

*Internet of Things (IOT) Based Smart Health Care System for  
Elderly Behaviour Analysis*

**Snowber Mushtaq<sup>1</sup>**

Department of Computer Science and Engineering  
Islamic University of Science and Technology  
Awantipora, J&K – India

**Nailah Afshan<sup>2</sup>**

Department of Computer Science and Engineering  
Islamic University of Science and Technology  
Awantipora, J&K – India

**Rayees Ahmad Dar<sup>3</sup>**

Department of Computer Science and Engineering  
Islamic University of Science and Technology  
Awantipora, J&K – India

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**Abstract:** *The mean lifetime of the population is increasing day by day. As the people grew older there are lot of issues related to their health, they require regular care takers. They have to undergo lot of regular tests, regular check up and monitoring. The main problem we need to address is Mild Cognitive Syndrome, weakness and disability in elderly population. We need to design wearable devices that can continuously monitor certain basic health elements like blood pressure, oxygen level etc, and the devices must be able to transmit information to doctors if the value passes certain critical level, So that our elderly population can live a better life. The system must be scalable, adaptable and must be communicate. The Internet of Things (IOT) has the features of data collection, transmission, storage and management, thus can be used to develop such systems.*

**Keywords:** *Internet of Things (IOT), Hospital Management, Wi-Fi, Behaviour Analysis, Sensors.*

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## I. INTRODUCTION

The inhabitants of human livings on earth are inflating gradually. Here in this paper we are going to discuss IoT enabling technologies that will smoothen the inflating population. IoT in combination with cloud computing facilitates the flow of information easier to population. Among the growing population it is predicted that about 122 million populations will be elderly by 2060. We need to model modernized technology for providing care to our elderly population at home. As it is safer to keep our elderly population mostly at home. For this we need to design our homes with independent living technology which will provide long term care, comfort and encourage to our elderly population. The people with chronic, lung disease or mental disabilities need also continuous attention. We need to integrate our home with smart technology that can provide personal care. We need to design applications that can provide appointments between doctors and patients using internet. The smart temperature controlling system needs to be designed and controlled via internet. The architecture of the homes should be designed in such a way that it is enabled with elevators, large doors and corridors for people with disability. We know more than 60% of population are familiar with cell phones and we can control all the devices using cell phones [1].

The rate of growth of elderly people (age > 60) is about 3.25% per year, which is more than other age groups. About 70% of deaths are due to chronic disease. In order to reduce the deaths we need to check the basic physiological parameters using wearable sensing technology. This technology enables the wet electrodes connected to body for measurement of blood pressure, respiratory rate, heart rate, oxygen level, ECG etc. All the measured parameters are sent to doctors and family members through internet or mobile application for immediate medications. The information can also store for further analysis. IoT is an

emerging standard for information exchange and it provides web based services. The sensing technology includes measurement of ionic signals/ currents inside the body of a human being and these signals need to be converted into electronic signals [2]. Its types are: Dry electrodes, wet electrodes and non contact electrodes. Wet electrodes are the standards used in medical labs for monitoring; it involves electrolyte gel for conduction which is applied on skin. For long term use this causes discomfort and irritation. Dry electrodes provide direct contact with skin and don't need gel for conduction. And this can be used in wearable monitoring devices. Non contact electrodes have the ability of sensing without direct contact with skin. They are sensitive to environmental parameters and this technology is not matured yet [3]. With the advancement of micro-electronics, improvement in bandwidth has helped the survival of Moore's law. This has helped to compact the devices, decreasing the cost of product and increasing the performance. We have today very high density, higher bandwidth products available and having very thin packing due to which we are able to use them as wearable devices [8].

There is a need to address the quality of life elderly people using information technology, communication technology and argument reality to lead a better life. It is expected that we have 20% people of elderly age out of which 3 to 9% have mild cognitive impairment, out of which some of them have a chance of having Alzheimer's disease and some can encourage for better life. BREATHE is programme for analysis of behaviour of elderly persons, patients by caretakers and they can share with doctors. So, the persons can be entertained by various resources like social networking sites etc.

## II. LITERATURE REVIEW

Smart health care system for patients and elderly person is a diverse system which includes mainly Internet of Things (IoT), wearable devices, Image processing. But, the problem involves with sensors which are the basic components of this system, they are expensive and has high power consumption. And also we need have data storage system for storing data from sensors and other components for making intelligent system for health care. City4Age was the project started by European government and under this platform main focus was to develop a framework for early detection of Mild Cognitive Impairment (MCI) .So, that our elderly people can live a better life. Its various phases include First phase: Data Collection Phase, this phase includes collection of data. Second Phase: Data Capturing Phase, Here we need low cost and low power sensing infrastructure called (Internet of Things) IoT for heterogeneous system that can communicate and integrate data. Third phase: REST API , Representation state transfer application programming interface is a robust technology with low bandwidth usage making it suitable for internet and communication between various software programs.

For the collection of data we need to capture smaller atomic events called Low Level Elementary Actions (LEA's). It gives us very fine information for detecting behaviour of elderly person. The three main categories of LEA's include personal LEA's, home LEA's, and City LEA's. Personal LEA's include capturing users state like walking, climbing, moving etc,. Home LEA's include mobility of user inside home and the status of home appliances like temperature, noise, humidity etc,. City LEA's include outdoor actions of person and interaction of person with environment [4].

Smart hospital management system can be developed with IOT for digital communication within hospital and outside like human to machine communication, machine to machine communication, machine to doctor . Here we need fine modelling of the system and it needs to be developed on some service oriented architecture. The smart eICU helps doctors and nurses to monitor the patient's vital organs in the intensive care unit. QUALCOMM is a cloud based platform for communication with other devices. Cisco has also developed a system for e health care system.

Scope of the system, include study of patients of remote areas for insurance and disease diagnosis. The network includes wired, wireless, World Wide Web architecture and NOSQL for unstructured data and information is stored in hospital information system. In this system we define the minimum, maximum and critical values of various parameters [5].

### III. IOT AS EMERGEING TECHNOLOGY

IOT has the ability to connect various devices called sensors and enable communication between these devices called device to device or machine to machine communication and the devices can be controlled from faraway places. They have the capability to collect information, analyze it and send over a communication media. We have already certain technologies available for same purpose like zigbee, Bluetooth, 802.11 and 6lowPAN. Among all Wi-Fi is the best technology.

Wi-Fi (Wireless Fidelity) has an advantage of higher speed and higher range over other technologies. As we know all the devices now a days have Wi-Fi as the enabled technology. Nowadays, all the smart phones have Wi-Fi enabled in it. It is IEEE 802.11 standard for wireless local area networking and it is a trademark of Wi-Fi alliance and it commonly uses 2.4 gigahertz and 5.8 gigahertz bandwidth for its operability. It allows transmission of information without internet cord, its access points are available all around and it can pair with other devices. And this technology enables IOT to work intelligently and automatically.

Proximity sensors have the ability to detect the presence of nearby objects without touch. Photo sensors can be used for monitoring the heart rate of a person in health care system. There are two main categories of IOT devices. One wearable devices for monitoring basic things regarding health care and can be controlled by handheld devices and second smart devices have independent controllers but proximity sensors come under both.

### IV. SYSTEM ARCHITECTURE

We know nowadays all hospitals have their own websites, which are operated by programmers and all data uploading is done manually. All the information like when is doctor available, appointments etc are all available on the website. With the invention of technology like sensors and communication protocols, we can automatically connect all the devices. When the patient is admitted in hospital, he is assigned patient id and some wearable device is given to him. This consists of a set of sensors for measuring basic parameters of human body. And some additions sensors can be attached for critical cases for measuring parameters like ECG, EEG, MRI, CT-SCAN etc. All the readings from these sensors are automatically uploaded to the website for a particular patient id and in turn can send information to doctors if it crosses certain limit. We can manage no of patients, no of beds available in hospital, availability of doctors automatically.

Wi-Fi provides the means of communication between various sensors that in various LEA's. RFID (Radio Frequency Identification Technology) is used for identification of various sensor devices and people. The RFID contains RFID tag, RFID reader, RFID back-end database. RFID devices are of two types Active and passive. Active requires power resources and passive doesn't need power resources. Here main provocation is to provide interoperability and communication support between various devices using IoT technology.

The personal data capturing system is meant for collecting data and provides a means for capturing data from various sensors. It has data related to various things like mobility of patients, location of patient both inside and outside, environmental parameters of user like humidity, temperature, weather conditions etc. And interactions of patient with environment all this data is captured in the capturing unit.

REST API is meant for sending this data to the doctors and keeping record of patients various health parameters and its variations. And to keep them in cloud for further analysis and if the values cross certain limit an automatic message is sent to doctors and patients care takers.

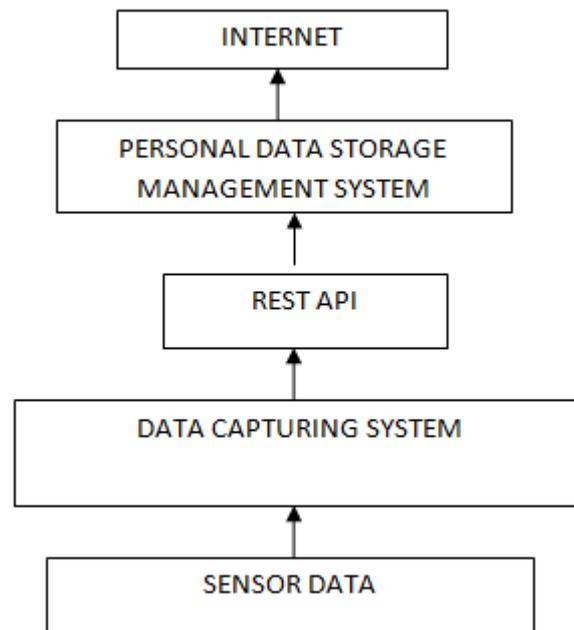


Figure 1: Architecture of a system

## V. CONCLUSION

The main focus of this paper is to find how to integrate technology with health care for developing smart health care, smart hospital management system. The battery power of the devices is limited and need to be focused for efficient power management. The daily data generation of this system is of huge amount, so we need to manage huge amount of data, store it on cloud and applying big data analytics on it for efficient study of it.

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