SMART HEALTH GUARDIAN: IOT-ENABLED REAL-TIME HEALTH AND SAFETY MONITORING

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ABSTRACT

This project shows a network of wearable health sensors that can connect to the Internet of Things (IoT) for safety and health care purposes. The system uses wearable sensors to keep an eye on things like temperature, vibration, and heart rate in the body and the environment. An Arduino module processes the data from the sensors, an LCD shows it, and an intelligent IoT gateway sends it to a server. The gateway connects to both a web server on the local network and the cloud for processing, storing, and displaying data. The system lets you watch patients in real time, finds unusual health problems, and sends out alerts quickly to make patient care and hospital staff safety better.

Keywords: IoT, health, SPO2, heart rate, LCD, DHT11, safety, and protection.

1. INTRODUCTION

More and more healthcare professionals are using these innovations to address areas of concern because they could greatly improve medical administration and other areas. At the same time, a lot of regular people use Electronic Health apps and Health (ICT-managed therapeutic organizations) to grow, strengthen, and improve their healthcare networks. In some important circumstances, the SMS is delivered to the expert or to a family member. Health analysts are responsible for a big change in the healthcare industry since they are slowly taking advantage of the benefits that these changes offer to the social security sector. In the same way, many average people are using EHealth and M-Health (Mobile Health) apps to help and support their doctors. Health analysts are making a big difference in the healthcare industry as they slowly take advantage of the benefits that these new technologies provide to the social security sector. Many frequent clients are also using M-Health (Mobile Health) apps and EHealth to help and support their doctors. Part of this matching process is both reliable and quick to last. Form that looks like something else (PMS). One of the biggest concerns in society is social security. The most important thing about the medical system is that it is a huge benefit to people, as the World Health Organization's (WHO) parliaments plainly illustrate. To get people to believe you and pay attention, it's important to have a flash that looks like the new repair machine. In a planned and long-lasting fashion, the social insurance system will help people get better therapeutic ties, no matter where they are. If these

technologies make the Internet easier to use, they make the world a better place and make sure that social security and organizations stay safe and well-organized. At the heart of the Internet of Things idea are sensors, parts, and remote systems that let people give permission to access applications and data. The IOT is more obvious in places that aren't getting prosperity treatment, though. It's a cliché to state "prosperity is money," but it's true that better outcomes are important. Because of this, it's important to use an IOT platform that offers safe and profitable analysis. People are giving up the old way of adapting to a system that is more technologically advanced and centered on the individual. This is happening as human institutions becoming smaller. As the age of many societies continues to rise and more people are affected by chronic diseases like diabetes, heart disease, obesity, and others, it is becoming more and more important to support mental and physical health if you want to live on your own. Some promising methods are sensing, remote health monitoring, and, in the end, figuring out what people do every day. The Internet of Things, or IoT, is getting a lot of attention in many areas, especially in the realm of personalized healthcare. The body area sensor network (BASN) of the IoT architecture, on the other hand, has been widely employed, for example, in health monitoring that is always on. ECG monitoring is a very common way to find out if someone has heart disease. The main point of this paper is to introduce a new system for keeping track of your health in real time: the WISE (Wearable IoT-cloud-based health monitoring system). WISE employs the body area sensor network (BASN) architecture to keep an eye on health in real time. Wearable sensors that are built in include heart rate, body temperature, and blood pressure sensors. Second, many of the wearable health monitoring technologies that are currently available need a smartphone to analyze, display, and send data. This will change how often individuals use their phones usually. A lightweight, wearable LCD can be added as a backup option for getting real-time data while in WISE. The cloud gets the data from the BASN right away. It seems likely that the quantity and makeup of the world's population will continue to alter in the next decades. These demographic patterns have an effect on many parts of society, but the health and healthcare sectors are the most affected. People now think that living longer is a tremendous chance to live better and longer lives, and the number of people who do so has gone up a lot, especially in richer countries. This is something to be happy about. Older people usually need more medical care than younger people do, so the living environment and the healthcare system both need to be greatly improved. Also, elderly people are more likely to get chronic diseases as a normal part of getting older. Along with this demographic time bomb, healthcare expenses are rising quickly in every country on the earth. The number of people in the world is growing very quickly. When more people move to cities, it puts a lot of pressure on them to adjust to city life. Cities are continuously adding more medical facilities and resources, but it's still not clear how much is enough. Because of the high demand on city healthcare systems, technology has improved to give the right answers to the problems that keep coming up. Because more and more people have medical limitations, remote healthcare is increasingly a part of our life. Wearable sensors have been more popular in the last several years, and they are getting cheaper and more useful for keeping track of activities and personal health. Researchers have looked into how this kind of cutting-edge technology may be used in medicine, such as for managing and recording data and keeping an eye on patients' health over time. Emerging technologies like the Internet of Things [2] can help us get to the next level of health services. It makes sure that gadgets carried by or built into patients

are cheap, reliable, and useful so that patients, medical equipment, and doctors may all connect easily. The sensors record a continuous signal that is linked to important physiological indicators before being sent via the wireless network for communication. The data that was created is processed, recorded, and looked at using the existing medical records as a guide. Using the data records and decision support tools they have, the doctor can make a better guess and suggest an early course of treatment. This study has shown that current technologies can predict health concerns even when a doctor isn't available. In addition to making predictions, machines may also make drugs by carefully looking at medical data. The progress of technology will greatly lower the cost of healthcare and make disease prognosis more accurate. This will affect everyone's life and health monitoring. This study talks about the idea of a service model for patient comfort from a technological and economical point of view. It also talks about the problems that still need to be overcome when it comes to using IoT in the medical field.

2. LITERATURE SURVEY

When it comes to checking on the well-being of patients, we have looked into the many tests that have been done using contemporary methods. This study looks back on the work done on the remote patient observation framework and the patterns that go along with it for persistent checking frameworks. [2] suggests a design for a health monitoring system that uses Raspberry Pi and the Internet of Things. They used new ideas in distributed computing and the Internet of Things (IoT) in their work. The suggested model keeps an eye on the heart rate, blood temperature, and oxygen saturation. Distributed computing gives tough information capacity a boost. Because of this, the information gathered by the wearable sensors on a patient's body is kept in the cloud, where it can be viewed from anywhere using the g projection. The expert needs to log on to the website to get the patient's information and make a report on how they are doing. Patients can access the wellbeing report after they log in. The website has a visiting option for patients and specialists to use to talk to each other. The framework acts as a bridge between the patient and the expert to get across the barrier of separation. This is a smart and useful way to pay for things in rural places where there aren't enough clinical offices. In [3], it is advised to use an Arduino-based system to keep an eye on the health of older people. As the population ages, it is becoming more and more important to have a specific framework for keeping an eye on well-being. In this case, the proposed system checks the interior temperature, circulatory strain, and pulse and sends the information to healthcare providers. These limits are often guessed at during basic health examinations because they are good signs of a person's health. One has been given to make sure that the specialist gets an SMS when the alarm button is touched in an emergency. The web worker gets information so that the patient and specialist can see the features. The main test was seeing the elder generation put off adopting this new technology. They should be taught how to operate modern mechanical equipment like computers and cell phones. In [4], Wireless Bluetooth technology with Android is looked into as a way to check on someone's health from a distance and detect falls. The framework keeps an eye on wellness restrictions such body position, fall detection, temperature, ECG, and current GPS location. To move the data, you need to establish up many Bluetooth connections with an Android phone at the same time. The information is also sent to the employee through the internet and looked into and processed using an Android app. In case of an emergency, the information is sent to the person who is in charge of the issue. This strategy is good for those who are at a lot of risk, such tourists, inexperienced laborers,

officers stationed at high altitudes, and others, because it is flexible, productive, lightweight, and adaptable. IoT has taken over the industrial sector in recent years, especially when it comes to automation and control. Wireless technology has been getting better in recent years because it needs to work with a lot of different fields. Biomedical is one of the current movements to make healthcare better. IoT technology are being used not only in hospitals but also in places where people take care of their own health. So, a smart system keeps an eye on a number of factors that improve efficiency, save costs, and use less power. The clever system looks at this paper. Doctors are an important part of the conventional way of checking health. It takes a lot of time to register, make an appointment, and check in. Later, more reports are made. Because the process takes so long, workers typically skip or put off routine checkups. This modern procedure takes less time to do. Wireless technology has been more popular recently because it is necessary to keep different sectors running. IoT has taken over the industrial sector lately, especially in automation and control. Biomedical technology is one of the newest things to happen in healthcare. IoT technology is making it possible for personal healthcare spaces to open up as well as hospitals. Because there is a smart system, various factors that are known to improve efficiency, lower costs, and use less power are also noted. According to the smart system, this document is reviewed. [5] Medical professionals have been working for a long time to make people happier and healthier by coming up with new ideas and doing research. We can't ignore how important their work has been in the medical world. The basic ideas from the past are still there in the way cars are built now. This technology also makes it easy to find out early on if you have a long-term illness. Blood pressure, breathing rate, body temperature, and heart rate are all important vital signs that help doctors figure out what is wrong. This project uses the Internet of Things (IoT) to get heart rate and temperature data. The modern health care system has come up with new ideas like the cloud of things and wearable technology. One of the many things the Internet of Things can do is record and send patient monitoring data from a distance. This link needs to send data securely, and the purpose of this research is to send data in a private method. The recommended approach shows how cloud computing with health care may be safe. There are two key parts to it that work together. phase of storing data and phase of getting data back. During the storage phase, data is updated and kept for later use. During the data retrieval stage, pull the data out of the cloud. A user who has been authenticated can ask to utilize the cloud server. A patient who wears a wearable device updates his record every five to ten minutes. It refreshes every minute when in emergency mode. The wearable device sends results to a phone via Bluetooth or NFC. You can send this to a cloud server via GSM or 3G. The cloud server gives each patient their own unique address. Data on cloud servers is utilized to make sure that the right patient is being authenticated and that the right request is being made. WBAN is changing telemonitoring systems because of personalized medication and home-based mobile health. WBAN may capture the output and collect the information that sensors send. This output result is sent to the health monitoring system's controller wirelessly. This article employs Zigbee because it fits the requirements for a guaranteed delay in health telemonitoring systems that use WBAN technology. Zigbee is the system for communication. Afef Mdhaffar, Tarak Chaari, Kaouthar Larbi, Mohamed Jmaiel, and Bernd Freisleben talk about low power WAN networks as a way to look at data that has been collected in health care systems. They have put up a wide area network (WAN) that can talk to each other at a distance of up to 33 m2 and at an altitude of

about 12 m. The main purpose of Lora WAN is to save energy, and they have also proved that it uses ten times less power than GPRS, 3G, and 4G networks. We have given you the IOT architecture so you can learn how to use it step by step. The hardware costs $50 for GPRS and $10 for Lora WAN, and it uses 2.8 milliampere-hours and 20 milliampere-hours when it is not being used. For GPRS, the highest data rates are 86.5 kbps for uplink and 14 kbps for downlink. For Lora WAN, the highest data rates are 50 kbps for both uplink and downlink. These results show that Lora WAN works well as a health monitoring solution in the IOT. Alramzana Nujum Navaz, Mohamed Adel Serhani, and Mohammed M. Masud measured ECG signals at different times and in varied situations. We have thought about energy awareness, limited computing power, and lost network continuity. A mathematical model that does each task one at a time has been made to solve these problems. There have been three main suggestions made about how to figure out the process [10]. Ayush Bansal, Sunil Kumar, Anurag Bajpai, Vijay N. Tiwari, Mithun Nayak, Shankar Venkatesan, and Rangavittal Narayanan are all working on a system that can find important heart events. Hamid Al-Hamadi and Ing-Ray Chen [11] say that a trust-based health IOT protocol that uses risk categorization, reliability trust, and the chance of losing health as design factors for making decisions can be used to find symptoms that lead to fatal heart events with an advanced remote monitoring system. Anuradha Muthuraman Thangaraj Pichaiah Punitha Ponmalar Subramanian came up with the term "digital hospital" to mean hospital management. We compare baseline protocols and trust-based protocols to see if they are feasible. Automatic activation of standard electronic medical records. It also talks about a smart, autonomous hospital management system that uses the Internet of Things (IoT) and has been put into use. [13]

3. EXISTING SYSTEM

The health monitoring system uses a lot of sensors to check things like heart rate, body temperature, and how well the body can move. These measurements are only shown on LCDs. In the current model, we can't use a wireless connection to send data across longer distances. In case of an emergency, the suggested model with IOT configuration immediately tells the patient's doctor and a family member.

4. PROPOSED SYSTEM

We employed temperature, heartbeat, and humidity sensors in the recommended health monitoring system to keep an eye on different parts of human health and show the information on an LCD and an Internet of Things server. The buzzer module will let us know automatically anytime our pulse rate changes, which might mean that our blood pressure is either too low or too high. The server will also get the updates it needs.
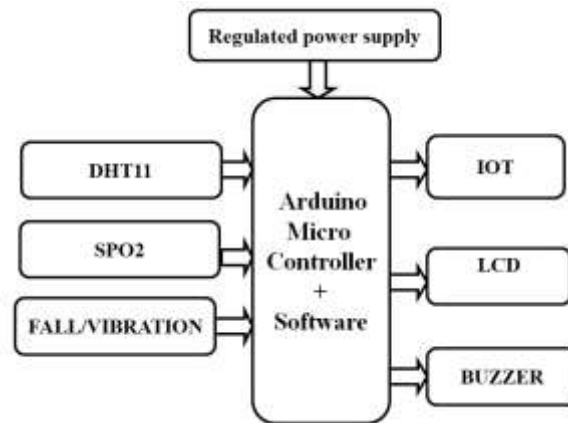
Fig.1. Proposed block diagram

WORKING MODEL:

This method's purpose is to set up a well-organized remote monitoring system for health. The goal is to keep an eye on the patient's heart rate and body temperature while they are with the NRF innovation specialist. Medical centers offer treatment services based on how well patients are doing. The patient's temperature and pulse are constantly being measured and written down on their body. This simple interface shows how the IoT Patient Safety Monitoring Program for Arduino and ESP8266 works. Pulse and LM35 temperature sensors keep an eye on BPM and the surrounding temperature separately. The Arduino makes the program and shows it on a 16 by 2 LCD panel. starts the data flow over WLAN ESP8266 gadget works with both WiFi and the Internet of Things application server. This gadget talks to an IoT server. In the end, you have to figure out which channel the item is talking on in order to corroborate facts from anywhere on Earth. Here is a description of the hardware modules that will be used in the proposed arrangement.

Fig.2. Proposed Circuit diagram

5. RESULTS

Fig.3. Proposed Output model

A 12-volt regulated power supply that changes to 5 volts of direct current is utilized to turn on the circuit here. The LED will light up on its own when there is 5 volts of current, which is what it does. The 5-volt direct current that is created goes to each piece of hardware in the circuit. The vibration sensor acts as a switch in the circuit, letting the doctor know that a fall might happen. that sends the controller's data to the satellite. We're using a piezoelectric buzzer and an IOT server for the output. The IOT server sends data to the webpage over a Wi-Fi network. Every five seconds, the information on the webpage changes. The buzzer and the IOT server are output modules.
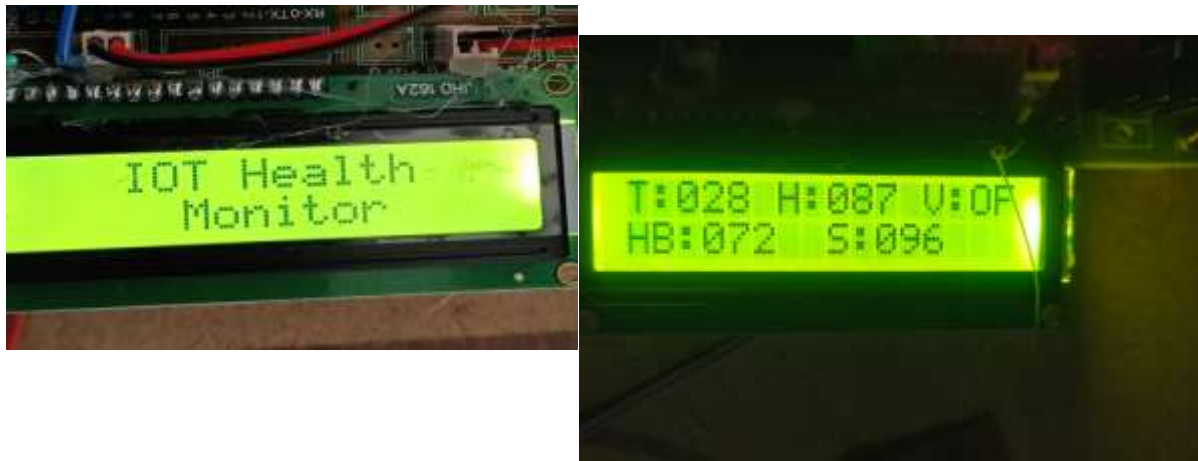
Fig.4. LCD Output

For doctors to be able to help in these important situations, they need to always know the patient's heart rate, temperature, and humidity levels. An Internet of Things-based patient health monitoring system will make it possible to keep an eye on ICU patients without the need for people to do so. The output of the amplifier and sensor circuit was connected to the Arduino. The periodic AC signal that made up the measured output showed that there were variances in peak-to-peak amplitude between individuals. We sent a sinusoidal signal and the server's output to an Arduino board. We used a Wi-Fi module to send the data we obtained.

S.No	Temperature	Humidity	Heart_Beat	SPO2	Fall_Status	Date
1	27	90	81	97	ON	2025-09-15 11:44:18
2	28	80	84	99		2025-09-12 11:54:59
3	28	80	0	0		2025-09-12 11:53:09
4	28	81	0	0		2025-09-12 11:52:49
5	28	84	77	100		2025-09-12 11:38:56
6	29	95	0	0		2025-09-12 11:27:54
7	32	98	79	100		2025-09-12 11:27:28
8	28	85	0	0		2025-09-12 11:26:50

Fig.5. Web server Output

Table.1 Results comparison Table

Parameter	Existing Model	Proposed Model
Microcontroller	8051	Arduino
Speed	Low	High
Complexity	High	Low
Efficiency	LOW	HIGH

6. CONCLUSION

We made an E-health system based on Arduino that links all the input modules, like sensors for heart rate, temperature, humidity, and position movements, with output modules, like LCDs, buzzers, and wireless communication. We did this with an Arduino processor. The proposed system kept track on and recorded many health indicators on the IoT platform, like heart rate, temperature, and finger angle movement. The suggested system checked the values of these parameters and gave out alerts. We want to add more sensors to the health monitoring system in the future, like a body fat measurement device and a gluecometer.

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