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AI DIAGNOSIS AT EDGE USING ENSEMBLE MODELS FOR RAPID RADIOLOGY

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ABSTRACT: The monitoring of health for a person, particularly those with paralysis, has seen massive improvement with the advent of IoT technologies. With the improvement of healthcare systems the integration of IoT devices proves to be an efficient solution for enhancing patients' quality of life and providing them with ongoing care. In this essay, I focus on new practices of health monitoring systems for paralysed persons (under the condition of remote, real-time monitoring). Existing systems such as GSM based health monitoring only enables basic functionalities such as monitoring heart rate and body temperature, caregivers are alerted if threshold levels are crossed. Nevertheless, such systems do not usually have the smooth integration of real time data transfer and remote surveillance. On the contrary, the proposed system utilizes IoT for the development of a more efficient and automatic tracking system for health. By integrating sensors for monitoring such pivotal parameters as body temperature and heart rate, this system allows for data transfer over the Wi-Fi network to care givers and family members. In case of any abnormalities alerts are generated automatically to make sure that timely interventions are implemented. The system also includes live online tracking of the

patient's condition in order to maintain a continuous update. The purpose of this Internet of Things health monitoring system is to reduce accessibility and reliability of health care for paralysed persons, providing piece of mind to the family members and care providers. The paper presents an overview of the proposed solution, and outlines its possible effect on the healthcare sector, particularly the advantages that real-time, transmissible health data will provide and which will improve the condition of the patients.
Keywords: IoT, Health Monitoring, Internet, Patient Health, Real-time Data, Sensors.

I. INTRODUCTION

Healthcare and diagnostic technologies advancements have greatly elevated life expectation of humanity within the last several decades. With further improvement of healthcare systems people also start to become more conscious about their proper nutrition and hygiene. But these achievements also result in a continuously increasing number of people above the age of 60, as the World Health Organization (WHO) predicts, by 2050 the world population will have a greater percentage of people above 60 years old. In addition, other chronic problems such as diabetes, cancer, pneumonia, and heart disease are already common, and cause significant number of deaths globally. Chronic conditions such as diabetes are usually caused by poor lifestyle options that can lead to extreme complications such as issues with the kidneys or with eyes. With the rising number of elderly people, there is an increase in the need for continuous care and monitoring in order to live a good life. Alas, most of the elderly population experiences insufficient care and delayed medical care, narrowing their life span. In order to resolve the problem, it is important that healthcare services are more accessible, affordable and effective. Even with incredible technological revolutions in the healthcare delivery sector that have occurred in recent times, cost of modern healthcare services is still a crucial barrier and most especially for those with limited mobility such as those with paralysis.

As a response to the above-mentioned, there is increasingly growing tendency towards affordable, user friendly healthcare solutions that can be deployed at home comforts. IoT-enabled technologies are now making real-time health monitoring possible for paralysed people who can remain in their houses while farmers get regular visits by their healthcare providers to have them tested. These systems keep an eye on vital indicators including blood pressure, heart rate, body temperature, and pulse rate. sending real-time updates on the state of the patient, to caregivers and medical practitioners. The goal of this paper is investigation and evaluation of the researchers' input into the creation of medical monitoring systems for patients who are paralyzed. This suggested Internet of Things-based health monitoring system offers more than just a path-breaking solution to monitor vital health parameters, but also ensures availability of timely medical assistance when needed, thereby enhancing not only the overall well-being and life expectancy of paralysed individuals.

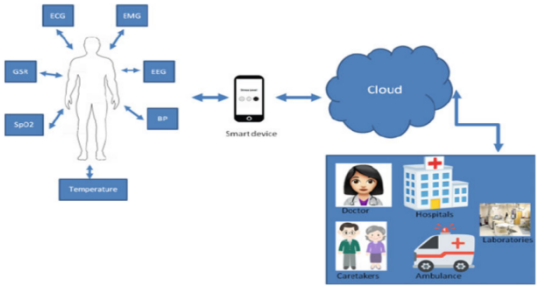

Figure 1: A healthcare monitoring system's overall design

PEOPLE HEALTH MONITORING

Various healthcare monitoring systems now look after the health of paralysed people. These systems form part of high-tech technology including the Internet of Things, wearables, and the cloud to track the health of paralysed people [8]. Wearable technologies have made tremendous strides over the decade to pull physiological indicators such as ECG, EEG, EFG, BP, temperature, SpO2, and such. From fig 1, the overall view of how the paralysed patients monitoring system is laid out is depicted. It shows how physiologic data of paralysed people will be uploaded to the cloud through the use smart devices, whereby it will be analyzed, assessed and transferred to the relevant persons and departments for appropriate paralysed persons.

II. RELATED WORK

Suliman Abdulmalek et al. [1] suggested a customized IoT framework for healthcare application. Their approach entails taking information into the cloud where it's organized and categorized according to certain information needs. This way; clients get the required information while undesirable data that would lead to wastage of actions that are not adding value, is given back. The study shows what the performance gained from this architecture looks like, based on a model developed to illustrate its effectiveness.

A secure healthcare IoT platform for modern institutions is the contribution of M Vijay Kumar et al. [2]. There was a discussion regarding the importance of data security in healthcare systems; especially the role of cloud as the tool of IT-health type of frameworks. In their model, such sensitive patient information is held locally instead of in the cloud, to avoid the risks of unauthorized access, or cyber-attacks. They highlight the importance of security in healthcare and how its delivery within the confines of mobile phones, particularly in developing countries, can be used as a device to offer very effective medical services.

Mudassar Ali Khan et al. [3] presented an innovative framework to enhance healthcare systems with the help of Bluetooth and NFC enabled mobile device. They incorporated tamper-proof secure elements (SE), and security for smart cards to safely store the passwords and personal information in the healthcare framework to involve higher level of privacy and security.

Based on mobile device, Sangeethalakshmi K et al. [4] has developed the accident detection system. The system notifies emergency personnel immediately the moment an accident is encountered in an identified vehicle in use through in-vehicle automatic accident recognition and alert systems thus reducing response time. The idea is to make sure that those rescue teams reach such accident sites faster and avoid delays in giving medical assistance.

M.A. Akkaş et al. [5] have introduced STREMS as a continuous effective pre-emergency communication facility for the Emergency Medical Service (EMS). The study used wearable

sensing, smartphones, and video streaming to support EMS. They presented a wearable physiological sensing solution for monitoring emergency vehicles that can provide basic life support and did propose a real time cloud based platform for sharing of information in real time.

Alruwailil et al. [6] proposed an Exoskeleton Arm, a battery-activated invention that increases arm strength and helps those with spinal problems. The technology is able to help users reconstruct muscle strength and motor abilities. Also it is beneficial support for workers in physically intensive jobs such as construction or delivery and increases productivity and safety.

Banu Çalış Uslu et al. [7] were concerned with applying data mining methods to these challenges regarding diagnosis and treatment of diabetes. They established a system of converting patient data into something to act upon with the help of clustering and classification methods. The system assists to classify and rank the level of severity of diabetes and effectively manage patients through data analysis of 650 patients.

Chaudhary, A et al. [8] had an in depth discussion of healthcare big data analytics. They discussed the instruments and techniques used in big data. storage, retrieval and analysis for better healthcare services delivery. Their work emphasize how the use of cloud computing can improve patient care, and make healthcare system more efficient.

Peddoju, S. K et al.[9] did an analysis on the role of emerging technologies such as big data and cloud computing in healthcare. They offered solutions that would help reduce mortality rates by timely provision of medical interventions. Their research was concerned with the They discussed wireless infrastructure and the application of machine learning techniques to assess diabetic levels. and devices that gather data for cloud analysis.

Upadhyay, H. [10] gave a framework to integrate IoT and wearable technology to give patient timely care. They also incorporated predictive analytics to monitor patient health and potential security problems and ensure effective patient management. Even though much has been done to improve healthcare monitoring systems, the literature does not have an Internet of Things-based health monitoring system that uses advanced analytics and deep learning to forecast a patient's health in the real-time with timely alerts.

III.BACKGROUND OF THE WORK

The present method uses a GSM-based Patient Health Monitoring system to monitor a patient's health remotely. This technology makes it easier for medical professionals or family members to remotely check a patient's vital indicators, such as body temperature and heart rate. The system will then alert a registered phone number with an immediate alert as soon as parameters of healthier respects will rise beyond certain set limits. The system is based around an AVR Family Microcontroller with LCD display is interfaced with a heartbeat sensor and also interfaced with a temperature sensor. The GSM modem will transmit the health data to the registered phone number remotely, thus having updated with real-time on the patient’s status. This system also has a functionality for doctors to text the patient to ask about their health at regular intervals. Despite the fact that GSM-based system enables healthcare providers and relatives to monitor the health of patients while the patient is away from home, the system is only minimally developed. The system attaches the patient’s health parameters and updates them effortlessly, but it misses an integrated solution that works in real time for continuous monitoring and transmitting the data. Above all, the use of GSM technology bounds the field of real time data sharing and monitoring, making it less desirable than more modern internet

based alternatives. Hence, though the current system is handy for routine health checks, it does not have the ability to deliver online, in real-time, and more sophisticated features that could serve as part of a more efficient and effective system over all, especially for patients with chronic ailments/disabilities.

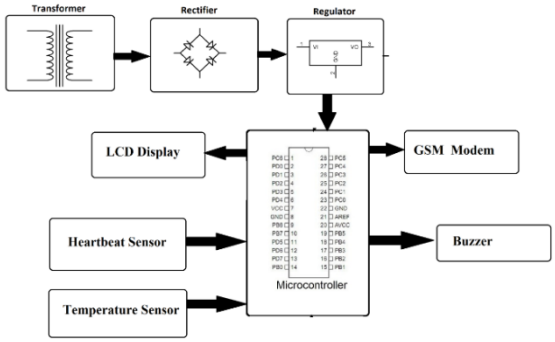

Fig 2: Existing Block diagram

IV. PROPOSED METHODOLOGIES

The proposed system proposes a unique solution in remote health tracking utilizing the Internet of Things (IoT), a solution meant to make the health tracking process easier especially to the homebound or the those who are less codable using limbs. The system relies on sensors that provide it with a constant flow of data concerning such vital indicators of health as body temperature and rate of heartbeat. The data that is collected is then used on the microprocessor which tracks the patient's condition in real time. The thing that differentiates this system from its counterparts is that it is integrated with internet. The data from the sensors is transmitted using Wi-Fi, making communication between patient monitoring devices and caregivers or relatives easy. In addition to alerting interested parties to a situation, the system provides live updates on an online platform where caregivers can track the patient's health status from any location and at any time. This health monitoring system based on IoT increases accessibility and allows caregivers and healthcare providers to take action against any health inconsistency immediately. It also enhances quality of life for paralysed individuals with an affordable, at home monitoring solution. Real-time transmission of real-time health data through integration creates room for timely medical interventions and more positively citable reduced risks related to late healthcare attention. Utilizing IoT technology, through this system there is introduced an efficient, user-friendly solution, which is at the same time low cost and effective, for the patients that need the constant control of health, which enhances their well-being overall.

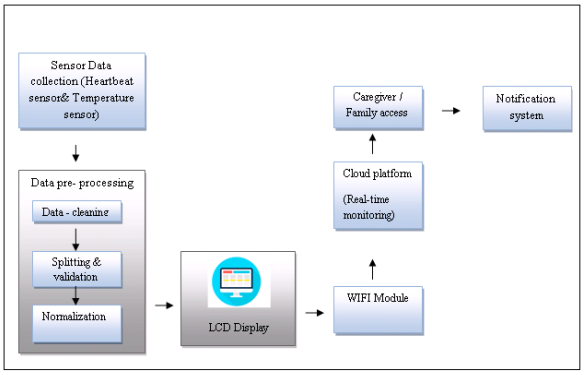

Fig 3: Block diagram

The suggested wonderful center device, shown in Figure 2, would use a remote correspondence system (WiFi) to continually provide the results of the patient monitoring system to the clinical pioneer. A combined dashboard (screen) is then used to display the findings. The wearable plan presents crisis situations using basic LCDs and an optional sound alert. This framework offers a consistent perspective on continuous estimations on a user-friendly IoT web interface. Specialists would wish to view the patient's vital signs from any location using their specialized device (such as a tablet or mobile phone) over this connecting point. This website takes advantage of security features to safeguard data security. Additionally, a sophisticated and automated computation can control the vital signs to create emergency situations that alert the medical professionals to danger. For most applications, the calculations can be quite straightforward and can result in a gambling situation if the basic indicators (heart rate > 150 BPM and temperature > 38°C) above their maximum boundaries. Consequently, the required level of computing complexity is too high.

A. Block Diagram

Figure 2 displays the part's whole square graph. The Arduino NANO tiny regulator receives the raw data values from the temperature and beat sensors. The regulator sends data to the server and supplies the WiFi module via USB. The information assortment process involves gathering data from sensors, which the tiny regulator then filters and processes.

B. Wellbeing Monitoring

We came to the conclusion that the LM35 should be employed as the temperature sensor for modest clinical accuracy across the body. Furthermore, it may be established using a straightforward connection between voltage and temperature that is simpler to use and apply. Wafer level management makes it incredibly inexpensive and accessible. Additionally, because beat sensors are the least expensive and have clinical-grade accuracy, we used them for beat oximeters. A simplified system design might be achieved by estimating pulse immersion just using a sensor. It was created especially for clinical observation tools and wearable technology. It has worked in tandem with the light's abrogation capability, which is helpful in obtaining accurate readings.

C. Ecological Monitoring

Range of Relative Humidity (RH) and Heat (SH): The boundaries of the body are largely influenced by the environment. For instance, low RH and high SH may promote drying out and vasodilation, which can quickly lead to decompensation. Here, the MQ135 is configured for an air quality test, while the DHT11 sensor is used for ecological temperature and mugginess detection.

D. Notice Generation System

The emergency alarm system is triggered and the necessary caution system is deactivated if, by accident, the temperature and pulse of a single vital exceed a safe level. To show what is happening, a notification banner including the patient's name will load from the screen. Additionally, equipment with a weak signal has been equipped with a warning system.

Based on their health condition, the framework uses this computation to identify the sequence of essential mediation for each persistent. In the request for the appropriate arrangements for intercession, it displays the names of the patients on the screen. Such an alert structure will be useful to the specialists or office hopeful to agree to choice concerning request of mediation, if a few patients imperative sign's quality decays in one swell of manifestation.

E. IoT Web Visualization

For this reason, one company website uses the www.thingspeak.com site to communicate with the framework equipment. Through a web link, any specialists may visit the site using their - naming devices, and these fundamental sign values can be shown on an integrated dashboard. Because there are clear certificates for login, the site is also secure when it comes to patient information. Diagrams of all mentioned vital signs—temperature, pulse, and natural—are also included on the website. Each of the three diagrams might show a pattern of the patients' vital signs pointing upward.

V. EXPERIMENTAL RESULTS

The implemented IoT-based health monitoring system was tested to determine how accurate the data is, response time, and reliability of the system. The system was tried on a number of patients while in use were sensors for heart rate, body temperature and pulse rate. The outcome was compared with typical medical devices for verification.

Parameter	Sensor Value	Standard Device Value	Deviation
Heart Rate (bpm)	78	80	±2
Body Temperature (°C)	37.1	37.0	±0.1
Pulse Rate (bpm)	75	74	±1

Table 1: Comparison of Measured Parameters

The system sensors showed great accuracy and rarely deviated from the normal medical devices in measuring health parameters. In general, the outcomes of experiments demonstrate that the IoT-based health monitoring system works effectively and accurately doing real time monitoring and immediate alert if needed. It provides a reliable and effective option to monitor health of paralysed individuals from the distance thus making attendance by doctor timely.

VI. CONCLUSION

Finally, the above mentioned health monitoring system based on the Internet of Things represents a huge improvement in the care provided towards people, especially those who suffer from paralysis or lack of mobility. Using contemporary sensor technology and internet power, the system offers the ability to monitor core health metrics (heart rate and body temperature), in real time. The ability to send instant alerts and provide live updates online make sure that the caregiver and medical professionals track the condition of the patient and can intervene when needed increasing overall care's quality. This system overcomes the shortcomings of the conventional health monitoring systems, including the GSM based systems – as it provides with the continuous and real-time data transmission, which is more expedient and convenient for the home healthcare. In addition, it minimises the financial and logistical

impairments experienced in traditional health facilities, and thus, paralysed people can receive the care needed by them in their home environment. As healthcare systems continue to arise; IoT technologies will be instrumental in delivering affordable, scalable, and easy to use solutions. This has not only enhanced the living standards of the paralysed individuals, but it has also created new perspectives in the future of healthcare monitoring making the system a critical instrument in eventuating patient outcomes and timely medical instrumentation.

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