IoT based Semi-Paralysis Patient Healthcare Monitoring

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Abstract— In this research, a wireless system that allows several paralysis patients in hospitals to have their vital health data monitored in real time is presented. The technology keeps an eye on vital information like heart rate all the time. Each patient has a transmitting module attached to them that uses Bluetooth to encrypt and broadcast the patient's data serially. The data is received by a receiver device at the doctor's office, which decodes it and shows it continually on a PC or laptop interface. This enables the physician to watch over and keep an eye on several paralyzed patients at once. The technology also keeps an eye out for irregularities in the patient data. An alarm linked to the system will sound and produce visual notifications to let staff members know that a patient in that specific room may require immediate medical assistance if there are any possible problems with their condition. A GSM modem in the system notifies all unit doctors of the patient's room number who needs urgent treatment if the doctor is not in the office. Because paralyzed individuals are unable to communicate normally, the technology comes with a wearing glove that lets them sign like regular people.

I. INTRODUCTION

With the modern healthcare system, doctors can watch patients in real time from a distance, diagnose them early, and treat them for any health risks. The field of telemedicine, or medical telemetry, is fast changing due to advancements in wireless communication technologies. Recent years have seen significant progress in the development of research prototypes and commercial solutions for remote health monitoring. These developments depend on wired and wireless communication networks to provide medical diagnostics and patient consultations. Modern healthcare is used to reduce hospital readmission rates, lower the cost of hospital stays, lower the skill level and frequency of visits from home-care professionals, and promote health education at all levels. It also aims to provide more effective use of physicians. It is inevitable that the population will age, and infectious illnesses will no longer be the leading cause of mortality due to advancements in medicine and civilization. Therefore, it is crucial to rescue senior individuals in the event of disease or catastrophe. Patients now place greater importance on improved healthcare, both in hospitals and at home. Information systems for telemedicine have grown in importance, especially the intelligent ones that offer high- quality healthcare monitoring at a reduced cost of labour and drugs.

Modern technology has advanced healthcare to a new level with computer-based portable embedded devices, enabling individuals to handle their regular check-ups at home. Furthermore, it's critical to give them ongoing monitoring in non-clinical environments. In recent years, researchers have concentrated on hand gesture detection, which has gained popularity for developing robotics applications and being expanded into the realm of prosthetic or artificial hands that can mimic the behaviour of a genuine human hand. Utilizing a robotics system would expedite the healing process and, eventually, provide tele-rehabilitation management, enabling patients to work out from home. The technique for detecting finger movement used in this research is similar, but we tried to look at it from a slightly different angle and developed a little but important biomedical application. Patients with partial bodily inaction can benefit from this concept.

II. LITERATURE SURVEY

2021 IEEE National Biomedical Engineering Conference (NBEC)-Paper Name: Automated Paralysis Patient Monitoring System - Author name:- Vijay Kumar, Kaythry Pandurangan ,Vinu R
Abstract: Paralyzed individuals may struggle to communicate their requirements through speech or sign language due to a loss of motor control in the brain. Our suggested solution assists the impaired person in this scenario by enabling them to show a message on the LCD with a single hand gesture. The suggested method reads the hand's different tilt

directions to function. The patient wears a glove with the transmitter linked to it. To send different messages, the user only needs to tilt the gadget in different ways. Motion data are measured with an accelerometer. It then sends this data to the microcontroller, which interprets it and shows the appropriate message based on the input it received. As soon as the accelerometer sends a motion signal, it sounds a buzzer and displays the message. After that, the information is sent online to the IOT Adafruit server, where the message is shown. Patients afflicted with paralysis can communicate their vital requirements to others with this approach.

Paper Name: Gesture Recognition by using Flex Sensor for Patient Monitoring - Author name:- Tejaswini A. Futane ,Bhagyashree
M. Mathane, Sneha S. Khode, Aditi K. Sanga Abstract: Since a parallelized person typically cannot interact with a regular person, we are building a glove that will allow them to communicate with normal people by allowing them to provide signs through a wearable glove. This project's primary goal is to identify the finger positions and provide the doctor with instructions. The device is made up of a glove with flex sensors connected to an electronic conditioning circuit. The glove can be used for a number of additional tasks, including: (1) sign language recognition; (2) remote finger movement diagnostics; and (3) virtual reality engagement. The method used to determine the position of one hand's fingers is the main topic of this paper, along with its implementation. It can be applied to rehabilitation; in this case, we concentrate on biomedical applications that show parallel patient and physician coordination. Thus, this system is straightforward and reasonable.

Paper Name: PARALYSIS PATIENT HEALTH CARE SYSTEM USING IOT-
Author name:-Sameer Bante, Vivek Pardhi, Chaitali Warbhe, Jyoti Mesram, Snehal Bagde
Abstract: The aim of this project is to develop a system that allows caregivers to monitor patients who are paralyzed by using an accelerometer to detect and measure wrist motions. Given the prevalence of paralysis as a condition, the patient's hand wrist motions are crucial to the proposed method. By putting a device on the right side of the hand, one may measure the angle of tilt and use it to convey different kinds of messages. In the event of an emergency, notifications will be sent to the caregiver via a Blynk application and a Wi-Fi module. This will facilitate effective communication and ensure that the patient's needs are satisfied in every circumstance as soon as possible.

Paper Name: Enhancing Paralysis Patient Care through an IoT-Enabled Healthcare Ecosystem - Author Name: -G. Shanmugaraj, Shaik Mariam Fathima, Alluri Gnapika,
K. Mohanambal
Abstract: Developing our country's healthcare system contributes to its success. IoT makes it possible to track a patient's health while they solve problems, which significantly reduces the need for doctor visits, hospital stays, and readmissions. It is common knowledge that individuals suffering from paralysis are unable to express their demands due to the immobility of major body parts. Here, we develop a tool that uses IoT to meet the needs of a patient with paralysis. This system helps paralysis patients communicate their basic needs, such as food, water, and a bathroom, as well as emergencies, by tilting their finger in different directions. It is beneficial for both literate and illiterate people who can hear, see, and smell.

III. METHODOLOGY

Monitoring individuals with paralysis using a combination of flex sensors, a heartrate sensor, and accelerometers can be a transformative approach in understanding their movements, muscle activity, and body positions. Flex sensors, which respond to flexion by adjusting their resistance, are essential components for monitoring joint mobility in individuals with paralysis.

Through the continuous monitoring and documentation of resistance levels, healthcare professionals can acquire valuable insights into the extent of movement in each joint, allowing for precise evaluations of progress and the development of customized rehabilitation approaches.

The utility of flex sensors transcends mere movement monitoring, as they also facilitate real-time notifications to healthcare providers concerning basic patient needs like hunger or thirst, thereby enhancing the quality of patient care. In parallel, accelerometers are crucial in capturing acceleration data, which is critical for the monitoring and analysis of bodily movements and positions. By capturing information on body orientation, posture, and movement, accelerometers aid in identifying alterations in body position and the occurrence of specific movements, ultimately improving patient care.

The inclusion of a cardiac monitoring device enhances the monitoring process through the provision of precise measurements of pulse and heart rate variations in patients. Utilizing microcontrollers or wearable gadgets, information from sensors like flex sensors, cardiac monitors, and accelerometers can be effectively collected and sent to a computer or cloud-based system for centralized storage and thorough examination. This examination of data plays a vital role in monitoring alterations in joint mobility, body alignment, and movement trends over a period. By embracing a comprehensive strategy that integrates data from various sensors, healthcare providers can devise customized rehabilitation plans, obtain a comprehensive comprehension of patient conditions, make well-informed decisions, and ultimately enhance patient results

IV. HARDWARE COMPONENTS

Raspberry Pi:-

The Raspberry Pi 3 is a versatile and compact computer that functions as a central point for collecting data from linked sensors, analyzing it in real-time, and transferring it to cloud services such as ThingSpeak. This capability supports continuous data transmission, facilitating remote supervision and management of various devices. Due to its adaptable GPIO pins, the Raspberry Pi 3 effortlessly interfaces with sensors and actuators, making it a favored option for both hobbyists and experts. Key components necessary for ensuring optimal performance consist of a dependable power supply, a micro SD card containing the operating system, and a protective enclosure.

Flex sensor :-

The flex sensor is an innovative tool that utilizes variations in resistance to identify bending motions. When affixed to body parts capable of movement, such as fingers or toes, it captures precise gestures and muscle activity. When combined with an Analog-to-Digital Converter (ADC), the sensor transforms analog signals into digital information, facilitating precise measurement and examination of bending motions and muscle activity. This valuable information holds broad implications for areas like gesture recognition, physical therapy, and human-machine interaction, fostering progress in healthcare, robotics, and associated fields.

Accelerometer:-

The motion sensor tracks acceleration across multiple axes, offering valuable insights into body movements and activities. It detects significant events like falls or prolonged immobility, enhancing safety and health monitoring capabilities. By connecting to the Raspberry Pi's GPIO pins, it enables real-time data transmission and analysis, providing users with valuable insights. This sensor is ideal for applications like fitness tracking and home security systems, and its integration with the Raspberry Pi's processing capabilities ensures a smooth and intuitive user experience, unlocking possibilities for innovative IoT and smart device solutions.

MAX30100:-

The Maxim Integrated MAX30100 integrated circuit is a cutting-edge solution that simultaneously measures blood oxygen levels (SpO2) and heart rate (HR). This advanced device offers a more comprehensive range of features and functionalities than a standalone heart rate sensor, providing a wider scope of health metrics. To seamlessly connect this device with the Raspberry Pi, specific libraries and configurations are required. These libraries enable effective communication and data exchange, unlocking the full potential of this integrated health monitoring solution.

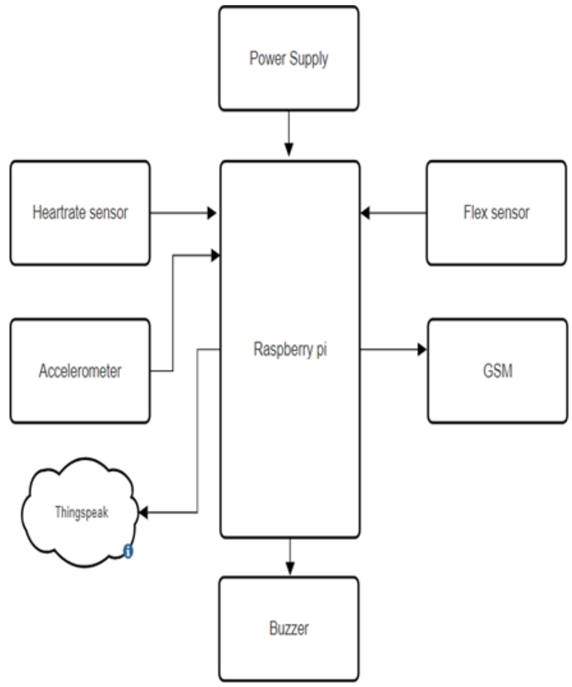
Buzzer:-

The audible alert component, a passive buzzer, plays a vital role in Raspberry Pi software, generating local notifications or alarms in response to sensor readings or system events. Through its integration with the software via a GPIO pin, users can directly control the buzzer's operations, enhancing the system's responsiveness and adaptability. This feature enables timely alerts of critical information, significantly enhancing the Raspberry Pi's utility in real-time notification and alarm applications, making it an indispensable component in various projects.

ADC Converter (ADS1115):-
The Adafruit ADS1115, an Analog-to-Digital Converter (ADC) chip, plays a vital role in converting analog voltage signals from a flex sensor into digital values that the Raspberry Pi microcontroller can understand. This conversion process enables the detection and measurement of physical movements or interactions, which is essential for various applications. Utilizing the I2C protocol, the ADC chip ensures efficient and reliable data transmission to the Raspberry Pi, providing accurate sensor readings for further analysis and decision-making. By bridging the gap between analog signals and digital input, the ADC chip serves as a crucial intermediary, enabling various functions and applications to access and utilize sensor data effectively.

V. BLOCK DIAGRAM

A detailed block diagram showcases a robust monitoring system centered around a Raspberry Pi, a compact microcomputer. This system seamlessly tracks and records temperature, heart rate, and flex sensor data, ensuring reliable operation and alerting users to emergencies through an integrated buzzer. The Raspberry Pi acts as the brain, collecting sensor data and transmitting it to the ThingSpeak cloud platform for remote access and real-time monitoring. This versatile system has far-reaching applications in healthcare, enabling remote patient monitoring and prompt response to vital sign abnormalities. Additionally, it can be used in industrial settings for temperature control and monitoring in manufacturing processes. By harnessing the power of Raspberry Pi and cloud computing, this system provides a reliable and robust means of tracking critical data in various fields, including telemedicine, health monitoring, and industrial automation.



VI. CIRCUIT DIAGRAM

A] Flex Sensor

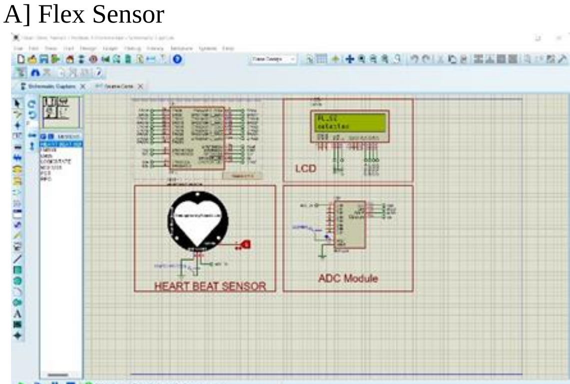


Figure 1

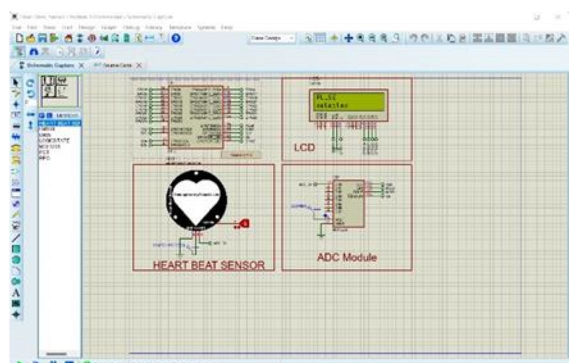
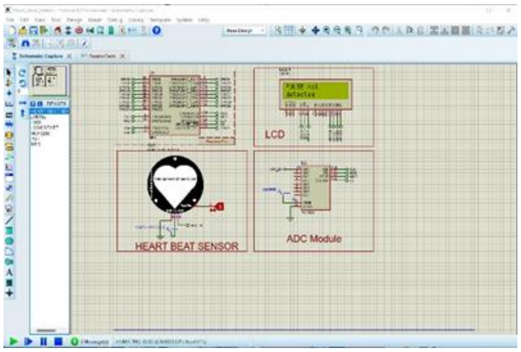


Figure 2

B] Heartrate Sensor



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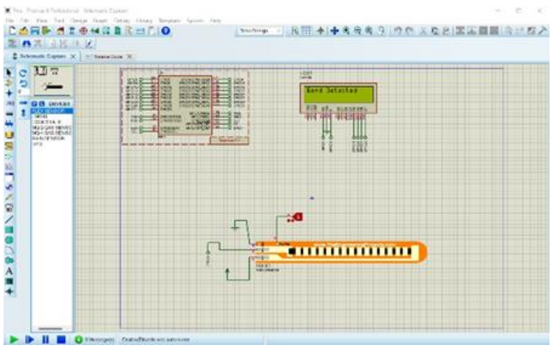

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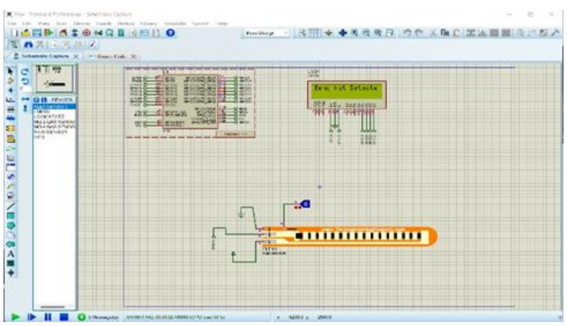
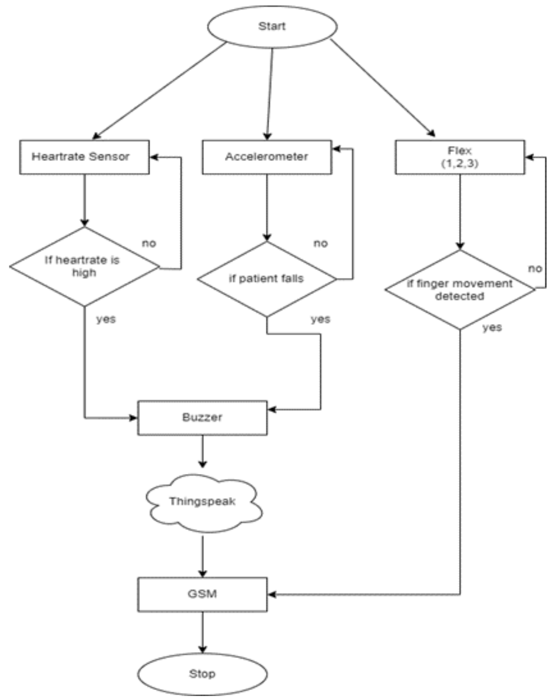
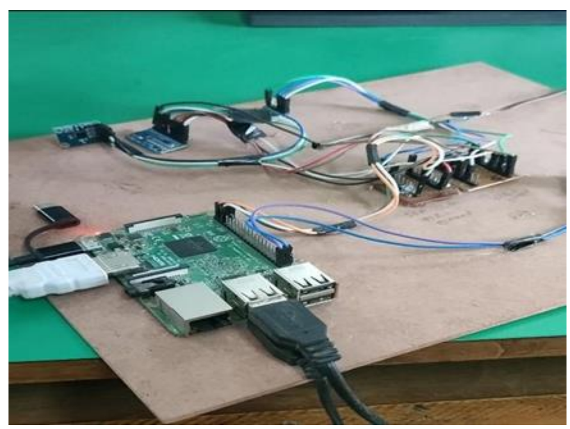


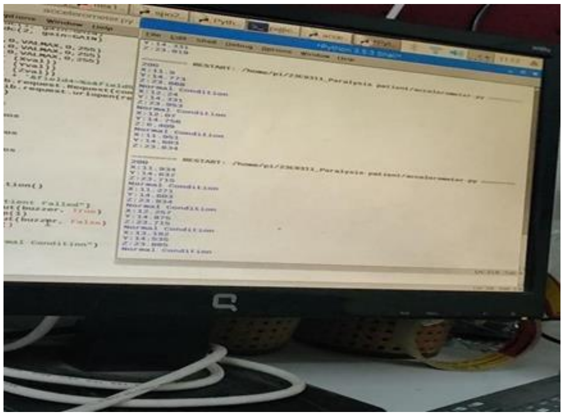
Figure 5

VII. FLOWCHART

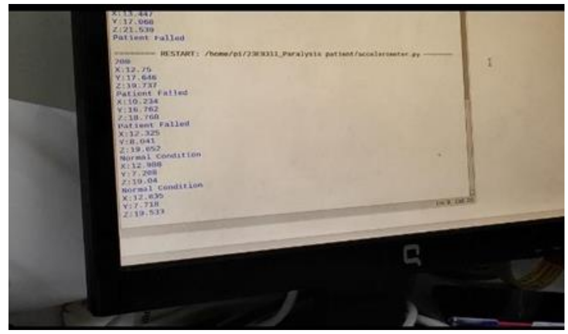


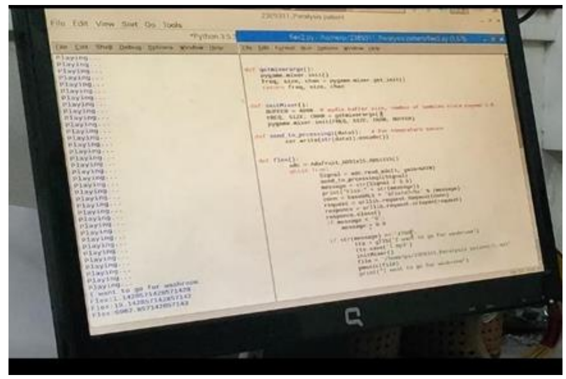
VIII. RESULTS AND OUTCOMES





Our primary objective was the development of a continuous health monitoring system for patients. We presented a prototype model that utilizes wireless body area networks for monitoring patient health. This system allows healthcare professionals to remotely monitor, provide advice, and diagnose patients or their family members before they require emergency care. Data is securely stored online, enabling professionals and family members to remotely access and monitor patient health. An Android application facilitates patient monitoring, and individual sensor calibration ensures the accuracy of data. This technology is especially beneficial for patients with speech or language impairments as it helps bridge the communication gap between patients and healthcare providers. It utilizes voice commands and gestures for communication with the receiver. Moreover, the portable device operates with minimal power consumption, thus enhancing the accessibility and efficiency of remote patient care.





CONCLUSION

This study introduces a wireless body area network-based system designed for continuous health monitoring, which enables remote patient care and prompt interventions. Healthcare professionals have the ability to remotely monitor vital signs, offer guidance, and provide initial diagnoses, thereby improving the efficiency of emergency care. The utilization of secure online data storage allows for easy access by healthcare providers and family members, ultimately enhancing patient care. Additionally, an

Android application further improves monitoring capabilities, while precise calibration of individual sensors ensures the accuracy of data. This innovative technology empowers patients who are unable to speak or move, bridging communication barriers with healthcare providers, all while maintaining low power consumption to enhance the effectiveness and efficiency of remote patient care.

FUTURE SCOPE

The healthcare sector's future demonstrates significant potential due to advancements in communication and environmental management. Brain-Computer Interface (BCI) technology is set to improve the conversion of thoughts into text, allowing patients with severe physical limitations to communicate more effectively. The utilization of AI-powered sentiment analysis will be integrated into electronic health records to monitor patients' emotional progress and create personalized treatment strategies. Patients will have the ability to control smart home devices, facilitating remote care and promoting independence. Robotic assistants will assist in daily activities, enhancing quality of life and lessening caregiver responsibilities. These developments will revolutionize healthcare by emphasizing patient-centered care, efficiency, and compassion, while also increasing access to underprivileged populations.

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