A Review Paper on Design and Implementation of Smart Health Care System using IoT

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Abstract- Diagnosis and monitoring of health is a very important task in health care industry. Due to time constraint people are not visiting hospitals, which could lead to lot of health issues in one instant of time. Priorly most of the health care systems have been developed to predict and diagnose the health of the patients by which people who are busy in their schedule can also monitor their health at regular intervals. Many studies have shown that early prediction is the best way to cure health because early diagnosis will help and alert the patients to know the health status. In this paper, we review the various Internet of Things (IoT) enable devices and its actual implementation in the area of health care children's, monitoring of the patients etc. Further, this paper addresses how different innovations as server, ambient intelligence and sensors can be leveraged in health care context; determines how they can facilitate economies and societies in terms of suitable development.

Keywords- *Internet of Things (IoT);ambient intelligence; monitoring; innovations; leveraged.*

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I. INTRODUCTION

Now a day's, Internet has become one of the imperative part of our daily life. It has changed how people live, work, play and learn. Internet serves for numerous ideas such as in education, finance, business, industries, entertainment, social networking, shopping, e-commerce etc. The next innovative mega trend of Internet is Internet of Things (IoT). The IoT connects smart objects to the Internet. It can facilitate an exchange of data never available before, and bring users information in a more secured way.

The Internet of Things (IoT) is an innovative concept reflecting a connected set of anyone, anything, anytime, anyplace, any service, and any network as shown in figure 1. The IoT is a megatrend in next-generation technologies that can culminate the complete business gamut and can be thought of as the interconnection of uniquely identifiable smart objects and devices within today's internet infrastructure with extended benefits. These benefits typically include the advanced concatenation of the devices, systems, and services that goes beyond machine-to-machine (M2M) scenarios. Therefore, initiating automation is feasible in nearly every domain. The IoT provides appropriate solutions for a wide range of applications such as smart cities, traffic congestion, waste management, structural health, security, emergency services, logistics, retails, industrial control, and health care.

Medical care and health care represent one of the most attractive application areas of the IoT [2]. The IoT has the potential to give rise to many medical applications such as remote health monitoring, fitness programs, incurable diseases, and elderly care. Compliance with treatment and elixiring at home and by health care contribution is another important potential application. Thus, various medical devices, sensors, diagnostic and imaging devices can be viewed as smart devices or objects constituting an interior component of the IoT. IoT-based health care services are foreseen to reduce costs, increase the quality of life, and enrich the user's experience.

In order to make our health care services robust immense and secure, the IoT relies on several enabling technologies. Congregating real-time data from different sources, in this case, unlimited number of patients for a considerable period of time has become very simple and fast using the potential of IoT. The potential of IoT for health and medical services are tackled by smart sensors which accurately measures, monitors and analyze a variety of health status designators. These include basic crucial health signs such as pulse rate and blood pressure. With the help of IoT's potential, doctors are now able to collect real time raw data from numerous patients for a continual period of time through smart devices connected on an interconnected network, which ensure them not only with trustable and reliable results but also time saving which will be of maximum benefits. Internet of Things (IoT) is going to revolutionize health care by significantly lowering costs and improving quality.

II. RELATED WORK

Deepika Agrawal et al. [1] proposed an IoT based health monitoring system that collects all the medical

relevant data of a patients, including patients heart rate, blood pressure and ECG and sends alerts to the patient's doctor regarding patients full medical information, providing a fast and reliable health care service.

Sapna Tyagi et al. [2] defined the role of IoT in health care deliverance and its technological aspects that makes it a reality and examine the opportunities. This system build's a network among all entities (doctors, patients, Labs, Pharmacists, Nurses) participating in health care that not only limits to the entities under one umbrella but also cover's nationwide entities. Tried to implement the concepts of IoT where these entities would be directly communicating to the cloud.

Alexandru Archip et al. [3] defined the steps taken to design and build a low-cost monitoring system prototype. The system focuses on remote patient monitoring in hospital wards, following an ICU discharge. The system offers mobile support in order to facilitate faster and better medical in emergency cases and has been developed using low-power dedicated sensor arrays for EKG, SpO2, temperature and movement.

S. Sivagami et al. [5] defined a proposal for smart hospital system (SHS), which relies on different, yet complimentary, technologies, specifically RFID, WSN and smart mobile, interoperating with each other through a Constrained Application Protocol (CoAP)/IPv6 over low-power wireless personal area network (6LoWPAN)/representational state transfer (REST) network infrastructure. In this proposed system, the sensors are built to get the environmental conditions of the hospital for which hospital staff would be responsible and RFID is used for this monitoring. For the patient , nurse would be responsible for tracking/monitoring the patient health condition (temperature and heart rate), based on which graphical chart is generated which is shared with doctor.

Nitha K. P. et al. [6] reviewed the concept, applications and various existing technologies in health care. The system uses all the potentialities of Internet of Things by connecting with smart devices or things with the human beings to provide them the best health care and also enumerated the key difference between and brief elucidation of the scope of IoT in personalized health care, that ranges from wrist worn devices to health care systems.

Alex Page et al. [7] proposed that network sensors either worn on body or embedded in living environment that can help in providing rich information captured on continual basis which is aggregated and effective minded about the patient's physical and mental health. They have proposed a system where the data acquisition is performed multiple wearable sensors that measure physiological biomarkers such as ECG, skin temperature, respiratory rate, EMG muscle activity and posture. A zigbee or Bluetooth is used to transfer sensor data to the concentrator. Often a storage/processing device in vicinity of a mobile client, sometimes referred to as a cloudlet, is used to augment its storage/processing capability whenever the local mobile resources do not fulfill the applications requirements. The cloudlet can be a local processing unit (such as a desktop computer) which is directly accessible by the concentrator through WiFi network. Cloud based medical data storage and the upfront challenges have been extensively addressed in the literature. Analytics that use the sensor data along with e-Health records that are becoming prevalent can help with diagnoses and prognoses for a number of health conditions and diseases. Additionally, Visualization is a key requirement for any such system. This treasure trove of data, when analyzed and presented to physicians in easy-to-assimilate visualizations has the potential for radically improving healthcare and reducing costs. Also highlighted several of the challenges in sensing, analytics, and visualization that need to be addressed before systems can be designed for seamless integration into clinical practice.

S. M. Riazul Islam et al. [9] proposed An intelligent collaborative security model to reduce security risk; discussed how different innovate technologies such as big data, ambient intelligence, and wearable's are leveraged in a health care context; addressed various IoT and eHealth and regulations around the world. Furtherly, analyzed the distinct IoT security and privacy features, as well as including security requirements, threat models, and attack taxonomies from health care perspectives and defined the advances in IoT-based health care technologies.

Danilo De Donno et al. [10] proposed A novel, IoT-aware, sharp-witted architecture for automatic monitoring and tracking of patients, personnel and biomedical devices within the hospitals and nursing organizations. Staying true to the IoT vision, they proposed a Smart-Health-System (SHS) which relied on different, yet complementary, technologies, specifically RFID, WSN, and smart mobile technologies.

Cecilia Occhiuzzi et al. [11] proposed An Ambient Intelligence platform, here after denoted as NIGHTCare for remote monitoring and control of overnight living environment which is entirely based on RFID passive technology which is bale to recognize nocturnal behaviors and activities, generates an alarm to the operators, families, or towards first-aid remote centers in case of anomalous or pathological events and support diagnostics. The NIGHTCare platform deploys miniaturized wearable tags (WT) properly integrated into clothes, conventional ambient tags (AT) dispersed in the environment, a long-range UHF RFID reader, a physical layer software engine for real-time processing and a web-based graphical processor with warning modules. By processing the electromagnetic signals arising from the interaction between the subject and

surrounding environment, the system detects and reports the presence or the absence of the user in the bed, his/her jerky movements and the motion patterns, accidental falls, prolonged absence from the bed and prolonged periods of inactivity such as fainting, unconsciousness or even death.

Mohamed Adel Serhani et al. [12] proposed a frame work to collect patients data in real time, in order to perform appropriate nonintrusive monitoring and propose medical and/or lifestyle engagements, whenever needed. The framework completely relies on service-oriented architecture (SOA) and the cloud which allows seamless integration of mobile technologies and services to smoothly collect the vital data of the patients wearable biosensor devices. The data are stored in the cloud which and made available that can be accessed by the physicians and/or by any other authorized entity.

Hasmah Mansor et al. [13] proposed an health monitoring system which helps the doctors to monitors the patients health vital signs via web. Designed and developed the body temperature measurement device that helps the doctors to measure the patient vital signs via internet and as well as to trace the patients history which indicates an alarm to the doctors in case of abnormality signs in patients health.

Ming Li et al. [14] proposed a novel patient-centric framework and a suite of mechanisms for data access control with the PHR stored in semi trusted servers in order to achieve fine-grained and scalable data access control for PHR's by leverage attribute-based encryption (ABE) techniques in order to encrypt every patient's PHR file. Made focus on multiple data owner scenario and has divided the user in the PHR system into multiple security key management which gradually reduces the key management between the users and the owners. A high degree of patient privacy is guaranteed simultaneously by exploiting multi-authority ABE that enables dynamic modification of access policies or file attributes, supports efficient on-demand user/attribute revocation and break-glass access under emergency scenarios.

Yi Mao et al. [15] proposed an early warning system (EWS) designed to identify or to trace the signs of clinical deterioration and provide early warning for serious clinical events. Also introduced a bucketing technique that identifies and captures the changes in the vital signs. Meanwhile, managed to handle the missing data so that the visit who don't have all the parameters can still be classified. Conducted a pilot feasibility study by using an amalgamation of logistic regression, bucket bootstrap aggregating for addressing over fitting, and exploratory under sampling for addressing class imbalance. Also showed that this combination can significantly improve the prediction accuracy for all performance metrics, over other major methods.

Pragati Gupta et al. [17] described the wireless sensor network and its application to wearable physiological monitoring, In the conventional wearable physiological monitoring system, the sensors are integrated at specific locations on the vest and are interconnected to the wearable data acquisition hardware by wires woven into the fabric. But the main drawbacks associated with these systems are the cables woven in the fabric pickup noise which results in corrupting the physiological signals. Also repositioning of the sensors in the fabric is difficult once integrated. So in order to overcome with this physiological monitoring sensors must be designed by miniatures electronics which must be placed strategically at various locations of the vest. Number of sensors integrated into the fabric form a network (Personal Area Network) and interacts with the human system to acquire and transmit the physiological data to a wearable data acquisition system. The wearable data acquisition hardware collects the data from various sensors and transmits the processed data to the remote monitoring station.

Robert Matthews et al. [18] derived a description and evaluation of a wireless version of a system based on these innovative ECG sensors. Developed a new class of miniature, ultra low noise, wearable and ultra low power wireless capacitive sensor node called Eco that does not require direct contiguity to the skin, and has equivalent performance to gold standard ECG electrodes.

Yunxia Chen et al. [19] derived a general formula for the lifetime of wireless sensor networks that holds the underlying network model including network architecture and protocol, data collection initiation, lifetime definition, channel dwindling characteristics, and energy consumption model which identifies two key parameters at the physical layer that affects the network lifetime. Based on this formula, they have proposed a medium access control protocol that utilizes both the channel state information and the residual energy information of individual sensors.

Rita Paradiso et al. [20] proposed a system based on a textile wearable interface which is implemented by integrating sensors, electrodes, and connections in fabric form, innovative signal processing techniques, and modern telecommunication systems. The system shows the feasibility of a system based on fabric sensing elements. Designed to monitor individuals affected by cardiovascular diseases, in particular during the reformation phase. The system can also help professional personnel's who are subjected to considerable physical and psychological stress, environmental and professional health risks.

III. PROPOSED SYSTEM

The proposed system aims to cover an end-to-end smart, efficient and innovative health application that can be built

up from two functional building blocks. However the main function of the first building block is to gather all sensory data that are related to the monitoring of the patients, whereas the second block functions is to store, process and present the resulted information at the server where the doctors can access health reports following the case of the monitored patients.

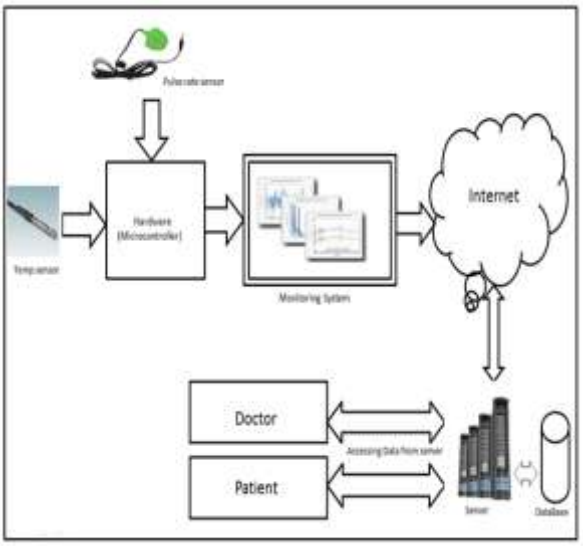

Figure1: Proposed Block Diagram of IoT based Smart Health Care Kit

As depicted in Figure 1, which illustrate the overall model, the system consists of a robust health monitoring system that is intelligent enough to monitor the patient health automatically using IoT. This would help the doctor's to monitor patient's report from anywhere and at anytime.

The system uses smart sensors that generate raw data information collected from each sensor and send it to a data server where the data can be further analyzed and converted into a graph analysis and statistically maintained at the server which can be used by the medical experts.

IV. CONCLUSION

The internet has immensely changed the way we live, intercommunicating between people at a virtual level in several contexts spanning from professional life to social relationships. The IoT has the potentiality to add a new dimension to this process by establishing communication among smart objects, leading to the vision of "anytime, anywhere, any media, anything" communication. Ingenious use of IoT technology in health care not only bring benefits to doctors and managers to access wide ranges of data sources but also challenges in accessing heterogeneous IoT data, especially in a mobile environment of real-time IoT application systems.

The health monitoring system is beneficial to the patients as well as to the society where the implementation of such systems will save hospital bill, waiting time, and also reduce the long queues in the hospitals.

This paper tries to emphasize on a health care system which is enabled with IoT technology that not only realizes the illustration and traceability of health care actors but guarantee the improved health care services. The key motive behind the proposed system is to provide better and efficient health services to the patients by implementing networked information so that experts and doctors can make use this data and could provide fast and efficient solution.

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