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ENHANCING MEDICAL MONITORING DEVICE USING WEARABLESENSORS AND RASPBERRY PI: AN INTERFACING OF IOT

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Abstract:The Internet of Things (IOT) and wearable technology have combined to create revolutionary advances in healthcare monitoring. A health monitoring sensor patch, a ground-breaking invention presented. It was created for seamless incorporation [3]through IOT-connected healthcare systems. The suggested sensor patch integrates [5] a variety of biometric measurements, including electrocardiography (ECG), temperature sensors,heartbeat sensors, and others to enable thorough healthparameter monitoring. [2] Then the data will gathered and get monitoring the patients by the cameraconsultation in the home or any other places. [9] The patient get serious in any situation he can make a voicecall or video call then he can get a treatment in any location [8]. Its adaptable design allows for installation on a variety of bodily parts. The wearable sensor patch described in the abstract, which combines stiff and flexible parts to enable seamless communication alongside the [1] (IOT) Internet of Things, provides a breakthrough idea in healthcare. The sensor patch's technological innovations and uses in various healthcare contexts are highlighted in the abstract. Transformative improvements in healthcare are now possible thanks to the technology's quick development. The revolutionary potential of an intended to transform healthcare through [4] seamless Internet of Things (IOT) integration is highlighted in this abstract. The advantages for patients, remote monitoring, and personalized treatment are emphasized. [12] The abstract establishes the tone for the entire paper by highlighting the importance of the investigations in developing the IOT and wearable technology in healthcare intersection.

Keywords— IOT (Internet of Things), ECG, Raspberry Pi, Pi Camera, Health Monitoring,Heart Beat, Virtual Doctor Consulting.

1.INTRODUCTION:

The adoption of modern advances has caused notable changes in the medical scene in an era marked by technical developments and the ongoing evolution of healthcare. [4] Among these developments, the introduction of fashionable sensor patches has sparkedan entire revolution in healthcare by allowing for the first time ever real-time monitoring and customised insights. This study explores the possibility of buildingIOT Connectivity, [8] delving into the area of healthcare innovation. A smooth and thorough tracking of health system is presented by utilising the power of many sensors, particularly the heart rate monitor and

ECG sensor, along with the computational powers of the Raspberry Pi computing device [3] and the visual information that comes from the Pi camera. This networked system goes beyond the limitations of conventional healthcare, empowering people to actively manage their health and developing an active attitude to medical procedures. A thorough picture of the user's physical status is acquired through the study of variability in heartbeats, [6] ECG layouts, and visual data, ensuring the early identification of irregularities and prompt medical intervention. [4] By providing possibilities for remote monitoring, the amalgamation of these kinds of technologies not only improves patient care but also lessens the strain on the healthcareinfrastructure. [10] We will examine the synergistic combination of both the software and hardware components as we delve into the deep intricacies associated. While the electrocardiogram (ECG) monitor offers insights into a heart's electrical patterns, the heart rate monitoring provides actual-time data on cardiac activity. The Raspberry Pi acts as the centre of compute, coordinating processing, analysis, [8] and link to the cloud. [6] By permitting visual input, the Pi camera expands the system's functionality and improves the diagnostic capabilities. [6] In healthcare has been made possible by an amalgamation of wearable sensor technologies, [10] IOT connection, and enhanced data processing. The purpose of this article is to investigate the prospects associated with an Upgrade equipped with heart rate as well as ECG sensors, a Raspberry Pi, and a Pi camera. By enabling decisive monitoring, prompt interventions, and individualized care, this system has the potential [5] to revolutionize healthcare as we work our way through its complex design and functionality.

2. LITRATURE REVIEW:

IOT integration makes it possible to access medical data remotely and maintain constant connectivity. Healthcare personnel may monitor individual patients in contemporaneous fashion using IOT platforms, making educated decisions and offering individualised care. The potential to obtain videoconferencing and remote patient monitoring is increased by the IOT's connectivity with sensor devices and Raspberry Pi.

S. D. Mamdiwar et al., 2021. Recent developments in wearable sensor systems with IoT support for healthcare monitoring. Over the past few decades, the Internet of Things has been crucial to numerous sectors. Integrating wearable sensor systems with IoT is the next stage in healthcare seamlessly. The numerous IoT topologies, as well as diverse data processing, transport, and computing paradigms, are extensively discussed in this paper. It assembles IoT- assisted peripheral sensor systems incorporate a variety of communication methods and devices, and this discussion covers its many uses in healthcare their benefits to humanity. With a summary of diverse research and technologies, a comparative comparison of all wearable medical technology is also covered. This evaluation also examines every issue that wearable sensor systems with IoT assistance typically encounter, as well as the particular challenges that must be resolved to improve these systems in nursing and discusses the potential upcoming technological and architectural advancements that can be done to enhance the healthcare sector.

Lakshmi G. J. and others, 2021. Intelligent healthcare solution for monitoring patients abroad that is cloud- based. The need for quick adoption of more cutting-edge digital health technology, particularly remote health monitoring, has been made

clear by Covid-19. The dynamic simplicity of use of low-cost issue solutions, improved patient care, less complications, and increased efficiency are all results of the technological advancement in healthcare and approving decision-makers in healthcare who have intelligence understanding at the critical stage of care.

Ananth S, et al. (2019, April) IoT-based smart health monitoring system. IOT constitutes a single of the fields that will experience rapid growth in the coming years and is crucial to the healthcare industry. IOT fosters human connection by utilising wearable technology to intelligently empower people's wealth and health. A new trend in the internet of things has been sparked by recent advancements in wireless sensor networks. Healthy living is major Internet of Things application. Smart health care systems can swiftly monitor patients with unusual health conditions and deliver a rapid the patient’s needs can be met. Wearable technology that continuously monitors the patient's activity and health can provide this kind of solutions. The primary goal of this effort is to do a thorough investigation on collecting sensor data, analysing that data, and providing feedback is based on several health criteria for patients.

Zeb, K., et al. (January 2019). Using a Raspberry Pi, an IoT-based healthcare monitoring system converts monitored data into real-time clinical input. The world's population is ageing and chronic diseases have increased dramatically in the last ten years, which calls for effective health monitoring systems (HMS) for people's comfort. This strategy is not only more affordable but also a workable replacement for conventional healthcare the elderly and those with chronic illnesses abstain Visits to healthcare facilities (such as hospitals and nursing homes) lessen the pressure on those facilities. In this research, we proposed an intelligent IoT system. Patient health metrics like high blood pressure, heart rate, and ECG are continuously monitored by HMS. Information from the blood pressure, heart rate, and ECG sensors automatically observed by a Raspberry Pi camera linked to an Arduino UNO. Raspberry Pi receives sensor data from Arduino UNO and feeds it to servers. Eventually, the server transferred data to the webpage that is revised every two minutes from the database through Wi-Fi. Using the internet, doctors may view data from any location and provide feedback with text.

J. L. Bayo-Monton et al. (2018). Internet of Things and wearable sensors together to advance eHealth. Health and sociological data show that as life expectancy rises, patients' years with chronic illnesses and co- morbidities also rise. The development of ICT has led to the exploration of novel methodologies and paradigms to provide successful and cost-effective health services. Electronic medical records and health sensors are essential tools for encouraging patient involvement, illness self-management, and helping clinicians diagnose and treat patients remotely monitor patients' health. Information merging fast prototype using five physiological sensors and two inexpensive Raspberry Pi and Arduino are popular and widely used computing devices. Which is completely described with the intention of reproducibility, intended to assess the contrasting two deployment scenarios, namely the Raspberry Pi 3 as well as personal information. Computer, we may determine how well portable technology can incorporate wearable sensors. Utilising internet resources and a straightforward communication protocol, the combination of components is implemented by deploying an animation engine to send data from detectors to a display device utilising two data retrieval methods.

M. R. Yuce et al. (2018). A network system for internet of things (IoT) interconnected to security and health monitoring software. A hybrid implantable sensor network system for applications connected to the Internet of Things (also known as IoT) for safety and health monitoring. The method aims to increase working safety outside. A wearable region of the body network (WBAN) is used in the proposed system to gather user data, and an LPWAN is used to connect the WBAN to the Internet. The WBAN's wearable sensors are used to measure the surrounding environmental conditions using a Safe Node and to keep track of the subject's vital signs using a Health Node. Within the proposed network, a stand-alone server on premises (gateway), which can analyse the unprocessed signals from sensor devices, display the environmental and physiological data, and initiate an alert if any emergency situation is recognised, is designed. An IoT cloud server is deployed to link the gateway to the Internet and offer additional functionalities like monitoring of the internet and mobile applications.

S. C. Mukhopadhyay et al. (2022). Healthcare wearable sensors: from creation to use. the use of devices with sensors for medical purposes. Due to its function in tracking physiological signals and movements, wearable sensors play a crucial role in the microelectronics sector. Intercultural interaction modules have been included with sensors that have been developed and manufactured utilizing a variety of methods of production for Trans receiving signals.

Khan MA and others (2023). Internet of Medical Things-Based Satellite navigation Patient Monitoring System Visualization. Healthcare workers now use automated patient tracking (RPM) as a vital tool for managing and monitoring patients, especially those with chronic conditions. As the use of the internet more Medical Things (IoMT) instruments have become more generally accessible, RPM has improved its capacity to offer current data and knowledge to healthcare practitioners. However, storing and analyzing such a massive number of data is still a challenging issue. Professionals in the healthcare industry can review data collected by IoMT technology in real-time using the visualization technique recommended in this article. The system's dashboard allows healthcare workers to keep track of the medical condition of patients and spot any data abnormalities.

Junaid S. Bet al.,(2022, October). The developments in the healthcare management system's emerging technology. The development of IoT, AI, and block chain technologies has fast gained traction as a new area of study in a variety of postsecondary and industrial fields, particularly in the healthcare industry. Many patients now have access to enhanced personalised healthcare thanks to recent improvements in healthcare delivery, which have benefited their wellbeing. The next phase of medical technology is the seamless integration of these new technologies, including wearable sensor devices helped by IoT, AI, and block chain. Surprisingly, IoT and artificial intelligence (AI)-powered technologies are transforming healthcare from a traditional hub-based structure to a more individualised healthcare management framework (HMS) as a result of the fast deployment of smart wearable sensors.

P. P. Ray, D. Dash, and others (2023, January). A review of the energy efficiency and future of the internet of wearables for omnipresent e-health care. A new paradigm for smart computing called the Internet of Wearable technology Things (IoWT) has arisen, especially for small, resource-constrained, and Internet-enabled ecosystems. We present energy- efficient approaches for minimizing power the elimination issue

in IoWT. With the development of low-cost sensors and a vibrant market place, such IoWT systems have inevitably become important for monitoring multiple use cases, such as medical facility administration, activity recognition, and safety assurance.

S. Khan et al. (2021). A brief overview of recent developments in wearable printed temperature measurement devices for biomedical applications. The tremendous desire to monitor human health parameters and to foresee the early signs of chronic diseases is what is causing wearable bio sensing technologies to rise so quickly. For continuous tracking of numerous biomarkers via wearable and implantation sensing patches, various sensors are being developed. Among the several wearable bio sensing patches, the temperature sensor has proven to be a crucial physiological metric.

3. RESEARCH METHODOLOGY:

The required health problems for maintaining them must be identified in order to apply the health analysis system. Typically, the following has covered sensors like the temperature sensor, blood pressure sensor that exists, heart rate sensors an ECG device, acceleration sensor, and raspberry pi with GSM.

1) Raspberry Pi: As a multi-processor, this gadget performs admirably. It includes a graphics card, RAM, a volatile memory, device interfaces, and other wireless device interfaces that are external. Even though the Raspberry Pi uses a tiny amount of electricity, it is nonetheless affordable and effective. As with a typical PC, it needs power supplies, a display unit, and a keyboard to input commands. The Raspbian OS, which is based on Linux, is used by Raspberry Pi. The Raspberry-Pi is implemented using the programming language Python. It can communicate with additional peripherals via wireless technologies like Bluetooth, NFC, ZigBee, and cellular networks.

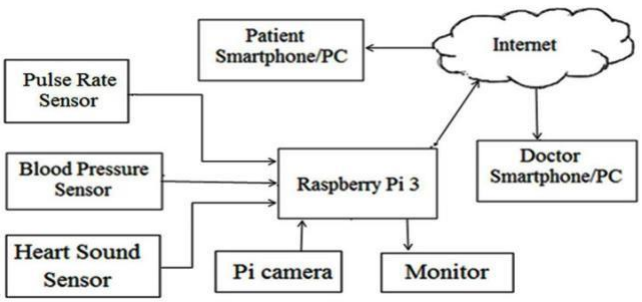

Fig.1.Architecture of Raspberry Pi in Health care

2) ECG Monitor: The top of the skin is utilised for electrocardiography (ECG), which records heartbeat activity. Every minute, it can spot a change in an electric cylinder on the skin's surface. The duty to obtain accurate data falls to an ECG amplifier. An ECG is a visual representation of the voltage that the heart muscle produces while the heart beats. The heartbeat is measured using ECG and MCU. The electrodes' primary purpose is to calculate heart rate; there are just two connections one for a particular hand and the other for one hand. This highlights the need for a

reliable reference that can be used by researchers and industry experts to develop, categorise, and analyse ECG monitoring systems. In this article, we provide an extensive list of ECG monitoring devices that has been validated by experts and we also undertake a thorough, systematic evaluation of the literature. This offers evidence-based assistance for understanding the elements, settings, and applications of ECG monitoring systems. This offers evidence-based decision- support for critically analysing the parts, contexts, characteristics, and difficulties of ECG monitoring systems.

Fig.2.ECG Sensor in Health care.

Thus, a generic engineering model for electrocardiograms monitoring systems is suggested, the value chain of ECG monitoring systems is thoroughly analysed, and a thorough analysis of the pertinent literature is presented, categorised in accordance with the experts' taxonomy and emphasising troubles and current trends and the Internet of Things (IoT) to deliver effective, financially conscious, and completely integrated monitoring systems.

3) Temperature Sensor: This sensor uses a voltage to determine body temperature. The sensor LM35 is superior to the thermostat since it can convert temperatures from Kelvin to Centigrade and is suited for wireless applications. The LM35 is a thermometer with an analogue output voltage that varies with temperature. It offers output voltage in Celsius (Celsius), not Fahrenheit. No additional calibrating circuitry is needed. The module LM35 provides 10 mV/degree Temperature sensitive. Output voltage increases along with temperature. It consists of a 3-terminal thermometer that is used to gauge ambient temperatures between -55 °C and 150 °C. The temperature output from the LM35 is more accurate than the output from a thermistor.

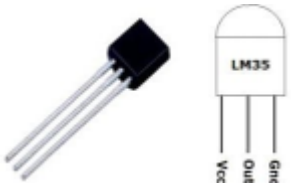

Fig.3.LM35 Temperature Sensor in Health care.

The constant stream of temperature readings generated by an LM35 temperature gauge linked to the microcontroller's analogue input pin A1. On the serial monitor, the temperature is shown in degrees Celsius with a one-second pause between readings. The LM35 sensor outputs 10mV per Celsius level, therefore the code takes the sensor's ADC value first, transforms it to a corresponding voltage, and then

translates the corresponding voltage estimate to an accurate temperature calculation in degrees Celsius.

4) Heart Rate Monitor: It is utilised to gauge the patient's heartbeat. The heart beat sensor in this instance is powered by +5V DC. As a result, the hand artery nerves receive the digital result. This operates on the basis of light modulation through arterial nerve blood flow at each pulse. The ideal heart rate range is 60 to 100 beats per minute. The heart rate of a person can potentially be determined using these sensor modules. It achieves this by illuminating an IR causing LED on the innermost portion of a fingertip and using a phototransistor on the opposite side of the finger to detect minute variations in the received IR. The blood pumping through the finger is

what causes the variations in the transmitted IR. Although they operate on the same fundamental concept as commercial gadgets, medical devices are obviously much more capable.

Fig.4.Heart Beat Sensor in Health care.

5) An Internet-based network typically the Internet is used to host and offer a pooled, centrally located server resource known as a cloud server, which various users can access as needed. Cloud servers can supply processing power, storage, and applications in the same ways as a conventional physical server would. Through a system of cloud computing, server locations can be situated in any part of the world and provide services remotely. Traditional dedicated server hardware, in contrast, is often installed on-site for the sole purpose of one organisation.

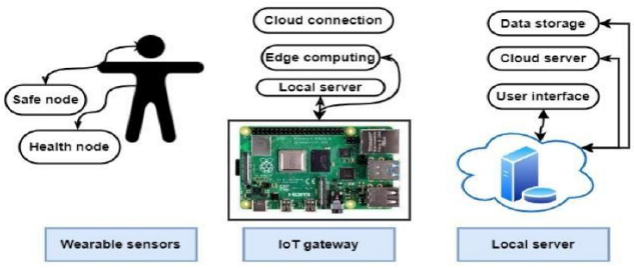

Fig.5.Cloud Storage Methodology

4. PROPOSED SYSTEM:

An Internet of Things (also known as IOT) project is the Patient Monitoring System with Raspberry Pi. With the use of live video streaming, this project is utilised to keep an eye on patients while in the ICU in a hospital and provides details about the patient's health defining features. This is keeping an eye on the patients' health status for the patients' families and doctors. Our solution allows for the analysis of ongoing

patient data in the ICU. The Raspberry Pi could be used for broadcasting of the footage. Our system is intended to be utilised in ICUs for patient monitoring and measurement of numerous parameters like blood pressure, heart rate, and temperature. Additionally, the patient's parameters can be compared to threshold values, and if there are any differences, instant messages can be sent.

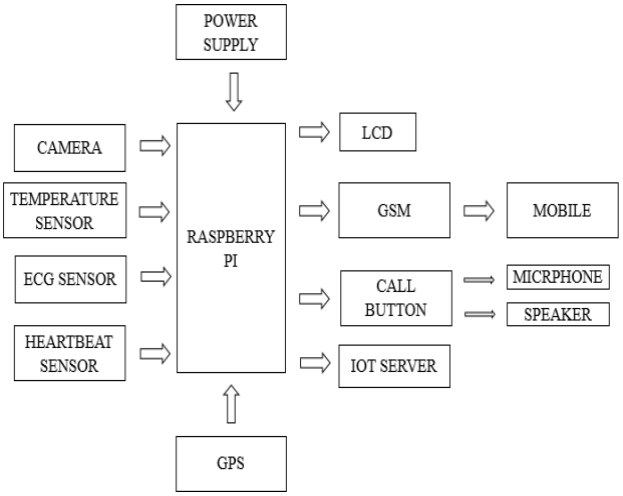

Fig.6.Proposed Block Diagram

5. WORK FLOW:

The benefit of this framework is that it constantly updates the video and patient status. In our project, we assess temperature, pulse, diastolic pressure, and systolic pressure using wearable sensors. To determine if the individual's health is in a safe state or not, several parameters are measured.

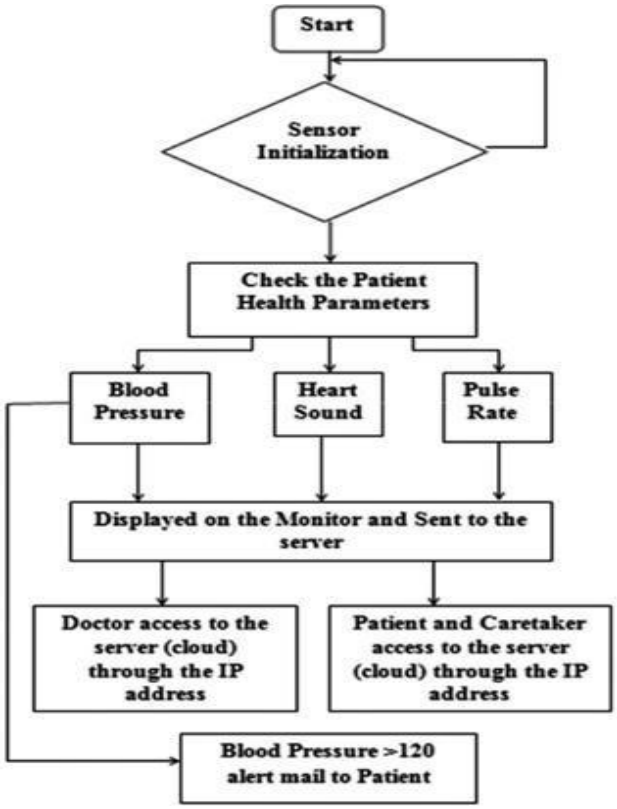

Fig.7.Cloud Storage Methodology

The Raspberry Pi will be used to carry out this live streaming. Databases are also constructed to regularly store parameter values. The system include live streaming for family members to watch over the patient, the ability for the doctor to assess the patient's status and adjust therapy accordingly, with this system, patients receive significantly more care than in the past. Doctors and family members can access the website with a username and password to increase system security, and the database will be continuously updated on a regular basis.

6. RESULT:

Processing of Data from Wearable Sensors subjects' pulse rates were accurately measured by heart rate data obtained via wearable sensors. Wearable sensors that recorded ECG data gave us information on the electrical processes of the heart. The sensor data was successfully processed by Raspberry Pi and transferred across the IoT platform. Real-time communication of information from a wearable gadget to a distant server was made possible via an IoT Connectivity and Data Transmission. The regular and dependable data transmission allowed for continuous monitoring of the participants' vital signs. The upgraded device's preciseness and efficacy were compared to those of conventional monitoring techniques, and the enhanced device's quicker data transmission and shorter response times were shown to be superior to conventional techniques. The improved medical monitoring equipment demonstrated potential uses in post- operative care, early disease identification, and remote patient monitoring.

7. CONCLUSION:

IoT technology is the combination of several technologies that allows different parts and objects to communicate with one another and utilise various network technologies. The suggested method provides patients with better and more efficient health care services, and the data gathered is networked globally via the internet and communication devices, which are then connected to cloud services. Doctors can use this data to quickly and efficiently solve a patient's problem. The suggested concept is a fully functional system that allows a doctor to check on a patient at anytime, anyplace. If the threshold value is achieved that instructs patients to consult a doctor, an emergency alert email is sent to the patients. The doctor may physically monitor the patient from their residence with the help regarding the Pi camera that is utilised in the system, which is beneficial for individuals who are recommended to take total bed rest and paralysed patients. The suggested framework aims to implement new health care organisations that can deliver high- quality and affordable healthcare services to patients utilising a combination of large-scale evaluation of data, virtualization, and computer technologies. More sensors will be added to the system under development, and all things will be connected to the world of the web for rapid and simple access. To make it simpler to access the improved model, it can also be implemented as a mobile application. The doctors can use the Pi camera to watch and offer instructions to patients who are recommended to spend all of their time in bed, as well as those who are paralysed. The system is set up for individual

interactions access to it, which can be used by many by providing a unique ID to each patient or member in the hospital or at home.

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