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IMPLEMENTING HEALTH MONITORING SYSTEM THROUGHIOT-ENABLED SMART DATA TRANSFER

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Abstract

The proposed system seems to be a promising solution for monitoring the health parameter of elderly people and Athletes at home. The use of wireless sensors microcontroller and Bluetooth modules makes it easyto collect and store data on various physiological parameters such as Pulse Rate, Oxygen level and Temperature. One of the most significant advantages of this system is that it provides Real-time data monitoring which allow doctors to monitor their patients' health conditions remotely. Additionally, the data can be assessed from anywhere in the world using the Internet which makes it easy to provide medical assistance and feedbackto the patients. In conclusion, The proposed IOT-Based intelligent HMS system has the potential to provide an efficient and cost-effective solution for monitoring the health conditions of elderly people and patients with chronic diseases at home. It can also reduce the burden on healthcare institutions and improve the quality of life for patients by providing continuous monitoring of their parameters.

Keywords: Internet of things in health care, Arduino UNO, Pulse rate and SPO2 level sensing, Temperature sensor, Transformation of data transferring, Smart Health monitoring.

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1. INTRODUCTION

The term "Internet of Things" (IoT) means a collection of objects and events, or "things," that have detectors, algorithms, and other innovations built into them in so that they can link to it and exchange information with some other hardware and software throughout the internet. These technologies can be simple domestic items or highly developed manufacturing equipment. Researchers predict a rise in the more than seven billion IOT systems that are currently connected will increase to ten billion by the year 2020 & 22 billion in 2025.The healthcare sector has seen a considerable transformation as a result of technological improvements, becoming ever more clinical and convenient. Patients could now electronically send their medical information to healthcare practitioners and evaluate their status at home via the creation of tiny gadgets such as smartwatches. As a result, healthcare is now more affordable and available to those who live in rural and distant places. The precision of diagnoses has increased, patients waiting have decreased, and outcome measures have improved because of computer vision, big data analysis, Internet - of - things, Bluetooth detecting, internet technology, and cloud - based services. On the whole, internet has changed the healthcare sector, rendering it more successful, patient-friendly, & convenient. Another more linked and smart world has been made possible by the Internet of Things (IoT), which has changed how we interact with our surroundings. IoT has integrated into communications technology by linking numerous gadgets and detectors to the world wide web with the use of cutting-edge protocols in terms. Several industries, including healthcare, automotive, agricultural, and remote monitoring, are using IOT system. For example, IoT in agriculture gives workers the ability to keep an eye on crops development and environmental conditions, which could also contribute to improved harvests and increased productivity. To guarantee more secure and efficient mobility, To track and share data in healthcare systems, Internet of things have indeed been connected with a range of physical equipment and network topologies. By gathering physical information like temperature, pulse rates, Electrocardiogram,

Electroencephalography, and certain other important indications, sensors—either integrated or activity trackers the human psyche have changed treatment. Environmental data, including such temperatures, moisture content, period, and duration, can also be captured in parallel to collected data, which contributes in drawing accurate and useful conclusions about the patients' health state. The gathered information can be utilised for a variety of things, such evaluating the performance of a therapy, following the progression of an illness, and sending out instant notifications in an emergency. Yet, organizing and using this much

data is a challenge. Interaction among consumers and sufferers in a variety of settings, including medical, education, and industry, relies on efficient and safe connection. There are a number of activities that are done to sustain this partnership, which include: Usage of Secured Messaging Services.

2. METHODOLOGY

An automated system to track a patient's SPO2 level, body temperature, heart rate, and transferring the data to the patient via internet. Utilizing health parameters and such symptoms gathered by the system, we additionally extend the current method for determining whether the person has any chronic disorders or diseases.

A. BLOCK DIAGRAM

The sensors used here are Temperature sensor, MAX30100 Pulse oximeter. This action is achieved by using Arduino UNO and communication is done by Bluetooth

HC05 module. The photo-detector where positioned closed to one another in a pulse oximeter. When a finger is used in the reflecting approach, the light reflects directly to the detector. The blood pressure in the finger increases with each pulse rate, increasing the amount of light reflected again towards the detector the micro controller provided threshold value. Through using predefined Bluetooth HC05 module connected to the Arduino UNO microcontroller, the microcontroller automatically notifies the patient's physician or family members when the constantly sensed heart rate reaches or exceeds the predetermined limit. As well the current patient information may be accessed by the physician from the system sothat the necessary therapies can be given.

Fig 2. Block diagram of Smart Health monitoring system

B. CREATION ABOUT AN EMBEDDED DEVICE TO TRACK SPO2 AND PULSE RATE

IoT-based SpO2 and heart rate monitoring systems typically include a sensor module that takes readings of these physiological parameters and sends the data via the web to a data center or cloud- based network. Using an internet or portable application. Medical experts, caretakers, or patients themselves can view and evaluate the data.

MAX30100 SENSOR:

A non-invasive tool for measuring heart rate and blood oxygen saturation levels is the MAX30100 pulse oximetry and heart-rate sensor module. It is intended to be incorporated into wearable technology including wristbands, fitness bands, and medical equipment. The MAX30100 sensor measures the process of absorption of blood arteries by combining two LEDs, a photodetector, and signal artificial intelligence techniques. The IR LED is absorbed by deoxygenated blood whereas thered LED emits light that is absorbed by oxygenated blood. The MAX30100 is able to determine the

blood saturation point of oxygen (SpO2) and pulse rate by calculating the ratio of absorbed light between the multiple wavelengths. An integrated 18-bit ADC is built inside the MAX30100 sensor module to digitise the analogue signals.

C.CONSIDERING A WIRELESS TECHNOLOGY: HC05 BLUETOOTH:

The HC-05 module operates on the Bluetooth 2.0 protocol and a serial port profile (spp) creates a wireless serial connection . In open space, it has a range of up to 10 metres (or 30 feet) and uses the 2.4 GHz frequency spectrum. The device is simple to integrate into a variety of projects and has a tiny form factor. It can be operated with a voltage ranging from 3.3V to 5V and has four pins for power, ground, and serial communication (TX and RX). The HC-05 module can be set up to work in a variety of modes, including JK flip flop mode, as well as pair with other Bluetooth devices. Additionally it has the ability to make a wireless serial connection between an Arduino or other microcontroller and a computer or mobile device. Overall, the HC-05 Bluetooth module provides a flexible and affordable way to give DIY electronics projects in telecommunications features.

3. HARDWARE SPECIFICATIONS

ARDUINO:

Arduino is the core of the projects hardware, an accessible hardware and software platform called Arduino is used for electronic projects. It is intended to make it simple for users to develop interesting projects even if they have no

prior knowledge of circuits or coding. A microcontroller board with several input/output pins makes the hardware, which can be used to operate other electrical parts including detectors, robots, and lights. Users can develop program in the software platform's Integrated Development Environment (IDE) and transfer it to the Arduino board. Several software applications, like C and C++, can be used to create Arduino boards of various sizes and designs. Many applications, including robotics, automation, data logging, and interactive art pieces, frequently make use of Arduino boards. They are well-liked by experts, learners, and enthusiasts alike due to their adaptability, simplicity, and inexpensive price.

TEMPERATURE SENSOR:

The temperature sensor is a component that detects temperature differences and converts information it in to an electrical impulse. It is used to check the temperature. Temperature sensors are capable of helping determine the degrees of a variety of materials, including gases, fluids, and particles. There are numerous varieties for temperature sensors, each of which has unique benefits and drawbacks. The following are a few of the most popular kinds of sensing devices. The majority of temperature sensors were indeed thermometer. They are constructed from two distinct alloys that are attached at a single end. A voltage is generated as a result of the temperature differential between both the thermocouple's two edges. This voltage can be detected and used to determine the temperature.

RTDs (Resistance Temperature Detectors) are temperature sensors that use metal wires or films whose resistance changes in response to temperature. The resistance that exists in the wire or sheet likewise rises when the RTD's temperature rises. Thermistors are temperature sensors that use a semiconductor material to modify resistance in response to temperature fluctuations. Thermistors have a shorter temperature difference than RTDs but they're more precise. With infrared sensors, you can figure out a material's heat by measuring the infrared rays it emits. In industries, they are frequently employed for quasi temperature measuring. The usage as well as the level of measurements precision will affect the selection of temperature sensor.

4. SOFTWARE SPECIFICATIONS

EMBEDDED SOFTWARE:

The software that controls the IoT device's microcontroller is known as embedded software. It is in charge of gathering sensor data, processing it, and exchanging it to various machines or systems.

MIT APP INVERTER:

The Massachusetts Institute of Technology (MIT) has developed MIT App Inventor, a browser tool that enables users to design mobile apps for Android without needing to master procedure - oriented languages like Java or C++. Android apps are user-friendly drag-and-drop visual programming environment. Users can design a variety of apps with MIT App Inventor, including games, social networking apps, instructional apps, and more. The platform offers several tools and elements that can be used to create apps, such as user interface elements, database elements, media elements, and more. As MIT App Inventor is free and open-source software with a sizable user and tech community, there is a tonne of learning and troubleshooting resources available. In addition, the platform has a simulator that enables users to test their apps on a pc before putting them into use on real Android devices. For people who are new to programming or have little coding knowledge, MIT App Inventor is a strong tool for building Android apps.

A. PYTHON LIBRARIES AND MODULES FOR SMART HEALTH MONITORING SYSTEMS:a.) FLASK:

A web framework called flask is utilised to create the backend server that receives and processes sensorinformation.

b.) REQUESTS:

A library used to communicate sensor information over HTTP to an IoT device or cloud platform.c.) PANDAS:

A data analysis and manipulation library is the technique may be applied to analyse and organise the storage ofsensor data.

d.) MATPLOTLIB:

A library for displaying data is called Matplotlib. To make sensor information more accessible, it can be utilised to produce graphical representations.

e.) SCIKIT-LEARN:

Scikit-learn is a library for data analysis as well as machine learning. Based on the sensor information, it may be utilized to create predictive models that can identify health anomalies and forecast upcoming health problems.

RESULTS AND DISCUSSION

All of the findings from this study are displayed and addressed in this part.

MEDICAL APPLICATION:

Temperature sensors are used to measure body temperatures in medical settings. A thermometer, for instance, can be used to check a patient's temperature to see if they have a fever or to gauge how well a therapy is working.

A. ILLNESS DETECTION**:**

Temperature sensors can be used for illness detection because fevers might be an early symptom of sickness. A smart health monitoring system can identify alterations that can signal the beginning of an ailment by continuously monitoring a patient's temperature

B. CHRONIC DISEASE MANAGEMENT**:**

Those with chronic disorders, such as diabetes, which might impact their body temperature, can have their temperature monitored using temperature readings. A smart health monitoring device that monitors temperature fluctuations can send warnings or messages to the patient or their healthcare provider if there are

any major changes.

1. POSTOPERATIVE CARE:

After surgical procedure, temperature sensors are able to keep a record of a patient's body temperature, which can assist identify any post - operative pain like infections or other problems.

2. SLEEP MONITORING:

Temperature sensors can be used to monitor a person's temperature while they sleep, which can provide insights into their sleep quality and identify any disruptions that may be affecting their sleep.

3. STRESS MANAGEMENT:

Detecting changes in body temperature that could be signs of stress or anxiety requires the use of temperature sensors. A smart health monitoring system can offer information or actions to assist regulate anxiety levels by keeping track of these variations. All things considered, temperature sensors can offer useful information for smart health monitoring systems, enabling early diagnosis of health problems and improved treatment of long-term disorders.

SPO2 DATA COLLECTED FROM SMART HEALTH MONITORING SYSTEM:

SPO2 READINGS:

This is the system's primary source of data. The percentage of oxygen-saturated haemoglobin is the Spo2 values, which are commonly represented as percentages, tell us it is present in the blood.

TIME MEASUREMENTS:

The device would also keep track of the time when each Spo2 reading was taken. With the use of this data, it is possible to

chart the evolution of the Spo2 level over time and spot any developments or patterns.

USER ID:

The device must keep track of the user ID for each measurement if it were to be used by several users. This information can be used to monitor trends in a person's health and make sure the right user is assigned to theappropriate data.

DEVICE ID:

The system may additionally keep track of the ID of the measurement-taking device. For the sake of quality assurance and debugging, and also this information may be helpful.

PULSE RATE:

Measurement of heart rate in addition to Spo2 level is possible with some smart health monitoring devices. The cardiovascular system can be monitored using this data, and any anomalies or irregularities can be found.

ACTIVITY LEVEL:

Depending on the system design, it may also gather information about the user's activity level during each measurement. The impact of activities on Spo2 levels and general health can be determined using this data.

ENVIRONMENTAL ASPECTS:

During each observation, the device may also record environmental aspects including temperature, humidity, and air quality. Any outside elements that might be affecting the user's health can be found using this data.

In general, Blood oxygen level data obtained from a smart health tracking system can offer insightful information about a person's respiratory and cardiovascular health, as well as other variables that can be impacting their well-being.

PRACTICAL USE OF HCO5 BLUETOOTH MODULE:

WIRELESS DATA TRANSMISSION:

A sensor or health monitoring device and a mobile application or cloud server can both wirelessly transfer data when using the HC-05 module. As there are no visible connections or wires required, the user is able to monitor their health parameters in real-time.

REMOTE MONITORING:

Remote access is possible with the HC-05 module, even if the patient is not physically present at the same place as the monitoring device. One illustration is the use of a smartphone app by a doctor to remotely monitor a patient's heart rate, blood pressure, or other vital indicators.

ALERT SYSTEMS:

If the patient's health metrics exceed a predetermined threshold, the HC-05 module can be used to start alerts. For instance, the system can inform a health professional or send a message to the user's mobile device if their blood pressure or heart rate rises too excessive.

The HC-05 Bluetooth module offers wireless data transmission, remote monitoring, smart wearables, alert systems, and data analytic applications, making it a useful part of a smart health tracking system.

CONCLUSION

In conclusion, smart health monitoring devices are an important step forward in improving healthcare outcomes and empowering patients to take charge of their health. As technology continues to evolve, these devices will become even more accessible, affordable, and integrated with healthcare systems, making it easier for patients to receive timely and efficient care. Smart health monitoring devices are revolutionizing the healthcare industry by providing real-time monitoring of a

patient's vital signs and health data. These devices offer several advantages such as early detection of health issues, improved patient outcomes, reduced healthcare costs, and enhanced patient engagement. With the advancement of technology, smart health monitoring devices are becoming increasingly sophisticated, with features like artificial intelligence, machine learning, and cloud computing, providing personalized and accurate health data.

FUTURE SCOPES

Smart health monitoring systems have a bright future as they offer numerous benefits to both patients and healthcare providers. Here are some of the potential future scopes of smart health monitoring systems:

PORTABLE ADVANCEMENTS:

Due to the creation of wearable devices, such as wristbands or smartwatches, continuous real-time monitoring of oxygen saturation and pulse rate is now possible without the need for invasive therapies.

WIFI CONNECTIVITY:

Data must be able to be accessible at any time and from any location by being able to wirelessly transfer it fromthe sensor device to the cloud-based platform or mobile application. Wireless networks include Bluetooth and Wi-Fi, for instance.

ANALYTICS POWERED BY THE CLOUD:

Cloud-based platforms enable the collection and analysis of huge amounts of data, providing knowledge that can be used for monitoring health conditions or early illness detection.

Deep learning can be used to update this system

Integrating of IoT-based SpO2 and heart rate monitoring systems with electronic health records (EHRs) allows for effective data transmission between medical professionals and improves patient health.

TELEMEDICINE:

Smart health monitoring systems can help with telemedicine by enabling patient and healthcare practitioner consultations through the internet. For people with mobility challenges or who live in distant places, this can make healthcare more accessible.

Enhanced data security: It's critical to make sure that sensitive healthcare data collected and stored by health tracking devices is private and shielded from online dangers. This data may be safeguarded and attacks prevented with the aid of upcoming advancements in data protection techniques.

BETTER PATIENTS' EXPERIENCES:

By enabling healthcare professionals to evaluate patients in authentic from a distance, health monitoring systems can assist to enhance patient results. It can aid in the early identification of health problems and stop consequences from developing.

Effective medical tracking systems can improve patient involvement by providing simple ways to view their medical data and enabling users to take an active role in their treatment. This may result in increased treatment plan adherence and enhanced general health benefits.

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