Internet Of Things (IOT) Based Patient Health Monitoring System

Gali Pavan Kalyan [1]

Dr.H.N.PratiHari, Professor,ECE,St.Martin's Engineering College,Hyderabad.

Dr Debajyoti Mishra, Assistant Professor, ETC,IGIT,Sarang, Utkal University ,Odisha.

Abstract: The human services industry can be the greatest recipient of the IoT upheaval. By building IoT-based frameworks in doctor's facilities and centers, alongside setting up IoT-based outpatient checking arrangements, clinics can enhance access to persistent consideration, while expanding care quality and decreasing working expenses. The essential building squares of an IoT-based framework are sensors that gather tolerant information, Internet entryways for transmitting that information and distributed computing to store and process this information. The cloud stage is likewise used to break down this information to produce important bits of knowledge for specialists and medicinal staff.

The last stage includes the production of web and versatile applications which the restorative staff can use to choose the following game-plan. In patient-driven IoT frameworks, the patients are additionally given portable applications and even wearables for observing their wellbeing.

A BSN (Body Sensor Network) is a system intended to work self-sufficiently to Interface the different medicinal sensors and inserts situated inside and additionally outside of the human body; which offers adaptable activity and cost sparing alternatives to both human services experts and patients. This work outlines the plan and usage of a savvy wellbeing observing framework. Here, a patient can be checked utilizing an accumulation of lightweight wearable sensor hubs for ongoing detecting and examination of different essential parameters of patients. The gadgets flawlessly assemble and share the data with one another and additionally store the data, making it conceivable to gather record what's more, break down information. Accordingly, patients will have high caliber administrations in light of the fact that the

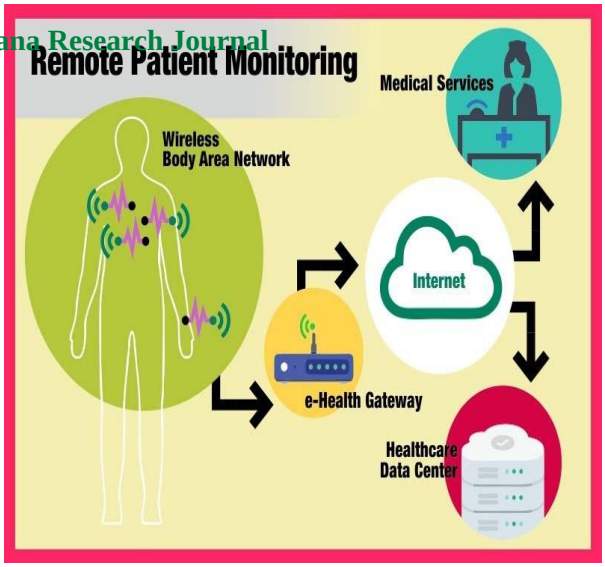
framework underpins therapeutic staff by giving the ongoing information gathering, by taking out the manual information gathering and by empowering the checking of gigantic quantities of patients.

Key word: Arduino (ATMEGA328), Iot(esp8266),Temperature module, Body sensor network.

Introduction

A BSN (Body Sensor Network) is an uncommon reason arrange intended to work independently to interface with different medicinal sensors and inserts situated inside and outside of the human body. Presenting it in restorative checking will offer adaptability of activity and cost sparing alternatives to both social insurance experts and patients. They diminish client uneasiness and improve portability. Applications in this class incorporate checking of the human physiological information, following and checking of the patients inside a healing facility, tranquilize organization in healing facilities and so on. Vitals signs are utilized to gauge body's essential capacities which can be useful for checking general soundness of a man. The principle vision of the social insurance industry is to give better social insurance to every one of the general population anyplace and whenever in the world. This ought to be done in a more patient inviting and monetary way. Consequently to expand the patient consideration productivity, there is a need to enhance the patient checking gadgets. The restorative present reality faces two issues in understanding checking; initially, the need of human services suppliers what's more, guardians to be available at the bedside of the patient and second is that the patient is confined to quaint little inn wired to expansive machines. With the end goal to accomplish adaptable and amicable patient consideration, the previously mentioned issues ought to be comprehended and as the The most recent couple of decades have seen a consistent increment in future in numerous parts of the world prompting a sharp ascend in the quantity of elderly individuals. An ongoing report from Joined Nations anticipated that there will be 2 billion (22% of the total populace) more seasoned individuals by 2050. In expansion, inquire about shows that about 89% of the matured Individuals are probably going to

Fig (1): Iot communication system



live autonomously. In any case, medicinal inquire about reviews discovered that about 80% of the matured individuals more established than 65 experiences something like one ceaseless ailment making many matured individuals experience issues in taking consideration of themselves. In like manner, giving a better than average nature of life for matured individuals has turned into a genuine social test right then and there. The quick multiplication of data and correspondence advancements is empowering creative social insurance arrangements and instruments that indicate guarantee in tending to the previously mentioned difficulties. Presently, Internet of Things (IoT) has turned out to be a standout amongst the most amazing correspondence standards of the 21th century. In the IoT condition, all articles in our every day life moved toward becoming part of the web because of their correspondence and figuring capacities (counting small scale controllers, handsets for computerized correspondence).

Literature Survey:

In the existing system, we use active network technology to network various sensors to a single PMS. Patients' various critical parameters are continuously monitored via single PMS and reported to the Doctors or Nurses in attendance for timely response in case of critical situations. The sensors are attached to the body of the patients without causing any discomfort to them. In this PMS we monitor the important physical parameters like body temperature, ECG, heart beat rate and blood pressure using the sensors which are readily available. Thus, the analog values that are sensed by the different sensors are then given to a microcontroller attached to it. The microcontroller processes these analog signal values of health parameters separately and converts it to digital values using ADC converter. Now, the digitalized values from more than one microcontroller are sent to the Central PMS. Each of the sensors attached microcontroller with a transceiver will act as a module which has its own unique ID. Each module transmits the data wirelessly to the gateway attached to the PC of the Central PMS. The gateway is attached

to the PC i.e. Central PMS which is situated in the medical center, is capable for selecting different patient IDs and allowing the gateway to receive different physical parameter values the patient specified by the ID.

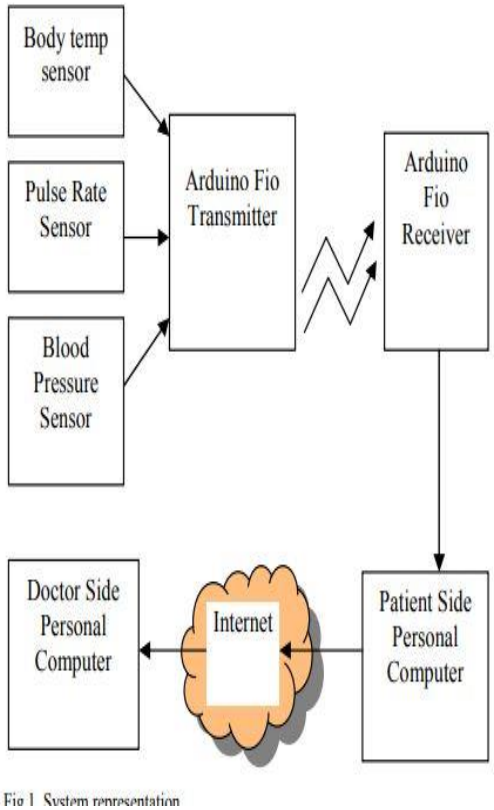


Fig 1 System representation

Fig (2): Block diagram of Internet of things (Iot) based patient health monitoring system

Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider

community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

Features of the Arduino UNO:

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

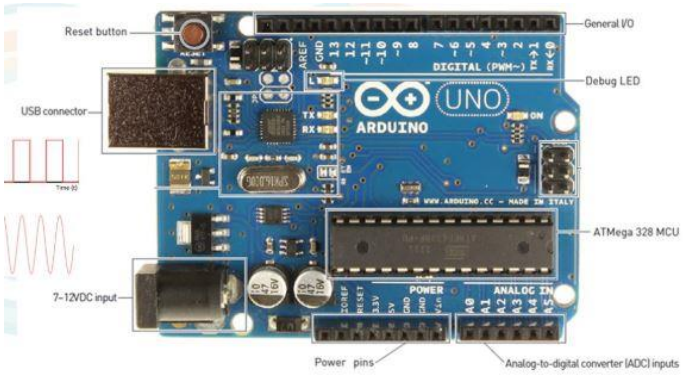


Fig (3): Arduino base board

IOT (ESP8266)

As Internet of Things is quickly becoming a reality, it is intriguing more and more developers as well as prospective users. In a simplistic view, IoT can be seen as a sophisticated network of things. Things that are not just typical computers or mobile phones or machines but the things like door-lock, diapers, watches or anything you believe in to make life smarter and easier. It is excellent combination of multiple technologies to enable better life. The Internet of Things is the collection of objects on the internet or network that humans rely on to make their lives easier.

Espressif's ESP8266EX delivers highly integrated Wi-Fi SoC solution to meet users' continuous demands for

efficient power usage, compact design and reliable performance in the Internet of Things industry. With the complete and self-contained Wi-Fi networking capabilities, ESP8266EX can perform either as a standalone application or as the slave to a host MCU. When ESP8266EX hosts the application, it promptly boots up from the flash. The integrated highspeed cache helps to increase the system performance and optimize the system memory. Also, ESP8266EX can be applied to any microcontroller design as a Wi-Fi adaptor through SPI / SDIO or I2C / UART interfaces. ESP8266EX integrates antenna switches, RF balun, power amplifier, low noise receive amplifier, filters and power management modules. The compact design minimizes the PCB size and requires minimal external circuitries. Besides the Wi-Fi functionalities, ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor and on-chip SRAM. It can be interfaced with external sensors and other devices through the GPIOs. Software Development Kit (SDK) provides sample codes for various applications.

Fig (4): Iot communication network

WI-FI Protocol

- 802.11 b/g/n support
- 2 x Wi-Fi interface, supports infrastructure BSS Station mode / P2P mode / SoftAP mode support
- Hardware accelerators for CCMP (CBC-MAC, counter mode), TKIP (MIC, RC4), WAPI (SMS4), WEP (RC4), CRC
- 802.11n support (2.4 GHz)
- Supports MIMO 1×1 and 2×1, STBC, and 0.4 μs guard interval
- WMM
- UMA compliant and certified
- Antenna diversity and selection (software managed hardware)
- Configurable packet traffic arbitration (PTA) with dedicated slave processor based design

provides flexible and exact timing Bluetooth co-existence support for a wide range of Bluetooth Chip vendor.

Applications

- Home appliances
- Home automation
- Smart plugs and lights
- Mesh network
- Industrial wireless control
- Baby monitors
- IP cameras
- Sensor networks
- Wearable electronics
- Wi-Fi location-aware devices
- Security ID tags
- Wi-Fi position system beacons

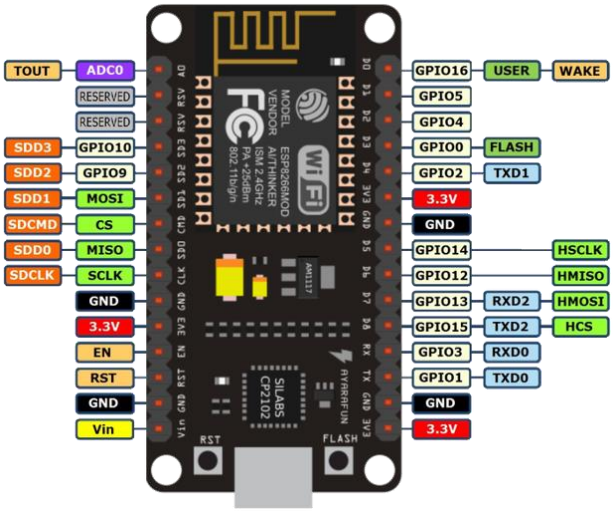


Fig (5): Iot hardware module and pin out

1. **Temperature sensor (LM35)** - It is a sensor used to measure temperature. The LM35 series are precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It measures temperature more accurately than thermostats. It is sealed and does not undergo oxidation. It does not require output voltage to be amplified.

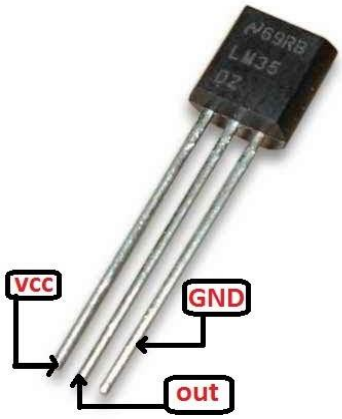


Fig (6): lm35 pin out

Heart Beat Sensor – This is used to monitor the amount of oxyhaemoglobin. It measures the heartbeat per time, conveyed in Bpm(bits per minute). This technique is used to measure heart rate since change in blood volume is synchronous to heart beat

Fig (7): Heart beat sensor module

16x2 LCD:

- LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons

1. The declining prices of LCDs.

2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.

3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data. Ease of programming for characters and graphics LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).

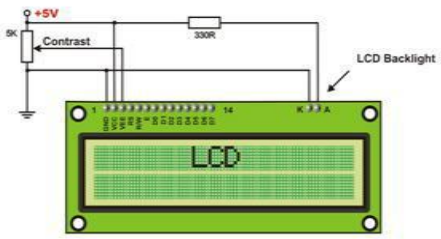


Fig (8): LCD circuit

IOT Applications and Applications of this project

This is an important sensor based project which has the latest technology implemented in it. And it has many applications & advantages as mentioned below.

1) IOT Healthcare is the most demanding field in the medical area. This project is for, elderly person in our home. Also for the senior citizen living alone or living with 1 or 2 members. This project really proves helpful when family members need to go out for some emergency work.

2) Disable patients can use this project. Disable patients who find it really difficult to go to doctors on daily basis or for those patients who need continuous monitoring from the doctor.

Advantage of this project

1) IOT Monitoring proves really helpful when we need to monitor & record and keep track of changes in the health parameters of the patient over the period of time. So with the IOT health monitoring, we can have the database of these changes in the health parameters. Doctors can take the reference of these changes or the history of the patient while suggesting the treatment or the medicines to the patient.

2) Hospital stays are minimized due to Remote Patient Monitoring.

3) Hospital visits for normal routine checkups are Minimized.

4) Patient health parameter data is stored over the cloud. So it is more beneficial than maintaining the records on printed papers kept in the files. Or even the digital records which are kept in a particular computer or laptop or memory device like pen- drive. Because there are chances that these devices can get corrupt and data might be lost. Whereas, in case of IOT, the cloud storage is more reliable and does have minimal chances of data loss.

Future development

We can add a GPS module in IOT patient monitoring using Arduino Uno and WiFi module project. This GPS module will find out the position or the location of the patient using the longitude and latitude received. Then it will send this location to the cloud that is the IOT using the Wi-Fi module. Then doctors can find out the position of the patient in case they have to take some preventive action.

Conclusion:

IOT platform provides a simple environment to connect the hardware devices through the cloud and users. Then by using IOT we can make any type of devices by different type of sensors and modules. This project is useful for Patient who required regular check the parameters. The previous data storage facility provides to the doctors to better treatment environment by this friendly device. The simpler working and Mobile app GUI provides the friendly connection between the devices to users. As device also provides the location updates, body condition status and medicine alerts, it is very useful for take care the patients by doctors and relatives. Finally we can say, this is a complete healthcare device.

References

[1] MoeenHassanalieragh; Alex Page ; TolgaSoyata; Gaurav Sharma ; Mehmet Aktas; Gonzalo Mateos; BurakKantarci; SilvanaAndreescu ,"Health Monitoring and Management Using Internet-of-Things (IoT)Sensing with Cloud-Based Processing: Opportunities and Challenges", 2015

[2] M. Shamim, Ghulam Muhammad, "Cloud-assisted Industrial Internet of Things (iiot) – Enabled framework for health monitoring", 2016

[3] H. S. Park, H. M. Lee, HojjatAdeli, I. Lee, "2006",A New Approach for Health Monitoring of Structures: Terrestrial Laser Scanning

[4] Nicola Bui, Michele Zorzi, "Health care applications: a solution based on the internet of things", 2011

[5] Min Chen, Yujun Ma, Jeungeun Song, Chin-Feng Lai, Bin Hu, "Smart Clothing: Connecting Human with Clouds and Big Data for Sustainable Health Monitoring", 2016

[6] In Lee, Kyoochun Lee, "The Internet of Things (iot): Applications, investments, and challenges for enterprises", 2015

[7] Hongyang Zhang; JunqiGuo; Xiaobo Xie; RongfangBie; Yunchuan Sun, "Environmental Effect Removal Based Structural Health Monitoring in the Internet of Things", 2013

[8] Junaid Mohammed; Chung-Horng Lung; Adrian Ocneanu; AbhinavThakral; Colin Jones; Andy Adler, "Internet of Things: Remote Patient Monitoring Using Internet Services and Cloud Computing", 2014

[9] CharithPerera, ArkadyZaslavsky, Peter Christen, DimitriosGeorgakopoulos, “Sensing as a service model for smart cities supported by Internet of Things”, 2013 [10] Himadri Nath Saha, “Comparative Performance Analysis between nrf24l01+ and XBEE ZB Module Based Wireless Ad-hoc Networks”, 2017

[10] Himadri Nath Saha, “Comparative Performance Analysis between nrf24l01+ and XBEE ZB Module Based Wireless Ad-hoc Networks”, 2017

[11] HN Saha, A Mandal, S Abhirup, “Recent trends in the Internet of Things”, 2017

[12] M Narsaria, D Bhattacharya, HN Saha, “Performance Optimization and Evaluation Algorithm”, 2016

[13] R Singh, HN Saha, D Bhattacharyya, PK Banerjee, “Administrator and Fidelity Based Secure Routing (AFSR) Protocol in MANET”, 2016

[14] D Choudhury, D Kar, KR Biswas, HN Saha, “Energy efficient routing in mobile ad-hoc networks”, 2015

Author

Gali Pavan Kalyan.

Ph.D research scholar in Utkal University

Dr.H.N.PratiHari,

Professor,ECE,St.Martin's Engineering College,Hyderabad.

Dr Debajyoti Mishra, Assistant Professor, ETC,IGIT,Sarang,

Utkal University ,Odisha.