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An Iot Based Smart Health Monitoring

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ABSTRACT

Our project is a working model which incorporates sensors to measure parameters like body temperature, heart beat rate. An Arduino microcontroller board is used for analyzing the inputs from the patient Temperature, heartbeat. This project provides a device which will continuously monitor the vital parameters to be monitored for a patient. If any critical situation arises in a patient, this unit also raises an alarm. This is very useful for future analysis and review of patient's health condition. For more versatile medical applications, this project can be improvised, by incorporating dental sensors and annunciation systems, thereby making it useful in hospitals as a very efficient and dedicated patient care system. In recent years, the world is facing a common problem that the number of elderly people is increasing. Hence, the problem of home-care for elderly people is very important. In this, IoT is becoming a major platform for many services & applications, also using Node MCU not just as a sensor node but also a controller here. Paper proposes a generic health monitoring system as a step forward to the progress made in thisdepartment till now.

Keywords— Smart Health Monitoring, Critical Situation, Internet of Things.

INTRODUCTION

Smart health monitoring is a technology-driven approach that utilizes various devices, sensors, and software to track and monitor an individual's health status in real-time. This technology enables healthcare providers to collect and analyze data related to a person's health, providing a more comprehensive view of their wellbeing [1]. Improving the efficiency of healthcare infrastructures and biomedical systems is one of the most challenging goals of modern-day society. In fact, the need of delivering quality care to patients while reducing the healthcare costs and, at the same time, tackling the nursing staff shortage problem is a primary issue. As highlighted, in fact, current procedures for patient monitoring, care, management, and supervision are often manually executed by nursing staff. This represents [2], de facto, an efficiency bottleneck, which could be a cause of even tragic errors in practices. Recent advances in the design of Internet-of-Things (IoT) technologies are spurring the development of smart systems to support and improve healthcare- and biomedical-related processes. Automatic identification and tracking of people and biomedical devices [3] in hospitals, correct drug–patient associations, real-time monitoring of patients' physiological parameters for early detection of clinical deterioration are only a few of the possible examples [4].

IoT (Internet of Things) based smart health monitoring is an innovative approach that utilizes interconnected devices to track and monitor the health status of individuals in real-time. This technology enables healthcare providers to collect data on patients' vital signs, medication adherence, and overall wellbeing, providing a more comprehensive view of their health [5].

The following are some of the key components of an IoT-based smart health monitoring system:

Wearable Devices: Wearable devices such as smart watches, fitness trackers, and medical sensors are used to collect various data on an individual's health, including heart rate, blood pressure, blood sugar level, and sleep patterns[6].
Internet Connectivity: These devices are connected to the internet, allowing data to be transmitted to a central database for analysis.

Cloud-based Data Analytics: The collected data is analyzed using cloud-based analytics tools, which can provide insights into a patient's health status, predict potential health issues, and recommend appropriate actions[7].

Mobile Applications: Mobile applications are used to display the collected data, provide alerts and notifications, and allow patients to communicate with their healthcare providers.

A. Benefits of IoT-based Smart Health Monitoring:

Improved Patient Care: This technology enables healthcare providers to monitor patients' health in real-time, enabling them to respond promptly to changes in a patient's health status and provide timely interventions [8].
Remote Patient Monitoring: Patients can be monitored remotely, reducing the need for frequent hospital visits, savingtime and money.

Personalized Care: By collecting data on individual patients, healthcare providers can provide personalized care, tailored to each patient's specific needs.

Preventive Care: The technology can help identify potential health issues before they become critical, enabling healthcare providers to take preventive measures.

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C. Preventive Care: The technology can help identify potential health issues before they become critical, enabling healthcare providers totake preventive measures.

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E. Overall, smart health monitoring has the potential to revolutionize healthcare delivery, providing more personalized, efficient, andeffective care.

LITERATURE REVIEW

Also there are three issues in wireless sensor networks full connectivity, power consumption and coverage area for the sensors (Wang et al., [9]. To increase the connectivity, transmission range can be improved or increase the number of sensors. Both these techniques decrease the lifetime of the network. Hence to ensure connectivity between the nodes and to reduce power consumption is to making some of the activenodes to go to inactive mode

The other methods use POS is, either for non-linear programming or linear programming to minimize the battery usage by using two algorithms based on POS. Development of routing protocol is done using multi-objective fitness function and encoding. This paper proposed the cluster algorithm for minimizing energy consumption. Physical to network layer optimization is done to increase lifespan of network and reduce battery consumption. The important applications and requirements are collected to overcome thisproblem (Jurdak et al., [10].

(Zhou et al., [11] suggested a stochastic approach for energy harvesting which uses deterministic model to assume, that energy harvesting value is known prior to the transmissions. Later, using the Lyapunov optimisation problem, the optimal solution is arrived at by verifying both the deterministic and stochastic methods. In the deterministic models, the volume of energy to be harvested is known prior to the transmission. In the stochastic model, the harvested energy known for the current period only, where an online power estimation algorithm runs. In the deterministic approach, offline power estimation algorithm runs. Based on these problems, optimal and efficient solutions have been obtained using the Lyapunov optimisation algorithm. The stochastic model gives an efficient solution whereas the deterministic approach gives an optimal offline solution.

The residual energy and transmission distance have been used by (Xiang et al.,[12]) for optimising energy usage in software defined wireless sensor networks. The software defined node can monitor humidity and temperature together at the same time due to the multi-tasking nature of the software nodes. It is a NP hard problem as the control nodes are optimal in the case of consuming energy. Generally multi-tasking mode in sensor networks consumes more energy, so control nodes are used for minimising energy. Since it is an NP hard problem, particle swarm optimisation is used to solve the problem.

Clustering is useful for addressing the energy constraints across a bigger boundary where sensors are deployed in large numbers. Since the working of all the sensors is autonomous, clustering is the only idea that can be used to group these autonomous sensors to monitor energy consumption. The idea behind clustering is these sensors form a group and a leader is elected on the basis of some parameters. The leader usually is called the cluster head. Common sensor nodes usually transmit data and packets to the cluster head node, which in turn, aggregates the data and forwards it to other clusters for analysis and processing. The cluster heads may be elected on the basis of various parameters like node with the highest remaining energy; distance to the base station is minimal, node with good transmission range, etc. Clusteringhas these advantages as suggested by Boyinbode et al., [13].

PROPOSED SYSTEM

The figure shows the functional block diagram of the system hardware. The system has been designed to take several inputs to measure physiological parameters of human such as temperature, heart rate. The inputs from the sensors are integrated and processed. The results are displayed on the Monitor. The program is a user interface, allowing a report on the current status of the individual. Once the user has connected to the receiver unit, data is automatically updated on the screen. Heartbeat and body temperature were displayed on the display. The design is modular which makes it rather easy and straight forward to add extra sensors for measuring and monitoring other parameters. Then sensor values are upload to the think speak.

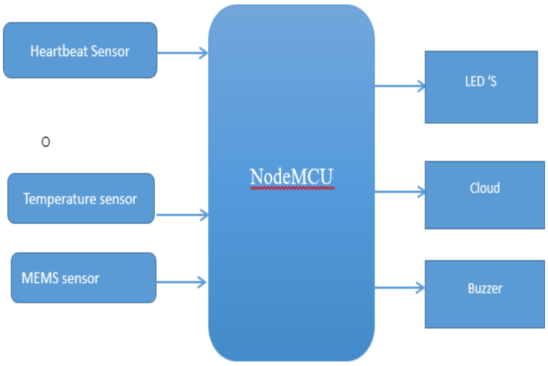

Figure 1: Architecture of proposed system

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your microcontroller. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces; it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

- Remote monitoring
- Monitoring the patient as easy one.
- In proposed Arduino microcontroller isused.
- Multi parameter monitoring system.

EMBEDDED SYSTEMS

Overview of embedded systems

An embedded system is a special-purpose computer system designed to perform one or a few dedicated functions, often with real-time computing constraints. It is usually embedded as part of a complete device including hardware and mechanical parts. In contrast, a general-purpose computer, such as a personal computer, can do many different tasks depending on programming. Embedded systems have become very important today as they control many of the common devices we use. Since the embedded system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance. Some embedded systems are mass-produced, benefiting fromeconomies of scale.

Physically, embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

In general, "embedded system" is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems — such as the operating systems and microprocessors which power them — but are not truly embedded systems, because they allow different applications to be loaded and peripherals to beconnected.

Embedded systems provide several functions

- Monitor the environment; embedded systems read data from input sensors. This data is then processed and the results displayed in some format to a user or users
- Control the environment; embedded systems generate and transmit commands for actuators.
- Transform the information; embedded systems transform the data collected in some meaningful way, such as data compression/decompression

Although interaction with the external world via sensors and actuators is an important aspect of embedded systems, these systems also provide functionality specific to their applications. Embedded systems typically execute applications such as control laws, finite state machines, and signal processing algorithms. These systems must also detect and react to faults in both the internal computing environmentas well as the surrounding electromechanical systems.

There are many categories of embedded systems, from communication devices to home appliances to control systems. Examples include;

• Communication devices
e.g.: modems, cellular phones
• Home Appliances
e.g.: CD player, VCR, microwave oven
• Control Systems
e.g.: Automobile anti-lock braking systems,robotics, satellite control.

MEMS SENSOR

Principle

Breakout board for the 3 axis ADXL335 from Analog Devices. This is the latest in a long, proven line of analog sensors - the holy grail of accelerometers. The ADXL335 is a triple axis MEMS accelerometer with extremely low noise and power consumption - only 320uA.The sensor has a full sensing range of +/-3g.There is no on-board regulation, provided power should be between 1.8 and 3.6VDC.Board comes fully assembled and tested with external components installed. The included 0.1uF capacitors set the bandwidth ofeach axis to 50Hz.

Product Features:

Accelerometers are used to sense both static (e.g. gravity) and dynamic (e.g. sudden starts/stops) acceleration. One of the more widely used applications for accelerometers is tilt- sensing. Because they are affected by the acceleration of gravity, an accelerometer can tell you how it's oriented with respect to the Earth's surface. An accelerometer can also be used to sense if a device is in a state of free fall. This feature is implemented in several hard drives: if a drop is sensed, thehard drive is quickly switched off to protect against data loss.

Range

The upper and lower limits of what the accelerometer can measure are also known as its range. In most cases, a smaller full-scale range means a more sensitive output; so you can get a more precise reading out of an accelerometer with a low full- scale range. You want to select a sensing range that will best fit your project, if your project will only be subjected to accelerations between +2g and -2g, a ±250g-ranged accelerometer won't give you much, if any, precision. We have a good assortment of accelerometers, with maximum ranges stretching from ±1g to ±250g. Most of our accelerometers are set to a hard maximum/minimum range, however some of the fancier accelerometers feature selectableranges.

Interface

This is another one of the more important specifications. Accelerometers will have either an analog, pulse-width modulated (PWM), or digital interface. Accelerometers with an analog output will produce a voltage that is directly proportional to the sensed acceleration. At 0g, the analog output will usually reside at about the middle of the supplied voltage (e.g. 1.65V for a 3.3V sensor). Generally this interface is the easiest to work with, as analog-to-digital converters (ADCs) are implemented in most microcontrollers. Accelerometers with a PWM interface will produce a square wave with a fixed frequency, but the duty cycle of the pulse will vary with the sensed acceleration. These are pretty rare; we've only got one in our catalog. Digital accelerometers usually feature a serial interface be it SPI or I²C. Depending on your experience, these may be the most difficult to get integrated with your microcontroller. That said, digital accelerometers are popular because they usually have more features, and are less susceptible to noise than their analog counterparts.

CONCLUSION

In this paper, we have presented and proved the prototype for an automatic system that guarantees a constant monitoring of various health parameters and prediction of any kind of disease or disorder that prevents the patient from the pain of paying frequent visits to the hospitals. The proposed system can be set-up in the hospitals and massive amount of data can be obtained and stored in the online database. Even the results can be made to be accessed from mobile through a Think speak software. The system can be further improved further by adding artificial intelligence system components to facilitate the doctors and the patients. For instance, if a patient's health parameters are changing in the same pattern as those of a previous patient in the database, the consequences can also be estimated. If the similar patterns are found repeatedly, it would be easier for the doctors and medical researchers to find a remedy for the problem.

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