

The Role of Internet of Things in the Healthcare Industry

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Abstract- Internet of Things is an innovative computerized system which is used for several applications across industries through their flexibility and capabilities. Independently living old age population is increasing now a days. They are requiring medical assistance in time, really it is a big issue. Continuous monitoring is an essential process to solve this issue. Medical devices have been enriched by incorporating cyber and physical capabilities to provide better health care services. With the help of wireless communication protocols, the IoT provide the interconnection facilities between the medical devices and other monitoring hardware. Supporting with the technology and smart devices, the IoT applications perform data collection, automation, and operations. IoT play a vital role in improving the health, safety and care of patients through healthcare monitoring system. Through the healthcare monitoring system the patient getting immediate help from the medical persons. In addition they may get medical assistance and recommendations also. This paper presents the strengths, weaknesses, challenges and overall suitability for a wearable IoT health care system.

Keywords : Internet of Things, Healthcare monitoring system, Wearable devices, Wireless sensor networks.

I. INTRODUCTION

The Internet of Things is a network of physical things like vehicles, home appliance and other items connected with software and do the operation of data actuation and sharing. Every connected device having a unique identification. IoT network devices having limited CPU, memory and computation power. The major enabling technologies and protocol are RFID, NFC, Bluetooth, wireless sensor and WiFi. With the support of these technologies IoT do the major operations like data collection, analysis, integration and processing. IoT enhance the process of several fields particularly in medical receive high level performance recently. Integration of body wear devices it provides more accuracy, faster reaction and constant improvements in medical research and patient healthcare. They have improved the accuracy and size of medical data through various data gathering process from real-world cases. Through the medical care system and integrated instruments, it can improve the accuracy of patient treatment and analysis. This system deliver required data to superior or responsible persons in time. Use this data the medical professional do their analysis and treat the patient immediately, here the criticality should be avoided.

The rest of this paper is organized as follows. The next section discussed the functions of IoT in healthcare and

Section 3 reviews the examples of IoT in healthcare. The advantages of IoT in healthcare are given in Section 4. Benefits of the IoT in healthcare are discussed in Section 5. The challenges in healthcare using IoT are presented in Section 6. The last Section concludes this paper.

II. FUNCTIONS OF IOT IN HEALTHCARE

In a Healthcare station or in a hospital the doctors or nurses like to monitor the patients' health status. Here Wireless sensor networks play an important role to collect the data and to communicate all values to a central station like the healthcare office or a hospital controlling authority room. In emergency cases, the system can react on alarm notifications immediately without the distress call from a patient. Sensitive data are associated to patients that can be used to share with nurses, doctors and authenticated persons securely with the help of IoT system. Well established infrastructure can be deployed locally in healthcare station with the permission of the patients. Here the IoT system taking care the sensitive data will be secure and protected by relevant mechanism and share the authentic persons. The application can provide the functions for a day care assistant for elderly people in their everyday life like ingesting pills, outpatient care and ambulatory care if required. It is

necessary to share patient's information to all working shift employees to provide round the clock support without losing any information.

IoT should be able to provide the following services/applications:

- Remote assistance to share data between stakeholders.
- Monitor and store the health related data.
- In case of emergency system provide alarm notification to concerned persons.
- Provide security and privacy for sensitive data with the help of specialized applications.
- Share the real-time data between involved employees and stakeholders.
- Preorder medicine can be delivered in time through pharmacy.

The main objective of the IoT in healthcare is to link doctors with patients through a smart device, without constraints. The patients might open up better, helping the doctors reach a better diagnosis faster. It may improve disease management and reduced the health care costs. Each activity of the patient's information is recorded with the help of smart devices which is associated with the patients. Recorded information share to the assistance provider, this retrieved information should play a vital role in the diagnoses, detection of illness and treatment process. With the high-speed networks, intelligence information gathering, remote monitoring mechanism and wearable devices are used to improve the performance of the healthcare system ultimately the patient got proper treatment in time and come out from the life thread. IoT supplied the powerful emergency support service through advanced automation and analytics. Analyze the emergency in the complete ways from far away locations and provide the necessity instruction to the concern persons through the medical advice given by the professionals.

Most of the systems are having sensors and actuators rely on some proxy concept, i.e. sensors communicate to some more powerful entity with authentication of the sensors. In the healthcare system connected with wearable sensors and medical devices which are gathered the medical data from human body or mind it can be done remotely at home too. The IoT devices can check for blood pressure, blood glucose level, heart rate act, and any spike or change in the normal levels will be identified and alerted before they become serious. Specialized sensors are installed in devices for brain activity monitoring which is uses electrical simulation to understand the functioning of nervous system and it allows the medical expert to visualize the brain. Several companies are manufactured fitness smart watches and fitness bands to monitor health condition of the wearer and also pass the health data to the concern person through

connected devices. Use this information the medical professionals make decisions it avoid the critical situation. Micro controller based solution can track the health of the child, check the heart rate, breathing rate and sleeping position any unusual measures are gathered immediately the system can notify it to parents and medical professionals, it may prevents the infant death syndrome.

III. EXAMPLES OF IOT IN HEALTHCARE

OpenAPS is a simplified Artificial Pancreas **System** (APS)

This system designed to adjust an insulin pumps and insulin delivery automatically and keep blood glucose level in a normal range with the help of the sensors and transmitters.

Connected inhalers

The most immediate use for IoT technology in healthcare is not to assist in diagnoses, though, but to ensure adherence. Adding sensors to medicines or delivery mechanisms allows doctors to keep accurate track of whether patients are sticking to their treatment plan.

Activity trackers

Patients will wear an activity tracker for up to a week prior to treatment and then continuously for several months over the course of multiple treatments. The trackers will assist in logging activity level and fatigue, with appetite also being logged directly, and all data saved to their personal smart phones. This is particularly the case for a disease such as cancer, for which the reaction to therapy plays an important and determinant part in prescribing the right treatment.

Ingestible sensors

The main purpose of this technology, trialled with an antipsychotic and a hypertension pill, is to monitor adherence. However, in this case, the pill dissolves in the stomach and produces a small signal which is picked up by a sensor worn on the body, which again relays the data to a smartphone app.

Connected contact lenses

Alcon has licensed Google's smart lens technology which involves non-invasive sensors embedded within contact lenses. The lenses may eventually be able to measure glucose levels of diabetes patients via their tears and then store the information in a mobile device.

Depression-fighting Apple Watch app

The app, developed alongside Cambridge Cognition, is designed to monitor and assess cognitive function, with the trial set to examine how an app compares with traditional testing and self-assessment when reporting mood and cognition. Both passive and active data is collected.

Coagulation testing

This is the first device of its kind for anticoagulated patients, with self-testing shown to help patients stay within their therapeutic range and lower the risk of stroke or bleeding.

IV. ADVANTAGES OF IOT IN HEALTHCARE

Enhanced disease management – patient health can be monitored constantly and in real time. This allows for accurate and prompt diagnosis of certain diseases.

Better treatment results – with IoT, timely treatment can be assured. As IoT devices are connected via the cloud, healthcare providers can constantly and consistently checkup on their patients. This helps them make informed and timely decisions.

Decrease in treatment costs – in many parts of the world, healthcare is very expensive. IoT helps solve this challenge. Patients who need constant monitoring can be discharged early, and their post-op progress can be monitored via mHealth apps. This would mean a decrease in hospital stays and expensive treatments.

Improvement in patient experience – with a decrease in costs, instant disease diagnosis and a promise of better treatment, the entire patient journey is enhanced. This will only increase the trust patients place in their doctors.

V. BENEFITS OF IoT IN HEALTHCARE

Benefits of IoT in healthcare include location based health wearable's that notify the personnel who are needed medical help including the individual suffers an accident. IoT based remote monitoring is the one of important benefit in healthcare. Here medical professionals can have a real time visibility of patient health condition. Help of the IoT we can prevent the critical condition curtail loss of life. IoT with its embedded capability can predict when medical equipment might be required maintenance, this avoids the entire loss of equipment cost and the downtime of the equipment to be calculated easily which is helpful to plan for arrange the new or alternate immediately. If you have aged parents living alone, and you worried about their health and safety, this problem to be solved with the help of IoT in healthcare system. You can get their health related

information frequently through the smart devices which are connected with your parents.

VI. CHALLENGES IN HEALTHCARE USING IOT

The Patients data are collected from different devices it can be used by different medical devices which are fulfilling the need of patient diagnosis defined by the medical professional. For example a diabetes patient glucose level to be monitored frequently and send the report to the physician while also gathered the data related to asthma on a separate device which is going to the asthma care physician in this scenario the data from different IoT devices and send it to the different physician here we need the locking facility to stop the irrelevant data to share the unrequired physician. Another issue is the collected data send to the physician without the context of full patient record it creates the complication so we need to provide the wearable device data with the master record of the patient.

Security is the main concern in IoT with healthcare here very sensitive data is collected from the various IoT devices and it transmitted to the destination. If it received by the wrong person, it can be very danger but the implementation of the security mechanism is somewhat difficult. Most of the medical IoT devices are using clinical setting here we ensure the manufacturer of medical equipment should take responsibility adding security features and make it ready to face cyber security risks.

Today patient need more than one device to capture the different type of health data, it can required more number of sensors and a hub which is used to process the information, Lacking of common hardware for compatible with different sensors create cost related issues.

VII. CONCLUSION

The main contribution of this paper is that it focus on Healthcare monitoring system using IoT applications. Paper discuss the fundamental technologies that might be used in IoT in different aspects related to IoT healthcare and highlights the strengths and advantages. This paper address the challenges in IoT and presents the existing system of IoT in healthcare. It conclude that the IoT have a positive impact on supporting patient healthcare and keep the privacy and security for patient sensitive data. IoT applications offer the chances for providers to have visibility to the patient health condition. In future IoT will create a new business endeavor with hospitals, pharmaceuticals and medical professionals.

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