



## SMART HEALTH CENTER: AN AID TO HAND-OPERATED PRACTICES

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### Abstract

**The health care industry remains the quickest to adopt the Internet of Things and cloud computing which uses remote servers on Internet to store, process and manage data rather than a local server. The reasons for this trend is integration of IoT traits into medical devices greatly improves the standard of service, bringing particularly high value for the aged, patients with chronic conditions and requiring constant supervision. Smart devices are widely applied to supply continuous aid, for instance observing pulse rate, temperature, blood pressure, etc. Wireless body sensor network permits the integration of low power, miniaturized, intelligent pervasive sensing nodes to observe body functions and perceive the surroundings. Thus physicians can examine patients physiological information in time and can provide real time diagnosis. This paper will demonstrate automatic information transfer from sensors to cloud through mobile app to lessen doctors efforts.**

**Keywords: Bluetooth, Cloud computing, Internet of Things, Wireless body sensor networks.**

### I. Introduction

The internet of things (IoT) is the network of physical devices, vehicles, buildings and other items embedded with electronics, software, sensors, actuators and network connectivity that enable these objects to collect and exchange data. In 2013, the Global Standards Initiative on Internet of Things (IoT GSI) defined the IoT as "the infrastructure of the information society"

[22]. Some applications of IoT are smart cities, home automation, smart agriculture, etc.

Cloud computing refers to the practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer.

The hospital might be very far from rural areas, during such situations by the time patient reaches at the location it would be too late for doctors to operate. What can be the solution to solve this problem? The new arising concept of smart healthcare system could solve this to great extent. Above discussed problem can be mitigated by providing preliminary treatment if we have basic information like patient's heart rate and sugar level. This can be done easily by using smart healthcare system application as people require very little technical or medical knowledge to use. These parameters after monitoring can be easily shared with the doctor specified. This system is not only useful for outdoor patient but same can be used by indoor patients too. This technology offers the means for preventing errors and adverse events (e.g., medication errors, miscommunications, delays in treatment). Continuous monitoring of critical patients is done and doctors are alerted for different anomalies.

Recently, wearable devices are widely applied to offer continuous healthcare, e.g., physiology parameter monitoring for remote healthcare, heart rate record for workout intensity or training, and calorie burn during fitness.

The figure 1 gives the brief idea about the concept which we want to implement.

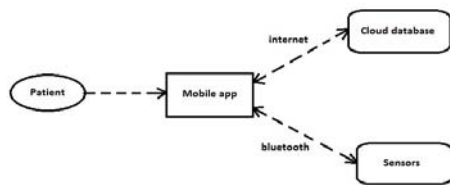


Figure 1: Deployment diagram

## II. Literature survey

The smart watches, health monitors, pedometers, activity trackers and virtual reality headsets are all part of the emerging landscape of wearable technology, which promises to not only change the way we exercise and communicate but also support the emerging healthcare[1].

The benefits of fast growing technology and innovation were adopted to improve access to quality health care services for university students in their university health centers[2].

The next upgradation in health technology was to create standards-based secure access to patients personal data and medical records by using RFID tags and Web Service with the help of hardware kit. Customers can view and update their personal medical information via the web site, which seamlessly synchronise with one another [3].

RFID adoption in healthcare can not only reduce cost and improve efficiency by tracking asset and people, but also reduce medical errors to improve patient safety and save lives. Although deploying RFID technology is a complex issue since it involves technological, economical, social, and managerial factors.

Careggi Polyclinic in Florence deployed a mobile app called Careggi Smart Hospital. The application was designed for Android smartphones and tablets freely downloadable from the Google Play Store, providing various useful tools to the hospitals users such as personnel and structures finding, wayfinding and the possibility to access personal medical records collected on regional electronic health record[4].

An intelligent wallet for individuals that collects and stores human bio-signals using medical sensors, and context data using environment and motions sensors on personal smart devices was proposed by Arif M. Bhatti, Mehedi Masud[10]. The paper stated in [7] introduces the problem scenarios, constraints, requirements, risks, sample architectures and

proposed integration solution presented with TOGAF components. The growing number of waiting lists, rising pressure on medical professionals and accountability for medical negligence motivated the authors to take initiative towards a core model integration strategy in various legacy infrastructure systems.

S.C Mukhopadhyay reviews the latest reported systems on activity monitoring of humans based on wearable sensors and issues to be addressed to tackle the challenges in his work[11]. The applications of IoT in personalised healthcare to achieve excellent healthcare at affordable costs is mainly the aim of using this technology[12]. The IoT functions and how it is used in conjunction with wireless and sensing techniques to implement the desired healthcare applications was proposed by Alok Kulkarni and Samapada Sathe. The author elaborates the essential role of IoT in healthcare systems and immense prospects of Internet of things in healthcare systems in his paper[17].

The research of the author mentioned in [18] combines ubiquitous computing with mobile health technology. Wireless sensors and smart phones to monitor the wellbeing of high risk cardiac patients was used. The smart phone was able to analyze in real-time the ECG data and determine whether the person needed external help from his caretakers. In the paper [14], a patients biosignals are measured by means of a body sensor network which communicate wirelessly with a handheld device. Alarms and biosignals can be transmitted over wireless communication links to a remote location, and a remote health professional can view the biosignal data via a web portal. In the paper[6] the author describes alert portable telemedical monitor (AMON), a wearable medical monitoring and alert system which targeted high-risk cardiac and respiratory patients by continuous evaluation of vital signs using lowpower design techniques.

The information regarding various biomedical devices is given in [19]. This information can be used to identify working of various sensors and their uses as well as new types of sensors, research works and inventions can be found here.

Our paper proposes an integration of all the above benefits and subtracting the drawbacks. It makes use of sensors to sense the physical condition of the patient and passes on the readings

to an app. The app which consists of all the details and features required to the patients as well as doctors.

### III. Motivation

The elder people and the patients admitted in the hospital need constant monitoring. The doctors face problems meeting every patient personally and updating their prescriptions on hard copies of their files. The outdoor patients these days don't find time to visit hospitals and have a regular checkup.

Smart Health center is an alternative to the traditional healthcare methodology, helping to reduce the number of caretakers needed, improving the quality of life of the population and replacing the old school paperworks. Along with the worldwide increasing complexity of health care systems and the fact that modern medicine is turning into a data-intensive science, traditional approaches for handling this big data can no longer keep pace with demand, also increasing the risk of delivering unsatisfactory results. Consequently, to cope with this rising flood of data, smart approaches are vital.

This work thus comes from the top management idea to develop an application for smartphones which can be easily integrated in everyone's life reducing efforts of doctors and patients as well. Additionally the application allows the user to view his medical records via a common smartphone, thus reducing physical access to hospital.

### IV. Technology used

#### A. Internet of Things:

The internet of things (IoT) is the network of physical devices, vehicles, buildings and other items embedded with electronics, software, sensors, actuators and network connectivity that enable these objects to collect and exchange data. Sensors are used to monitor data automatically and transfer it to mobile application. Sensors will sense data automatically according to constraints provided for instance, if pulse rate is found high blood pressure and sugar level will be monitored automatically. It also consists alert system if pulse rate shoots above normal range or goes below, doctor of particular patient will get informed immediately.

#### B. Cloud computing:

Cloud computing refers to the practice of using a network of remote servers hosted on the Internet

to store, manage, and process data, rather than a local server or a personal computer. Cloud computing can reduce the expense such as software, networking, licensing fees and thus increase adoption. Cloud service models are Infrastructure as a Service (IaaS), Platform as a service (PaaS) and Software as a service (SaaS). In this system cloud is used as an IaaS. It deals with the delivery of computing resources like storage capacity, network and processing. Cloud computing approach increases the flexibility and due to this providers do not need to change infrastructure as demand changes.

#### C. Bluetooth:

Bluetooth devices are the most used devices and is one of the most popular protocol for small point-to-point networking. Bluetooth is fast and consumes less power. In this system Bluetooth is used as medium for data transfer between sensor and mobile phone.

### V. Experimental setup

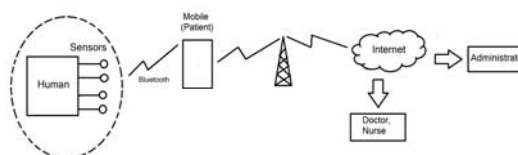


Figure 2: Block diagram of system

#### A. Sensors

The sensors are used to accurately sense the body temperature, pulse rate, blood pressure, etc. The sensors are placed on the body and a BASN (Body Area Sensor Network) is formed. The sensors can communicate with Bluetooth.

#### B. Sensors and Mobile Connectivity

The connectivity between sensors and the mobile app is achieved through Bluetooth. The sensors have inbuilt Bluetooth facility through which the data can be transferred. The sensors use open ISM band which operates in 2.4 GHz frequency. An alternative to Bluetooth can be IEEE 802.15.4 standard protocol ( ZigBee ).

#### C. Android Mobile App

The mobile app is compatible with Android 2.2 Froyo version and higher. The app has several facilities like getting Doctors Appointment, checking sensors readings, chat facility with doctors. The app have an authenticated login with login id as mobile number and password. The interface is different for patient and doctor. This app even takes care about generating the bill

receipt. The bill is generated on the basis of treatment cost, room charge, etc.

#### D. Data transfer to Cloud

This project uses google cloud for data storage and computation. The data sensed by the sensors is transferred to mobile through Bluetooth and then is transferred to cloud. The mobile should have internet facility to transfer the readings to cloud database. The data on the cloud can be viewed by doctor as well as patient. Doctor can view the data on the cloud and give the prescription to the patient. The cloud stores the previous data of the patient which could be useful by the doctor while treating him.

Table 1 shows sample sensor readings of body temperature and blood pressure for three patients.

Sensor Reading	Patient 1	Patient 2	Patient 3
Body temperature	98.6	99	102.2
Blood pressure	122/84	141/78	109/84

Table 1: Sample sensor readings.

#### E. Alert System

This system alerts the doctor when any anomaly in the reading is occurred. When the sensors reading varies drastically then an alert is send to the doctor. Hence doctor need not attend patient frequently. The alert contains the message regarding the anomaly caused in reading which indeed helps the doctor in patient treatment.

### VI. Conclusion

IoT advances in healthcare industry and is used for patient monitoring, easy aid and provide timely services to the patients and may save the life of million people. In this paper, we developed a system and utilised known technologies such that the system may provide real time data to patients as well as their doctors and ensures the healthiness of patients. This system limits the efforts of doctors by making use of IoT and database on Cloud which is all based on Internet available everywhere nowadays. It reduces the paper work by making the system digitalized. Also, sensors provide accurate results thus helping in providing right diagnosis to illness of patients.

### VII. Future scope

In future, the technology, for example Bluetooth, used in this system can be further upgraded to new technology invented lately. The sensors used

can be replaced by new sensors which are developed. Also there is a need to make sure that the privacy and quality of life of person is influenced and better with the improvement in system features and its security.

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