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Survey On IoT Based Architecture In Healthcare Applications

Inas Bellary[1], Vaishali Bagade[2]

[1]*Student, EXTC, ARMIET Engineering College, Mumbai University, Shahapur, India*
[2]*Assistant Professor, EXTC, ARMIET Engineering College, Mumbai University, Shahapur, India*

Abstract

Observation and recording of different medicinal parameters inpatient outside the healing facilities have gained immense attention. The reason behind this venture is to create a framework for observing the patient's body while utilizing a web network. The capacity of this framework is to estimate-certain organic parameters of the patient's body like temperature, heartbeat, and blood volume by utilizing sensors, which will detect the body temperature, heartbeat, and circulatory strain of the patient and provide data to the IOT Cloud stage via wifi-Module. All data about the patient's wellbeing will be added on the cloud, thereby empowering the specialists to screen the patient's wellbeing, where they can ceaselessly screen the patient's condition using a smart telephone. The outcomes demonstrated that this task could adequately utilize Wi-Fi innovation to screen persistent wellbeing status. Moreover, the Wi-Fi module's power utilization (ESP8266) can be diminished as much as could reasonably be expected. Accordingly, the outlined framework provides low intricacy, less power utilization, and is exceedingly compact for social insurance observation of patients.

Keywords *--IoT(Internet of Things) cloud, WiFi-module, Sensors, Arduino board, Raspberry pie, Smartphones, Heartbeat rate.*

I. INTRODUCTION

Innovation streamlines and eases human life. It influences the general issues, one being the therapeutic field. It profits from the innovation in various ways; now, it is less demanding to analyze interior infections utilizing some advanced gadgets. The medicinal services division is experiencing an immense change, with advanced abilities modifying how the specialists cooperate with their patients. These days, patients possess the instruments to assess their health themselves and help specialists to have prompt access in understanding the information. One such type of wearable gadgets is the Apple watch. These gadgets are expensive, and it is hard to discover these gadgets utilized by needy individuals, who are confronting the greatest piece of ailments load. Besides, presently, numerous medicinal gadgets still require investigation once it goes to the idea of the Internet of Things[1]. The idea of the IoT involves the utilization of electronic gadgets that catch or screen information and are associated with a private or open cloud, empowering them to trigger certain occasions naturally. Restorative information, for example, circulatory strain and pulse, are gathered by sensors on fringe gadgets; this information is transmitted to social insurance suppliers or outsiders using remote media transmission gadgets[2]. The information is assessed for potential issues by a social insurance expert, and the concerned suppliers are quickly informed once an issue is recognized. Subsequently, convenient mediation guarantees a positive patient result. The elderly and the incessantly sick require extensive restoration. The World Health Organization demonstrates that elderly individuals, who usually experience the ill effects of immense sickness, require an exceptionally viable and capable course of action.

As demonstrated by the National Broadband Plan by the Federal Communications Commission (FCC), the usage of remote patient checking under IOT advancement will save the social protection industry $700 billion in more than 15–20 years. Herein, it is imperative to center on IoT innovation to profit from the latest innovation. Bluetooth, ZigBee, and Wi-Fi are the regular remote advancements for remote patient observing frameworks[3]. Notably, their appropriateness and ease of use for remote patient observation are generally changing. Hence, there are huge contemplations while choosing an innovation for IoT medicinal gadgets; one should be aware of particular necessities' attributes. The proposed framework will help patients in remote spots (e.g., home human services), and that does not just require observing an interminable malady state but keeping patients away from that state. By actualizing this venture, it will offer a modest framework for remote patient's wellbeing assessment, which can spare their lives by giving crisis alarm progressively[4].

II. DEFINITION AND CONCEPT

Definition:

Numerous interesting technologies can be used for IoT, but in our opinion, the technologies mentioned in the previous section are the most

important ones at present. IoT is a broad concept and not easy to define; however, it is a synonym of the following process. The Internet of Things is the connection of heterogeneous, (everyday) objects embedded with intelligence (e.g., computing capabilities, a unique identifier, and communication abilities (Miorandi et al.,2012)), which allows them to interact and exchange data (Cambridge Advanced Learner's Dictionary & Thesaurus, 2017). This interaction and data exchange may be performed by different communication channels and can be direct. Nevertheless, the collected data passes through a cloud structure where it is analyzed[5]. This process is autonomous, thus without human intervention. The process runs in the background and does not continuously require human confirmation. At the end of the process, information can be communicated to the user in more advanced service applications, but the focus should minimize the human input.

A. *Related concepts:*

The definition presented in the previous section can be used to compare different concepts related to IoT with diverse characteristics. A clear distinction between these concepts allows the appropriate classification of applications. The use of IoT in the future could result in mixed information for the end-user and actions from smart things. If the ultimate objective is the automation of every possible process, including human behavior, then applications will directly influence the human actions by actuators in the network instead of communicating information to the user (Miorandi et al., 2012). This ultimate objective is more associated with the term **cyber-physical system** (CPS). CPS and IoT are similar concepts, as they use the same kind of technology (wireless networks, sensors, cloud computing), and both are used for process automation. The only difference is that for CPS, the focus is on the actuation of objects, controlling physical entities (e.g., logistics and production systems), and for IoT, the focus is on the network structure used for the interaction of objects, which allows the collection and integration of data (Minerva et al., 2015). This network structure is required for the actuation of different objects in the CPS systems.

B. IoT HEALTHCARE NETWORKS

The IoT health care network or the IoT network for healthcare (hereafter ''the IoThNet'') is vital IoT in health care. It supports access to the IoT backbone, facilitates the transmission and reception of medical data, and enables the use of healthcare-tailored communications. As presented in Figure2, this section discusses the IoThNet topology, architecture, and platform; however, it should be mentioned that the proposed architectures in [IV] can be considered as a good initiating point for developing insights into the IoT network.

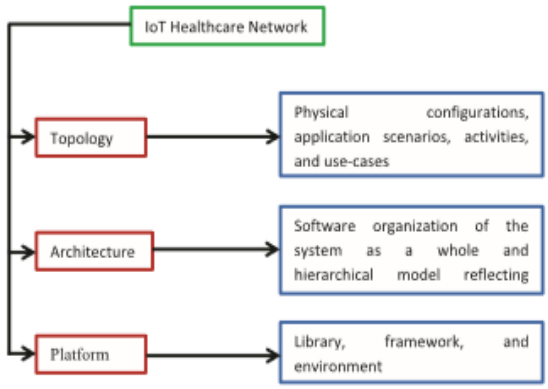

FIGURE 2. IoT healthcare network (IoThNet) issues.

C. The IoThNet TOPOLOGY

The IoThNet topology refers to the arrangement of different elements of an IoT healthcare network and indicates representative scenarios of seamless healthcare environments. Figure3 describes how a heterogeneous computing grid collects enormous amounts of vital signs and sensor data such as blood pressure (BP), body temperature, electrocardiograms (ECG), and oxygen saturation and forms a typical IoThNet topology. It transforms the heterogeneous computing and storage capability of static and mobile electronic devices such as laptops, smartphones, and medical terminals into hybrid computing grids. Fig. visualizes a scenario in which a patient's health profile and vitals are captured using portable medical devices and sensors attached to their bodies. Captured data are then analyzed and stored, and the stored data from various sensors and machines are used for aggregation. Based on the analyses and aggregation, caregivers can monitor the patients from any location and respond accordingly; the topology includes a required network structure for supporting the streaming of medical videos. For example, the topology in Figure 4 supports the streaming of ultrasound videos via an interconnected network with worldwide interoperability for microwave access (WiMAX), an internet protocol (IP) network, and a global system for a mobile (GSM) network, as well as usual gateways and access service networks[6].

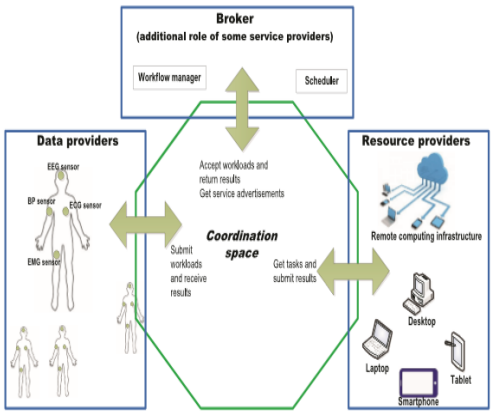

FIGURE 3. A conceptual diagram of IoT-based ubiquitous healthcare solutions.

III. PROBLEM DEFINITION

In the hospital facilities, where patient's status should be frequently checked, which is normally done by a specialist or other paramedical staff by continually watching certain critical parameters, for example, body temperature, heartbeat, and circulatory strain along these lines; this errand becomes monotonous after a certain period. Subsequently, it can cause issues. Notably, numerous specialists have previously endeavored and tackled such issues in several ways; however, the prior techniques in a few cases either SMS will be sent utilizing GSM or RF module will be utilized to send patient's information sender gadget to collector gadget[7]. Furthermore, in the previous cases, the historical backdrop of the patient is not revealed, and only present information is available. Thus, the motivation behind this task is to maintain a record of patient's information and to provide crisis alarm whenever required, thereby utilizing distinctive innovation, which is an Internet of Things (IOT), where it enables us to store patient's information on the cloud. Accordingly, the previous history of the patient will be accessible for specialists whenever required. By executing this task, we can screen patients remotely and can anchor their lives by giving crisis caution progressively.

IV. SYSTEM ARCHITECTURE

In this system, a mobile physiological monitoring system is presented, which can continuously monitor the patient's heartbeat, blood pressure, and other critical parameters in the hospital. We presented continuous monitoring and control mechanisms to monitor the patient condition and store the patient data in the server using Wi-Fi Module based wireless communication; moreover, we presented remote health care data acquisition and smart storage system[8].

The sensors of temperature, heartbeat, and blood pressure are connected to the Arduino board. The value from the Microcontroller is provided to the Web Server using Wifi-connectivity. The parameter values can be viewed by the Android application installed in doctors and patient's smartphones. In our system, Arduino Board is used. The Microcontroller is connected with all other hardware units in the module.

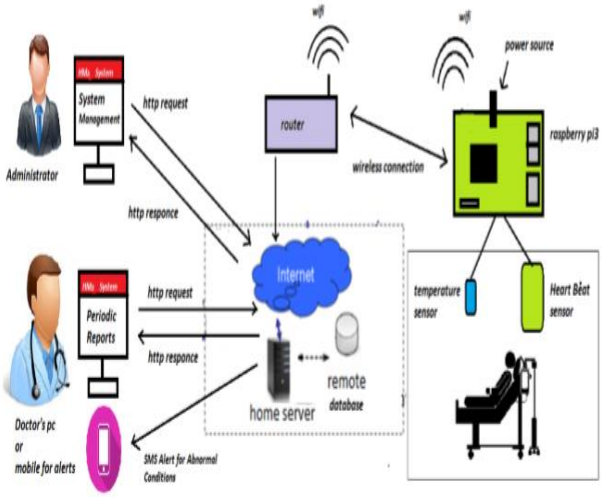

Fig 2.1 System Architecture

V. HARDWARE MODULE

A. Raspberry Pi:

A] Raspberry pi: -

fig 3.1 Raspberry pi 3 model B

In this paperwe used important hardware. The core task is to achieve physical parameter from the heartbeat sensor and temperature sensor and convert it into digital form. This hardware is called as a local processing unit (LPU).

B. DHT11:

The DHT11 is a low-cost digital temperature sensor. From a high-performance 8-bit Microcontroller, it gives a fast response and high accuracy. This sensor provides new data once every second.

fig 3.2 DHT temperature sensor

c) Easy Pulse:

C] Easy pulse: -

Fig 3.3 Easy Pulse

Easy pulse is used to measure the heartbeat and DIY heartbeat sensor because just put a finger inside it measured cardiovascular waveform. The latest version of Easy pulse is (V1.1). It uses an infrared light source to illuminate the finger at one side and a photodetector on another side in order to measure variation in the transmitted light due to changed blood volume inside the tissue, as the analog wave as well as digital pulse as the output that is synchronous with a heartbeat.

VI. OBJECTIVES

- Internet of Things (IoT) is an emerging technology, which comprises a huge amount of smart objects and smart devices connected to the internet for communicating with each other.

- In this project, to analyze and compute the patient health, we used Raspberry Pi, an essential component.

- These smart devices are used to measure temperature, blood pressure, sugar level, heartbeat, lung and respiration information, which are further used to evaluate the health condition of the patient.

- The final results are displayed on the android device, on a web server, and are sent to the user via SMS.

- These data results can be stored in the database center, which can be invoked from a remote location at any time in an emergency case of the patient without delay.

- This project may play a vital role in saving a patient lives in an emergency

VII. CONCLUSION

IoT is a combination of various technologies that enable different devices and objects to interact by using diverse network technologies. The main idea of the proposed system is to provide better and more effective health care services to patients with networked Internet information, such as cloud experts and doctors who can use this data and provide a quick and effective solution. The final model will be equipped with a function where the doctor can check his patient anywhere, anytime. Emergency alert e-mail is sent to the patients if the threshold value is reached, for the patient to consult the doctor. This system helps patients who are advised for complete bed rest and the paralyzed patients, where the doctor can physically monitor the patient from home with the help of a Pi camera, which is used in the system. The objective of the proposed framework is to adopt a new production of medical systems that can provide health care services with high-quality and low-cost for patients using this combination of large data analysis, cloud computing, and computing technologies. The enhanced designed system will connect more sensors and connect all the objects to the internet for quick and easy access. The proposed model can also be deployed as a mobile application for easy access worldwide. The mobile application can be enhanced with the ambulance services, doctor's list, and nearby hospitals. The patients who are advised for complete bed rest and the paralyzed patients can also be monitored and given the doctors' precautions by visual and audio interaction using the pi camera. The system is implemented for one-to-one access, which can be implemented for several patients by giving a unique id for each member/patient in the home or the hospital.

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