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Patient Healthcare Monitoring System Using IOT

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Abstract- India is a most populous country in the world. Due to over populous the wellbeing of people is one of the serious issues in recent time. The thought of this project is to save the life of many people who are taken their last breath. With the help of IOT we can make it possible. This paper highlights and identifies the application of IOT in healthcare system using ARDUINO In this project the critical condition of the patient can send to the doctors present in nearby hospital. By using different sensors are connected in the ambulance will give the overall information of patient and notification will be generate in the application which is already downloaded in doctors smart phone. If the patient, chances is less than the app will suggest nearby hospital and doctor can start their treatment until the recovery of the patient. All these sensors are connected to the cloud.

Keywords- Arduino, ESP32, Heartbeat Sensor, Temperature Sensor, IoT, ECG sensor.

I. INTRODUCTION

Now a days use of IOT increasing day by day. The Heath-Monitoring system present in ambulance useful in road accident, bleeding, Heart attack, Burns, Asthma attacks, Diabetes, etc. Almost all the monitoring applications in this digital world totally depend on wireless sensor networks (WSNs) due to their undeniable advantages such as different network topologies, less maintenance, less infrastructure, etc.

The sensors will sense and analyze such activities in hassle free manner. This health- care system does not require any human interventions so that system will work fast in real time and speed will exponentially increase. Here the different kind of sensor will work differently such as Temperature sensor will help to monitor and controls the temperature of the air delivered to the patient. It can also monitor the humidity and control the moisture content of the air. Heart rate monitor sensor are used to monitor heart rate, pressure sensors can be used for non-invasive, high-fidelity, continuous radial artery pulse wave monitoring.

The embedded technology in the objects helps them to interact with internal states or the external environment, which in turn affects the decisions. Internet of Things can connect devices embedded in various systems to the internet. When devices/objects can represent themselves digitally, they can be controlled from anywhere. The connectivity then helps us to capture more data from more places.

Healthcare monitoring systems have become an integral part of modern healthcare services. The traditional healthcare monitoring systems are limited in their scope and efficiency. However, the emergence of IoT technology has opened new avenues for healthcare monitoring systems. The IoT-based healthcare monitoring system is a network of devices, sensors, and software that enables real-time monitoring of patients' health conditions. The system collects data from sensors and devices, processes it, and presents it to healthcare professionals for analysis and decision-making. The IoT-based healthcare monitoring system has the potential to revolutionize the healthcare industry by providing cost-effective, efficient, and accurate healthcare services.

II. PROPOSED ALGORITHM

Our proposed system consists of an end-to-end smart health application that can be building up from two functional building blocks. Main function of the first building block is to gather all sensory data that are related to the patient information, whereas the second block functions are to store, the ambulance location.

The function working is illustrated as, when the patient's heartbeat rate changes badly, the Arduino which recorded all the patient's information, GSM shield to send an SMS message containing this information, patient ID and the location of the patient which has been taken via GPS shield, to his doctor's mobile phone, to send an ambulance to the patient location.

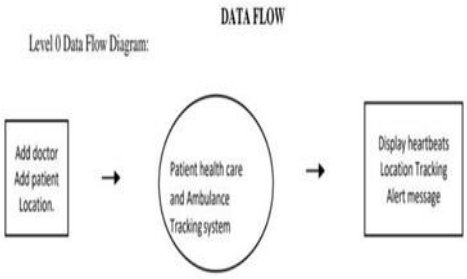

Fig 1. Level 0 Data Flow.

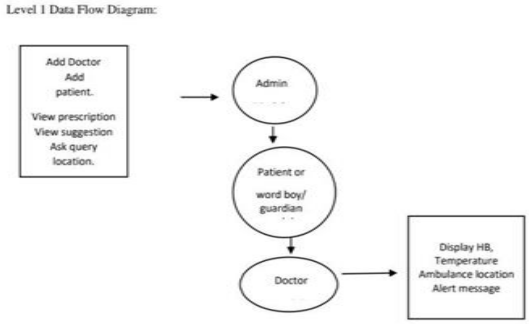

Fig 2. Level 1 Data Flow.

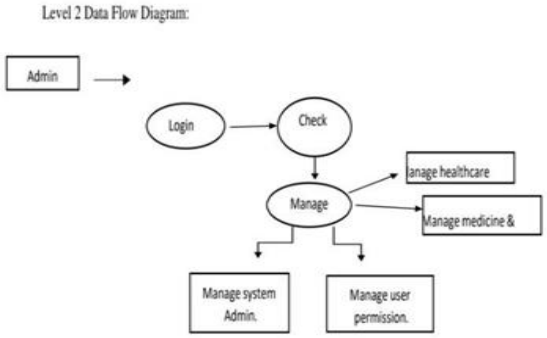

Fig 3. Level 2 Data Flow.

The application also consists of updating or deleting a patient history for doctor convenience. If any of the parameter goes beyond the normal range, then emergency message sends to the mobile. The proposed outcome of the system is to give suitable and effective health facilities to patients.

III. HARDWARE COMPONENTS

- ESP 32 microcontroller
- ATMEGA328 microcontroller
- Ultrasonic sensor
- DC Motor
- Different sensors for monitoring patient's health like temperature sensor, ECG etc.
- Buzzer
- LED

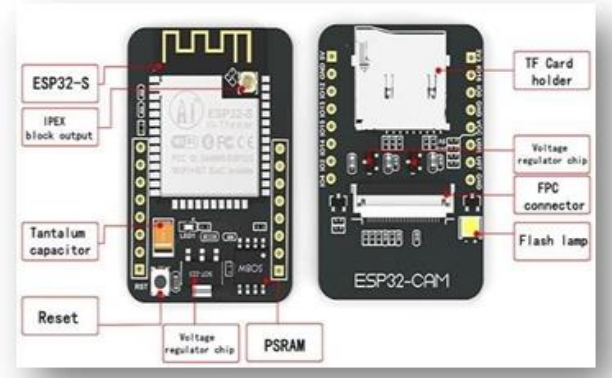

Fig 4. ESP 32 Microcontroller.

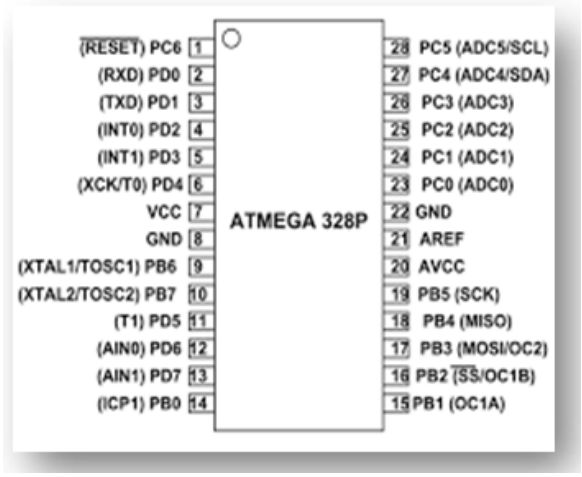

Fig 5. ATMEA 328P.

IV. MICROCONTROLLER USED

The ESP32 and ATmega328 are both microcontrollers that can be used in IoT- based healthcare monitoring systems, but they have different capabilities and strengths. ESP32 is a powerful microcontroller that has built-in Wi-Fi and Bluetooth connectivity, which makes it ideal for IoT applications. It also has a faster clock speed and more memory than the ATmega328, which allows it to handle more complex tasks and data processing.

In addition, the ESP32 has more input/output pins and supports more communication protocols. ATmega328, on the other hand, is a more basic microcontroller that is commonly used in simple electronic projects. It has a lower clock speed and less memory than the ESP32, but it is still capable of running basic programs and handling simple input/output tasks. It is also more cost- effective than the ESP32, which makes it a good choice for low-budget projects

V. SYSTEM ARCHITECTURE

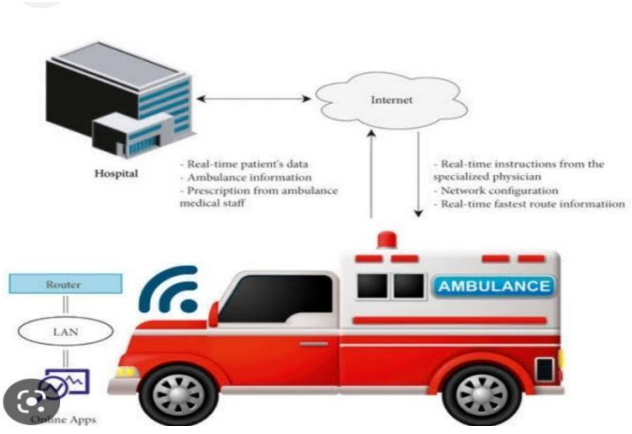

Fig 6. The system architecture of IOT based emergency health care monitoring system in ambulance in this figure.

The system architecture of IOT based emergency health care monitoring system in ambulance is shown. Where in the ambulance the patient in critical situation transfer to the hospital and the doctor can get access of patient health through app in local area network which is connected through the internet. The data which is sense by the sensor is send to the nearby hospitals present in that particular area. the sender and receiver can connect and get access through the cloud.

VI. BLOCK DIAGRAM

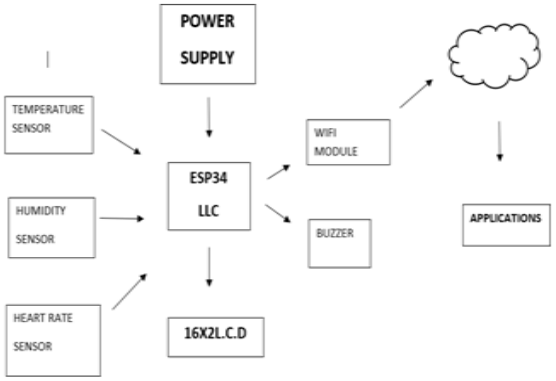

Fig 7.Block Diagram.

1. Sensors:
The sensors are the first component of the system, which collect the data from the patients. The sensors include temperature sensors, blood pressure sensors, heart rate sensors, glucose sensors, and oxygen sensors, which measure various vital signs of the patients. The sensors can be attached to the patients' body or can be placed in the environment to monitor the patients' activity levels and environmental factors.

2. ESP32:
The ESP32 is the second component of the system, which acts as a gateway between the sensors and the cloud. The ESP32 is a low-cost, low-power microcontroller that provides Wi-Fi and Bluetooth connectivity. The ESP32 collects the data from the sensors and sends it to the cloud using Wi-Fi or Bluetooth communication protocols.

3. ATmega328:
The ATmega328 is the third component of the system, which controls the sensors and manages the data collection and transmission process. The ATmega328 is a microcontroller that runs on the Arduino platform and provides digital and analog I/O pins to interface with the sensors. The ATmega328 reads the data from the sensors and sends it to the ESP32 using serial communication.

4. Cloud:
The cloud is the fourth component of the system, which stores and processes the data collected from the sensors. The cloud provides the scalability and flexibility required to handle large amounts of data generated by the sensors. The cloud can also perform data analytics and machine learning algorithms to generate insights and predictions based on the data.

5. Application:
The application is the fifth component of the system, which presents the data to the healthcare professionals for analysis and decision-making. The application can be a web-based dashboard or a mobile app, which provides a user- friendly interface for the healthcare professionals to view the patients' data, set alerts and notifications, and communicate with the patients.

6. Communication Protocol:
The communication protocol is the sixth component of the system, which enables the data transfer between the various components of the system. The communication protocol can be Wi-Fi, Bluetooth, ZigBee, or any other wireless protocol, depending on the requirements of the system.

7. Data Security:
The data security is the seventh component of the system, which ensures the confidentiality, integrity, and availability of the data generated by the sensors. The data security component can include various measures such as encryption, access control, and authentication.

Overall, the block diagram of an IoT-based healthcare monitoring system using ESP32 and ATmega328 depicts a network of interconnected devices, sensors, and software components that work together to provide real-time monitoring and analysis of patients' health conditions. The system enables healthcare professionals to make informed decisions based on the data generated by the sensors, which can lead to improved healthcare outcomes for the patients.

VII. MODULES DEVELOPED

1. Sensor Module:
This module would consist of various sensors to capture patient health data such as temperature, heart rate, blood pressure, and oxygen levels. The sensors can be connected to the IoT device Kuchvia Bluetooth, Wi-Fi, or other wireless protocols.

2. Data Processing and Analytics Module:
This module would process the data collected by the sensor module and analyze it to identify patterns and anomalies in the patient's health. The data processing module would need to include algorithms to detect and report any critical health conditions of the patient.

3. Cloud Connectivity Module:
This module would enable the IoT device to connect to the cloud, where the patient's health data can be stored and accessed by healthcare professionals. Cloud connectivity

module would also allow for remote monitoring of patients by healthcare professionals.

4. Alerting and Notification Module:
This module would notify healthcare professionals and family members in the event of an emergency or critical health condition of the patient. It would need to include an alerting mechanism such as SMS or email, to ensure timely action in case of emergencies.

5. User Interface Module:
This module would provide an interface for patients and healthcare professionals to access and view the patient's health data. It would need to be intuitive, user-friendly, and customizable to meet the needs of different users.

6. Data Security Module:
This module would ensure the security and privacy of patient data by implementing strong encryption and access control mechanisms.

7. Power Management Module:
This module would manage the power consumption of the IoT device to ensure long battery life and reliable operation.

8. Device Management Module:
This module would allow healthcare professionals to manage the IoT devices used in the healthcare system. It would include functionalities such as firmware updates and device provisioning.

VIII. APPLICATIONS

- Patient monitoring is done at every 50 seconds.
- Shortest path is provided for ambulance.
- Doctors can monitor patient from remote location.
- Patients get prescription easily without delay.

IX. CHALLENGES AND FUTURE DIRECTIONS

1. **Challenges**:
The IoT-based healthcare monitoring system faces various challenges such as data security, privacy, and interoperability. The future directions of IoT-based healthcare monitoring systems include the development of advanced sensors, communication protocols, and data processing techniques. The integration of IoT-based healthcare monitoring systems with other healthcare systems such as electronic health records and medical devices will also be a future direction.

2. Future Scope:
- Advanced analytics
- Predictive maintenance
- Telemedicine
- Personalized medicine
- Wearable technology
- Remote patient monitoring
- Integration with electronic health records (EHRs)
- Virtual reality (VR) and augmented reality (AR)
- 5G connectivity
- Improved data security

X. CONCLUSION

In this system our main concern was ensuring the health monitoring system for the patient. The doctors can monitor, advice and diagnosis their patient and family member before the emergency situation. So, the doctors and family members can monitor their patient from a remote location at any time. In emergency situation ambulance can be reach to the patient location.

Through this application, patients can ask query to the doctor related to their health at any time. And gets the suggestion from doctors. The data is stored and published online. The final result is transferred to thecloud using Arduino, and the users got the output from system using message. We can use our system in real time and people will get the benefit of it. Our system is user-friendly and also cost effective.

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