any emergencies the patient is sent and data automatically through the mail for medical medication.

VII. CONCLUSION

Since the start of the COVID-19 pandemic, researchers have been striving to help society face many problems caused by this pandemic. Among the recent initiatives, one has drawn the authors' attention: producing low-cost, open-source mechanical ventilators. The motivation comes from the worldwide shortage of mechanical ventilators in the treatment of COVID-19 patients—mechanical ventilators keep severely ill patients alive [1]. This paper contributes to this initiative.

This paper has detailed the construction of a functional, low-cost, and open-source mechanical ventilator. The authors' contribution to this topic aims to mitigate the effects of this worldwide ventilators shortage—a shocking, unfortunate event that hits hard deprived areas .This paper has shown a numerical method that can monitor, in real-time, whether the patient has a healthy or unhealthy pulmonary condition. This useful yet straightforward numerical method opens up the possibility of applications in other mechanical ventilators as well. In summary, this paper contributes to both fronts—theory and practice.

Alarms can be included in this project, using either an alarm screen or speakers, like the ones that alert clinicians when the pressure reaches some threshold values .

VIII. ACKNOWLEDGEMENTS

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IX. REFERENCES

[1] Ranney, M.L.; Griffeth, V.; Jha, A.K. Critical Supply Shortages—The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. N. Engl. J. Med. 2020, 382, e41.
[2] Pons-Òdena, M.; Valls, A.; Grifols, J.; Farré, R.; Cambra Lasosa, F.J.; Rubin, B.K. COVID-19 and respiratory support devices. Paediatr. Respir. Rev. 2020, 35, 61–63.
[3] Iyengar, K.; Bahl, S.; Raju, V.; Vaish, A. Challenges and solutions in meeting up the urgent requirement of ventilators for COVID-19 patients. Diabetes Metab. Syndr. Clin. Res. Rev. 2020, 14, 499–501.
[4] Ferrante, L.; Fearnside, P.M. Protect Indigenous peoples from COVID-19. Science 2020, 368, 251.
[5] Taylor, L. The pandemic's new centre. New Sci. 2020, 246, 12–13.
[6] Fitzgerald, D.A.; Maclean, J.; Rubin, B.K. COVID-19 pandemic: Impact on children, families and the future. Paediatr. Respir. Rev. 2020, 35, 1–2.
[7] Baqui, P.; Bica, I.; Marra, V.; Ercole, A.; van der Schaar, M. Ethnic and regional variations in hospital mortality from COVID-19 in Brazil: A cross-sectional observational study. Lancet Glob. Health 2020, 8, e1018–e1026.
[8] Levin, M.A.; Shah, A.; Shah, R.; Kane, E.; Zhou, G.; Eisenkraft, J.B.; Chen, M.D. Differential Ventilation Using Flow Control Valves as a Potential Bridge to Full Ventilatory Support during the COVID-19 Crisis: From Bench to Bedside. medRxiv J. 2020, 21, 1–25.
[9] Chase, J.G.; Chiew, Y.S.; Lambermont, B.; Morimont, P.; Shaw, G.M.; Desaive, T. Safe doubling of ventilator capacity: A last resort proposal for last resorts. Crit. Care 2020, 24, 1–4.
[10] Herrmann, J.; Fonseca da Cruz, A.; Hawley, M.L.; Branson, R.D.; Kaczka, D.W. Shared Ventilation in the Era of COVID19: A Theoretical Consideration of the Dangers and Potential Solutions. Respir. Care 2020, 65, 1–50.
[11] Branson, R.D.; Blakeman, T.C.; Robinson, B.R.; Johannigman, J.A. Use of a Single Ventilator to Support 4 Patients: Laboratory Evaluation of a Limited Concept. Respir. Care 2012, 57, 399–403.
[12] Huttner, B.; Catho, G.; Pano-Pardo, J.R.; Pulcini, C.; Schouten, J. COVID-19: Don'T neglect antimicrobial stewardship principles! Clin. Microbiol. Infect. 2020, 26, 808–810.
[13] Zuckerberg, J.; Shaik, M.; Widmeier, K.; Kilbaugh, T.; Nelin, T.D. A lung for all: Novel mechanical ventilator for emergency and low-resource settings. Life Sci. 2020, 257, 118113.
[14] Garmendia, O.; Rodríguez-Lazaro, M.A.; Otero, J.; Phan, P.; Stoyanova, A.; Dinh-Xuan, A.T.; Gozal, D.; Navajas, D.; Montserrat, J.M.; Farré, R. Low-cost, easy-to-build noninvasive pressure support ventilator for under-resourced regions: Open source hardware description, performance and feasibility testing. Eur. Respir. J. 2020, 55, 2000846.
[15] Vasan, A.; Weekes, R.; Connacher, W.; Sieker, J.; Stambaugh, M.; Suresh, P.; Petersen, J. MADVent: A low-cost ventilator for patients with COVID-19. Med. Devices Sens. 2020, 3, e10106.