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Electrical and Computer Engineering

DESIGN OF HEALTH CARE MONITORING SYSTEM BASED ON INTERNET OF THING (IOT)

Taisir Hasan Abdulameer ALHUSSEINI

Master of Science

Supervisor

Asst. Prof. Dr. Abdullahi Abdu IBRAHIM

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DESIGN OF HEALTH CARE MONITORING SYSTEM BASED ON INTERNET OF THING (IOT)

by

Taisir Hasan Abdulameer ALHUSSEINI

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The thesis titled “DESIGN OF HEALTH CARE MONITORING SYSTEM BASED ON INTERNET OF THING (IOT)” prepared and presented by “Taisir Hasan Abdulameer ALHUSSEINI” was accepted as a Master of Science Thesis in Electrical and Computer Engineering.

Asst. Prof. Dr. Abdullahi Abdu IBRAHIM

Supervisor

Thesis Defense Jury Members:

Asst. Prof. Dr. Abdullahi Abdu IBRAHIM	School of Engineering and Natural Sciences, Altinbas University	___________________
Asst. Prof. Dr. Sefer KURNAZ	School of Engineering and Natural Sciences, Altinbas University	___________________
Prof. Dr. Adem KARAHOCA	Computer Engineering, MEF University	___________________

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

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Taisir Hasan Abdulameer Alhusseini

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ABSTRACT

Design of Health Care Monitoring System Based on Internet of Thing (IoT)

Taisir Hasan Abdulameer ALHUSSEINI

M.Sc., Electrical and Computer Engineering, Altinbas University,

Supervisor: Asst. Prof. Dr. Abdullahi Abdu IBRAHIM

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The Internet has made this place a worldwide city and web of things (IoT) by allowing the range of captors and keen items to collect and process data for various use. In weakening the physical structures of the digital shrewd (IoT) shrewd items become a definitive building. The IoT has a variety of applications, including social security. Different restore and post-operative information should be screened. The human services correspondence using the Web of Things (IoT) technique is adjusted to achieve the therapeutic parameters in the nearby and remote zones. In this paper, we use the remote health care system using advanced information technology and new communications developments and remote physiological measuring technology. The remote benefit services framework provides for the 'free welfare authorities' and 'remote long-term human services administrations' through an entire 'remote social insurance data stage' work instrument by way of coordinated terminal programming and improved social insurance modules. This would encourage the real-time activities of elderly citizens and monitor the healthcare system. The information gathered from various sensors is stored on a local server that connects people, physicians and practitioners to the right information at the time of an emergency. In this way, the framework could increase availability, productivity and reduce well-being costs in order to increase peace of mind and safety. I hope the design and implementation of this system will improve elderly health monitoring in future.

Keywords: Internet of Things (IoT), Medical Services, Healthcare, Health Monitoring, Arduino

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LIST OF ABBREVIATIONS

IoT	:	Internet of Things
LCD	:	Liquid Crystal Display
ECG	:	Electrocardiogram/Electrocardiography
GSM	:	Global System for Mobile
SMS	:	Short Message Service
BSN	:	Body Sensor Network

1. INTRODUCTION

The Internet of things is an important component of the modern management of living and business (Internet of Things Russian Research Centre, 2013), including IoT, Internet of Everything, omnipresent computing, omnipresent Internet). All is possible with mm the internet of things, as a digital assistant, clever home, clever car and clever environment.

Consider an early morning waking situation. We should write down how you sleep and loaded the data in your bracelet to a cloud service. A coffee maker and a microwave obtained cloud information and recognized that you waked up and began to cook your breakfast. According to the same band results, your bedroom is illuminated. All lamps are turned automatically if you walk from the room to the kitchen. A cup of coffee is wait in the kitchen. The vacuum cleaner of the robot begins when you leave the house to go work.

This is the world that is based on IoT. There are already some smart IoT features and some are automation. But the Internet of Things can radically change the world and impact all companies and lifestyles. Rising technical costs have guided the rapid development of IoT. In the last few years, the cost reduction of various devices from 3D printers, to smartwatches and fitness trackers has been continuously observed. Dramatically reduced Bluetooth and wireless internet modules prices (for example about EUR 1per item for BLE), permit more and more devices connected to the internet. (Sklyar, 2016) [1];

Almost nothing does not cost electronic sensors, both temperature and humidity up to and including pressure and distance, sound strength, level of light, gravity and motion can be completely measured, sending to the installed software all the information reported. The price of computer power fell most noticeably and virtually every device could be integrated with a computer chip. This has led, however, to the removal of the conventional market barriers for new products and companies.

Internet of Things is a logical step to the creation of the global network, which initially allowed static pages to be accessed. Today, it contributes to artificial intelligence integrated systems that respond to the environment as a whole to permanent changes and human needs. Modern IoTs are still undeveloped, with no relation at all between 99 percent of all possible objects. This means that evolution of the Internet has started, but nothing is simple and architectures still are in production. The rule of the Metcalfe states: 'The value of the telecommunications network is proportionate to the number of connected users on the device (n2)' Imagine a situation whereby all new connected objects (sensors, actuators, computers, etc.) add value to the equation and significantly increase internet output. (Evans & Annunziata, 2012) [2];

According to some reports, in 2020 there will be up to 50 billion connected devices (Cisco, 2016) [1], a large number of which are currently present. Such rapid growth creates great difficulties in both the technological and business fields. There is nobody in the Internet of Things who knows how to do business: technology is not straightforward, customer desires are not yet specified, and even consumers themselves do not understand what they are purchasing. All these issues prevent IoT managers due to high risks and uncertain job scope. Developers have no idea how the final device or solution functions and what the project specifications are. It is not even clear how the demand is. In all, the Internet of Things is modern and unknown.

In the health sector, the Internet of Things offers a lot of choices where correct information is a easy and safe solution. IoT principles have already been applied in certain respects of medical care to improve quality and dramatically reduce costs. However, it clearly does not cover all future applications and target patients. With the ongoing growth of data collection, transmission and analysis processes and solutions, we can see a wider Internet of Medical Products for patient monitoring. (Niewolny, 2014) [4].

1.1 MOTIVATIONS

Rising de-vice and consumer demand is a constant factor in the communication network. The network capability, on the other hand, is constrained by technical limitations and financial expenditure. The communication network's capability sometimes falls short of the demand of people and their devices. Congestion in urban areas is high in the current network infrastructure while capacity in rural areas is low. For the large implementation of eHealth services, this raises significant challenges. In comparison, the number of health tracking apps and IoT devices is growing dramatically, as more people are aware of preventive health care. These devices generate "bigdata," which requires transmission, processing and real-time analyzes. The transmission in real time of large amounts of health information in the communication network system, including bandwidth and delay, presents new problems and challenges. Health data often contains various types of data (temperature, breath rate, glucose level), such as basic data from body to complex data (electrocardiography-ECG signal or EKG signals, electroencephalography-EEG signal). The timeliness of another classification of the data is dependent on whether the data must be obtained immediately for the purpose of diagnosis or on minor delays. This study addresses the main research challenge of efficient transfer of data into health care, both in urban and rural areas, within the current network infrastructure.

1.2 PROBLEM STATEMENT

It is commonly known that in the field of medicine there are lacunae which need to be bridged to provide patient care better [5], [6]. Universal divergences can be divided into four 'potential improvement zones, according to the Nursing Times [6].".

The first is that patients and their vital signs must be routinely monitored. This means alternatives to stop the prevalent apathy [7][8] have to be given to visit health facilities for intervention. Many patients appear to believe that the hospital will only be visited if a significant medical condition is involved [7]. The required focus and attention typically are not given to routine and scheduled inspections. This is generally because hospitals are busy and thus are a big user of time. Often distance from health facilities can also discourage daily visits to hospitals. [9]. This is due to substantial additional costs, such as transport. However, patients would be interested in understanding their health conditions and would be highly sensitive and cooperative in receiving any support that emergencies might provide [10]. Thus, solutions to track critical signs at the patient's convenience will increase patient involvement.

Health SPs must, therefore, follow innovative and non-obtrusive approaches to facilitate the involvement of patients in tracking these essential signs. Readings of vital signs at convenient places and times should be taken as much as possible. Devices with reliable Internet connectivity which are usually part of the everyday life of most patients, such as cell phones, will therefore be relevant when monitoring vital signs on a regular basis. In order to prevent the system from becoming obstructive, the minimization of control and the sensing device of vital signs would also be an important step. There is also a lot of work being done in order to fully minimize these devices to the fullest extent of everyday life as is evident in developments in health and wearable [11]. A framework must be developed for the agglomeration of these disparate measuring and tracking instruments with electronic health record systems (EHR) to map this application to the medical sector. This should be customized to the needs of end-users.

However, with such a system, data for key signs can be registered without needing to go to healthcare facilities unnecessarily. These institutions will be decongestant and save all players time by bridging the above-mentioned gaps. The captured data can also provide much of the required data to health researchers and doctors to carry out predictive health effectively, thus increasing health services [12]. During their daily duties, careers are guaranteed that they will receive prompt warnings. The general advantage is that the health sector offers more resources.

Remote health surveillance may provide valuable physiological data at home. Monitoring is suitable for patients suffering from elderly or chronic diseases who wish to postpone a long period. Wireless sensors are used to record and transmit interested signals and to schedule a processor to receive and analyze sensors automatically. We must choose suitable sensors in this project based on what you want to detect and develop algorithms to make your sensing. Examples are fall identification, cardiac signals control.

A remote health monitoring system approach was designed to expand health care from the conventional clinic or hospital to patients ' homes by means of a single parameter monitoring system. The system has been developed for the collection of cardiovascular detection data, fall system detection, heat data and some other parameters. Data from individual parameter surveillance systems were then used for remote detection.

During the design of potential medical applications, the following characteristics have been followed: (a) Convergence of medical practice and technology with the latest technological trends; (b) real, long remote control, lightweight, wearable sensor and long life of a system. With minimal buttons the interface should be easy to use.

1.3 OBJECTIVES

Our aim is to create a Smart Health Care System in which the elderly is constantly monitored with IoT and sensors. If the wellbeing of an individual is critical, a message is sent with the aid of the GSM module to the doctor and other relatives. It saves a lot of users' money that would be spent on treating some disease by warning them early of health problems. Our scheme is therefore an integrated, up-to - date version of many of these concepts that have already been introduced to further improve the health of elderly people. On wearable devices this project can be easily implemented. It can lead to reducing the lives of seniors with sensors and IoT implementation.

Try developing a remote medical device with locally accessible components. The Fall sensors include a microcontroller, an accelerometer and a wireless transmitter, temperature, humidity, tension, poisonous gas, air quality monitoring, the SPO2 module. The collected data was transferred to a receiver module wirelessly.

An effort to build a remote health system with components available locally.

i) The drop-detector, the temperature, the pressure and the heartbeat modules provide an accelerometer. The collected data was transferred to a receiver module wirelessly.

ii) The ECG is made up of an invasive infrared finger detector, LCD, engineered circuit to detect a heart signal and microcontroller. The analog signal detected was then digitized to give an LCD digital value.

iii) A simple PhP application with a database to remotely access all critical data where possible.

1.4 THESIS CONTRIBUTION

Health monitoring systems have seen rapid growth in hospitals and in many other health facilities and mobile health monitoring systems with new technologies are currently becoming a major concern for many countries around the world. The introduction of IoT technology makes it possible for healthcare to progress from person-to - person consultation to telemedicine. This article proposes an intelligent IoT healthcare system that can monitor the basic health signs of the patient and the inpatient condition in which the patient is actually accessible in real time. This device uses three sensors, called heartbeat sensor, body temperature sensors and room temperature sensors to gather data from the hospital area. For each case, the error percentage of the developed scheme is less than 5%. Patient status is forwarded through a network to the medical personnel, where the current condition can be processed and evaluated. The prototype developed is well suited for monitoring the efficacy of the system. We focus particularly on the clinical sector and look at open doors controlled by upcoming and usable innovations and the problems that need to be tackled with a certain objective to enable them to be incorporated in the act of solution.

Sensor usage senses the patient's conditions and data are collected and transmitted via a microcontroller. Doctors and healthcare staff also have to visit the patient to confirm his / her condition. Furthermore, the use of several intelligent microcontrollers offers high-level application in hospitals where a number of patients need to be tracked regularly. Here we are using the concept of wireless network technology to provide each patient with a unique identification ID that will enable the patient and his / her health parameters to be easily identified. Data can be transmitted to the patient surveillance system via the proposed system wirelessly, allowing continuous patient surveillance. Contributing to measurement precision and ensuring protection in an appropriate warning mechanism increases our patient loyalty and low costs in hospitals. Thereby, in a comfortable environment where distractions from hardwired sensors are not present, a person may engage in his daily activities. Physiological monitoring equipment with simple sensor interfaces with a Microcontroller can be quickly installed and reliably used for health monitoring. Thus, cheap devices can be designed based on the interfaces between human and machine. Our system tracks the different physical parameters of many patients efficiently and alerts them whether the parameters are higher than their vital values. Remote control therefore refers to an industrial automation sector that has entered a new age as wireless sensors are built.

In order to achieve health care, the Internet of Things network (IoT) provides a promising technology that will further improve health services. Using IoT wearable platforms, the users and their environment are able to gather necessary information and to communicate it wirelessly, to process it or store it to monitor the user 's history. Such access to outside networks will require preventive measures (for example, if a heart attack is expected) or immediate therapy (for example, if a consumer drops and needs assistance).

1.5 THESIS OUTLINE

The rest of this dissertation is structured as follows:

Chapter 2 addresses the subsequent work and existing research on the IoT paradigm. It explores such applications, processes, and ways of building on conventional approaches and main sign surveillance and management frameworks used in the fields of health and fitness.

The architecture and architectural aspects of the tele monitoring device proposed are discussed in Chapter 3. It introduces the functional system diagram and explains in detail the different system components. In addition, the chapter details the implementation of the hardware and software.

Chapter 4 describes the results of the research work carried out and highlights the significant contribution of the work. The chapter concludes with suggestions for further work on the same or similar subject.

2. LITERATURE REVIEW

This Chapter gives an overview of the Internet of Things and its connection with ICT health care. These electronic devices are becoming increasingly useful to health experts in technology [13] in recent days. In the medical field, IoT devices (Internet of things) are highly utilized. This paper deals with the health surveillance system. In the rural areas, the number of doctors is lower than in urban areas, especially among cardiac patients, high-pressure Blood patients, the hypertensive problem, diabetic patients, etc. Health services are not accessible in rural areas, except the state hospital. Therefore, there are more patients than the state hospital. In certain instances, the equipment has already expired. This hardware system is therefore able to submit the report directly to the doctors or interns, if any emergency call is required. Doctors will conduct their rest by reporting.

2.1 OF INTERNET OF THINGS (IOT)

The word Internet-of-Things (IoT), which does not contain a very stringent definition for the term, is used for many different concepts and applications. My personal views on this concept are clarified by a definition in order to establish a shared understanding. The following segment first offers a simple description of IoT technology and the way it operates. The description follows IoT-related principles and an example of how an IoT-app could look in the future.

2.1.1 Definition

There are many more interesting technologies for IoT, but I believe today the most important technologies listed in the previous section. IoT is a general term, but I assume IoT is synonymous with the phase that follows:

The internet of things is linked to heterogeneous objects (every day) embedded in intelligence [14] that enables them to communicate and exchange data (Cambridge Advanced Learner's Dictionary & Thesaurus, 2017). The link between them is specific identifier and communication capabilities (Miorandi et al., 2012) [12]. Different communication networks can carry out this interaction and exchange of data directly. However, the data collected passes through a cloud structure to be analyzed at some point. This mechanism is autonomous and thus human-free. The method goes background and needs human confirmation not constantly. In advanced service applications information can be transmitted to the user at the end of the process, but it should be reduced.

2.1.2 Enabling technologies

IoT is frequently mistaken for the first technology. Intelligent computers, network-connected computers or other devices are able to communicate (Wikipedia, 2016). There was, for example, a TV or a fridge connected to the internet and an update with apps that essentially provide the same options as a web browser but with a better user interface. It is incorrect to refer to these devices as IoT, because intelligent devices are a small part of the definition. The word intelligent objects or intelligent objects and not just computers are best used seven. Sicari, De Pellegrini & Chlamtac (2012) can be used in IoT according to the concept of Miorandi;

The sensing and/or actuating capacities are an optional feature (Miorandi et al., 2012). Over the past few years, major progress has been made in sensor technology; it is cheaper, simpler to mount and cheaper than ever before. In short, the perfect chance to make an entity intelligent. This is one why in recent years IoT has become so famous. But sensing abilities are not needed for smart things when using the concept of Miorandi et al. (2012).

Secondly, the technology which supports interaction of intelligent things is combined with, primarily, Wireless networks, wireless Internet, wireless sensor networking (WSN), Low Power Large Scale (LPWA) and broadband networks with long-range. (LoRa), etc.

Radio-frequency identification (RFID) is the third most useful technology for IoT applications. RFID technology allows for the conception, and enhances the standard bar code (Gubbi et Al., 2013), of microchips for wireless data communication. The RFID reader can read various tags, do not need a visual interaction and can write next to the ability to read. (He & Zeadally, 2015) [15].

2.1.3 Architecture

The word Internet-of-Things (IoT), which does not contain a very stringent definition for the term, is used for many different concepts and applications. My personal views on this concept are clarified by a definition in order to establish a shared understanding. The following segment first offers a simple description of IoT technology and the way it operates. The description follows IoT-related principles and an example of how an IoT-app could look in the future.

As is shown in Figure 4, IoT architecture consists of several layers from the lower to the top application layer. The two lower strata help collect data and the two higher layers permit data utilization in applications.

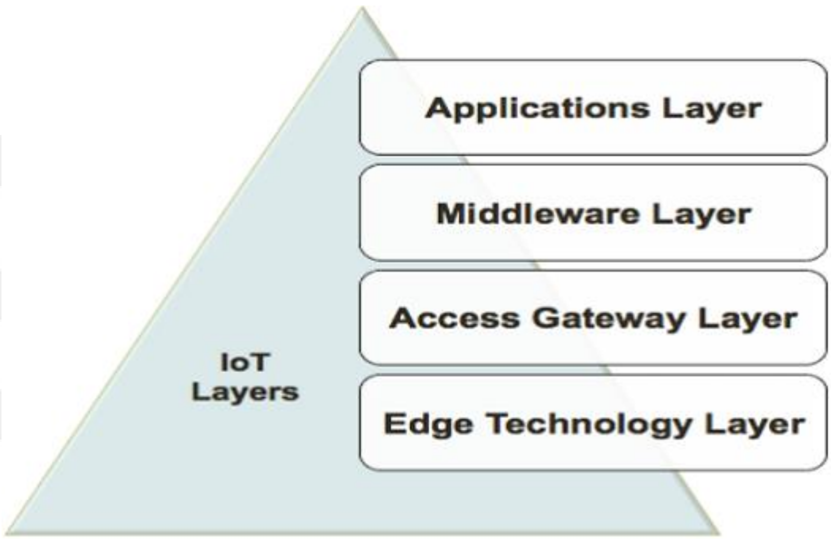


Figure 2.1: Layered Architecture of IoT [16]

The layers (from the bottom up) have the following functions:

a) IoT's key components are RFID systems. It makes a highly mobile system for data transmission called the RFID tag. An RFID reader reads the tag and processes the data collected in a specific application to fulfill its requirements. Without having to be in line of sight, RFID devices can be used to track medical items in real time. [19]

2) Access gateway layer: This layer is responsible for data handling, including data transmission and routings for message transmission, printing, and subscription messages, as well as for network layer or transport layer access layer. It sends data from the layer of edge to the middleware layer using Wi-Fi, Li-Fi, Ethernet, GSM, WSN and WiMAX communication technologies. [16, 20]

3) Middleware layer: a software platform that abstracts apps from stuff. It provides a broad range of services including device discovery and management, data filtering (EPC) or object name

services (ONS); data aggregate; semantic data analyzes; and access control, as well as discovery of information.

4) Code slayer: the top layer of this code. It is responsible for providing different IoT users with various applications. There are two sub-layers [21]:

a) Under-layer data management: offering directory support, service quality (QoS), cloud storage, processing of data, machine-to - machine (M2 M), etc.

b) Sub-layer application service: It interfaces end-users and company apps running above the IoT application layer.

Table 2.1: IoT elements and layers.

IoT Layers	IoT Components	Tasks	Used Technologies
Application Layer	Applications	Provide the disabled with care and assistance, and enable the disabled to read/view their health information	Smart home technology, robotics, Cloud computing, fog computing
Middleware Layer	Device Discovery, Access Control, Data Management	Enables communication between applications and things	CoAP, MQTT, REST, OMA Lightweight, OMA DM, EPC, ONS
Access Gateway Layer	Communication Technologies	Wireless WAN: Transmit information over Internet from devices or gateway	Wireless WAN: 2G, 3G,Long Term Evaluation (LTE), Long Term Evaluation- Advanced (LTE-A), 4G, Satellite networks, etc.
		Wireless PAN/LAN: Enables devices to share or exchange information themselves	Wireless PAN/LAN: RFID, Bluetooth, Wi-Fi, Li-Fi, ZigBee, 6LoWPAN
Edge Technology Layer	Physical Objects	Collect, monitor, identify, and provide data about disabled users in their environments	RFID, sensors, actuators

2.1.4 IoT Components

IoT contains different components that are part of the IoT concept. Later Table 1 addresses the most essential IoT components.

2.1.4.1 The Physical Objects IoT Component

Functional objects (also known as physical devices): Capture, classify, and track disabled user information in their environment. This involves devices that track vital signs (blood pressure, heart rate, glucoses, everyday life) of people with disabilities. The physical devices are connected to the Internet and turn the physical world's disabled knowledge into the digital world.

2.1.4.2 The Communication Technologies IoT Component

Personal area networks, local area networks (LANs) and broad-based (WANs) [22] are major types of disabled health IoT networks. Each type of network includes a number of wireless technologies in the access gateway layer portion of table 2.2.

Table 2.2: Selected features of PAN / LAN / WAN wireless technology.

Features	ZigBee	Bluetooth	Li-Fi	Wi-Fi	LTE/ LTE-A
Standard	IEEE 802.15.4	IEEE 802.15.1	IEEE 802.15.7	IEEE 802.11	LTE: 3GPP Rel. 9 LTE-A: 3GPP Rel. 10
Operating Frequency	2.4 GHz	2.4 GHz	N* 100 THz	2.4 and 5 GHz	Depend on different # of bands[2]
Range	10-300 m	200 m BLE 100 m (class 1) 10 m (class 2) 1 m (class 3)	Direct line of sight or reflected light	10-100 m (cf. Footnote [3])	Depend on different # of bands
Power Consumption	Low	Low	Low	High	High
Cost Rank	1 (lowest)	2	3	4	5 (Highest)
Data Rate	20,40,and 250 Kbs	1Mbs	>1Gbps	11 and 54 Mbs	LTE: 300 Mbs (DL) 75 Mbs (UL) LTE-A: 3 Gbs (DL) 1.5 Gbs(UL)
Network Topology	Ad hoc, mesh, peer-to-peer, or star	Ad hoc piconents	Point-to-multi point	Point-to-point	Cellular network
Healthcare Applications	Remote sensing and control: disease monitoring, personal wellness monitoring, home monitoring, personal fitness monitoring	Machine to machine (M2M): provide wireless connection between devices	Control medical equipment, automate procedures, and robotic surgeries	Networking, and Internet access	M2M services; monitoring, and tracking patients and devices
Provided Security	128 AES encryption	64/128 AES encryption,	1s and 0s encryption, availability, light does not penetrate through walls	WEP, WPA, WPA2 encryption, access control, authentication, and confidentiality	Authentication, 128 AES encryption
Security Issues	Exploiting the key exchange process, and battery lifetime	Denial of service, secure pairing, scalability, power consumption, and turning on/off the discovery mode	Reliability and network coverage; data in light "stream"	Eavesdropping and malicious attackers	Man-in-the middle attack, user identity threats, and sequence number synchronization

In the field of IoT healthcare, the following communications technologies are used most often [23] (ordering of costs):

a) ZigBee, based on the Low-Rate Wireless Personal Area network (LR-WPAN), is the IEEE 802.15.4 standard. It functions in the ISM (the commercial, science, and medical radio), which is 2.4 GHz, is less costly than Bluetooth. [24].

b) Bluetooth: The IEEE 802.15.1 Standard based on the Wireless Human Area Network (WPAN), used in the 2.4 GHz ISM band, is the standards for short-distance radio frequencies. [23]. [23]. Bluetooth-systems are low-cost (Bluetooth Smart or Version 4.0 +) and low-energy Bluetooth-type (BLE or BLE) is substantially reduced (operating on the cell for "months or years") and targets — among other things — in new medical applications. [26].

c) Visible Light Communication (VLC) is an optical device utilizing light rather than radio waves similar to Wi-Fi [27]. VLC utilizes a TCP / IP Protocol for quick pulse visibility of light from between 400 THz (780 nm) to 800THz (375 nm) for the transmission of data. LI-Fi uses LED lamps for transmitting and receiving information that are fitted to the transceiver and which provide room illumination. The data (1 on and 0, on), when the received signal is translated into digital data, are transferred to the LED and received via photoreceptors. [28].

d) Wi-Fi: There are various Wi-Fi versions, including IEEE 802.11x (Wirelos LAN or WLAN). Wi-Fi is fitted with three non-Interoperable DSS devices, FHSS and Infrared (IR). Wi-Fi users can use a range in three non-interoperability technologies. It provides dot-to-point and multi-point configurations. [29].

e) The "true" 4 G moving communication standard is a major improvement for LTE; the LTE is offering up to 3 times more data rates3 Gbs(LTe-A)[31] and lower data latency[32].The LTE-A should be backward-compatible with LTE[30] and upgradedM2 M services will benefit from existing LTTE networks. LTE-A must be backward-friendly compatible with LTE devices[30]. [30].

2.1.4.3 The Applications IoT Component

Intelligent technologies such as intelligent Home Technology provide users with support and support in the IoT application section! For particular applications this is responsible for data formatting and data flow schemes. Intelligent health systems with new ties to create and manage participatory health information between the natural environment of people with disabilities, their bodies and the Internet. Personally, individual actions can be tracked and statistics collected by removing wireless sensors within the house, towels and personal items, preceding dangerous behavioral abnormalities can be detected and alarms or remote measures can be triggered via suitably appropriate asses.

Production of information is performed in the layer of applications. Cloud and fog computing are used in IoT-based information processing technologies. Using physical input (e.g. RFID, sensor networks), a broad range of data can be created by healthcare apps that can be transmitted to the cloud using an IOT system to make storage, processing and management easy and efficient. [35]. The cloud approach advances health solutions by improved access to and efficiency of healthcare and lowers costs. [36].

2.2 HEALTHCARE AND IOT

IoT-based technology has already been used by many consumer appliances. Many people plan to turn to healthcare. The way we live and work is transformed by IoT technology. In addition, many aspects of our lives, including health care, will change. Many health-care apps now provide the opportunity to schedule appointments for patients on cell phones, smart devices, etc,

2.2.1 General IoT in Healthcare

In IoT medical info, insights into smart patient care are translated. Health care in technology is rapidly advanced and anything related to stuff. In healthcare, IoT is therefore so critical. Through using devices such as connected sensors and other objects, all details can be worn in the cloud and doctors can monitor the patient in real time.

IoT will enable lifesaving applications in the healthcare sector through the processing of data from bedside equipment, the visualization of patient details and a real time diagnosis of the entire patient care system (see figure 2.2). Many medical devices work worldwide today, which can lead to data loss and diagnostic errors. The data collected was stored in the cloud for this reason.

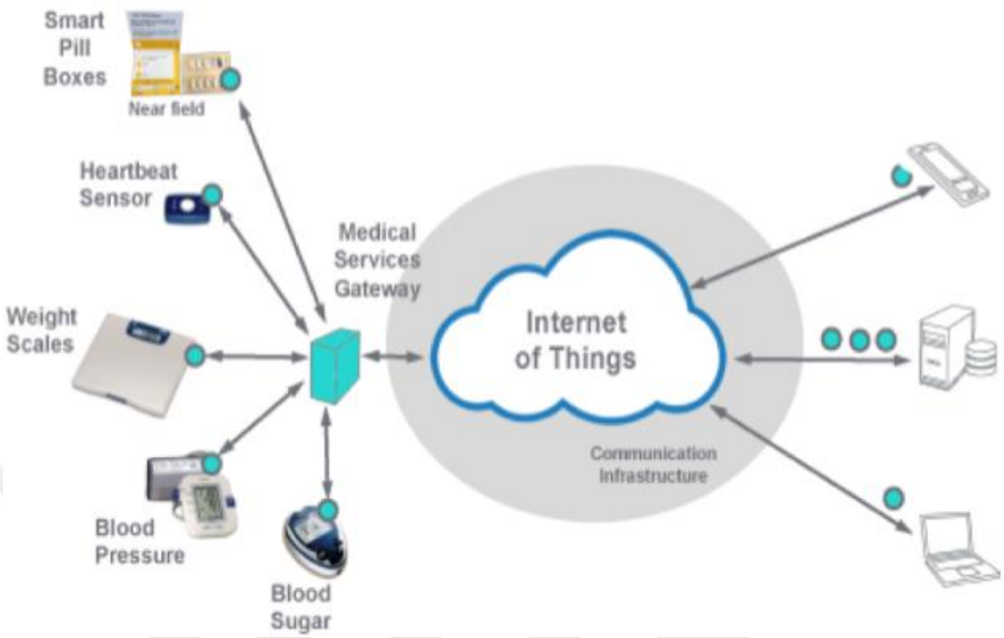


Figure 2.2: General IoT in healthcare [39].

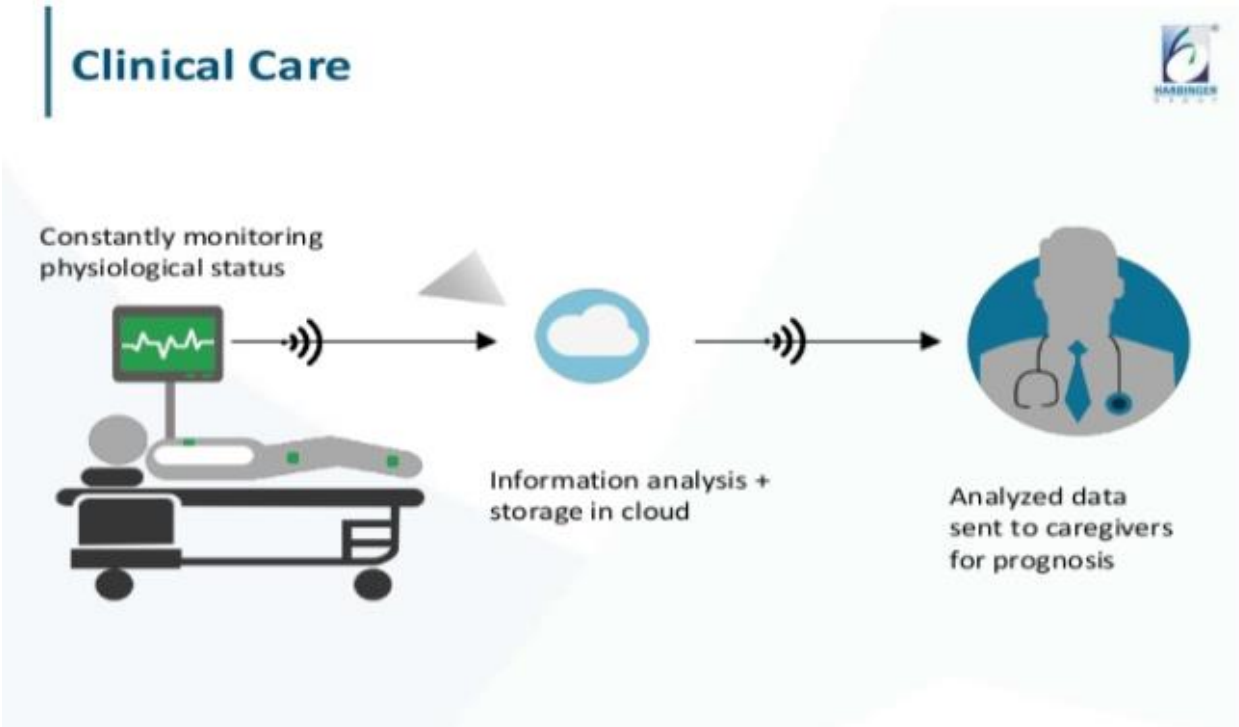
Patients or physicians can easily monitor, manage and save valuable minutes on a daily basis. The health care provider or physician makes a remote diagnosis and tracks the medical assets without being needed to visit every patient manually. The proper department of the hospital can be located with sensors and Wi-Fi when gathering sensual details.

2.2.1.1 Clinical Care

The patient is continuously tracked by using the IoT-driven sensor. The patient must be vigilant because of its non-invasive physiological status. The state of the patient is tracked using the gateway to collect the physiological details of the patient. The knowledge collected is preserved in the cloud [40].

This information is then wirelessly forwarded to careers / doctors, as shown in Figure 2.3. This enhances the quality of health care and reduces patient costs. [40].

Figure 2.3: Method in which physiological status is continuously monitored [41].



2.2.1.2 Remote Monitoring

In remote monitoring systems, general IoT monitors critical signals for a patient in real time and answers if patient health issues arise. As shown in Figure 2.3, a computer is connected to the patient. It transmits data from the patient's position on the vital signs. A telecommunications network links the sender to the hospital [40]. The hospital has a remote instrument to read the patient's vital signs. When the sensor is implanted into the patient's body, the data can also be transmitted electronically. The data will be passed securely to healthcare workers.

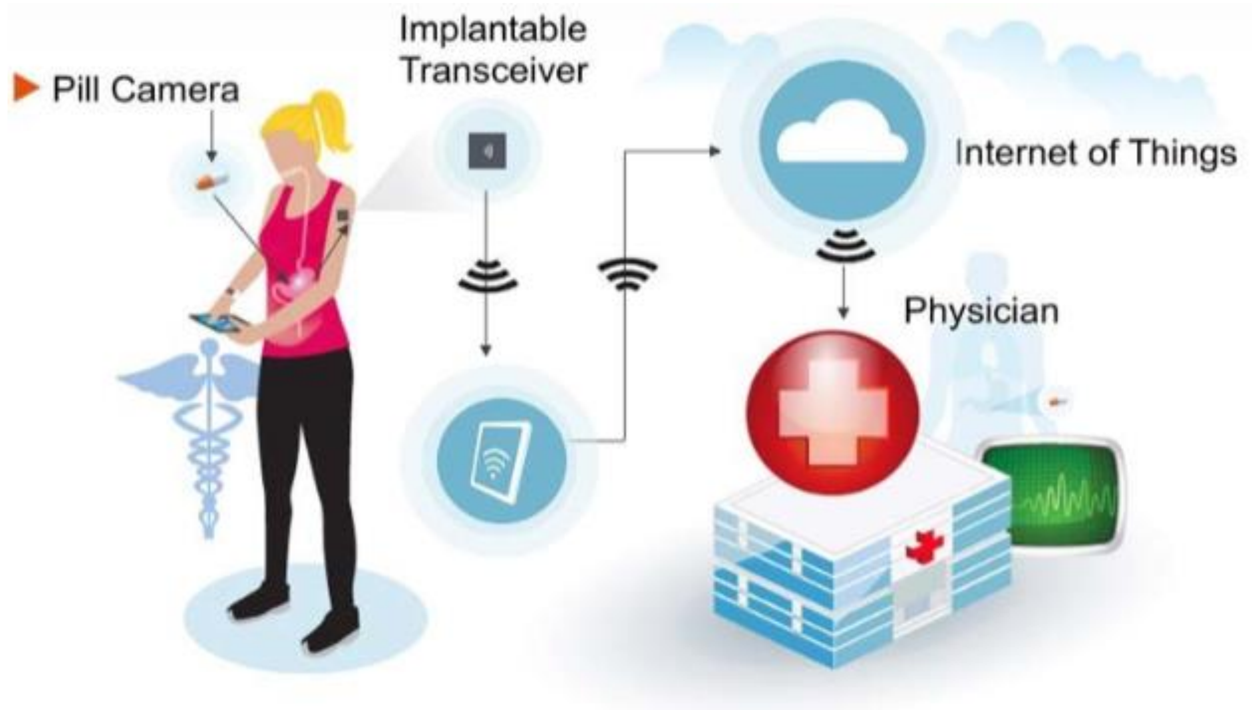


Figure 2.4: Remote health monitoring system [40].

2.2.2 Applications for IoT in Healthcare

- Blood Pressure Monitoring

One of the most relevant physiological parameters of the human body is blood pressure (BP). Blood pressure monitors are now popular in the safe and easy to use [42]. As the healthcare system progresses, Medical devices / systems are linked to the IoT device or sensors that enable patient-doctor communication. The IoT sensor connects an electronic blood pressure monitor that collects real-time BP patient data.

- Rehabilitation System

A recovery system can boost and restore mobility for the people with a certain impairment and can improve quality of life in order to minimize the issues associated with elderly and the lack of health experts [40]. There is an intelligent recovery framework focused on the group that offers efficient care. A process based on ontology in the design of the intelligent recovery system based on IoT can be used to easily communicate and distribute medical services according to patient requirements [43].

- Oxygen Saturation Monitoring

The pulse oximeter is a tool to constantly monitor the patient for saturation of blood oxygen [40]. Communications innovations have made various advancements, such as wireless networks and medical sensors are currently booming due to low energy consumption and low losses. Continuous pulse oximeters for oxygen in the blood and also for heart rate (HR) are used in many medical applications. The IoT sensor attached to the patient monitors and measures the patient's cardiac rhythm and oxygen level. [44].

- Wheelchair Management

Whoever has a physical impairment or is unable to walk and other bodily conditions uses wheelchairs. Smart objects can be connected via the Internet by Wireless Body Networks, which are a sensor for wheelchairs to use as a people-centered sensor device. Pressure coil (the resistive pressure sensor) will be present to detect the fall of the human body from its wheelchair. An intelligent wheelchair has a sensor to accelerate the wheelchair [45]. The doctor / patient can monitor the patient's information from the hospital continuously.

- •Smartphone Healthcare Applications.

For health care practitioners (HCPs), clever technologies and healthcare equipment deliver various advantages. There are now numerous medical applications available and ready to use in many ways, Health records, time and information, contact and physician consultation, ongoing patient monitoring and good clinical decision-making [46]. The use of mobile apps and sensors has increased treatment and access to care and improves performance for patients.

2.2.3 Challenges for IoT in Healthcare

•Protection and privacy: I could have several possible consequences, which could lead to hackers or hackers of devices that are connected to them (connected devices such as smartphones, sensors etc.). [47]. Whenever data is sent to another device, it must be encrypted.

•Integration: Another obstacle to incorporate effective IoT in healthcare is incorporating several devices and protocols into the network. The network actively collects data is linked to a large number of smartphones. There are also numerous communication protocols, which complicate the information collection process.

•Technology adoption: To develop a software application that provides creative ideas for doctors and patients not necessary to pay for new technologies. The expected product should also be monetized inside the healthcare system.

2.2.4 Advantages of IoT in Healthcare

• The IoT-connected devices and decision-making processes are easily based on thorough analysis that eliminate errors.

• Patient tracking is conducted in real time, eliminating unnecessary clinic visits substantially while also eliminating hospital stays, respectively. This will lower patient costs. [48].

•Linked health care helps patients to access details in real-time as the patient is tracked on an ongoing basis and decisions made accordingly. This will support to provide prompt care to enhance the results of treatment.

2.3 RELATED WORK

Recent developments have opened up great possibilities for creating an adaptive and smart ecosystem in healthcare systems. Sever form of important signs, including heart rate, body pressure, temperature and oxygen level, is measured by various sensors., in particular in the field of health and medicine. Several health and IoT health conditions were discussed by researchers. Researchers. This section describes health system research using various sensor networks.

A detailed analysis of the use of IoT in healthcare was addressed in [49]. They have discussed in this paper several approaches and the challenges IoT faces in healthcare in IoT systems. A technique for the prediction of wearable medical devices for chronic disorders has been explored to put smart health applications wherever they are used.

In [50] the idea for a real-time, clever monitoring system was made to intervene in the programming of sensors in an IoT-enabled healthcare system. There are several sensors with a fixed bandwidth linked to a local data processing unit with a shared channel. Many sensors have a broad range of access criteria for channels. The access to the channel should be discrete, in order to use the necessary bandwidth and delay in the shared channel for the sensors used by the intelligent health surveillance system. A plan technique has been developed to solve this problem for an IoT based device that removes the interference between different sensors and reduces the loss of data.

[51] In intelligent health systems, an IoT-aware architecture has been suggested. The introduction in hospitals and health institutes of an intelligent IoT-aware system for automatic patient monitoring and tracking. A Smart Hospital System has been developed based on different technology, in particular RFID and WSN. A HSN with 6 LoWPAN nodes that integrate UHF RFID functions will allow SHS to collect both environment and patient physiological parameters in real-time. The data sensed is transferred to a control center; this can be easily accessed by locals and remote users through REST web services via an advanced monitoring program (MA).

[52] implemented an IoT based intelligent recovery system. A have ology-based automation design approach is proposed in this research for the intelligent recovery system using IoT technology. Wireless Internet and other technology such as short-distance RFID, special identificatory (UID) technology and GPS (Global Posing System) technology are used in the recovery system. The architecture for service-oriented applications for the design, implementation, management and other types of healthcare services is developed. Any patient receives successful care after developing and implementing the IoT recovery method, and the two recovery techniques are correctly diagnosed. More than one patient is treated with this device.

In [53], a wireless device was proposed and identified for remote monitoring of oxygen saturation and cardiac rates. The pulse oximeters are used to measure the blood level of oxygen as well as the patient's heart rate. The calculated data is then transmitted via a WSN to a central monitoring station. The patients are continuous monitoring and information on the patient's oxygen saturation level and heart rate through the WSN is collected from the central monitoring station. If there is a problem, an alarm is automatically triggered. To show patients' results and measurements (data), a graphical user interface is created (GUI).

In [54], a secure, body sensor network IoT-based healthcare system was proposed. It operates by means of an IOT-based public communication network via BSN architecture to achieve device efficiency and transmission robustness. The use of the strong crypto primitive for two communication systems, one for confidential transmission and one for authentication between smart objects, the local handling device and the sensor backend. With the Raspberry PI Platform, the health system is introduced to show how realistic and feasible the mechanisms are.

In [55] a management framework is implemented for IoT-aware healthcare. A prototype is submitted to incorporate an IoT-Aware healthcare surveillance device, lowering healthcare costs and rising the need for advanced treatment. It warns you in real time about the patient's health if there is a problem and if there is a need for medical treatment or hospitalization., can construct an ad hoc extendable health monitoring system during runtime.

In [56], a wearable device-based solution with a reference system for the position heading was proposed to provide an Infant health check solution. The authors suggested a concept to monitor childhood through wearable device and camera to minimize infant mortality and accident rates. This model used the AHRS to calculate the location of the child and used multiple biometric sensors. Parents can therefore observe the health of the child.

The prototype device suggested by R. In an effort to include more mobiles for tracking cardiac problems, S. B. Rosli aims to identify cardiac diseases for patients [57]. The ECG signal is then analyzed by an Arduino TM to assess the heart rate with a pulse sensor. The user is alerted through a text message if it is outside the normal range. For communications between the phone and ArduinoTM, the Mobile Global System (GSM) module was used. Second, the user defines a "natural" range for the minimum and maximal heart rate. This range then passes to ArduinoTM via text to set a threshold. A sensor retains the user read data before the "Stop" text message is received. Only if the heart rate falls out of control is the user told with a text message.

G has developed a smartphone-based framework. Real-time monitoring and detection of heart failure by Wolgast [58]. A single lead heart monitor was used to send and receive data to and from the smartphone-based AndroidTM application with an ArduinoTM microcontroller, LE Bluetooth system and antenna. The main aim of this research is to examine and view the communications aspects in the most efficient manner with minimal noise. There are two modes for the AndroidTM application: one for displaying the ECG and the other for showing the intensity of the signal. The authors state that the device can provide a noise free signal with high precision to the smartphone and that the ST section only requires more software development for predictions of heart failure.

A. M and Dewan. Sharma suggested a hybrid algorithm that could be based on previous reports of cardio myelitis based on unknown patterns and other data related to cardio myelitis [59]. The main aim of the proposed method is to use data mining techniques and to make decisions about predictions of heart disease based on what is already stored in the hospital. One system suggested by M. In order to monitor heart condition, Koshti uses IoT-based devices [8]. With body worn sensors, the proposed device then sends the data to remote locations via ZigBeeTM modules and monitors and graphs the received data on a serial link on a computer. This device makes it hard for patients to monitor data in real time because computers are not so portable, unlike highly portable smartphones. It integrates wireless IoT devices for cardiac monitoring and heart attack prediction, which connect to smartphones and has a unique design.

The job of D. S. Medhekar uses the Bayesian classification to predict heart attacks and uses the Naïve Bayes algorithm to provide an input for an unknown data set. It operates in two levels. Second, the training process in which models and classes were developed using a database from the Cleveland clinic. Details on diagnosis of heart condition. The following is the test step when a probabilistic algorithm predicts that the entry is high, medium or low risk following a training sequence. [60]

P. Jambhulkar and V.Baporikar suggested the use of a system for predicting cardiac problems, by collecting broad data from the databases of Cleveland cardiac diseases, and by comparing various algorithms, classifying methods used on the collecting datasets[61], using the Data Mining (DM) and the Wireless Sensor Network (WSN). The most reliable approach for this method was found in Naive Bayes this study. In predicting the results on the ground of large data using probability theory it conducts more advanced classifications. The authors then suggested that WSN gathers many patients, and transmits them to a central system, in real-time. MATLABTM is then used to extract features required to predict heart conditions from data sets via MATALBTM using a DM technique. The device suggested does not use the smartphone and is not therefore a device for all users. The device may be used in the surveillance of patients by a hospital or cardiologist. A M device based on a smartphone. Raihan was developed with clinical data and data mining techniques to prevent heart failure. The mobile was used to build an AndroidTM application to collect information from the user. As an input to the application no sensors or real-time data are used. A consumer is asked to enter information in the form of answering questions such as age, precedents or other health-related details. These data are measured and interpreted by the application for the probability of a heart to be determined. For each user's data, a score is determined. The risk score is then estimated and presented to the user with a Chi-Square correlation, the exact test by Fisher and probabilistic techniques [62].

The University of Turku, Finland [63] is also undertaking further proposed work on the prediction of a heart attack. Their device will only use the gyroscope sensor on smartphone to anticipate heart attacks. The smartphone is located on the patient's chest and by a sensitive, embedded sensor, when blood flow to the heart muscle is disrupted, it can detect micro-movements. If baselines of the patient are reported before the heart attack, the proposed system would have an accuracy of 70%-90%. Table 2.3 offers a clear comparison of our system with other previously mentioned similar works demonstrating that our system is special.

Table 2.3: Comparison of our system and other related work

	IoT system	Has monitoring capability	Has detection capability	Prediction system	Low Energy system	Real-time system
Rosli' 16	N	N	Y	N	N	Y
Wolgast' 16	Y	Y	Y	N	Y	Y
Dewan' 15	N	N	N	Y	N	N
Koshti' 15	Y	Y	N	N	N	Y
Medhekar' 13	N	N	N	Y	N	N
Jambhulkar' 15	Y	Y	Y	Y	N	Y
Raihan' 16	N	N	N	Y	N	N
Our System	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**

2.4 CONCLUSION

Several aspects of the Internet of Thing (IoT) were discussed in Chapter two. Beginning with the Internet of Thing concept, the chapter dealt with IoT, the secret to IoT implementation. An IoT health system architecture, which consists of three perspectives, namely network-centered IoT, cloud-centered IoT and data-centered IoT, is explained in detail.

3. PROPODED SYSTEM

Research indicates that about 2000 deaths per month are due to the single carefree nature of their wellbeing. Since they have no time to get away from their health management because of their heavy workload. An increasing interest was shown in wearables, and a range of devices are now commercially available for personal health, wellness and activity awareness [3]– [4]. Researchers have considered applications in the field of niche recreational fitness for current devices such as Internet of Thing (IoT) to provide long-term recording, management and clinical availability for physiological knowledge patients [5]— [6]. IOT is a technological breakthrough to link objects via the Internet; In order to collect and send data on objects to other locations via Internet for storage and analysis, IOT is a global network concept that can be used in all environments. The definition of the Internet of Things by Forben magazine means things which interact with the Internet by using sensors, microcontrollers and communications transceivers, which is built with appropriate protocol stacks that enable them to interact and communicate with each other and therefore become an essential part of the internet. The internet now affects many aspects of the daily life of the potential user. IoT is a very dynamic distributed network consisting of many objects. People provide most of the content and information on the internet, while IoT provides information for small objects. IoT apps include smart home, medical IoT, farm IoT, smart distributors, energy use, connected cars, industrial internet, smart supply chain and many more.

IoT Healthcare Technology has a wide range of potential applications, such as remote monitoring and health integration, to revolutionize the medical industry for the coming decade. In developing health information systems, IoT-based healthcare systems play a major role in. Healthcare dependence on IoT is increasing daily to improve access to healthcare, improve quality of treatment and eventually reduce health care costs. An improved healthcare regime should address real-time health monitoring and early detection and provide home-based care in lieu of expensive clinical care [7].

In healthcare and the prediction of different diseases using various techniques, many researchers have suggested different IoT models. This section concentrates on the same area. The main purposes of this chapter are the development of health surveillance systems, i.e. body temperature and heart rate measurement, to design a system that can store patient data over time through database management. to evaluate sensor data collected.

3.1 SYSTEM OVERVIEW

All these developments are integrated into our system. In addition, our system is low cost and can be implemented very easily. For maintaining patient data, we use a local server. Furthermore, the collected details of the sensors attached to the body of the patient are also sent to the mobile phone registered in the GSM module. The sensors used in our model are low-cost. The data are picked up directly on computers that reduce people's power. We use a cheaper Arduino than raspberry pi. The proposed system consists of a microcontroller (Arduino), a NodeMCU, a heartbeat sensor, a temperature sensor and a high definition camera for blood group detection purpose. In our proposed framework, the heartrate and body temperature are automatically sensed, the readings are recorded continuously. Finally, after processing the collected data, these data are sent to the server through the existing Local Area Network. The doctors can check the health condition parameter through a web application developed using PHP. This framework can also detect the blood group from the blood sample by using the image processing algorithm.

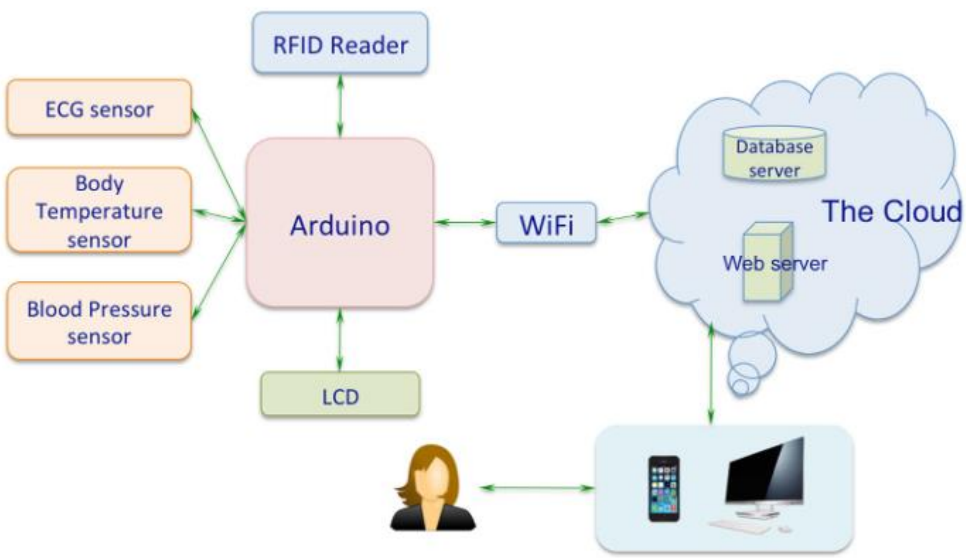


Figure 3.1 : PC-connected sensor block diagram.

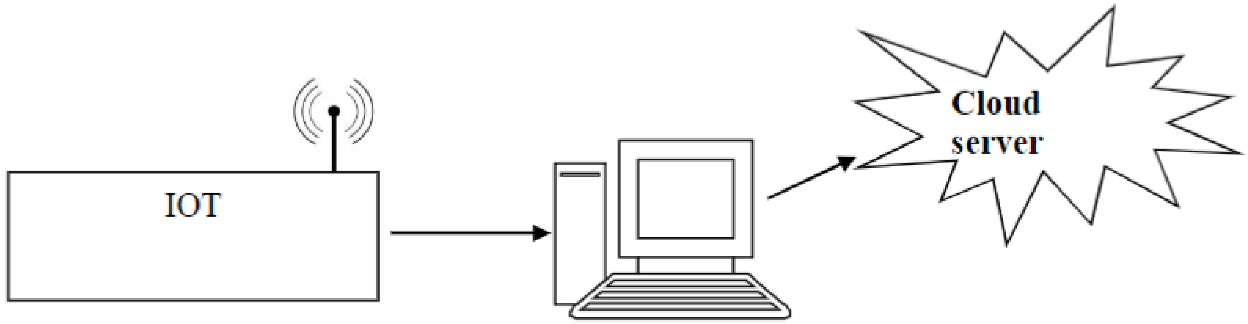


Figure 3.2: Monitoring Section

This health care system is the whole system which makes consumer and healthcare provider full contact. Glucose sensor, temperature sensor and ECG sensor are used for this system eye blink sensor. You can sense the body parameter according to your purpose and then we can process the data with the help of a microcontroller. These devices are given a detailed description and function below.

(a) The pulse rate sensor: The ECG-signal is collected by the pulse sensor that is interpreted by an ArduinoTM for heart rate determination. The user is notified by a text message if it is beyond the usual range. For communications between the phone and ArduinoTM, the Mobile Global System (GSM) module was used. Second, the user defines a "natural" range for the minimum and maximal heart rate. This range then passes to ArduinoTM via text to set a threshold. A sensor retains the user read data before the "Stop" text message is received. Only if the heart rate falls out of control is the user told with a text message.

(b) The ECG sensor ECG records the electrical activity produced through the depolarization of heart muscle that spreads to the skin on pulsating electric waves. The electricity is actually very tiny, but ECG electrodes attached to your skin can be reliably collected.

3.1.1 System Interface Description

Communication is an integral part of IoT since it is connected to data, processing and the user synchronization. For the patient's well-being and for the effective treatment of the doctor efficient communication is vital, and therefore must be handled precisely and precisely. In this paper the contact with our sensor is basically wireless in addition to analog data collection, taking into account patient mobility. We are more likely to use the internet to inform the physician of the patient's facts, and therefore internet contact is one of the most critical aspects of the proposed system as shown in figure 3.3. We would use the very best way, starting from raw data and finishing on our website, in which the doctor will access processed data. The process begins with sensors, which collect the patient's data and serial send the data to the processor via cable. This process involves the ECG sensor. It is transmitted as a data stream that literally reads the voltage and is read easily by our Arduino based microcontroller ATmega328. Our Arduino will serialize the data to the ESP8266 WiFi module in the next phase. As the interface between our raw data in electric signals and data over the Internet in our project, the ESP8266 acts as an essential communication interface. We successfully transmitted our data to the internet after this phase and justified our "Internet of Things" issue. Software and data, we have sent over the internet are the following steps: The data will first be visualized on the Web server sent to and saved and processed by ESP826 6 and will then be submitted for review by the user (in our case, the doctor). This sums up all our notification process for the doctor, who then gives the patient the best opportunity to become healthier with his expertise. [4][5].

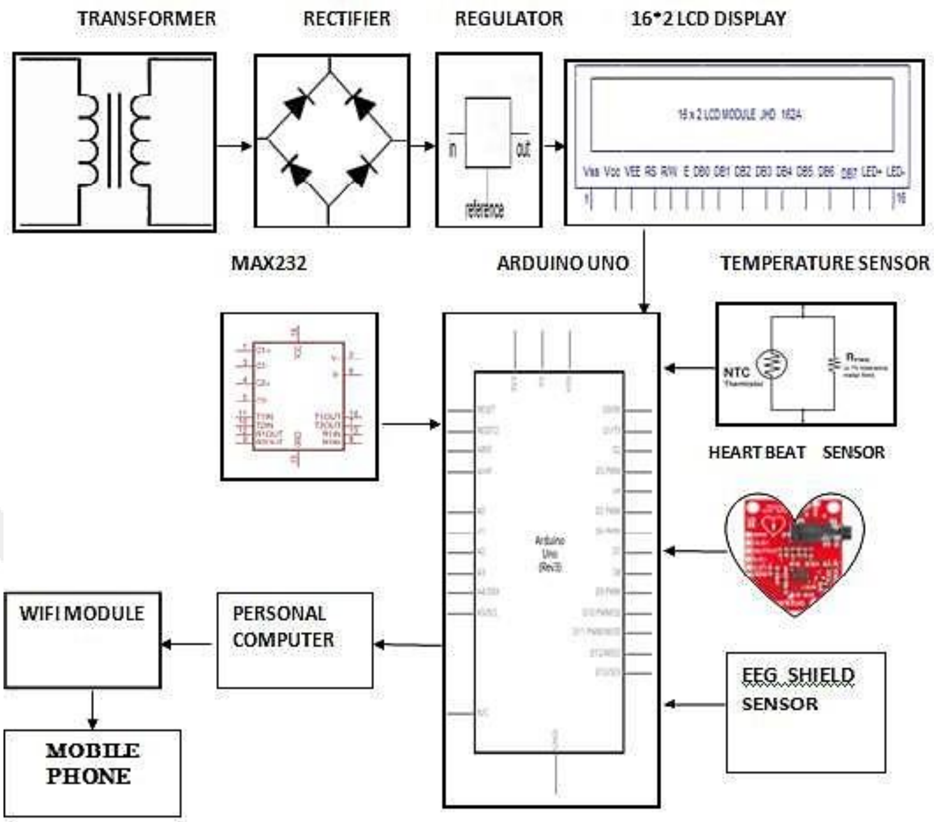


Figure 3.3 : Health surveillance system block diagram.

These subjects are of great importance to Freescale in designing and developing integrated technologies for the use of IoT-based health systems, including:

- Patient data-gathering sensors.
- Microcontrollers processing, analyzing and transmitting data wirelessly.
- Microprocessors that allow rich graphical interfaces for users.
- Health gateways for the further analysis and transmission of sensor data into the web server.

3.1.2 Architecture of physiological data acquisition system

This section describes the system architecture, data transfer and cloud processing, of physiological data acquisition systems. As shown in Figure 3.4, the hardware part includes the main part of the hardware of the Arduino Uno microcontroller. Hardware part contains the main system controller Arduino Uno. Different physiological parameters of the human body are used as bio monitors to feel: cardiovascular sensors, electric sensors, GSR sensors, and temperatures. The ESP8266-01 Wi-Fi system is connected to the internet. Arduino Uno is connected to bio sensors and other sensors to human body are connected to Arduino Uno's Web server via the Wifi module ESP8266-01. Arduino has a 16 * 2 display for the visualization of patient health data. On the other hand, a web application for collecting bio-sensor data is used in Software Part. The medical systems also contain historical patient health data, enabling physicians to thoroughly analyze medical data under critical conditions of the patient's health. The data is collected in the web application and shows patient physiological information.

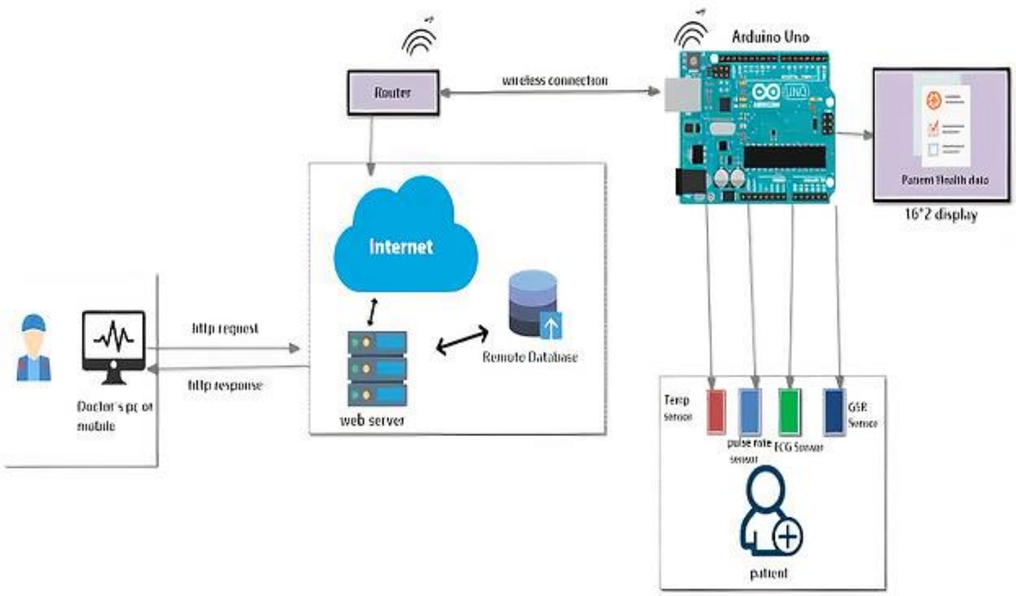


Figure 3.4: System Architecture

3.1.3 Methodology

The process begins with the sensors, which collect the patient data and send it serially via cable to the processor. It is transmitted as a data stream that literally reads the voltage and is read easily by our Arduino based microcontroller ATmega328. In the following stage our Arduino transmits data serially to the ESP8266 Wi-Fi module. ESP8266 is important for our project because the connection between our raw data in electrical signals and the data over the internet is an important communication interface. We successfully sent our data on the Internet after this move and justified our theme of the "Internet of Things (IoT)".

3.1.4 Hardware Modules

In this section, several described hardware devices for the development of a health monitoring system based on IoT.

3.1.4.1 Arduino Uno

The Arduino Uno is a microcontroller board based on ATmega328. This involves 14 digital output / input pins (6 of which can be used as output PWMs). It contains 6 analog pins (A0 to A5) and a crystal oscillator with a capacity of 16MHz. It contains all you need for microcontroller support; it is easily powered to a computer with USB cable through an AC-to - DC adapter or battery.

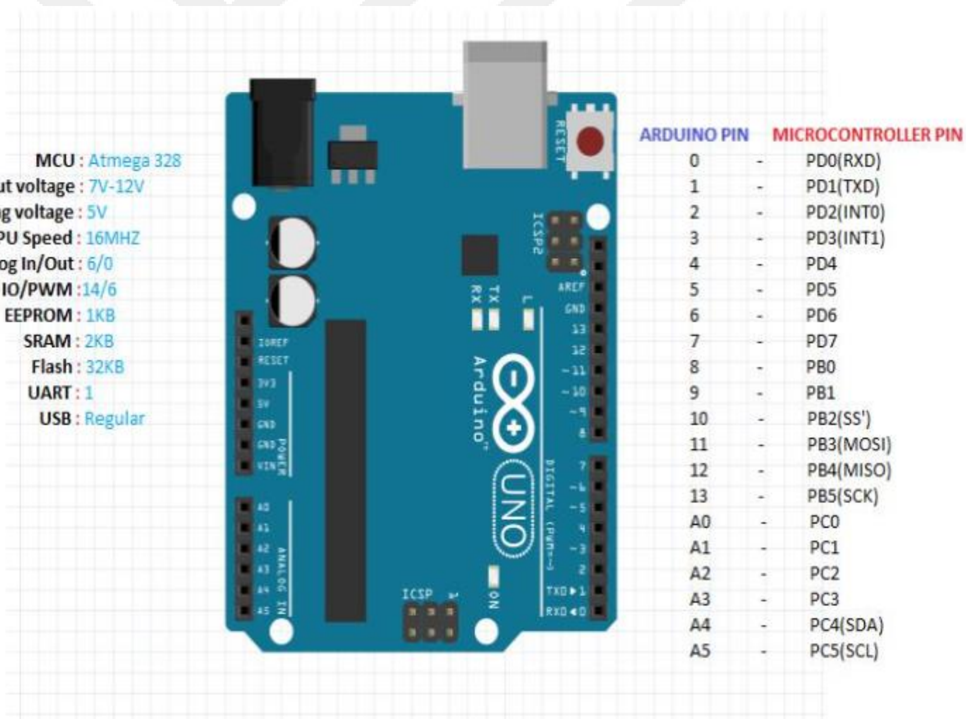


Figure 3.5: Arduino uno microcontroller

3.1.4.2 Pulse rate sensor:

The pulse rate sensor is a heart rate measurement device. Essentially it is an integrated, noise removal and optical circuit booster. Specifications: 3.3V – 5V voltage, 4mA current, LED indicator.

Figure 3.6: Pulse rate sensor

3.1.4.3 Body Temperature Sensor

The optical thermometer DS18B20 has a temperature of 9-12 bits Celsius. A 1-wire bus, which only includes one data line (and ground) for communication with the microcontroller. The DS18B20 can also directly extract power from the data line.

Figure 3.7: Body temperature sensor (ds18b20)

3.1.4.4 ESP8266 Wifi module

This small module enables a Wi-Fi system to be connected to microcontrollers and to create basic TCP / IP connections using Hayes-style instructions. The ESP8285 is a 1 MiB built-in ESP8266 which takes one-chip gadgets suitable for Wi-Fi connectivity into account. The following chips are followed by the ESP32.

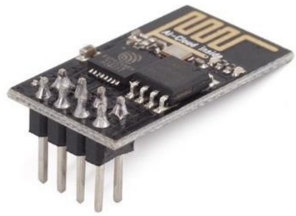


Figure 3.8: ESP8266-01 wifi module

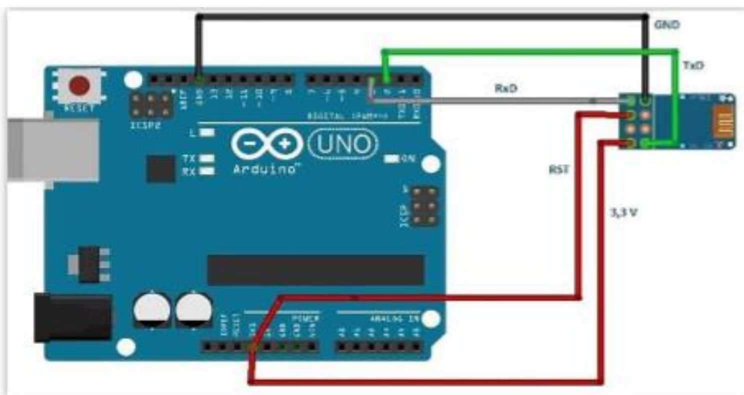


Figure 3.9: Connection Between Arduino UNO And ESP8266 Module

Figure 3.9 illustrates that TX and RX pins of ESP8266 module are connected to the digital pin number 2 and 3 respectively in Arduino Uno. The power is provided for ESP8266 module via the VCC 3v and GND pins from of the Arduino Uno.

3.1.4.5 Gateway layer.

A router-based network that routes the traffic from the microscope to the appropriate cloud is the gateway layer. It is obvious that this layer can contain single or multiple hops when public cloud is used and is fixed on one router in the proposed template.

3.1.4.6 Network Layer

The network layer is used to store sensor data with Ubidots and allows users to have remote access or even patient mentoring from any computer. The monitoring takes place with the help of a wireless smart phone linked to the Ubidots.

3.1.4.7 Data Acquisition

The essential components of the data acquisition unit are AD8232 chip and three adhesive electrodes terminals pointed as R for the right side, L for the left side and COM as aground as shown in Figure 3(a)The main task of theAD8232 chip is extracting, amplifying, and filtering the small signals of the heart electrical activity when a noisy condition occurs due to motion or remote electrode placement. Signal conditioning is achieved using a bipolar point high pass filter which is coupled with the instrument amplifier structure. The AD8232 chip contains a nonoperational amplifier that creates a three-pole low pass filter as well as reducing the additional noise. You may reduce the long high-pass filter to detect the long-distance tail phenomenon. AD8232 will be automatically set to a higher filter cutoff status when the amplifier signal mutations (such as the lead out of the case) have been generated in the right-side driver (RLD) amplifier and other conductor lead applications. The AD8232 can achieve fast retrieval, so the leading relation to the object measurement can be obtained as easily as possible after the value measurement. The Arduino Uno microcontroller AD8232 can be connected as shown in fig.3.10.

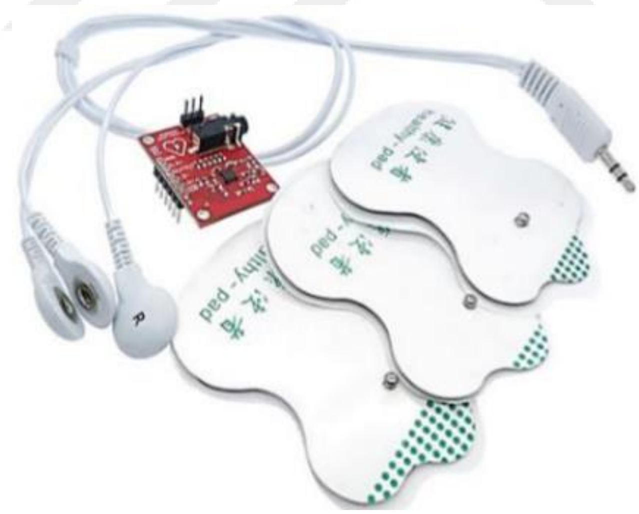


Figure 3.10: AD8232 Module

3.1.5 Software Description

Various software tools used to design the IoT based health monitoring system are described in this section.

The PHP and the SQL language of the user application is phpMyAdmin and the health-related data are forwarded via the Internet to the server. Details can be easily accessed online through proper patient authentication and health monitoring.

We can also find a tool for composing code, a message area, text console, a toolbar with standard catch-up and menu progression in the Arduino integrated development environment (or Arduino IDE). It involves the transfer of programs and speaks with the Arduino and Genuino equipment. Sketches are known as composed projects using Arduino Software (IDE). These images are composed in the content tool and are not included in the record extension. (.ino). The content is highlighted in the proofreader and is cut / bonded and search / suppled. In sparing and trading, the message zone is critical and also shows errors.

The title says that the result of the intelligent health monitoring system is extremely useful for both patients and doctors. The patient can monitor his health from home and visit hospitals at any time only when he or she really needs to be able to.

This can be done by using our system, the results of which are available online and from all over the world. From everywhere. Since this model is a prototype, our system shows and emulates nearly real-time values of different health parameters in the real world. Doctors can also study the effect of medicine and other such matters using the record of the patient's body.

3.2 SYSTEM DESIGN

Systems design is the process by which a system is defined to meet specified needs by architecture, components, modules, interfaces and data. The overall architecture of the product, the subsystems comprising the product and the way processor subsystems are designed. UML is used for designing the device. The standard object-oriented research and design language is Unified Modeling

Language. Using the diagram of the case and the series diagram, which are UML graph forms, below:

3.2.1 Use Case Diagram

A diagram of a case requires a number of elements and their connections. It outlines all communications situations for users and other external mechanisms to achieve application goals. Participants, cases and their relations are the key components of the diagram. The application is an external view of the system , showing how the user performs a task. The users who communicate with the program are participants.

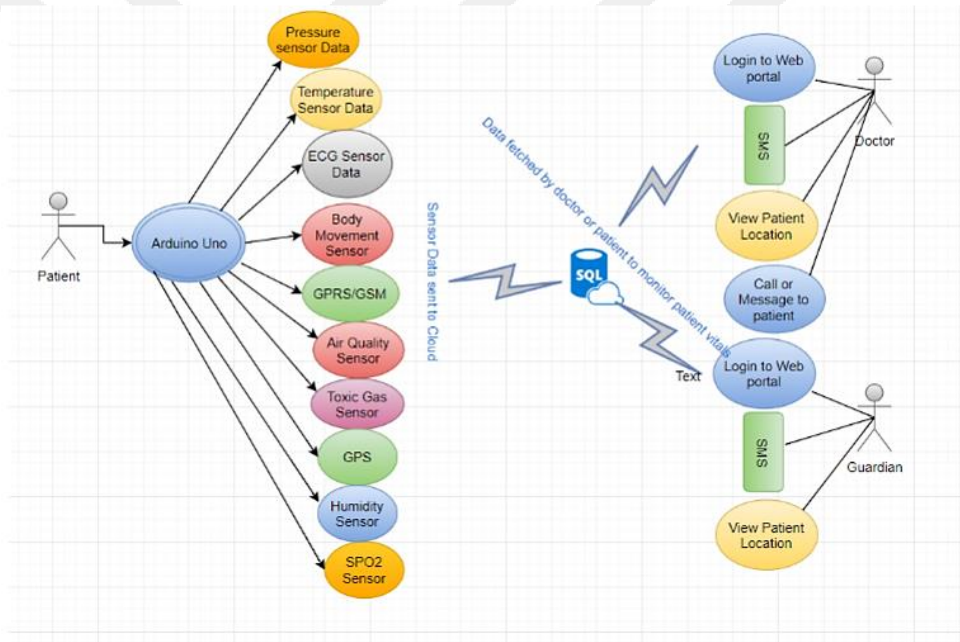


Figure 3.11: Use Case Diagram

Actors: Patient, guardian and doctor are the system's actors.

Use cases: We defined a set of use cases based on the application's functionalities and objectives.

• Login-This case of use indicates a series of acts that Subject to login in.

• This case outlines a series of procedures that the practitioner would use in the case of medical emergencies to call the guardian or patient.

• See location- This case demonstrates a sequence of actions the guardian or doctor wants when specifics of his or her location are collected.

• Messaging- This application case demonstrates some steps the doctor must take when a matter of emergency sends a message to the person's guardian.

3.2.2 Sequence Diagram

Series diagrams visually model your system's logic flux so that you can both register, verify and use your logic for research and design purposes.

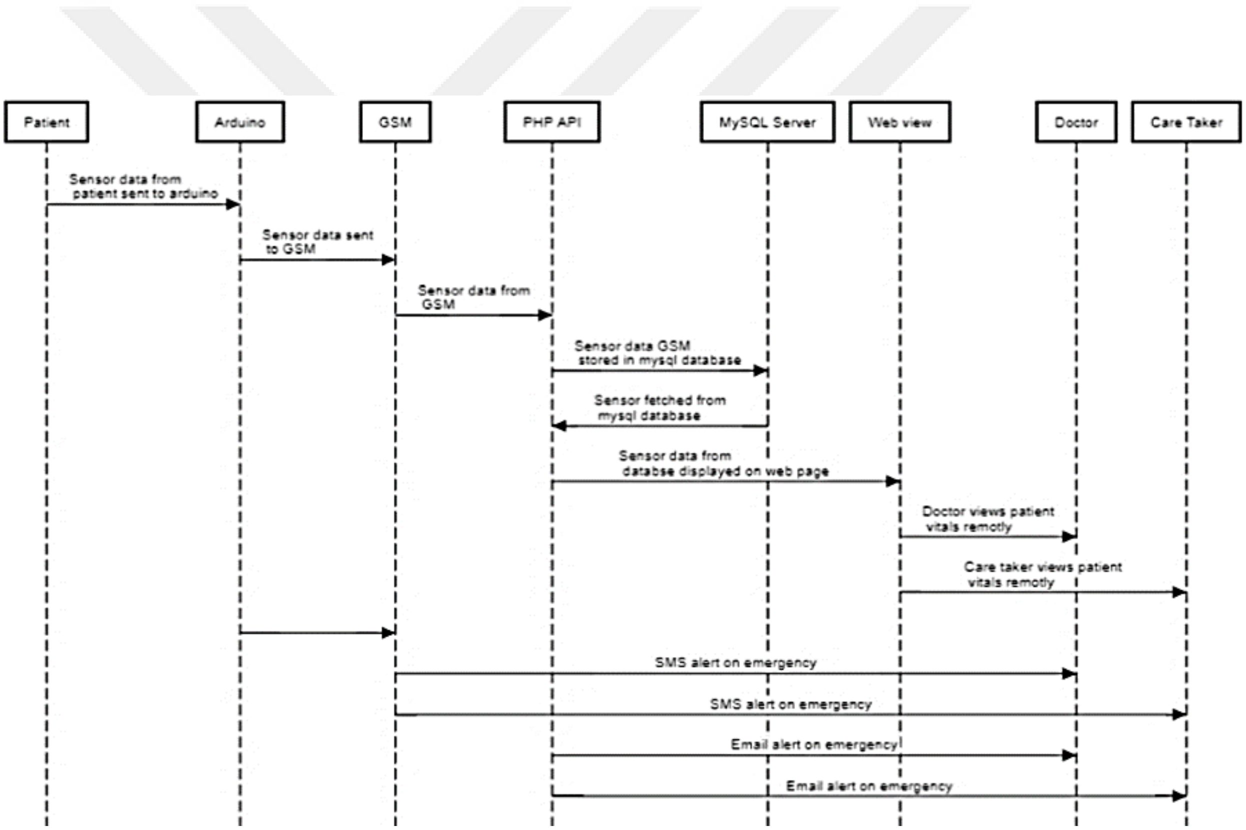


Figure 3.12: Sequence Diagram

3.3 DATABASE DESIGN

MySQL is the SQL Database Management System with the most common open source connections. MySQL is one of the best RDBMS for the creation of different web-based applications. The MySQL AB, a Swedish corporation, creates, sells and supports it. A reliable, cost effective and business efficient MySQL database service is offered by Oracle MySQL Cloud Service. Based on my SQL, it offers easy, automatic, integrated and enterprise-ready cloud service to help businesses enhance business flexibility and minimize expense. Oracle Cloud supplies the MySQL Business version. In this project, we have used a MySQL database with two tables. A table stores the patient's longitudinal and latitude sensor data and stores them.

3.4 DATA COLLECTION

ECG and Accelerometer data are to be collected for a number of patients, different age groups, and genders. Data is also collected for different activities for healthy test subjects. This allows us to look at the different patterns of the ECG signals and body acceleration data. The following subsections show the methods by which these data are collected.

3.4.1 ECG Data Collection

3.4.1.1 Using IoT device

Figure 4.1 shows the flow for ECG data is collected using the IoT device. First, when the electrodes that are attached to the body read the analog signal, this signal passes to the ECG acquisition device that has a built-in amplifier and a filter. Furthermore, a software-based amplifier and filter could be implemented to enhance the signal even more. The signal is passed to the Arduino used as an ADC, only then, sent to the AndroidTM mobile application using a LE Bluetooth device to be later graphed and analyzed on the smartphone.

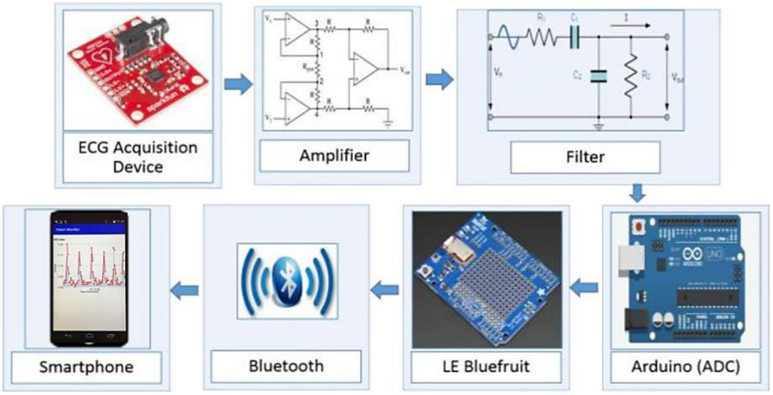


Figure 3.13: ECG Data Collection using IoT

The above architecture was initially used to collect data for a number of test subjects as seen in Table 3.1, none of which were diagnosed with heart problems.

Table 3.1: ECG collection details

	Height	Weight	Age	Testing scenarios
3 Females	5'5-5'7	120-180	20-34	Sitting ,Walking
5 Males	5'5-6'1	128-185	23-26	Sitting, Walking, Jogging/Exercising

The usage by users of our IoT system can be found in Figure 3.13. The user first powers the device using the cord, then wraps the brackets around its arm, fastens the red lead to the right part of the abdomen, the black leads to the right part of the chest and the blue leads to the left part of the chest.

3.4.1.2 Previous Stored datasets

In the future, ECG data can be obtained from hospital databases after taking the necessary permissions since the hospital has large sets of data for healthy and non-healthy test subjects diagnosed with heart disease. Large datasets like the ones at the hospital are helpful in testing our prediction algorithms offline. In addition, datasets can be obtained from databases of Cleveland, Hungary, Switzerland, and the VA Long Beach that are provided by UCI Machine Learning Repository [16]. Many different DM techniques and machine learning algorithms can be used to help create decisions based on archived datasets.

3.4.2 Accelerometer Data Collection

An accelerometer is available on any smartphone with data for the three axes. We assume that the smartphone is in the user's pocket. Data is collected internally, then graphed in real-time to give a good visual representation for the user. The numerical values can be easily displayed. Data obtained for each axis include the gravity component. So, to obtain the actual body acceleration, the gravity component is first removed prior to data representation. Acceleration data will only be considered and used when using our IoT device to collect ECG data, since it is unlikely that the stored ECG datasets at the hospital would have accelerometer data with them as well. We note that y-axis points upward, the x-axis to the side, and the z-axis is perpendicular to the smartphone surface. From this, we are able to determine the direction of the body movement.

3.5 HARDWARE AND SOFTWARE IMPLEMENTATION

3.5.1 Hardware Implementation

Figures 3.14 and 3.15 display the hardware application of the proposed device. NodeMCU, the temperature sensor, cardiac beats, blood pressure sensor, Arduino UNO and power bank constitute the key component of this circuit. The NodeMCU is operated by dc. NodeMCU is connected to heartbeat and temperature sensors. And the blood pressure sensor is attached to the UNO and then NodeMCU is linked with the acquired data. The three-sensor data are required for storage in NodeMCU. The gateway and IoT receive these data. Ubidots is used in the IoT as the obtained information is reflected. Finally, the doctor can easily manage the PC. This circuit was well connected and consisted of Arduino Uno, ESP8266 W-LAN and the AD8232 ECG sensor. The ECG leads are then positioned according to color coding on the patient's body. Now the circuit turning on continuously tracks the heart rate and generates the ECG waveform.

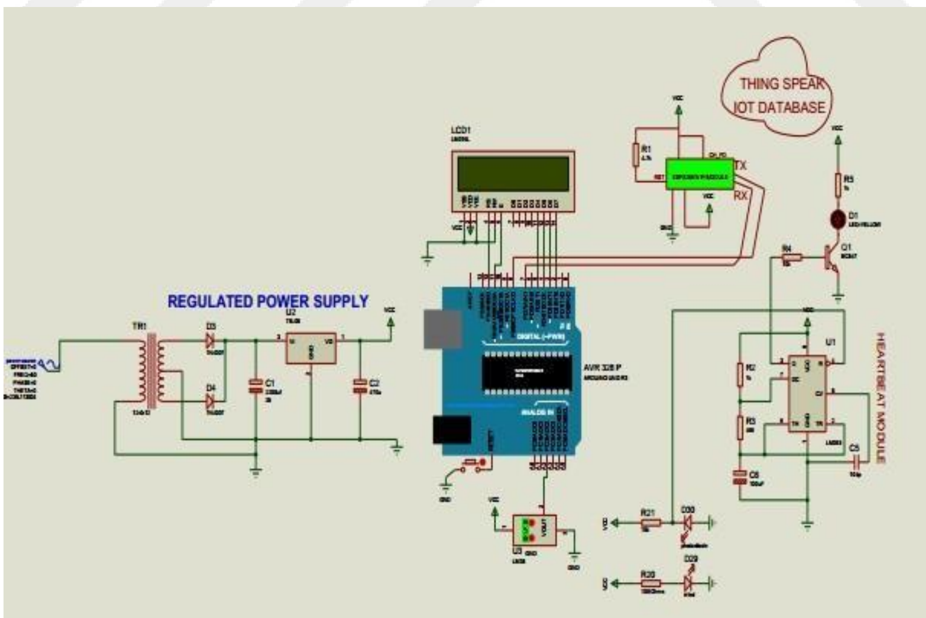


Figure 3.14: Circuit Design

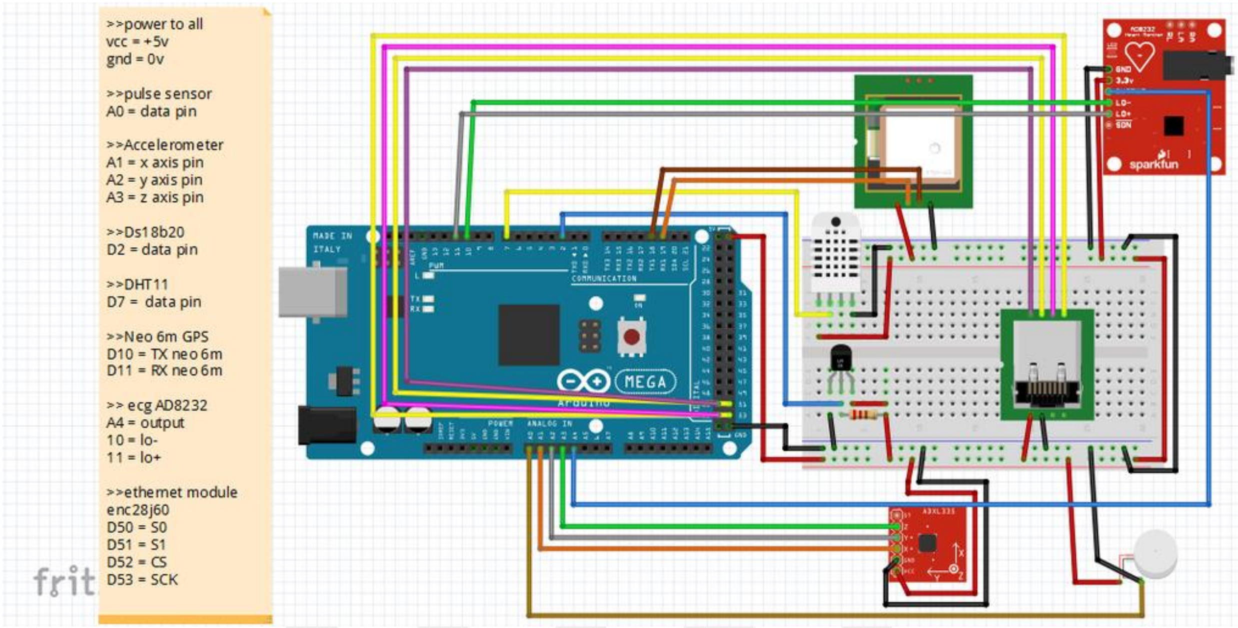


Figure 3.15: Internal components used for monitoring system Prototype.

3.5.2 Software Process

This project is built with Arduino's microcontroller linked to the patient's sensors. Both sensors and position data sent to the cloud from the MySQL microcontroller. A doctor or guardian may access the web portal at any time to track patient data. An SMS and e-mail warning sent respectively to the doctor and guardian's mobile and electronic mail when in emergencies, such as temperature spike or pulse spike or toxic gas detection, etc. Either a doctor or a caregiver can access the patient's own website at any time, and monitor the patient position, allowing medical providers to provide timely support at cases of emergencies.

3.5.2.1 Body Temperature Sensor Process

Maintaining the body temperature is necessary for a healthier state, as it is the duty of body cell enzymes to catalyze chemical reactions and those enzymes must have the required temperature to perform this role. If heat, dehydration, and death are not treated, high body temperatures can result. Low body temperature, if not addressed, may lead to hypothermia and death. Consequently, collecting immediate body temperature information helps prevent these problems. A LM35 analog temperature sensor for body temperature measurement is used in this paper. This sensor reads temperature from -55 to +150 per capita and has a tolerance of 0.5 per capita per capita. These sensors are mounted under the arm of the body (axilla) and are linked in Figure 1 and Figure 3.16 with analog inputs from Arduino UNO. Figure 3.16 illustrates the process of obtaining Celsius temperature. Analog data from the sensor are imported into an analog pin and data are converted digital value by Arduino via internal digital analog value (A / D). This converts the digital value into a Celsius temperature. This is subsequently transmitted to the Blynk Cloud Server via an ESP8266 WI-FI chip included in NodeMCU.

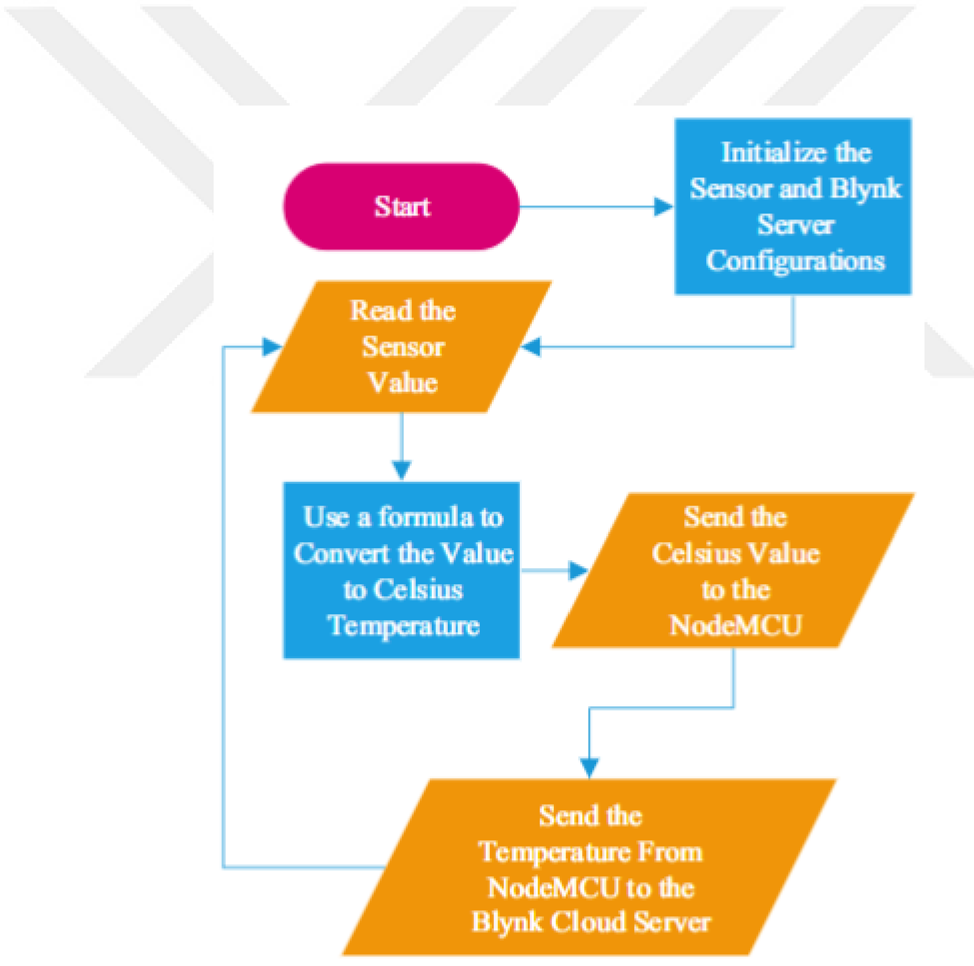


Figure 3.16: Flow Chart of the heartbeat and temperature

3.5.2.2 ECG Sensor Process

The division of the ECG code is initially carried out by examining the electrode attachment event. The microcontroller reads and smooths the analog signal. The samples were then buffered to the

Blynk cloud server in an array before regularly sending. The type of treatment is shown in Figure 3.17.

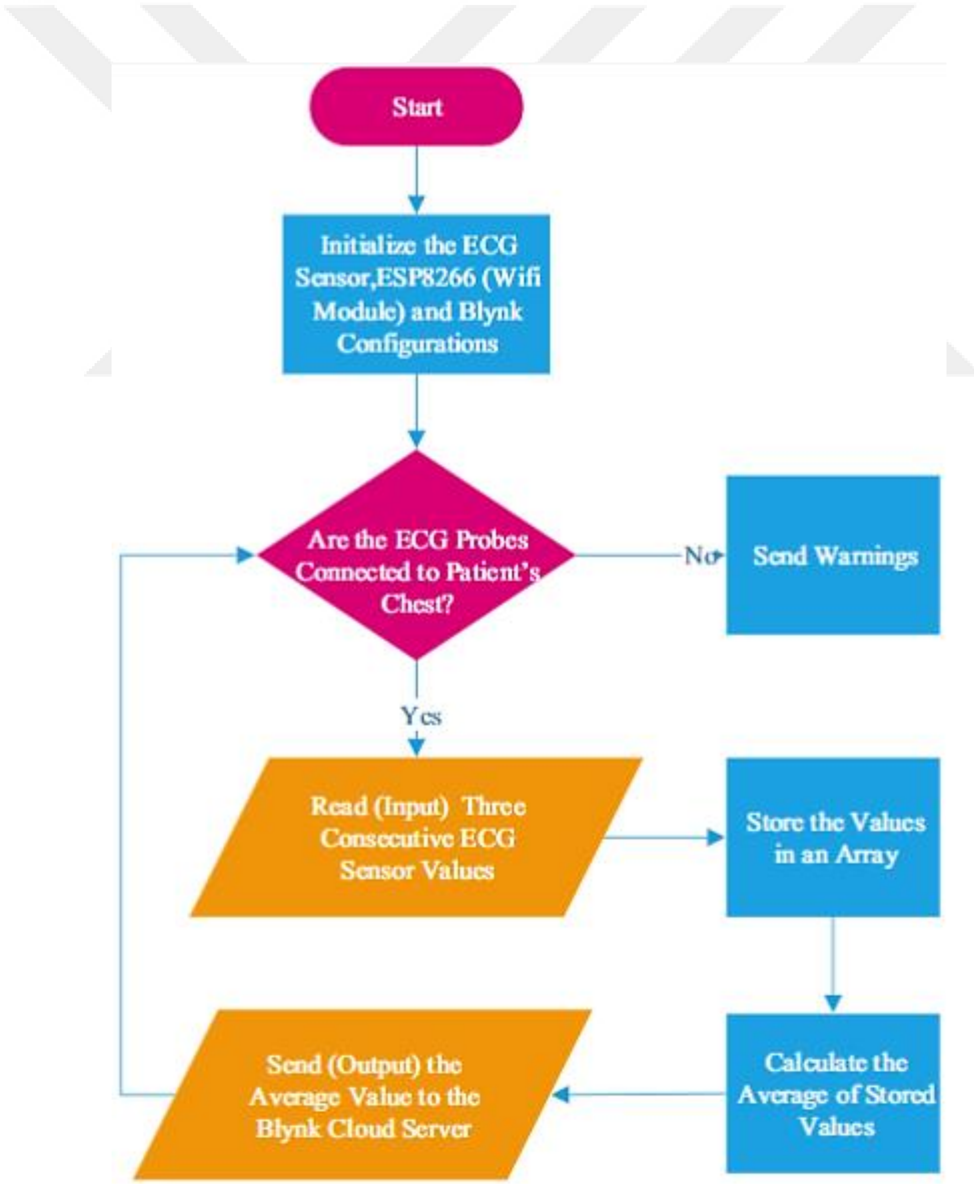


Figure 3.17: Flow Chart of the blood pressure

3.5.2.3 Method of communication

Figure 3.18 shows a floating diagram illustrating the existing NodeMCU-UNO communication. To ensure the serial communication NodeMCU is properly connected to the Arduino UNO, a very short message from a former machine is sent to the latter. The Arduino then tests and prepares JSON document and verifies the message to be forwarded to the NodeMCU. JSON is a

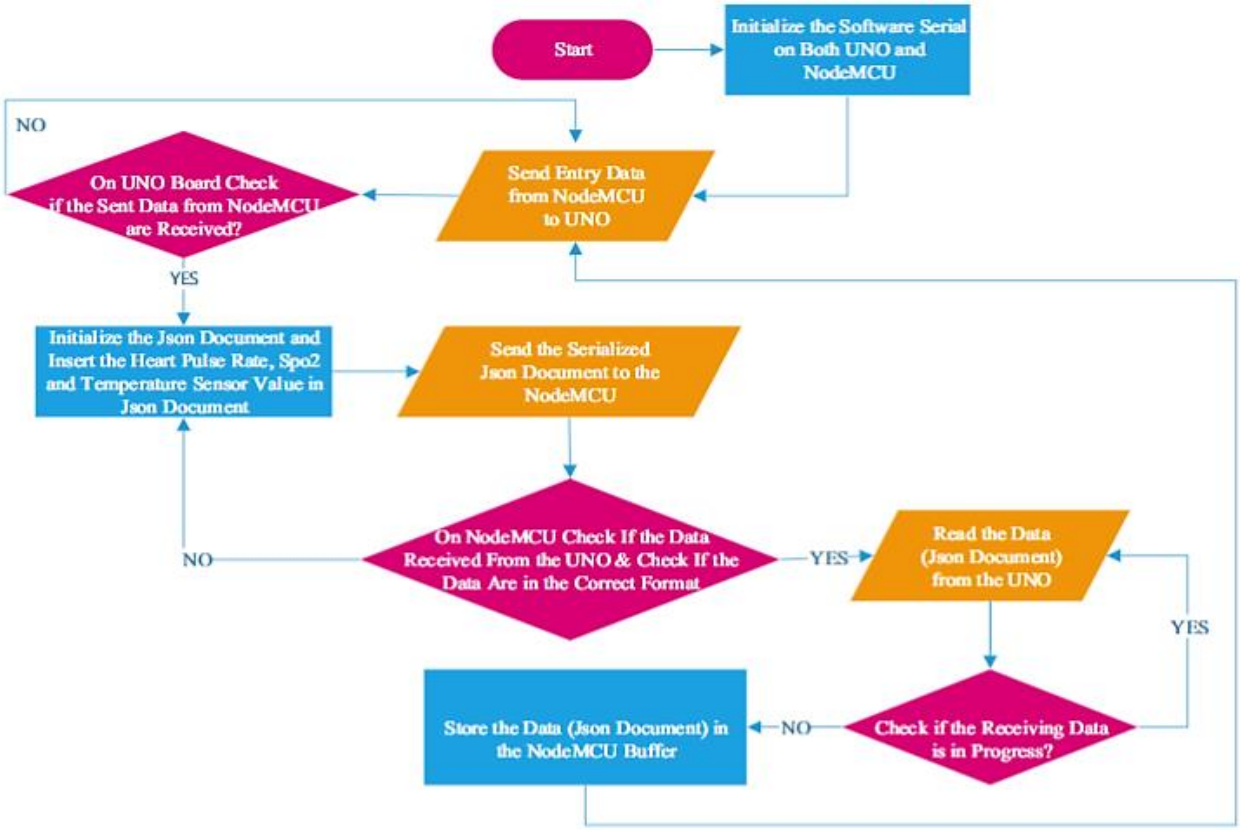


Figure 3.18: Flowchart of the communication between Arduino UNO and Node MCU

standardized text format used in the exchange of data. Its uniform architecture guarantees that the data collected are not missing or overlapping data in the correct format. This report sends the BPM, Spo2 and body temperature sensor data using the Json document to NodeMCU, while the ECG sensor is linked to NodeMCU directly. If the data has been obtained by this system, the feature ensures that all of the information is obtained after verifying that the data has been received to validate that the format is acceptable. The received data is then forwarded to the PhP request.

3.5.3 Arduino Micro controller Init

➢Gsm_init (): This event tests network compatibility and moves the Arduino board to the cloud prior to collecting sensor data. Below Arduino board Algorithm runs a number of AT commands that controls network connectivity and makes internet connection.

3.5.4 Location Tracking

➢GpsEvent (): The GPRS module in the current position co-ordinates of fetch board with this case. Gps Event collects GPRS module data and scans it to obtain accurate position co-ordinates in this algorithm.

➢Gprs_gsm_send (): The location co-ordinates are sent to the cloud via the GSM module using AT+HTTPPARA. GPS sender event immediately sends coordinates to MySQL database server once gps Event parses location information into coordinates. The PHP API retrieves server location coordinates and pinpoints the patient's position with a Google maps API.

3.5.5 Sending data to MySQL database server

➢Gprs_send (): Send sensor data to the cloud by the command AT+HTTPPARA using the GSM-module, this is an event where all sensor data is forwarded to the server in the MySQL database.

3.5.6 Sending SMS and Email alert

➢Mail (): PHP code analyzes server data and sends an emergency alert while patient data is being transferred to the server. Email warning is a message about a failing condition such as temperature swings, fall detection, failures in heartbeat etc., along with a patient web page connection. Click on the path to the patient's web site where physicians and caregivers are able to view patient vitality and the patient's current status.

3.5.7 Simulation Results and Graphical User Interface

The results are achieved and can be visualized on the internet generated on a PhP app, after the hardware and software implementation of the device. The temperature in Ubidots cloud is not obtained at Figure.3.19. The best connection for the internet of things is this application (IoT).

Figure. 3.19 displays a web server and NodeMCU temperature data table. The body temperature of the patient is obtained successfully from this study. The temperature results arrive at the NodeMCU, while the body is measured with a DS18B20 sensor, and the data is then reached in real time on the Ubidots server as shown in the figure. 3.19 The first day.

In a certain interval the output will be shown as a string. The application is simple, since only an analog value is shown, followed by a statement that describes the value shown.

The intelligent prediction module predicts the disease suffered by asking for different signs and based on the previous signs. At least 3-4 signs are established. The final conclusion is drawn. If more and more signs are reported, the outcome is more reliable. The Figure shows a sample screen shot of the web interface. 3.19 The first day.

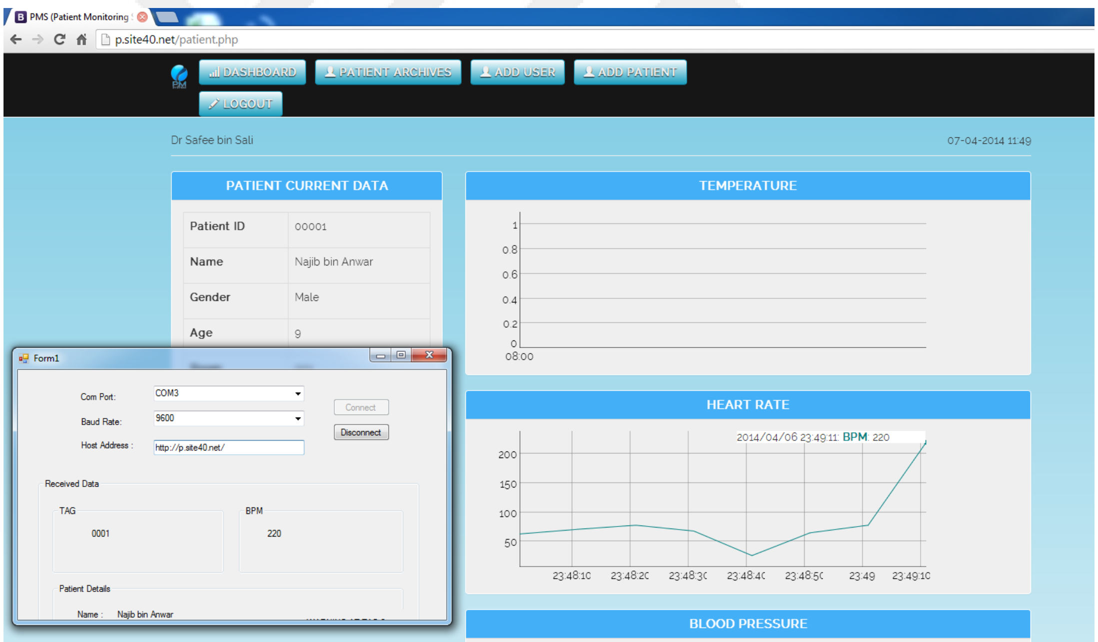


Figure 3.19: User interface on PhP My Admin

3.6 EXPERIMENTAL RESULTS ANALYSIS

3.6.1 Patient Monitoring System Process

The sensor consists of the Electrocardiograph (ECG) sensor AD8232. HM301D is three channels, whereas only the one channel ECG is sufficient and ADS1191 doesn't provide a good enough benefit to achieve good resolution. The best impedance and gain for AD8232 is [2]. ECG is the mechanism by which electrodes implanted on the body record the heart's electrical activity for some time. These electrodes detect minor electrical variations on the skin that result from the electrophysiology of the heart muscle during any heartbeat. The AD8232 is a clean chip that tests the heart's electrical activity. In order to test heart electrical activity, the AD8232 Single Lead Heart Rate Monitor is an inexpensive board. It can be diagrammed as an ECG or electrocardiogram and the output as an analog reading. The AD8232 Single Lead Heart Rate Monitor offers ECGs that can be highly noisy, an optional amp which helps to easily obtain a clear PR and QT signal. The AD8232 has a built-in ECG and other bio potential calculation applications signal conditioning block. In the presence of noisy circumstances, including those produced by motion or remote electrode placing, small biopower signals are extracted, amplified, and filtered. The 9 pins-LO+, LO-, Output, 3.3V or GND are the vital pins for the Arduino or other emerging boards to use this display. The AD8232 Heart Rate Sensor is included in this sensor. The ECG electrode is also supplied with RA (right arm), LA (left arm) and RL (Right leg).

3.6.2 Experimental Configurations

Analysis of a time domain uses temporal ECG data to measure different parameters such as RR (RRI) variability, cardiac velocity etc. [4]. It is important to understand ECG before addressing these parameters. Our heart is divided into 4 chambers: atrium left, atrium right, ventricle left, a ventricle right. The first electric pulse in the right atrium. Now this energy is heading from the atrium right to the atrium left. This electrical momentum is called a P-Wave because the right atrium is compressed so that the deoxygenated blood moves from atrium to ventricle right. This deoxidized blood then passes through the preliminary arteries into the lungs. The electrical impulse now compresses it, which has gone to the left atrium. Oxygenated blood flows by veins from the lungs into the left atrium. The heart beat is now determined by the number of QRS in one minute. Heart rate is expressed in bpm. The ventricles are waiting for repolarization in the ST segment. If T-wave arrives, it repolarizes the ventricles to allow atrium to pump into the blood.

The electrodes must be set around the heart and form a triangle to better sample the ECG signal. Figure 3.21 shows the three-lead positioning in our system. A safe volunteer is checked on many tests using the 3-lead positioning to check the reliability and accuracy of the device proposed.

Table 3.2 lists the main ECG sensor parameters, the Wi-Fi module, the server and the voluntary sector.

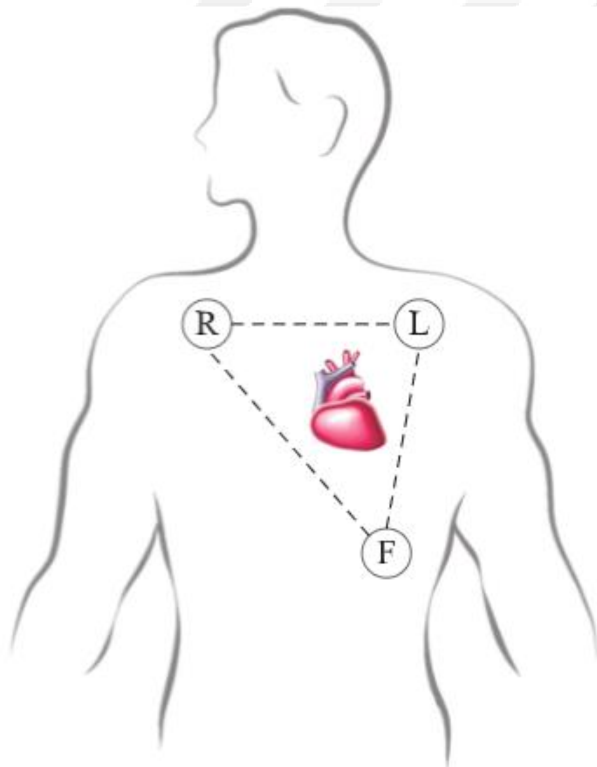


Figure 3.20: 3-lead ECG electrode placement

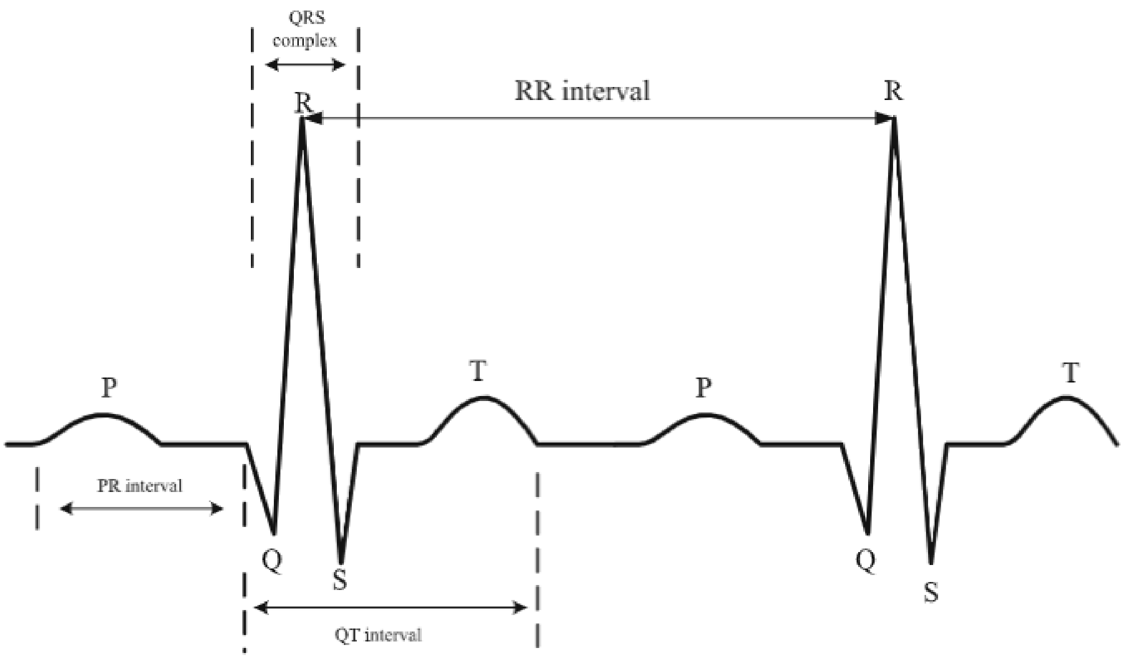


Figure 3.21: ECG signal showing P,Q,R,S and T waves

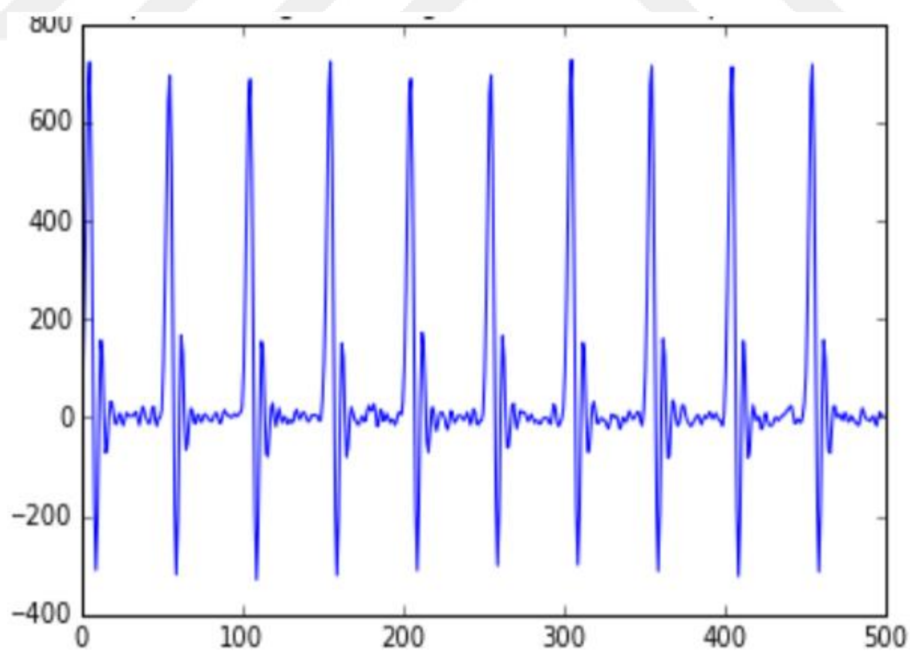


Figure 3.22: ECG signal plotted on serial plotter

Table 3.2: Key Parameters of the ECG monitoring system

	Parameters	Values
ECG sensor	Type	AD 8283
	Power voltage	3.6 v
	Output voltage	0-3.3 v
Wi-Fi module	Wireless transmission protocols	IEEE 802.11 b/g/n
	Power voltage	3.3 v
	Power consumption	<71 mA
Server	CPU	Intel Core i7-3632QM 2.2GHz / i7-3770 3.4GHz
	Operation system	Ubuntu 12.04 LTS, 64 bit
	HTTP server	Apache Tomcat 8.0.27
	Database	Redis 3.2
Volunteer	Gender	Male
	Age	22
	Height	179 cm
	Weight	65 kg

3.6.3 Results and Analysis

The developed system was evaluated with various subjects of different age under various conditions. The actual performance and performance of the unit for pulse, body temperature and ambient temperature sensors have been manually calculated for the test cases. Here only the humidity is measured with a room temperature sensor. The data demonstrates the efficacy of the method by calculating error rate.

ECG & Heart Rate Output at Node MCU & Cloud Server the Heart rate signal and Temperature values of the patient and their time base variation at Node MCU server are obtained as shown in figure 3.23 and figure 3.24 respectively whereas the ECG signal and Fig. 8. ECG signal and temperature variation obtained at cloud server. The signals/parameter values received are real time. The various observation of heart rate and temperature which are measured at different instant of time are tabulated in table 3.3.

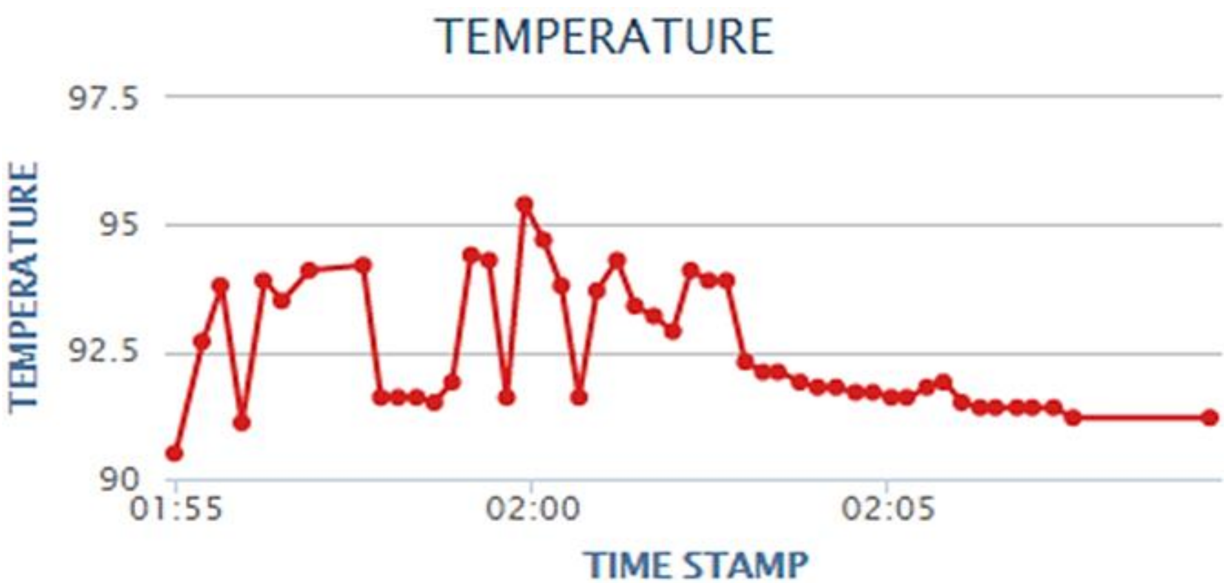


Figure 3.23: Time base variation of Temperature at node MCU

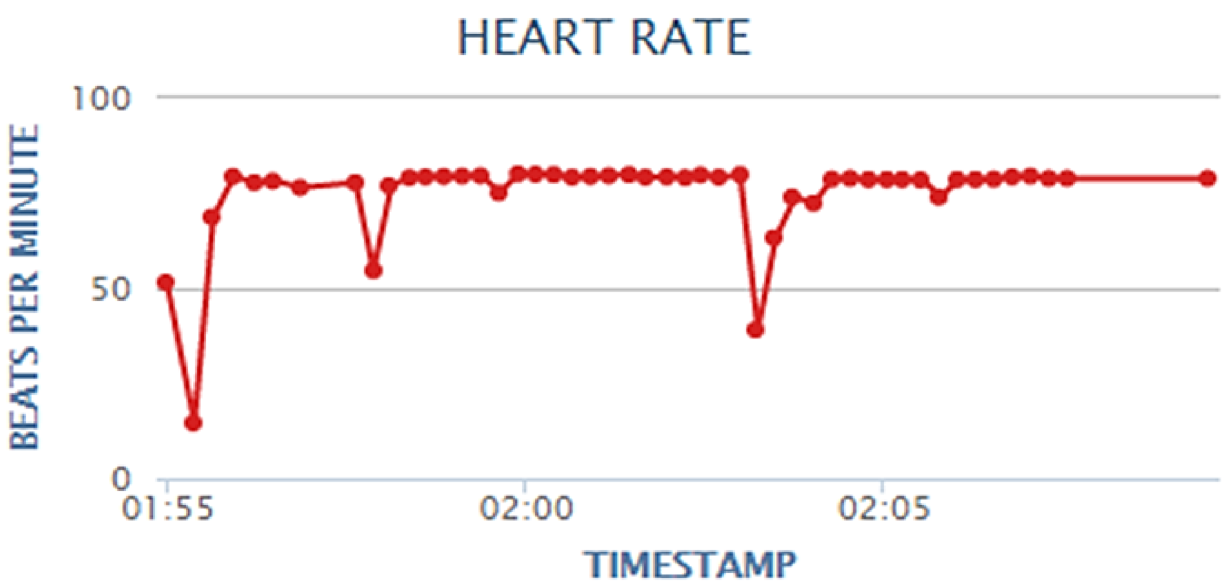


Figure 3.24: Time base variation of heart rate at node MCU

Table 3.3: Heart rate variation with respect to time

Time (HH:MM:SS) AM/PM	Heart Rate	Time (HH:MM:SS) AM/PM	Temperature
11:07:00 AM	83	11:07:17 AM	83.3
12:52:00 PM	80	12:52:01 PM	84.09
01:13:00 PM	150	01:13:55 PM	84.65
03:31:00 PM	79	03:31:00 PM	96.6
03:31:36 PM	80	03:31:11 PM	83.53
03:31:52 PM	79	03:31:52 PM	83.64
03:33:25 PM	80	03:33:00 PM	96.66
03:33:57 PM	79	03:33:25 PM	92.41

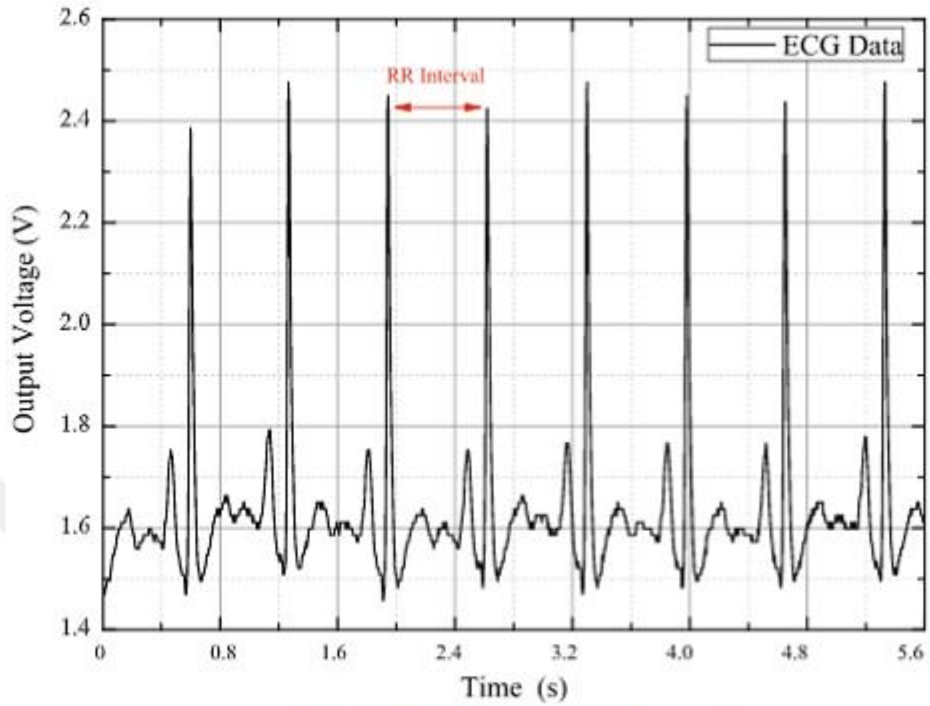
Part of the ECG data from the safe volunteer obtained in Figure 3.25a. The cycles between adjacent R waves (RR interval) are obviously basically the same, so there is no chance of arrhythmias. For example, two cycles of the signal, illustrated in Figures 3.25b, are chosen to show the main characteristics of the measured ECG signal. Some heart disorders can be identified preliminarily by comparing the levels of these characteristics with the normal ranges described in Table 3.' The interval between two R waves, as shown in Fig.8b, is 0.68s, which shows a stable volunteer cardiac ranking. In the processes of ventricular depolarization, the QT interval and QRS length are estimated to be 0.32 sand 0.11 s, respectively, which suggest no anomaly. Finally, the PR interval is also within the normal range, which means that the atrial depolarization mechanism is also normal.

This volunteer cannot end on the basis of the analysis above with a certain cardiac disorder corresponding to the foregone conclusion. The data collected by the proposed method therefore meet the precise and reliable criteria.

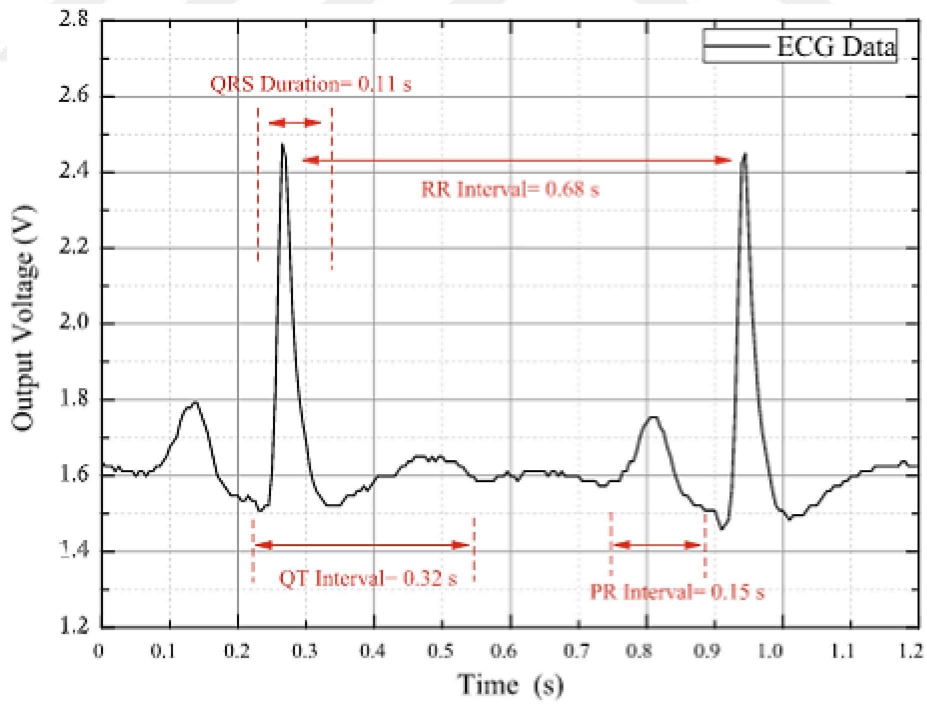
As a result of a shift in heart rate, the ECG signal is well known to lead to the volunteer 's motion. In order to detect the effect of movement on the ECG signal, the volunteer is tracked in two motion states, the fixed state and the move state. The comparison between the ECG signals in both countries is shown in Figure 3.26. The ECG time is higher than in motion, as a person in action is generally seen in the figure with a faster sinus rhythm. The amplitudes of the two signals are not, however, specifically separated, as the amp lithium of ECG relates mainly to human body resistance and distance between two electrodes.

Table 3.4: Normal values of key ECG praters

Features	Normal range (Second)
RR interval	0.6- 1
PR interval	0.12- 0.20
QT interval	0.32- 0.44
QRS duration	< 0.12



(a) Portion of the measured ECG signal.



(b) Key features of the measured ECG signal.

Figure 3.25: Data collected by the wearable ECG monitoring system(a)Portion of the measured ECG signal. (b)Key features of the measured ECG signal.

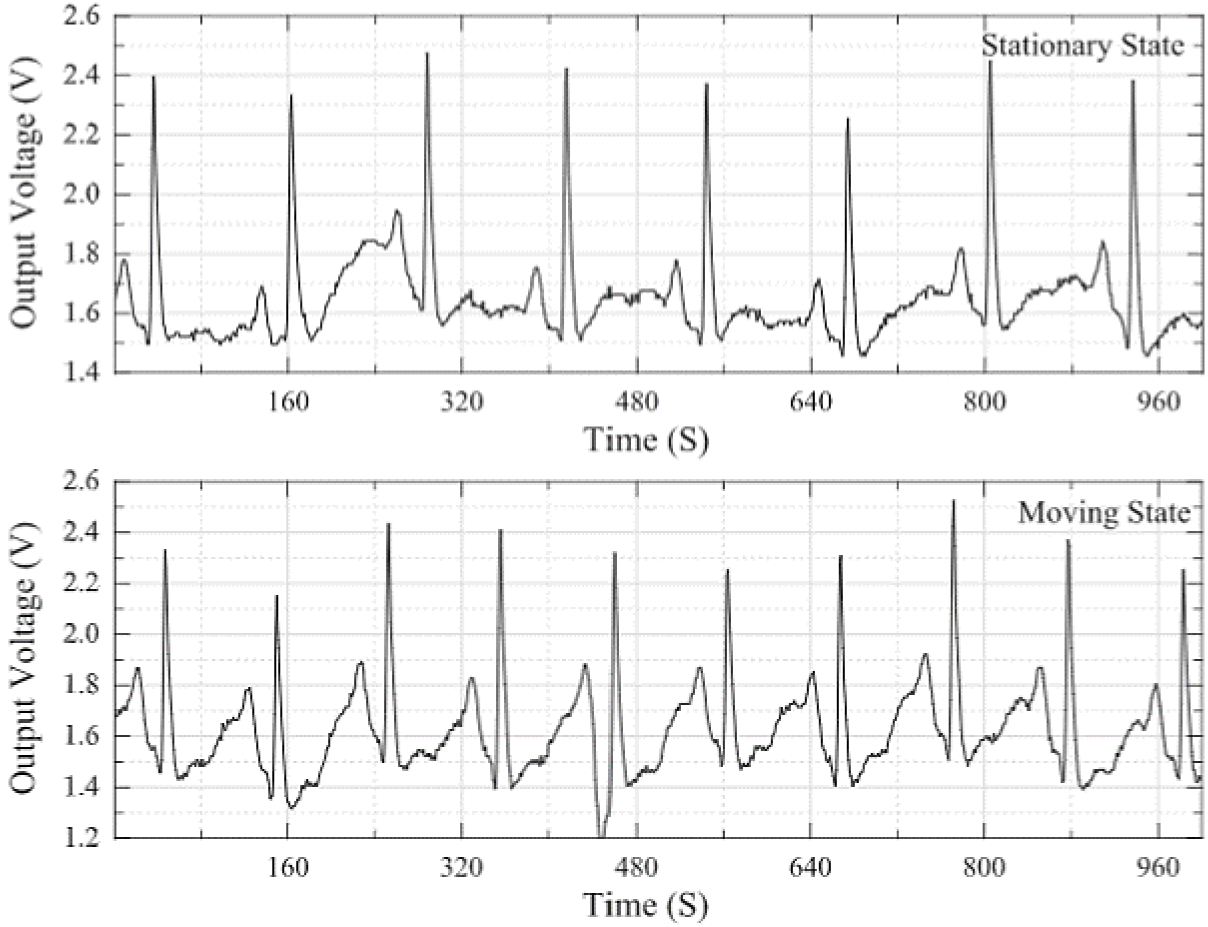


Figure 3.26: Comparison of the ECG signals in two distinct states

3.6.4 Comparison

Many systems have been proposed to design a healthcare system for monitoring remote patient's status using different techniques in data acquisition, data processing, data sending, and data displaying. In [66], [65]and [67], the ECG data are read using various ECG sensor models such as AD8232 and T7016 sensors, while [64] and [68] focused on heartbeat reading from remote patients. Most of the systems have used Arduino Uno and Raspberry Pi microcontroller because of its effectiveness and -effective. With the use of the internet as a transmission media, most of the systems achieve unlimited distance monitoring except [69] and [70] that used WiFi to monitor the patient's status data locally. Our proposed system achieves a significant task by monitoring the remote patient's data using IoT PhP application. However, Table illustrates the main differences between the proposed system and other related system.

Table 3.5: Comparing the proposed system with other related systems

Parameter	Proposed System	A. Kubal and C. K. [64]	A. Ahamed et al. [65]	S.LAVANYA et al. [66]	P. Kalaivan et. al. [70]	Z. U. Abideen and M. A. Shah. [68]
Data Reading	**AD8232 ECG sensor**	Heartbeat pulse, blood pressure and heart sound sensors kits	Bioprotech ECG T7016	Heart Beats sensor	AD8232 ECG sensor	The pulse oximeter, blood oxygen saturation, ECG, glucose sensors connected to a gateway router
Micro-controller	**Arduino Uno**	Raspberry Pi	Arduino Uno	Raspberry Pi	Arduino Uno	6LoWPAN
Transmission Technique	**Wi-Fi**	Wi-Fi	Bluetooth	GSM+Wi-Fi	Bluetooth	3G and 4G
Distance	**Unlimited**	Unlimited	10 meters	Unlimited	10 meters	Unlimited
Displaying Results	**Blynk Application on smartphone**	Web Page IP address	Processing application and smartphone	SMS Acknowledgment and Web page IP	Serial plotter and smartphone	Reporting emergency case as an email
IoT	**Yes**	Yes	No	Yes	No	Yes
Time	**Real-time**	Real-time	Real-time	Real-Time	Real-time	Real-time
Cost-Effective	**Yes**	Yes	Yes	Yes	Yes	No

3.6.5 Discussion

Heart rate and body temperature are very critical parameters of the human body. During calculation, physicians use various kinds of healthcare instruments like body temperature regulation thermometer, BP blood pressure measurement monitor, and heart rate monitor for heart rate measurement. In this research we have suggested an Internet of Things (IT) based HEALTH MONITORING SYSTEM. This system determines the patient's heart rate and sends the value of the heart rate into a cloud database in beats per minute (bpm). The vital parameters sent by this device can be evaluated by the doctors in the hospital. Physicians can also evaluate the parameters of health of patients not admitted to hospital in real time. This system can be incorporated into an outpatient environment, where the patients can obtain and forward all essential health parameters to the cloud. A doctor will examine all these important criteria beforehand while the patient is already on an outpatient basis. The primary objective of this device is the acquisition and cloud uploading of the physiologic parameter by using sensors. We have a built-in ECG and pulse rate sensor in this system.

• This machine size is very small, so it can be easily carried in different places portability.

•Doctors can remotely display information and interpret patients' ECG signals This is the main benefit of this device. Those in remote areas without access to a doctor would be more assisted by this method, As the machine sends all the website and doctors signs and values far away, it can provide a precise understanding of the heart condition of a person. This can also be used in ambulances that save a lot of time and save a person's life.

•The ECG signals and cardiovascular beat values are stored in this database and transmitted on the site through Arduiono Uno. For further analyses, ECG signals are stored here. For example The storage is necessary for the doctor to track the previous condition.

• For real-time ECG monitoring, this system is very useful. There must be an emphasis on noise reduction, so a very successful system can result.

• There will be no need for additional electronics in the future to create very small electrodes. •One of the greatest benefits of this device is that the heart beat and ECG signals of a patient which be seen instead of using large devices for this purpose by using a small circuit.

3.7 CONCLUSION

The device will continuously monitor patients, diagnose them and advise them. Data are stored and released online about health parameters. In the area of healthcare, the Internet of Things (IoT) is expected to be the world's pioneer in different fields. ICU (Intensive Care Unit) health monitoring patients need to monitor the signs of vitality from time to time (heart rate, body temperature, blood pressure ...). It decreases time in the system and is also optimized for the patient surveillance system. The doctor will then test his patient wherever and wherever. Doctors or nurses can use the machine for inspection and saving in the database quickly. On the basis of this work, doctors will use mobile devices and use the NodeMCU to implement them in a global network. DS18B20 sensor is placed in child to measure the temperature of the human body. At first, 31.94 degree Celsius is achieved in measurement but it increases to 36.50 degree Celsius after two minutes. Therefore, it can be known that the temperature values will be varied according to the surrounding, weather conditions and age.

4. CONCLUSION AND FUTURE ENHANCEMENTS

IoT and current well-being control challenges are established. New progress can be restricted by achieving a better quality and safety idea online. Scientists around the world have begun to study various mechanical responses to the improvement of the arrangement of human services so as to complement current governments by enabling IoT 's power. With the wide use of the web, this work is dedicated to updating web technologies in order to create a web-based world. Network of things can be used to navigate the environment in many ways but in the field of social insurance more benefit will be. Therefore, the present work is done to outline the structure of an IOT-based informed human services using a PIC. Our proposed model is explicitly designed to offer elderly people, who live far away from their loved ones, fundamental welfare administrations. Many of the implications of this overview are useful for scientists, engineers, welfare experts and politicians working in the field of IoT and health care and for seniors as a whole.

We are also investigating more issues for intellectual property administrations with IoT-based expertise where web offices in the provinces are not available. For the design framework to be more advanced, the future work of the project is important. In the built device, more sensors will be linked to the Internet to calculate various other health parameters which would be useful for patient tracking, i.e. to quickly which rapidly connect all items to the Internet. With Arduino Uno and the WiFi project, we can add a GPS module in IOT patient monitoring. This GPS module decides where or where the patient is based on the obtained longitude and latitude. Then the cloud that is IOT with the Wi-Fi module sends this position. Doctors will then find out the patient's status should they take preventive measures or fly to the patient.

REFERENCES

[1] Sklyar, V., 2016. Top tentechnologies for IoT. [Online] Available at: https://habrahabr.ru/post/308892/[Accessed September 2016].

[2] Evans, P. C. & Annunziata, M., 2012. ndustrial Internet, Pushing the Boundary of Mind and Machines, s.l.: s.n.

[3] Cisco, 2016. Internet of Things. [Online] Available at: http://www.cisco.com/c/en/us/solutions/internet-of-things/overview.html[Accessed September 2016].

[4] Niewolny, D., 2014. How IoT is revolutionizing healthcare, s.l.: Freescale.

[5]H. J. Wellens, “Sudden cardiac arrest - How can we improve results of resuscitation?,” Appl.Cardiopulm. Pathophysiol., vol. 16, no. 2, pp. 127–132, 2012.

[6]C. Boulanger and M. Toghill, “How to measure and record vital signs to ensure detection ofdeteriorating patients.,” Nurs. Times, vol. 105, no. 47, pp. 10–12, 2009

[7]World Health Organisation, “Prevention of cardiovascular disease and stroke: Guidelines forassessment and management of cardiovascular risk,” 2007

[8]S. Sarwar, “NCEPOD - National Confidential Enquiry into Patient Outcome and Death,” pp. 278–279, 2007.

[9]N. Brown, “What is Telemedicine,” Telemed. Inf. Exch. (TIE). http//tie. ..., pp. 1–11, 1996.

[10]B. McKinstry, J. Hanley, S. Wild, C. Pagliari, M. Paterson, S. Lewis, A. Sheikh, A. Krishan, A.Stoddart, and P. Padfield, “Telemonitoring based service redesign for the management ofuncontrolled hypertension: multicentre randomised controlled trial.,” BMJ, vol. 346, no. May,pp. f3030–f3030, 2013.

[11]Garmin, “HRM-Tri | Garmin,” 2016. [Online]. Available: https://buy.garmin.com/en-US/US/p/136403. [Accessed: 18-Dec-2016]

[12]K. L. Brigham, “Predictive health: The imminent revolution in health care,” J. Am. Geriatr. Soc.,vol. 58, no. SUPPL. 2, pp. 298–302, 2010.

[13] https://ac.els-cdn.com/S18770506301260/1-s2.0-S1877050916301260-main.pdf?_tid=dcbc873b-3c7a-4fea-8d41-f4c25d549727&acdnat=1521015990_964ce32f5ddee49a5b9eb8f73c99179f

[14] Miorandi, D., Sicari, S., De Pellegrini, F., & Chlamtac, I. (2012). Internet of things: Vision, applicationsand research challenges. Ad Hoc Networks, 10(7), 1497–1516. http://doi.org/10.1016/j.adhoc.2012.02.016

[15] He, D., & Zeadally, S. (2015). An Analysis of RFID Authentication Schemes for Internet of Things in Healthcare Environment Using Elliptic Curve Cryptography, 2(1), 72–83. http://doi.org/10.1109/JIOT.2014.2360121

[16] G. Santucci, “From Internet to Data to Internet of Things,” Proceedings of the Int. Conf. on Future Trends of the Internet, J.Wireless Personal Communications, vol. 58(1), May 2011, pp. 49-69.

[17]L. Atzori, A. Lera, and G. Morabito,“The Internet of Things: A Survey,” Computer Networks, vol. 54(15), Catania, Italy, 2010, pp.1-17

[18] S. Hussain, S. Schaffner, D. Moseychuck,“ Applications of Wireless Sensor Networks and RFID in a Smart Home Environment,” IEEE 7thAnnual Conf. on Communication Networks and Services Research, Moncton, NB, May 2009, pp. 153-157

[19] Kubo,” The Reaserach of IoT Based on RFID Technology,” IEEE7thInt. Conf. on Intelligent Computation Technology and Automation, China, Changsha, Oct. 2014, pp. 832-835.

[20]L. Atzori, A. Lera, and G. Morabito,“The Internet of Things: A Survey,” Computer Networks, vol. 54(15), Catania, Italy, 2010, pp.1-17

[21]X. Jia, Q. Feng, T. Fan, Q. Lei,” RFID Technology and Its Applications in Internet of Things (IoT),” IEEE 2ndInt. Conf. on Consumer Electronics, Communications and Networks (CECNet),Yichang, Apr. 2012, pp.1282-1285

[22]Typesof Networks."Last access Nov. 18, 2014. Available on: http://study.com/academy/lesson/types-of-networks-lan-wan-wlan-man-san-pan-epn-vpn.html.

[23] J. Newmarch and P. Tam,” Issues in Ownership of Internet Objects,” 5thInt. Conf. on Electronic Commerce Research, Montral, Canada, 2002.

[24]""ZigBee. Last access May 25, 2015. Available on:"http://www.radio-electronics.com/info/wireless/ZigBee/ZigBee.php

[25]"Bluetooth. Last access May 25, 2015. Available on: http://www.radio-electronics.com/info/wireless/bluetooth/bluetooth_overview.php.

[26]Bluetooth,Low Energy. Last access July28, 2015. Available on: http://www.bluetooth.com/what-is-bluetooth-technology/bluetooth-technology-basics/low-energy

[27] Ekta and R. Kaur,” Light Fidelity (Li-Fi)-A Comprehensive Study,” Int. J. of Computer Science ad Mobil Computing, vol. 3 (4), Apr. 2014, pp. 475-481

[28] B.R. Vatsala and V.R.C.," Internet of Things: Usage of Li-Fi and Need for Flow Control Protocol," Int. J. on Recent and Innovation Trends in Computing and Communication, vol. 2 (8), Aug. 2014, pp. 2510-2513.

[29]Wi-Fi. Last access May 25, 2015. Available on: http://www.radio-electronics.com/info/wireless/wi-fi/80211-channels-number-frequencies-bandwidth.php.

[30] LTE and The IoT-M2M Environment. Last access Aug. 4,2015. Available on: http://www.telit.com/fileadmin/user_upload/media/telit_lte-m2m_wp.pdf.

[31]Frequency Bands Optimal for the Internet of Things. Last access Oct. 1, 2015. Available on:https://iotee.wordpress.com/2015/03/18/frequency-bands-optimal-for-the-internet-of-things/

[32] P.K. Wali and D.Das," A Novel Access Scheme for IoT Communications in LTE-Advanced Network," IEEE Int. Conf. on Advanced Networks and Telecommunications Systems, New Delhi, India, Dec. 2014, pp.1-6

[33]D. Chen, G. Chang, L. Jin, X. Ren, J. Li, and F. Li,"A Novel Secure Architecture for the Internet of Things," IEEE 5th Int. Conf. on Genetic and Evolutionary Computing, Xiamen, China, Aug. 2011, pp.311-314.

[34] J. Cubo, A. Nieto, and E. Pimentel," A Cloud-Based Internet of Things Platform for Ambient Assisted Living," Sensors J., vol. 14 (8), Aug. 2014, pp. 14070-14105

[35] C.Doukas, and I. Maglogiannis," Bringing IoT and Cloud Computing towards Pervasive Healthcare," IEEE, 6thInt. Conf. on Innovative Mobil and Internet Services in Ubiquitous Computing (IMIS), Palermo, July 2012, pp.922-926.

[36] G. Garkoti, S.K. Peddoju, and R. Balasubramanian," Detection of Insider Attacks in Cloud Based e-Healthcare Environment," IEEE Int. Conf. on Information Technology, Bhubaneswar, Dec. 2014, pp. 195-200.

[37] C.H. Liu, F.Q. Lin, and et al.," Secure PHR Access Contorl Scheme for Healthcare Application Cloud," IEEE 42ndInt. Conf. on Parallel Processing, Lyon, Oct. 2013, pp. 1067-1076.

[38] Understanding The Cloud Computing Stack SaaS, PaaS, IaaS. Last access June 16, 2015. Availableon:http://broadcast.rackspace.com/hosting_knowledge/whitepapers/Understanding-the-Cloud-Computing-Stack.pdf

[39]H. Steg, H. Strese, C. Loroff, J. Hull, and S. Schmidt,"Europe Is Facing a Demographic Challenge -Ambient Assisted Living Offers Solutions," VDI/VDE/IT, Berlin, Germany, 2006, pp. 26-33

[40]D. Niewolny. 18 Oct 2013. How the Internet of Things Is Revolutionizing Healthcare, Freescale Semiconductors.

[41]Clincal care using IoT-driven sensor constantly monitors physiological status of the patient.[Online]https://image.slidesharecdn.com/webinariotinhealthcareanoverviewv5-150827151325-lva1-app6891/95/webinar-iot-in-healthcare-an-overview-11-638.jpg. [Accessed: 05-05-2017].

[42]S. M. R. Islam, D. Kwak, M. H. Kabir, M. Hossain and K. S. Kwak, "The Internet of Things for Health Care: A Comprehensive Survey," inIEEE Access, vol. 3, pp. 678-708, 2015.

[43]Y. J. Fan, Y. H. Yin, L. D. Xu, Y. Zeng and F. Wu, "IoT-Based Smart Rehabilitation System," inIEEE Transactions on Industrial Informatics, vol. 10, no. 2, pp. 1568-1577, May 2014

[44]C. Rotariu and V. Manta, "Wireless System for Remote Monitoring of Oxygen Saturation and Heart Rate, "Federated Conference on Computer Science and Information Systems (FedCSIS), Wroclaw, Poland, 2012, pp. 193-196.

[45]L. Yang, Y. Ge, W. Li, W. Rao and W. Shen, "A Home Mobile Healthcare System for Wheelchair Users, "IEEE International Conference on Computer Supported Cooperative Work in Design (CSCWD), Hsinchu, China, 2014, pp. 609-614.

[46]C. Lee Ventola, MS Mobile Devices and Apps for Health Care Professionals: Uses andBenefits.PT.2014;39(5):356:364.[Online]https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4029126/. [Accessed: 04-05-2017].

[47]How “Internet of Things” connects with physical devices, objects and Sensors [Online] http://www.binarytattoo.com/wp-content/uploads/2015/12/IoT-BTdesign.png. [Accessed: 12-04-2017].

[48]K. Patel, “Health and Medicine” IoT can help you obtain greater efficiency through smarter asset management, [Online] https://www.ibm.com/blogs/internet-of-things/6-benefits-of-iot-for-healthcare/. [Accessed: 04-05-2017].

[49]K. R. Darshan and K. R. Anandakumar, "A Comprehensive Review on Usage of Internet of Things (IoT) in Healthcare System,"International Conference on Emerging Research in Electronics, Computer Science and Technology (ICERECT), Mandya, India, 2015, pp. 132-136, pp. 374–380

[50]S. K. Dhar, S. S. Bhunia and N. Mukherjee, "Interference Aware Scheduling of Sensors in IoT Enabled Health-Care Monitoring System,"Fourth International Conference of Emerging Applications of Information Technology, Kolkata, India, 2014, pp. 152-157.

[51]L. Catarinucciet al., "An IoT-Aware Architecture for Smart Healthcare Systems," in IEEE Internet of Things Journal, vol. 2, no. 6, pp. 515-526, Dec. 2015.

[52]Bluetooth,Low Energy. Last access July28, 2015. Available on: http://www.bluetooth.com/what-is-bluetooth-technology/bluetooth-technology-basics/low-energy

[53] A.J. Jara, M.A. Zamora, and A. F.G. Skarmeta, “ Diabetes Management and Insulin Therapy in the Hospital and AAL environments based on Mobile Health, “ II Int. Workshop on Ambient Assisted Living, Valencia, Spain, 2010, pp.1-10.

[54] G. Santucci, “From Internet to Data to Internet of Things,” Proceedings of the Int. Conf. on Future Trends of the Internet, J.Wireless Personal Communications, vol. 58(1), May 2011, pp. 49-69.

[55]L. Atzori, A. Lera, and G. Morabito,“The Internet of Things: A Survey,” Computer Networks, vol. 54(15), Catania, Italy, 2010, pp.1-17

[56]Nuubo, wearable medical technology. Last access Oct. 20, 2014. Available on: http://nuubo.es/?q=en/node/162.

[57] R. S. B. Rosli and R. F. Olanrewaju, “Mobile heart rate detection system (moherds) for earlywarning of potentiallyfatal heart diseases,” in2016 International Conference on Computerand Communication Engineering (ICCCE), pp. 422–427, IEEE, July 2016

[58] G. Wolgast, C. Ehrenborg, A. Israelsson, J. Helander, E. Johansson, and H. Månefjord,“Wireless body area network for heart attack detection,” inIEEE Antennas and PropagationMagazine), vol. 58, pp. 84–92, IEEE, 2016.

[59] A. Dewan and M. Sharma, “Prediction of heart disease using a hybrid technique in data mining classification,” in2015 2nd International Conference on Computing for SustainableGlobal Development (INDIACom), pp. 704–706, IEEE, Mar. 2015.

[60] D. S. Medhekar, M. P. Bote, and S. D. Deshmukh, “Heart disease prediction system us-ing naive bayes,”INTERNATIONAL JOURNAL OF ENHANCED RESEARCH IN SCIENCETECHNOLOGY & ENGINEERING, vol. 2, no. 3, Mar 2013.

[51] P. Jambhulkar and V. Baporikar, “Review on prediction of heart disease using data miningtechnique with wireless sensor network,”International Journal Of Computer Science AndApplications, vol. 8, no. 1, pp. 55–59, Jan-Mar 2015.

[62] M. Raihan, S. Mondal, A. More, M. O. F. Sagor, G. Sikder, M. A. Majumder, M. A. A. Manjur,and K. Ghosh, “Smartphone based ischemic heart disease (heart attack) risk prediction usingclinical data and data mining approaches, a prototype design,” in2016 19th InternationalConference on Computer and Information Technology (ICCIT), pp. 299 – 303, IEEE, Dec.2016.

[63] “Smartphone app for heart attacks.”https://www.dicardiology.com/content/new-smartphone-app-detects-heart-attacks. [Last accessed July 2017].

[64] A. Kubal and C. K, "Design of E-Health Monitoring of Patient using Internet of Things," I J L T E M A S, vol. 5, no. 7, p. 5, 2017.

[65] A. Ahamed, K. Hasan, and S. Alam, "Design and Implementation of Low-Cost ECG Monitoring System for the Patient Using Smartphone," presented at the (ICEEE), Rajshahi, Bangladesh, 2015.

[66] S.LAVANYA, G.LAVANYA, and J.DIVYABHARATHI, "REMOTE PRESCRIPTION AND I-HOME HEALTHCARE BASED ON IoT," presented at the I C I G E H T '17, Coimbatore, India, 02 November 2017, 2017.

[68] Z. U. Abideen and M. A. Shah, "An IoT Based Robust Healthcare Model for Continuous Health Monitoring," presented at the Proceedings of the 23rd International Conference on Automation & Computing, Huddersfield, UK, 7-8 September 2017, 2017.

[69] B. M. Lee and J. Ouyang, "Intelligent Healthcare Service by using Collaborations between IoT Personal Health Devices," International Journal of Bio-Science and Bio-Technology, vol. 6, no. 1, p. 10, 2014.

[70] P.Kalaivani, T.Thamaraiselvi, and G. V. P.Sindhuja, "Real Time ECG and Saline Level Monitoring System Using Arduino UNO Processor," A J A S T, vol. 1, no. 2, p. 5, 2017.