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SMART HEALTHCARE MONITORING SYSTEM USING IOT TECHNOLOGY

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Abstract: In the everyday occupied work, monitoring the home patient and overseeing their state of health ceaselessly is an exceptionally troublesome task. Especially agedness person's ought to be occasionally monitored and to be educated to the doctor about their health status now and again to spare their life in critical situation. Health monitoring is the serious problem in today's world. Because of absence of appropriate health monitoring, quiet experience the ill effects of genuine medical problems. To take care of this issue, there are lot of IOT devices are there to monitor the health of patient automatically now days. A smart health monitoring system is put into practice which utilizes heart beat and blood pressure sensors associated with Raspberry Pico board to keep track the health of a patient. In the event, if a system notices any unforeseen changes in patient heartbeat and blood pressure, then it will spontaneously caution the doctor with a Short Message Service (SMS) about the patient's status with the assistance of global system for mobile communication (GSM) module and furthermore shows subtleties of heartbeat and blood pressure of patient live. On the off chance that the patient can't arrive at the clinic implies, Global Positioning System (GPS) module will assist the doctor with identifying the patient's area. In this manner, IOT based patient health tracking system effectually monitors the health status of patient and save their survives on schedule.

I. INTRODUCTION:

In “Kevin Ashton 1999” the word “IoT” was first created and considered it important as an arrangement for simulating multiple services. There are different definitions of IoT and the “Internet of Things” is a powerful network system that can be structured according to the

framework of standard collaborative communication agreements based upon the IoT European Research Cluster (IECR) project concept. IoT is an infrastructure that links everyone, wherever, wherever and wherever to all facilities, flexibly, through connectivity and networking. It is seen as a ground breaking development with several improvements over the years. The IoT came as a revolutionary idea, which was implemented in a smart world with a kind of rational energy efficient technology. "IoT has become a major focus of health, energy, the environment, public protection, food and water access, connectivity, manufacturing and so on, and much more in different areas of social use.

The Internet of Things (IoT) is essential in innovative applications such as smart cities, smart homes, education, healthcare, transportation, and defense operations. IoT applications are particularly beneficial for providing healthcare because they enable secure and real-time remote patient monitoring to improve the quality of people's lives. This review paper explores the latest trends in healthcare- monitoring systems by implementing the role of the IoT. The work discusses the benefits of IoT-based healthcare systems with regard to their significance, and the benefits of IoT healthcare. We provide a systematic review on recent studies of IoT-based healthcare-monitoring systems through literature review. The literature review compares various systems' effectiveness, efficiency, data protection, privacy, security, and monitoring. The paper also explores wireless- and wearable- sensor-based IoT monitoring systems and provides a classification of healthcare-monitoring sensors. We also elaborate, in detail, on the challenges and open issues regarding healthcare security and privacy, and QoS. Finally, suggestions and recommendations for IoT healthcare applications are laid down at the end of the study along with future directions related to various recent technology trends.

Scope of the Project:

The scope of this project includes developing a prototype that employs various non-invasive sensors to monitor key health indicators. The collected data will be transmitted in real-time to a centralized system, such as a cloud server or hospital management software, where it can be analyzed and acted upon. The project will also incorporate alert mechanisms like notifications or SMS messages to inform healthcare providers or family members in case of abnormal readings. However, the system will focus solely on external monitoring and will not include invasive devices or surgical applications.

II. PROPOSED SYSTEM:

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To take care of this issue, there are lot of IOT devices are there to monitor the health of patient automatically now days. A smart health monitoring system is put into practice which utilizes heart beat and blood pressure sensors associated with CONTROLLER board to keep track the health of a patient. In the event, if a system notices any unforeseen changes in patient heartbeat and blood pressure, then it will spontaneously caution the doctor with a Short Message Service (SMS) about the patient's status with the assistance of global system for mobile communication (GSM) module and furthermore shows subtleties of heartbeat and blood pressure of patient live. On the off chance that the patient can't arrive at the clinic implies, Global Positioning System (GPS) module will assist the doctor with identifying the patient's area.

Block Diagram:

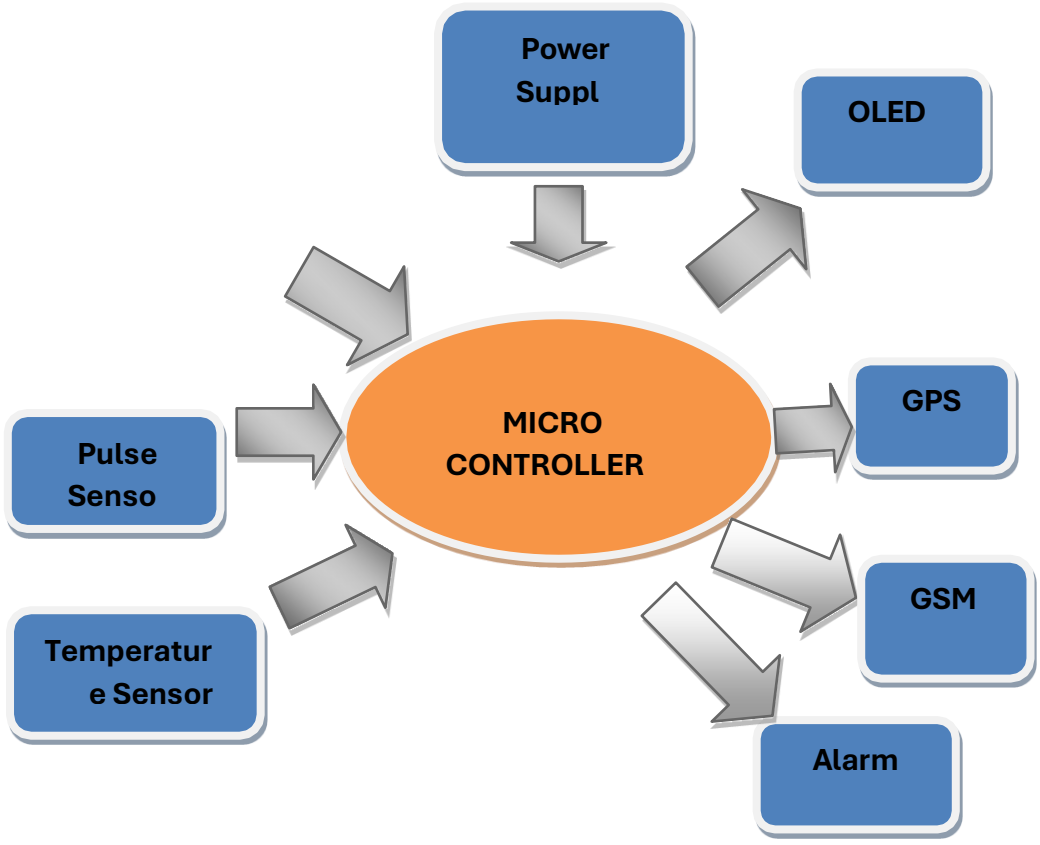

Fig 1: Block Diagram

Power Supply:

The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V. The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some

ripple or ac voltage variation. A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

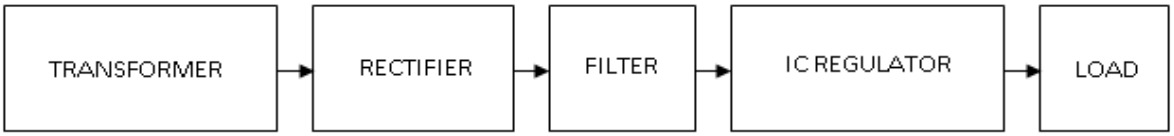

Fig 2: Block Diagram of Power Supply

Raspberry Pi Pico W

The Raspberry Pi foundation changed single-board computing when they released the Raspberry Pi computer, now they're ready to do the same for microcontrollers with the release of the brand-new Raspberry Pi Pico W. This low-cost microcontroller board features a powerful new chip, the RP2040, and all the fixings to get started with embedded electronics projects at a stress-free price.

Raspberry Pi Pico W is a brand new, low-cost, yet highly flexible development board designed around a custom-built RP2040 microcontroller chip designed by Raspberry Pi. Raspberry Pi Pico – 'Pico' for short – features a dual-core Cortex-M0+ processor (the most energy-efficient Arm processor available), 264kb of SRAM, 2MB of flash storage, USB 1.1 with device and host support, and a wide range of flexible I/O options.

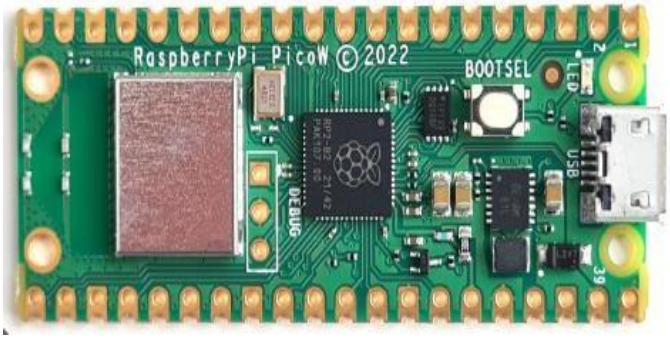

Fig 3: Raspberry Pi Pico W

ECG Sensor:

The ECG8232 sensor, commonly known as the AD8232 ECG sensor module, is a compact, low-power analog front-end designed specifically for ECG (electrocardiogram) and other biopotential signal measurement applications. It is widely used in wearable heart rate monitoring systems, fitness devices, and biomedical research due to its simplicity, affordability, and reliability. The module is built around the Analog Devices AD8232 chip,

which is capable of extracting, amplifying, and filtering small electrical signals from the heart to produce a clean and stable analog waveform that can be read using a microcontroller like an Arduino or Raspberry Pi. The sensor typically uses three electrodes, placed strategically on the body, to detect electrical impulses generated by the heart. These impulses are then translated into a readable analog signal, which represents the heart's activity in real-time.

The AD8232 module includes pins for power (3.3V or 5V), ground, analog output, and optional lead-off detection for safety. It is particularly useful in low-noise environments and features high common-mode rejection, making it effective even when motion or electrical interference is present.

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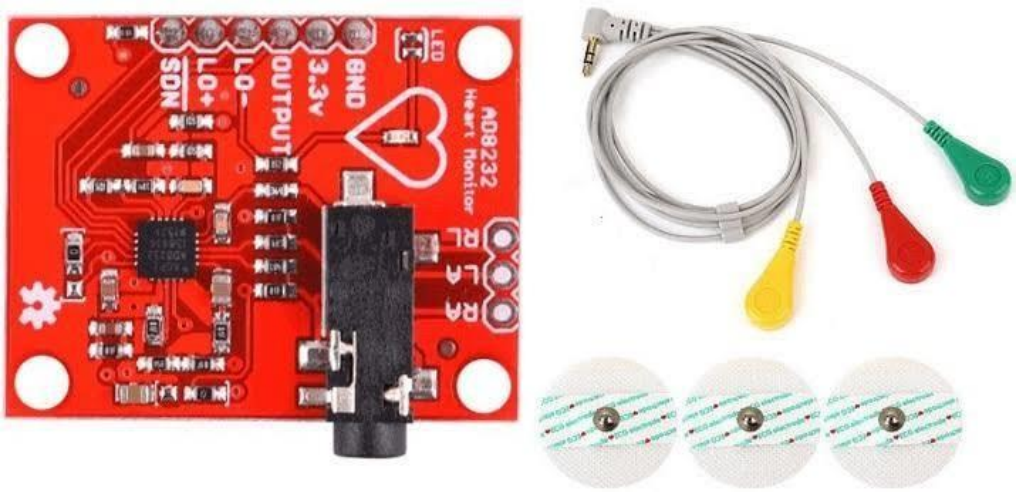

Fig 4: ECG Sensor

Pulse Sensor:

The Pulse Sensor is a compact, plug-and-play heart-rate sensor designed for biofeedback and health-monitoring applications. It operates by emitting light into the skin and measuring the amount of light that is either absorbed or reflected by the blood flow. As the heart beats, the blood volume in the capillaries changes, leading to variations in light absorption. These fluctuations are detected by the sensor and converted into an analog electrical signal, which can be read by microcontrollers like Arduino. The sensor is typically attached to the fingertip or earlobe and is widely used in fitness trackers, health-monitoring devices, and biofeedback systems

Fig 5: Pulse Sensor

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GY 906 (Temperature Sensor)

The GY-906, also known as the MLX90614, is a non-contact infrared temperature sensor that measures the temperature of objects without physical contact. It utilizes infrared radiation emitted by objects to determine their temperature, making it ideal for applications where contact-based measurements are impractical. The sensor features a built-in 17-bit analog-to-digital converter and communicates digitally via the I2C interface, ensuring high-precision temperature readings. It can measure both the temperature of the object in front of it and the ambient temperature around it. The GY- 906 is commonly used in medical thermometers, smart home systems, and industrial equipment.

Fig 6: IC Circuit

GSM:

Global System for Mobile Communications (GSM) modems are specialized types of modems that operate over subscription based wireless networks, similar to a mobile phone. A GSM modem accepts a Subscriber Identity Module (SIM) card, and basically acts like a mobile phone for a computer. Such a modem can even be a dedicated mobile phone that the computer uses for GSM network capabilities.

Traditional modems are attached to computers to allow dial-up connections to other computer systems. A GSM modem operates in a similar fashion, except that it sends and receives data through radio waves rather than a telephone line. This type of modem may be an external device connected via a Universal Serial Bus (USB) cable or a serial cable. More commonly, however, it is a small device that plugs directly into the USB port or card slot on a computer or laptop.

It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

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GPS:

The Global Positioning System (GPS) is a satellite based navigation system that can be used to locate positions anywhere on earth. Designed and operated by the U.S. Department of Défense, it consists of satellites, control and monitor stations, and receivers. GPS receivers take information transmitted from the satellites and uses triangulation to calculate a user's exact location.

GPS is made up of three parts: between 24 and 32 satellites orbiting the Earth, four control and monitoring stations on Earth, and the GPS receivers owned by users. GPS satellites broadcast signals from space that are used by GPS receivers to provide three-dimensional location (latitude, longitude, and altitude) plus the time.

The basis of the GPS is a constellation of satellites that are continuously orbiting the earth. These satellites, which are equipped with atomic clocks, transmit radio signals that contain their exact location, time, and other information. The radio signals from the satellites, which are monitored and corrected by control stations, are picked up by the GPS receiver. A GPS receiver needs only three satellites to plot a rough, 2D position, which will not be very accurate. Ideally, four or more satellites are needed to plot a 3D position, which is much more accurate. There are so many devices made with the implementation of Global Positioning system Google Earth is the most famous application that uses the signals received by the GPS receiver. It enables public also to access the maps which tell the users about locations around the world

Fig no 7: GPS Chip

Buzzer:

A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, house hold appliances such as a microwave oven, or game shows.It most commonly consists

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of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong

Fig 8: Buzzer

III. RESULT:

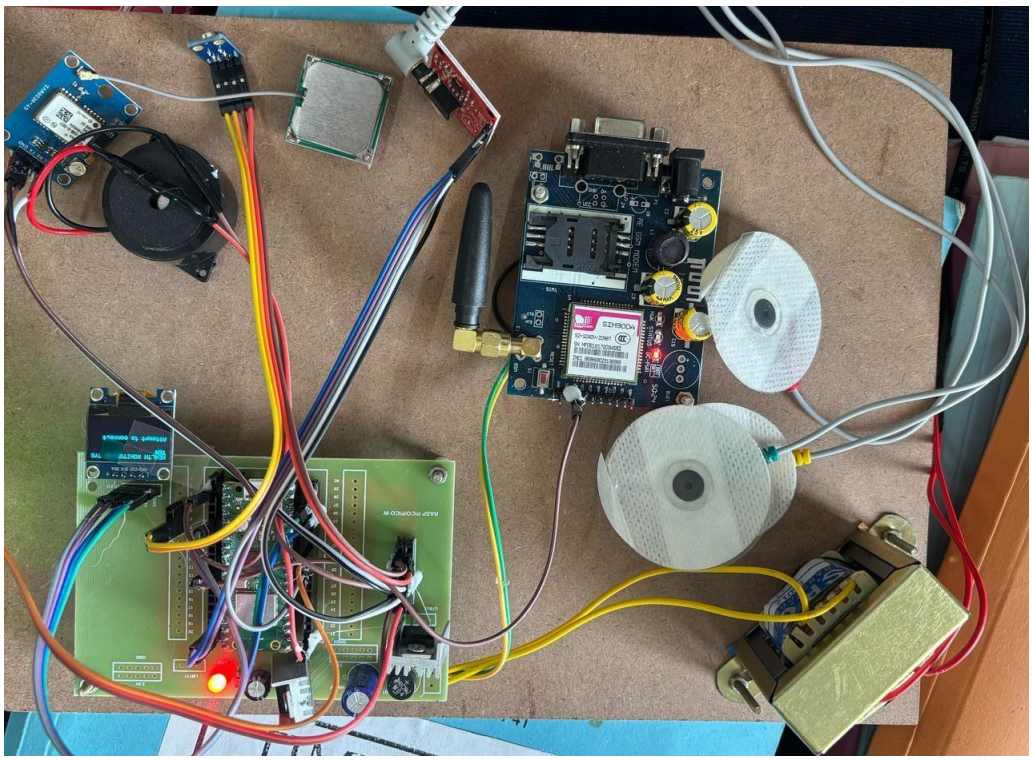

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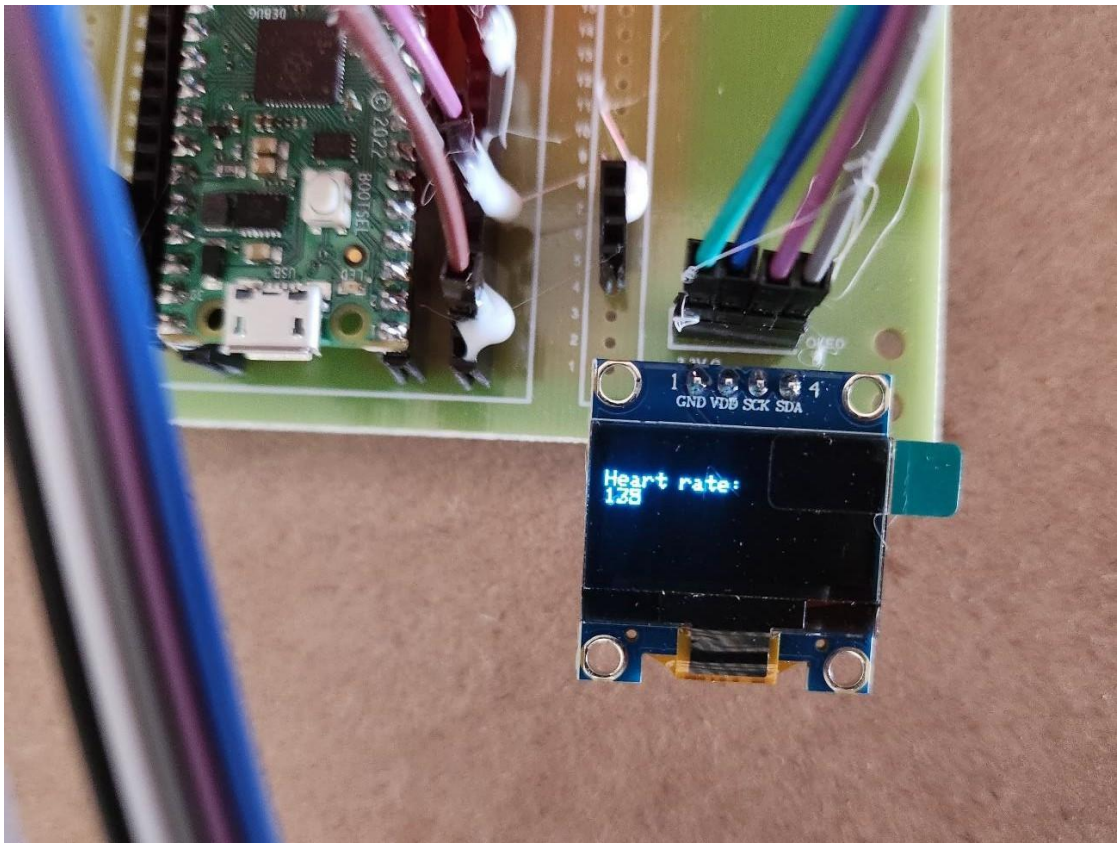
Fig 9: System in ON Condition

Fig 10:Output on OLED Sreen

The performance analysis and results of the Smart Healthcare Monitoring System affirm its effectiveness, precision, and applicability in real-time health monitoring scenarios. During testing and simulation, the system was subjected to a series of controlled and real-life conditions to measure its responsiveness, reliability, and accuracy. The RP2040 microcontroller, with its fast processing speed and low latency, managed the continuous data inflow from the ECG, Pulse, and GY-906 temperature sensors with stability and consistency. Pulse rate measurements from the optical Pulse sensor were found to be consistently accurate within a deviation of ±2 beats per minute when compared to medical-grade devices. The GY-906 infrared temperature sensor also displayed high precision, recording temperatures with a typical error margin of ±0.5°C.



The system's IoT integration was validated through seamless real-time data transmission to the cloud platform. Test cases involving abnormal conditions, such as simulating a high body temperature or low pulse rate, triggered alerts effectively within seconds. These alerts were communicated instantly to registered emails and mobile devices, demonstrating the system's readiness for emergency use. Power efficiency tests showed that the entire setup consumed minimal power, making it suitable for portable and battery-operated deployments. The system maintained stable operation for extended periods (up to 48 hours) without reboot or sensor drift, indicating strong reliability.

IV. CONCLUSION:

Smart healthcare monitoring through IoT technology is rapidly reshaping the future of medical care by making it more intelligent, connected, and patient-focused. With the integration of IoT devices into healthcare systems, real-time monitoring has become not only feasible but highly effective. Patients no longer need to be physically present in hospitals to receive quality care. From wearable health trackers to remote monitoring systems and intelligent hospital equipment, IoT is enabling continuous health observation, early detection of issues, and more informed clinical decisions. This technology is particularly impactful for individuals with chronic conditions such as diabetes, hypertension, or heart disease, where regular monitoring is essential. Instead of relying solely on periodic check-ups, IoT devices provide constant insights into a patient's health, helping to prevent complications and manage conditions more effectively. It also empowers patients by giving them access to their own health data, encouraging greater awareness and involvement in their care journey.

As technology continues to evolve, smart healthcare systems will become more efficient, accessible, and personalized. The ultimate goal is to shift from reactive to proactive healthcare where preventing illness is as prioritized as treating it. With the right support and innovation, IoT has the power to make healthcare smarter, more responsive, and truly patient-centric in the years to come.

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