IoT based Body Health Detection

[1,*]Abhinav Gupta, [2]Prerit Agarwal, [3]Rishita Varshney, [4]Akshita Sarin, [5]Samriddhi Bhardwaj

Department of Computer Science & Engineering, Moradabad Institute of Technology, Moradabad, U. P., India

[1,*]abhinavguptamit@gmail.com, [2]canonprerit@gmail.com, [3]varshneyrishita@gmail.com, [4]akshitasareen06@gmail.com, [5]samriddhi.bhardwaj19@gmail.com

***Abstract*— Among the applications that Internet of Things (IoT) is moving ahead with the world, Healthcare applications are generally significant. As a general rule, IoT technique has been broadly used to interconnect with the high level clinical assets and to offer brilliant and viable medical care administrations to individuals. The high level sensors can be either worn or be inserted into the body of the patient, in order to continuously screen there health parameters. The resultant data gathered in such way, can be analyzed, collected and mined to do the early expectation of any danger. The proposed framework works on the portable application dependent on constant remote observing of patients. The goal of the paper is to carry out a minimal expense framework and send the patient indispensable signs in crisis circumstances. Sensors are being utilized for estimating the patient essential signs by utilizing the remote organization. The information are gathered and communicated to the cloud for capacity through a Wi-Fi module associated with the regulator. The information is prepared in the cloud and input steps are taken on the investigated information, which can be additionally dissected by any person distantly. Far off survey decreases wait to caregiver and gives the specific status of patients. In the event that the patient necessities pressing consideration, a message is shipped off to the caregiver.**

Keywords— ***IoT, Sensors, Elderly ,Node MCU, Wi-fi, AAL***

I. INTRODUCTION

In recent years, the Internet of Things technology has attracted a more of attention because of its potential to reduce the burden on the health system caused by the aging of the population and the typical age-related problems. Therefore, now it is necessary to develop a system for real-time monitoring of physiological conditions (e.g.: body temperature, blood oxygen concentration, pulse rate, ECG, blood pressure, audio recognition mechanism and so onward) to ensure their quality's life, protection and well-being. These data can be conveyed to a smart phone or personal computer (P.C.) by a wireless technology and can be accessed through an android app and also these data can be used to observe health status without requiring the intervention of any doctor or other caregiver [1, 12]. When the data signify an observable problem (on comparing the monitored value with standard value) from which an elderly person may be at higher risk, the monitoring system can immediately activate an alarm that results in a rapid intervention by the concerned family person or doctor through the concerned app. In a world with an aging population, people are increasingly interested in developing solutions to help the elderly.

The Internet of Things is a new reality, it is completely changing our daily lives, and is expected to completely change the modern world. In order to combine these two important issues, this article introduces an IoT ready life support solution for the elderly [2-4]. The solution can track and record important patient information and provide a mechanism to trigger an alarm in an emergency. Efficient low power consumption/low cost and wireless capabilities make this solution suitable for any place, anyone can wear a discreet and comfortable device. The device has built-in functions to help the elderly or vulnerable family members communicate with emergency services and their loved ones. Third-party applications can provide more help [3,15]. To test the feasibility and effectiveness of the proposal, we built a prototype that is connected to a mobile application and allows real-time visualization of all the information (heart rate, body temperature and blood oxygen saturation) generated by the sensors in the device; with these Information, nursing staff can make decisions about the patient's health. The system is easy to learn and use, and is the first proof that our products can improve the quality of adult healthcare [3, 14].

The patient monitoring system allow clinicians to monitor multiple patients at the same time. The Heart rate represents healthy heart conditions. The average heart rate of adult men is 70 beats per minute, and the average heart rate of adult women is 75 beats per minute. You can use these values to monitor any of the condition of the heart. Body temperature indicate the state of any body. The range of normal human body temperature is 98.60 °F ± 0.70 °F. Any variations in body temperature of human may indicate harm to human health. The oxygen content in the blood is measured by the Spo2 sensor, which is having a very important parameter for human health body. Normal blood oxygen levels vary From 75 to 100 mmHg , if the amount of oxygen is less than 60 mmHg. It is considered as low. It is also a most important parameter of human health. So, regular monitoring of these vital various parameters is very important for better health observation. In order to measure these vital signs, an automated system for the continuous monitoring of must be developed[5].

In this document, the Arduino-based automatic patient monitoring system is designed and implemented, which can easily monitor the physical condition at a low cost.

Rest of the paper explains the existing approaches in the form of Literature review in section 2. The implementation of the work in Section 3, the results and discussion of the system implemented in Section 4, as well as conclusions and future scope are introduced in Sections 5 and 6.

II. LITERATURE REVIEW

A. Concept

Elderly health monitoring is essentially a monitoring model with different sensors. We chose the elderly for follow-up because they often have greater illness susceptibility than younger people do, and because working individuals typically find it challenging to regularly monitor older family members. Elderly people can be cared for at home, but it can be quite challenging to monitor their activities and conditions while at work, so maintaining their health is a wise decision [16]. A system that allows you to monitor the main daily activities of the elderly. The threshold is already available for use by the system. The system uses sensors positioned according to the needs of a system to collect the data about patient's daily activities. Compare the received data with the given threshold. If everything is remain normal, so no further examination will be performed [17].

However, the data is further examined using the proper predictive algorithms whenever an abnormality or deviation is recorded. When the situation is actually so critical, interested family members will be notified of the patient's present state and the likelihood of recovery using the current method [18].

The main content that this research tries to track is heart rate, temperature, oxygen level, and fall detection. The sensors we used in the research work according to the below steps:

- The sensors transfer the collected data set from the host periodically after a period of time.
- Compare the data collected in this way with the threshold assigned to the system.
- If the record reaches the threshold, the situation is considered normal and the system will not take any of the further action.
- The data set recovered in this way, if it contains any abnormalities, will be further analyzed to predict the severity of the person's condition, and an alert will be sent to the relevant authorities.

B. Related Works

Extensive research on system-related topics shows that very few of the related publications can really build their separate preliminary frameworks and system prototypes. Some of the publications, such as the Ambient Assisted Living (AAL) study , actually performed more of a literature survey of the current state of IoT monitoring systems. They also attempted to identify and highlight the main issues of body, quality of service, as well as a user-centric experience [8, 9]. Some of them are dedicated to highlighting or emphasizing the importance of the Internet of Things in the medical field, as well as some suggestions for the health monitoring system.

Some more related findings use some specific models for health monitoring, such as the “Model Driven Tree Reference Model” (MDTRM) abstraction, which explains the needs of the health sector for this model and determines the complexity of the model. it pointed to be a very useful model in the early stages of this research. This higher-level abstraction requires a general IoT entity library to describe its connections, the generation of architectural compatibility of certain systems, the determination of system complexity, and the comparative evaluation of the resulting architectural models. MDTRM can help system architects and designers use the Model Driven Model Tree Architecture Reference Architecture (MDTRAM) model to design a specific next-generation.

IoT architecture that matches any expected platform-specific implementation. Another related model we found is the architecture of the General Domain Model (GDMA). Monitoring and health through cloud processing is also a useful source of research because it helps to generate the raw data ideas from handheld device that are well-matched and more capable of measuring any physical quantities, which we can use to achieve meaningful results.

The Free Scale Home Health Hub reference platform uses various sensors to store patient data in the cloud, which can be accessed by persons related to the patient. The platform is also unable to connect any worrying situation to the patient [12]. Some of our investigations also led us to some projects, which even discussed the use of wireless network sensors to monitor the general health sector. They also try to share their thoughts by modeling structures such as cloud computing and big data.

C. Proposed System

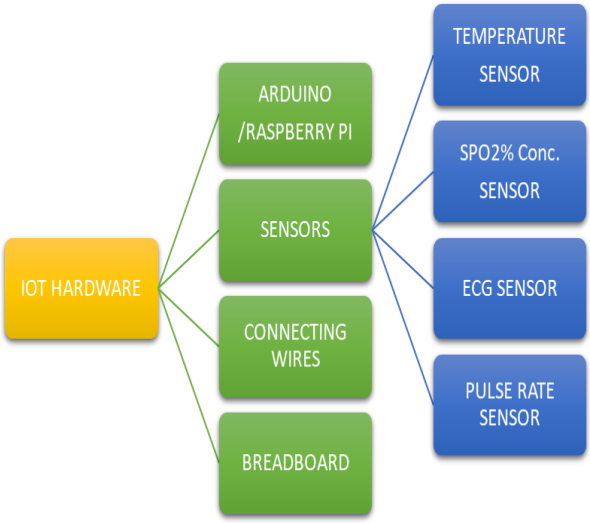
In all these ideas, models, frameworks, and platforms used in this research work, we differ from all of the above in a basic and fundamental sense. Previous studies may use multiple monitoring variables, instead, we use a more specific variables. However, the main functional difference is that our motivation for developing this research work is to provide functional responses and provide feedback to the host’s relatives so that they can quickly act for the host’s benefit. The answer will be in the form of SMS and WhatsApp messages. However, the basic idea of the research work is completely based on a different paradigm, because the existing equipment only reports the measured value observed by the sensor. If someone has not been informed of their health or has not taken appropriate measures, the readings are than absolutely useless. In our equipment, the relevant personnel will be informed of their health and initiate necessary measures [7]. The solution is that our project is to develop a device that can notify you of your health and alert you when the device detects a change compared to the previous monitoring. We will use AI to observe device registration and make a decision on that basis. However, it is true that in addition to providing useful usage feedback, monitoring conditions and predicting abnormalities is not a very simple process, nor is it easy to build it. This is one of the most interesting topics (related to the Internet of Things) at a completely different level. The useful information from the study is very helpful for running and providing a viable model. We had to work hard on feasible data, but the data was properly processed to continue the investigation. Therefore, this section focuses on most of the work related to our project and details the differences between our research and this work. A platform that monitors the daily activities of the host will be more useful to the attending physician. The daily activities performed by the monitoring system help clinicians make conclusions and prognosis for the diagnosis of the host in a quick way [13].

III. METHODOLOGY AND IMPLEMENTATION

In this segment the hardware required for the work and its implementation will be discussed with figures and the circuit connections.

A. *Hardware*

a) In order to implement this project, we need sensors to monitor the health of any elderly. To this end, we have selected four different standards to monitor the elderly. The



four standards we selected are body temperature, host's pulse rate, oxygen level, and fall detection. Therefore, we selected the following sensors based on these four criteria [13, 18].

Fig 1: Hardware Flowchart

1. *Temperature Sensor*

For collecting the temperature data from the host side we chose the model named DS18B20 related to figure 2. This digital thermometer provides temperature measurement from 9 to 12 degrees Celsius, and has a alarm function, with user-programmable non-volatile high and low set points. 1 Bus cable, by definition, it only needs a data line to communicate with the central microprocessor. In addition, DS18B20 can take power directly from the data line without an external power supply and provide accurate temperature data. The sensor provides data on a temperature scale of degrees Celsius, and then for simplicity, we can convert it into Fahrenheit [5, 8]. As soon as host touches the sensor, it becomes saturated with the host's body temperature and displays the temperature.

Fig 2: Temperature Sensor DS18B20

2. *Pulse Rate Sensor*

The running of the Pulse/Heart beat sensor PLSNSR1 may be simple. The sensor has sides, on one facet the LED is positioned in conjunction with an ambient mild sensor and on the opposite facet we've got a few circuitry. This circuitry is accountable for the noise cancellation and amplification work. The LED at the front facet of the sensor is positioned over a vein in our human body. This can both be your Finger tip otherwise you ear tips, however it need to be positioned at

once on pinnacle of a vein. Now the LED emits mild so that you can fall at the vein at once as shown in fig3. The veins may have blood float interior them handiest whilst the

Fig 3: Pulse/Heart beat sensor PLSNSR1

coronary heart is pumping, so if we display the flow of blood we will display the coronary heart beats as well [3].

3. *Fall Detection Sensor*

MPU6050 sensor module capabilities a gyroscope and an accelerometer. The gyroscope is used to decide the orientation and the accelerometer presents statistics approximately the angular parameter which include the three-axis data. To stumble on the fall, we are able to examine the acceleration importance with the brink value. If the fall is detected, the tool will ship an SMS to the involved person. Figure 4 as below:

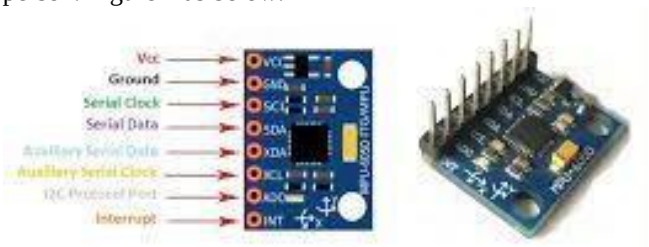


Fig 4: Fall Detection Sensor MPU6050

4. *SPO2 Sensor*

The MAX30100 is an included pulse oximetry and heartrate display sensor solution. It joins LEDs, a photodetector, optimized optics, and low-noise analog sign processing to stumble on pulse oximetry and coronary heart signals. The MAX30100 operates from 1.8V and 3.3V electricity components and may be powered down via software program with negligible standby current, allowing the electricity deliver to stay related in any respect. The tool has LEDs, one emitting a crimson mild, every other emitting infrared mild [6, 16].

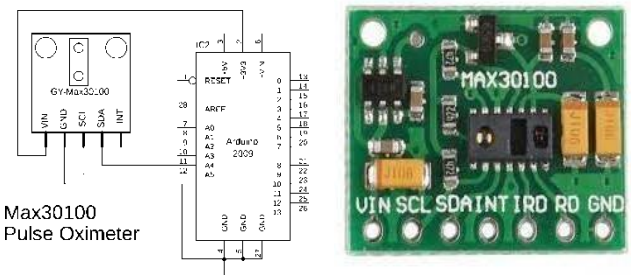


Fig 5: SPO2 Sensor MAX30100

5. SPO2 Sensor

Node MCU is an LUA-based open source firmware developed for the ESP8266 Wi-Fi chip. Since Node MCU is an open source platform, its hardware is open and can be edited/modified/created [18]. The Node MCU development board/kit includes an ESP8266 chip that supports Wi-Fi. ESP8266 is a low-cost Wi-Fi chip developed by Espressif, using TCP/IP protocol in figure 6. For many more information about ESP8266, please refer to ESP8266 Wi-Fi Module. version 2 (V2) can be used in the Node MCU development kit, that is, the Node MCU v1.0 (version 2) development board, which is usually shipped with a coloured PCB [9].

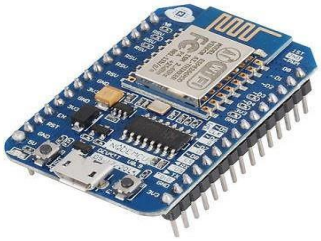


Fig 6: Node MCU

B. Software

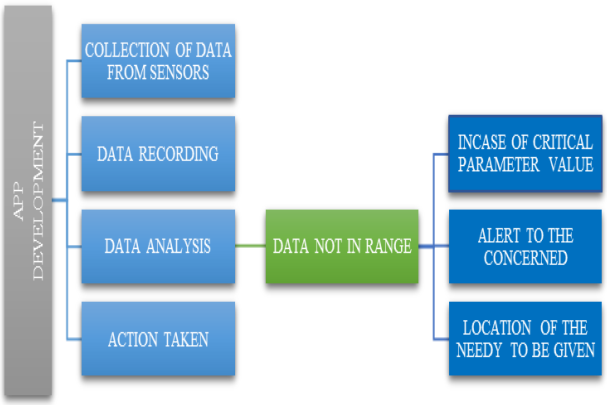


Fig7: Software Flochart

1. App Development

Today, mostly all of us have a smart phone which can help us to do different things just by the use of internet. Here we will make an app which will be connected to our hardware. It will help us in many different ways as data will be collected from the hardware device.It will record the data. Data analysis will be done through the app made online by the MIT app inventor.If the data is not in range, then it gives an immediate alarm.Sensors will be connected to the application In case of critical parameter values, it will call the concerned so that action may be taken within time [4]. It will also help us in knowing the location of the needy person.Sensor's Coding is done on the Arduino software.According to data received actions will be taken.

Fig 8: MIT app Inventor Interface

2. Data Collection and Recording

Once all the hardware type and Arduino is connected , we can start collecting data i.e. sensor readings from the sensors via Arduino. Since we are implementing a project based on the Internet of Things, we need to ensure a few things before implementing. As it ensures that it's fully automated i.e. there is no any human intervention

A tiny semicircular objec
sensor. The host merely ne
reading. The finger must be
sensor. The sensor sends d
gradually adjusting to the hc
convert it from compile to Fal
in Celsius format [2].

The pulse sensor is an
gadget with a green indication light in the centre. The green indicator light is on when the Arduino is powering the sensor. Simply touch the green light with your finger, and the sensor will immediately send information to the Arduino about the amount of pulses per minute.

Fall detection sensor uses accelerometers and gyroscopes which can directly provide linear and angular information. Sensor readings or correct fusion can be used to determine the true fall. Different types of detection methods differ in the composition of motion sensors and detection algorithms. The first detection method is to use an accelerometer. The second detection method relies on accelerometer and gyroscope [3, 14]. The gyroscope can display angular velocity, and the accelerometer can display linear motion information.

Data will be collected from the sensors and will be recorded in the online database for the future decision making, as therecorded data will help in the analysis.

3. Steps of Implementation

In order to complete this project and fully monitor the health standards of elderly people, we must perform several steps. The sensor management and data management of the Wi-Fi module (Node MCU) which has a systematic method to accomplish all of these. The following is a list of consecutive steps in this work:

1. Collect sensor data separately through Arduino.
2. Use ESP8266 to send data to the online database which is further connected to the application

developed through MIT App-Inventor.
3. Use the online database to classify data into different categories.
4.Analyze the saved data and present information to the concerned doctors and people related to related hosts.
5. If in case having any abnormal health conditions, then notifyor alert the correct person.

4. Data analysis and Action taken

Based on the data collected by various sensors, we have performed multiple analyses. The collected sensor readings are now being processed to send them to the caregiver when the readings change [12]. If the readings change, and falls not in the valid range, immediately an emergency call will be made and the message will get delivered. If the emergency contact does not answer, it will transfer the call to another emergency contact, if no response is received it calls an ambulance. In serious situations it can also generate alarms and vibrations if the reading changes sharply or the heartbeat slows down.

IV. CONCLUSION

Our Health Guardian is a successfully developed home care product. Elderly people in danger at home can send an emergency request .The results of the real evaluation have the function of this system. Confirm fall detection or. The system can provide immediate help for the elderly and also family members do not have to worry because their elders are taken care of by the innovative and reliable system.

V. FUTURE SCOPE

On adding more sensors will improve data gathering and analysis accuracy. Applicable to serving members of the military and has the potential to be used to deliver cheap healthcare in rural locations. In order for doctors to diagnose patients from various countries and cultures, a sizable database is being built. Our project can be thought of as a platform for IoT development in the healthcare industry. These creative and successful initiatives can advance technology in underdeveloped nations like ours. a task that has an impact on the current technological period.

REFERENCES

[1] Brock, D. L. (2001). The electronic product code (epc). Auto-ID Center White Paper MIT AUTOID-WH-002.

[2] Ni, Q., García Hernando, A. B., & de la Cruz, I. P. (2015). The elderly's independent living in smart homes: A characterization of activities and sensing infrastructure survey to facilitate services development. Sensors, 15(5), 11312-11362

[3] Ray, P. P. (2014, November). Home Health Hub Internet of Things (H 3 IoT): an architectural framework for monitoring health of elderly people. In Science Engineering and Management Research (ICSEMR), 2014 International Conference on (pp. 1-3). IEEE.

[4] Niewolny, D. (2013). How the internet of things is revolutionizing healthcare. White paper.

[5] Patel, S., Park, H., Bonato, P., Chan, L., & Rodgers, M. (2012). A review of wearable sensors and systems with application in rehabilitation. Journal of neuroengineering and rehabilitation, 9(1), 21

[6] de Battista, N., Rice, J. A., Sim, S. H., Brownjohn, J. M. W., & Tan, H. P. STRUCTURAL HEALTH MONITORING OF CIVIL INFRASTRUCTURE USING WIRELESS SENSOR NETWORKS.

[7] Hassanalieragh, M., Page, A., Soyata, T., Sharma, G., Aktas, M., Mateos, G., ... & Andreescu, S. (2015, June). Health monitoring and management using Internet-of- Things (IoT) sensing with cloud-based processing: Opportunities and challenges. In Services Computing (SCC), 2015 IEEE International Conference on (pp. 285- 292). IEEE.

[8] Tyagi, S., Agarwal, A., & Maheshwari, P. (2016). A conceptual framework for IoT-based healthcare system using cloud computing. In Cloud System and Big Data Engineering (Confluence), 2016 6th International Conference (pp. 503-507). IEEE.

[9] https://www.google.com/search?q=temperature+sensor+ds 18b20&source=lnms&tbm=isch&s a=X&sqi=2&ved=0ahUKEwik4eD_4aHTAhUIsY8KHaK PAKYQ_AUIBigB&biw=1366&bih= 669#imgrc=Iq8FIecPDinPqM.

[10] Ruhaini .H.Zawawi, " Active ageing in Malaysia," the second meeting of the committee on " International Cooperation on Active Ageing", in Tokyo, Japan, 19th July, 2013.

[11] J. Jong Gierveld, H. de Valk and M. Blommesteijn, "Living Arrangements of older persons and family support in more developed countries, 2015.

[12] Alexander BH, Rivara FP, Wolf ME. The cost and frequency of hospitalization for fall–related injuries in older adults. American Journal of Public Health 1992;82(7):1020–3.

[13] B. Xu, L. D. Xu, H. Cai, C. Xie, J. Hu and F. Bu, "Ubiquitous Data Accessing Method in IoT-Based Information System for Emergency Medical Services," in IEEE Transactions on Industrial Informatics, vol. 10, no. 2, pp. 1578-1586, May 2014.

[14] Sterling DA, O'Connor JA, Bonadies J. Geriatric falls: injury severity is high and disproportionate to mechanism. Journal of Trauma–Injury, Infection and Critical Care 2001;50(1):116–9.

[15] D. P. B. Renaux and F. Pöttker, "Applicability of the CMSIS-RTOS Standard to the Internet of Things," 2014 IEEE 17th International Symposium on bject/ Component/ Service-Oriented Real-Time Distributed Computing, Reno, NV, 2014, pp. 284-291.

[16] Sterling DA, O'Connor JA, Bonadies J. Geriatric falls: injury severity is high and disproportionate to mechanism. Journal of Trauma–Injury, Infection and Critical Care 2001;50(1):116–9.

[17] . P. Kostopoulos, T. Nunes, K. Salvi, M. Deriaz and J. Torrent, "F2D: A fall detection system tested with real data from daily life of elderly people," 2015 17th International Conference on E-health Networking, Application & Services (HealthCom), Boston, MA, 2015, pp. 397-403.

[18] Q. Li, J. A. Stankovic, M. A. Hanson, A. T. Barth, J. Lach and G. Zhou, "Accurate, Fast Fall Detection Using Gyroscopes and Accelerometer-Derived Posture Information," 2009 Sixth International Workshop on Wearable and Implantable Body Sensor Networks, Berkeley, CA, 2009, pp. 138-143