SMART HEALTH MONITORING SYSTEM USING IOT

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ABSTRACT

During the COVID-19 pandemic, the need for social isolation and quarantine measures has increased, leading to the development of IoT health monitoring solutions. These solutions offer an alternative to frequent doctor visits and in-person consultations. However, many individuals still require regular health monitoring and medical attention. To address this need, we have utilized technology to simplify patients' lives and enable early diagnosis and treatment. By leveraging Internet of Things (IoT) technology, we have created an intelligent and smart health monitoring system capable of tracking vital signs such as heart rate, temperature, and ambient air quality. This system proves particularly valuable in rural or village settings, where local clinics can communicate with city hospitals to share their patients' medical conditions. Whenever there are deviations from standard health parameters, the IoT system promptly notifies doctors or physicians. The use of high-speed internet connectivity ensures real-time data availability to healthcare professionals. This enables continuous monitoring of vital signs, and a web server cloud platform supports data visualization, allowing quick access to previous measurements.

Keywords: IoT, Temperature sensor, pulse sensor, Air quality.

INTRODUCTION

The global COVID-19 pandemic has posed a significant challenge to healthcare organizations worldwide, with confirmed cases of SARS-CoV-2 infection surpassing 56.4 million and causing over 1.35 million deaths as of November 19, 2020. These statistics highlight the increasing prevalence of COVID-19 cases worldwide. Individuals infected with the virus can exhibit a range of symptoms, including fever, breathing difficulties, reduced oxygen levels, persistent cough, nausea, vomiting, sore throat, headaches, loss of taste, and general discomfort. Notably, elevated body temperature, decreased oxygen saturation, and irregular pulse rate are considered concerning indicators. Low oxygen saturation can lead to hypoxemia, while difficulty breathing can result in hypoxia. These conditions require immediate attention and medical intervention.

Patients who neglect the signs of hypoxemia and an elevated heart rate are at a greater risk of mortality. To avoid unfortunate outcomes caused by inadequate care, it is crucial for COVID-19 patients to maintain a comprehensive awareness of their health status. This necessitates consistent monitoring of vital metrics, including body temperature, heart rate, and oxygen saturation (SpO2).

Scheduling regular health check-ups can be a challenging and time-consuming process, particularly for older individuals. Fortunately, IoT-based solutions present potential advantages in addressing this issue. IoT technology, which facilitates wireless data exchange among physical objects, has emerged as an innovative solution with a wide range of applications. The second wave of the COVID-19 pandemic has placed additional strain on healthcare systems worldwide, making it increasingly challenging to provide sufficient care to patients. Pulse rate and body temperature serve as fundamental indicators of an individual's health status. Through the utilization of IoT technology, remote monitoring becomes more accessible, enabling individuals to conveniently track these vital signs.

The main goal of this project is to develop and implement an innovative IoT-based smart health monitoring system specifically tailored for patients impacted by pandemics. This system will prioritize the continuous monitoring of crucial health parameters such as body temperature, pulse rate, and oxygen saturation levels. Through a mobile application, the device will offer real-time measurements of these vital signs, enabling patients to proactively seek medical assistance even without physical presence from healthcare professionals. The availability of a patient's pulse rate and oxygen saturation level is essential for healthcare providers to administer appropriate treatment. Our proposed approach aims to facilitate seamless communication between individuals and doctors, empowering patients to remotely convey their medical concerns. This device has the potential to benefit not only COVID-19 patients but also individuals with other medical conditions.

. LITERATURE SURVEY

In 2020, a team composed of S. Nair, N. Augustine, and L. Varghese introduced a Smart health monitoring system with the key aim of enabling wireless communication between patients and doctors for seamless data transfer. The system is designed to facilitate the monitoring of an individual's health status, and it promptly sends alerts to caregivers or guardians in case of any issues. The research publication emphasizes

the importance of this device in enhancing healthcare by enabling continuous monitoring and timely intervention.

In 2018, a team of researchers consisting of C. Senthamilarasi, J. J. Rani, B. Vidhya, and H. Aritha developed an IoT-based smart patient health monitoring system. Their goal was to enable effective patient monitoring for healthcare professionals regardless of the patient's location, whether it be in a hospital or at home. The primary objective of their innovative solution was to enhance patient care by facilitating continuous monitoring and providing real-time data to healthcare providers, thereby improving decision-making. The research publication emphasizes the significance of this system in enhancing patient outcomes and healthcare delivery..

Researchers F. M. Yassin, N. A. Sani, and S. N. Chin introduced a wireless monitoring system based on Arduino in 2019 to analyze heart rate and body temperature. The main objective of this system was to enable efficient monitoring of ICU patients, thereby reducing the workload for nurses and doctors who require frequent patient monitoring. The system utilized a range of LEDs to visually indicate the patient's health status, offering a clear representation of their condition. The research underscored the potential of this technology to improve patient care and optimize monitoring procedures in intensive care environments.

In a 2020 study, researchers M. M. Islam, A. Rahman, and M. R. Islam proposed the development of a smart healthcare monitoring system within an IoT environment. The project aimed to empower users to choose and monitor their own health metrics using an IoT-based device, enabling them to take control of their health management. The system's objective was to ensure prompt medical assistance for patients requiring it. Through the utilization of a single application, individuals could conveniently and rapidly share their health parameter data with healthcare professionals.

In 2021, a team of researchers consisting of M. M. Khan, S. Mehnaz, A. Shaha, M. Nayem, and S. Bourouis developed a specialized IoT-Based Smart Health Monitoring System specifically designed for addressing the challenges posed by the COVID-19 pandemic.. Their primary goal was to develop a comprehensive monitoring system using IoT technology that caters to the specific needs of COVID-19 patients. The system incorporates a mobile IoT application that enables timely notifications for both patients and doctors, particularly during critical situations.

In 2021, V. B. Shalini introduced a Smart Health Care Monitoring System that utilizes Internet of Things (IoT) technology. This system incorporates blood pressure and heart rate sensors, which are connected to an ARDUINO UNO board. By integrating these components, the system enables efficient monitoring of patients' health status in a streamlined manner. The research emphasizes the successful implementation of a smart health monitoring system that ensures continuous tracking of individuals' health.

. In 2019, researchers S. Ananth, P. Sathya, and P. Madhan Mohan presented a proposal for a Smart Health Monitoring System that utilizes IoT technology.The primary goal of their study was to comprehensively investigate the collection of sensor data, conduct thorough analysis, and provide feedback to patients based on diverse health criteria.. The research focused on developing a comprehensive system that enables effective health monitoring and personalized feedback for individuals.

In 2020, researchers P. Valsalan, T. A. B. Braemar, and A. H. O. Baabood proposed an IoT-based health monitoring system with the objective of enhancing the affordability and accessibility of healthcare for the general population. The system aimed to offer patients convenient access to private care and financial stability. The research introduced an innovative solution based on the Internet of Things (IoT), which simplifies the usage of complex medical devices while reducing costs. This approach enables individuals to monitor their health from the comfort of their homes, providing them with greater convenience and accessibility to healthcare services.

PROPOSED SYSTEM

The system proposed here showcases the ability of sensors to autonomously collect data upon powering on the system. It comprises three distinct sensors specifically designed to measure temperature, pulse rate, and SpO2 levels. These sensors capture physiological information from the human body, which is subsequently transmitted to an Arduino device. The Arduino processes and converts the data into a digital format, while simultaneously transmitting the measured data to a mobile application server. The mobile application then displays the data on an LCD screen, providing a convenient means for users to monitor their heart rate, oxygen saturation (SpO2), and body temperature.

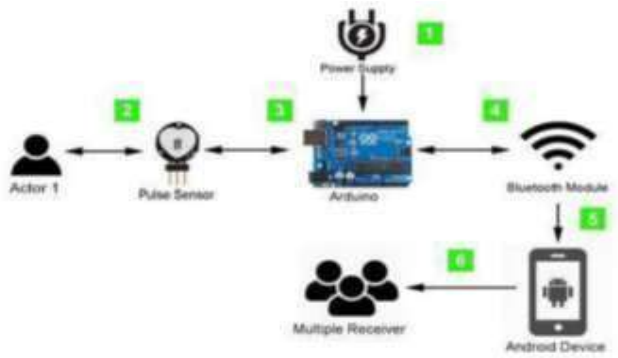

Fig: IoT-based human Health monitoring system

Using local Wi-Fi, the sensed parameters are received and stored in the cloud platform for the doctors to further diagnostics in improving the health of the human.

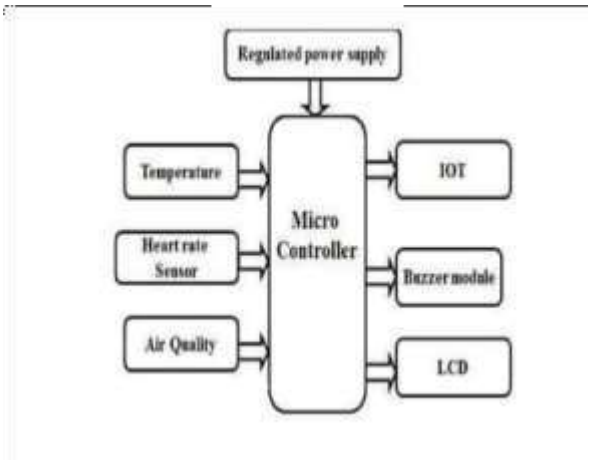

Fig: Block Diagram

The proposed health monitoring system comprises several sensors including an Air quality sensor, Pulse sensor, Temperature sensor, and the Arduino UNO microcontroller. Utilizing IoT technology, the system is designed to detect any deviations in the patient's health from standard values and promptly notify the doctor or physician.

Advantages of proposed system

- IOT Monitoring proves valuable in capturing, measuring, and continuously monitoring the fluctuations in a patient's health metrics over time. This enables the creation of a comprehensive record documenting the changes in health indicators through IOT health monitoring. By considering these changes and reviewing the patient's medical history, doctors can make well-informed recommendations regarding appropriate therapy or medication.

- Remote patient monitoring effectively reduces the need for prolonged hospital stays, thereby minimizing the frequency of hospital appointments for routine check-ups

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- Storing patient health parameter data in the cloud offers significant benefits when compared to traditional methods like paper records or localized storage on devices such as computers, laptops, or pen drives. Cloud storage provides a more reliable and secure solution, reducing the chances of data loss or corruption associated with physical storage methods. Additionally, cloud storage offers enhanced data protection measures and ensures easy accessibility, making it a preferred choice for storing sensitive patient health data.

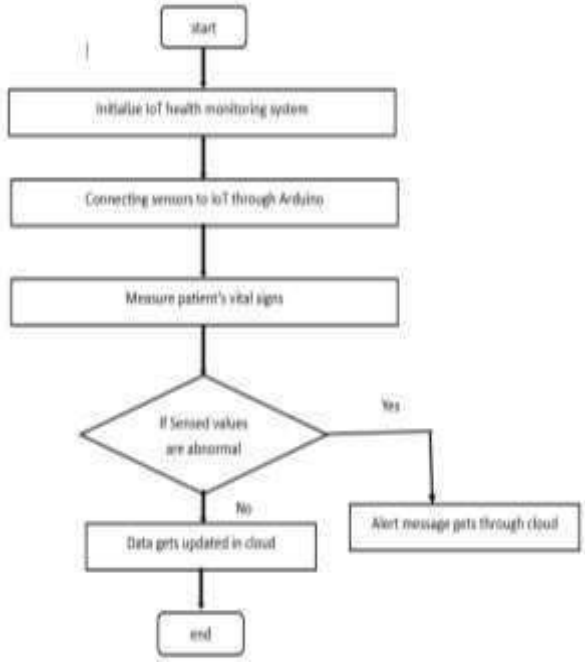


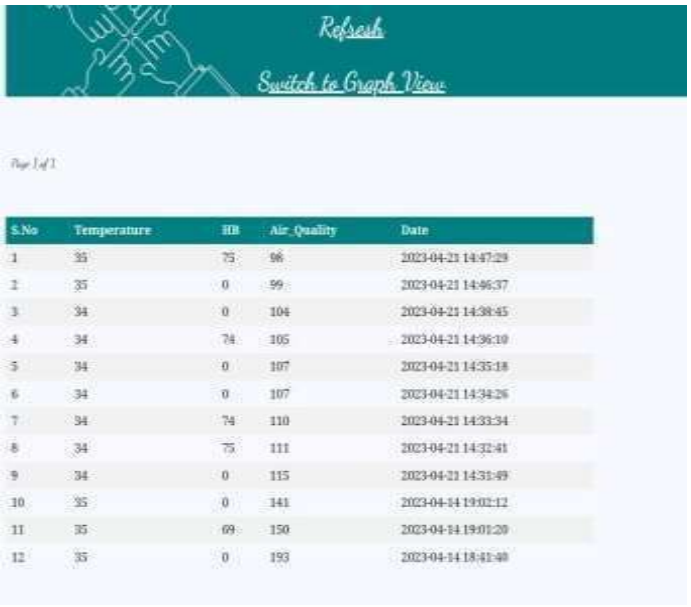
Fig: Flow Chart of Health monitoring System

The project begins by initializing the IoT health monitoring device, which involves integrating sensor components with a microcontroller to establish communication. Once a connection is established, the sensors start sensing values, which are then displayed on the screen if they fall below predefined thresholds. In case the sensed values exceed the standard limits, an alert is triggered to notify the user. Furthermore, the collected data is securely stored in a Cloud platform, enabling doctors to analyze it for diagnostic purposes. This encapsulates the operation of the health monitoring device, providing valuable insights into patient health.

RESULTS

The captured data from the sensors is stored in the cloud and updated at regular 15-second intervals. Any variations in the sensed parameters trigger the system to generate alert messages. By utilizing a cloud platform, multiple individuals can access the patient's condition and receive timely alerts, enabling prompt care and intervention. To ensure optimal treatment, the system implements continuous monitoring of temperature, SpO2, and pulse rate. Controlled via a mobile IoT application, both the patient and the doctor can receive notifications from the system, especially during critical situations, enhancing communication and facilitating effective healthcare

manage.



S.No	Temperature	HB	Air_Quality	Date
1	35	75	98	2023-04-21 14:47:29
2	35	0	99	2023-04-21 14:46:37
3	34	0	104	2023-04-21 14:38:45
4	34	74	105	2023-04-21 14:36:10
5	34	0	107	2023-04-21 14:35:18
6	34	0	107	2023-04-21 14:34:26
7	34	74	110	2023-04-21 14:33:34
8	34	75	111	2023-04-21 14:32:41
9	34	0	115	2023-04-21 14:31:49
10	35	0	141	2023-04-14 19:02:12
11	35	69	150	2023-04-14 19:01:20
12	35	0	193	2023-04-14 18:41:40

Fig: Data stored in the cloud

Sensed values like temperature, heartbeat, and air quality are stored in cloud.

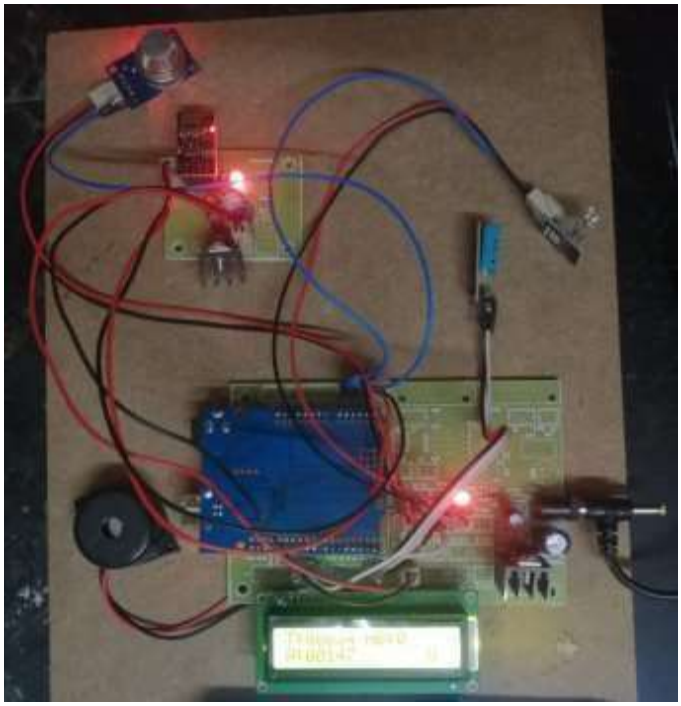


Fig: Hardware health monitoring System

The hardware configuration of the health monitoring system involves the integration of various sensors with the microcontroller. These sensors include a temperature sensor, pulse sensor, air quality sensor, and a buzzer. Through proper interfacing, the system effectively senses and measures the values, providing accurate readings under normal operating conditions. In the event of any deviation in the values, an alert is triggered, notifying the user along with the updated value of the sensed data.

CONCLUSION

Right from the start, our aim was to create a meticulously designed application-based framework for this system, specifically tailored to tackle the ongoing epidemic. The significance of this device is particularly prominent for individuals impacted by COVID-19, as well as those with respiratory conditions like chronic obstructive pulmonary disease (COPD) and asthma.. Its affordability, non-intrusive design, and versatility ensure accessibility for monitoring patients' well-being irrespective of their location. Moreover, it offers real-time notifications to individuals and healthcare professionals, promptly alerting them to critical situations demanding immediate attention. By enabling proper medical care, even in remote areas, this approach has the potential to reduce patient burdens. Early detection of medical conditions can empower patients to take necessary precautions, potentially saving lives. Therefore, deploying advanced health monitoring technologies is essential to ensure the safety of all individuals. In conclusion, this technology plays a vital role in the medical field by extending lives worldwide, and its future upgrades hold the promise of monitoring additional physiological aspects of the human body.

FUTURE SCOPE

The project shows great potential for diverse applications in the future, thanks to its combination of sensing devices and IoT technology. There are opportunities for further advancements to enhance its usability across various domains. For instance, extending the research could involve incorporating additional vital metrics like diabetes levels and respiratory monitoring to evaluate a patient's condition comprehensively. The system itself can undergo continuous improvements and adaptations, such as considering the utilization of a Raspberry Pi instead of the current microcontroller, which would provide greater flexibility. By integrating more sensors, the monitoring capabilities can be expanded to encompass a wider range of health metrics. Furthermore, implementing new algorithms can enhance the system's security, ensuring robustness and reliability. These ongoing developments and enhancements will contribute to the system's evolution and its ability to address a broader range of healthcare needs in the future.

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