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EMERGENCY PATIENT REMOTE MONITORING SYSTEM FOR APPLICATION OF EMERGENCY MEDICAL SERVICES

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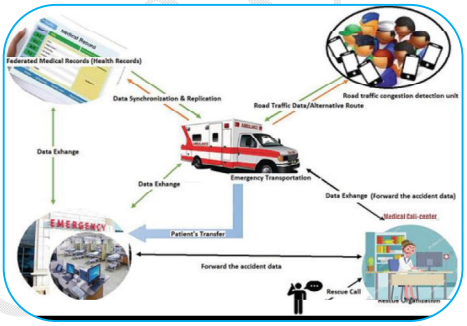
ABSTRACT:

Internet of Things (IoT) term represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. The IoT is comprised of smart machines interacting and communicating with other machines, objects, environments and infrastructures. Now a day's every persons are connected with each other using lots of communication way. Where most popular communication way is internet so in another word we can say internet which connect peoples ***(Janakiram, 2017).***



KEYWORDS: *Internet of Things (IoT) , smart machines interacting , environments and infrastructures.*

INTRODUCTION :

Today, we are seeing the electrification of the world around us. Almost any manufactured good now includes an embedded processor (typically a microcontroller, or MCU), along with user interfaces, that can add programmability and deterministic "command and control" functionality. The electrification of the world and the pervasiveness of embedded processing are the keys to making objects "smart." Your old toaster that mechanically controlled the color of your toast now has an MCU in it, and the MCU controls the color of your toast. The toaster completes its task more consistently and reliably, and because it is now a smart toaster, it has the ability to communicate with you electronically using its touchpad or switches. After a device becomes smart through the integration of embedded processing, the next logical step is remote communication with the smart device to help make life easier. For example, if I am running late at the office, can I turn on my house lights for security reasons using my laptop or mobile phone?

Communication capability and remote manual control lead to the next step … how do I automate things and, based on my settings and with sophisticated cloud-based processing, make things happen without my intervention? That's the ultimate goal of some IoT applications. And, for those applications to connect with and leverage the Internet to achieve this goal, they must first become "smart" (incorporate an MCU/embedded processor with an associated unique ID) then connected and, finally, controlled. Those capabilities can then enable a new class of services that makes life easier for their users **(Janakiram, 2017).**

The term Internet of Things was first coined by Kevin Ashton in 1999 in the context of supply chain management. However, in the past decade, the definition has been more inclusive covering wide range of applications like healthcare, utilities, transport, etc. Although the definition of 'Things' has changed as technology evolved, the main goal of making a computer sense information without the aid of human intervention remains the same. A radical evolution of the current Internet into a Network of interconnected objects that not only harvests information from the environment (sensing)and interacts with the physical world (actuation/command/control), but also uses existing Internet standards to provide services for information transfer, analytics, applications, and communications. Fueled by the prevalence of devices enabled by open wireless technology such as Bluetooth, radio frequency identification (RFID), Wi-Fi, and telephonic data services as well as embedded sensor and actuator nodes, IoT has stepped out of its infancy and is on the verge of transforming the current static Internet into a fully integrated Future Internet. The Internet revolution led to the interconnection between people at an unprecedented scale and pace. The next revolution will be the interconnection between objects to create a smart environment. Only in 2011 did the number of interconnected devices on the planet overtake the actual number of people. Currently there are 9 billion interconnected devices and it is expected to reach 24 billion devices by 2020 **(James, 2017).**

Our definition of the Internet of Things for smart environments is: Interconnection of sensing and actuating devices providing the ability to share information across platforms through a unified framework, developing a common operating picture for enabling innovative applications. This is achieved by seamless ubiquitous sensing, data analytics and information representation with Cloud computing as the unifying framework. With the alliance of microcontroller, GSM MODEM could be further used for some of very innovative applications including, GSM based home security system, GSM based robot control, GSM based DC motor controller, GSM based stepper motor controller, GSM based voting machine control etc **(Megalingam R K, 2015).**

Nowadays advance advertising system applications in educational institutions and organizations, crime prevention, traffic management, railways, advertisements etc. Been user friendly, long range and faster means of conveying information are major bolsters for this application **(Bui N, 2011).** The project aims in designing a notification system, which is capable of automatically sending information about results, circulars, schedules and time tables to the students or shopping centre will send about discounts or new arrivals to their customers. This project will be to design a GSM based electronic notice display system which can replace the currently used programmable electronic display. We can display any important information through web server on Notice board. And also we can send this information to registered mobile numbers.

IoT on Medical: Now a days, health related problems are mounting at a very high speed. High mortality rate is a big concern for many countries. Thus, today there is requirement of time to conquerhigh mortality rate. We, therefore, are modeling a system having several wireless sensors which will measure health related information like body temperature, blood pressure, saline level, heart beat rate, etc. and transmit over internet to be accessed by other user at remote location. Daily basis patient's health database is created and recorded and the same can helpful in analysis by doctor, if needed. This paper proposes a health examining system which is having capability of analyzing various parameters and discoveringhealth issues. Threshold values are set based on past reading from the database. At time of urgent situation when threshold values are crossed, alerts will be generated automatically which doctor can also see for taking necessary actions. People now a days are taking health seriously which help in prevention and/or detection of health issue at initial stage. Also, next generation smart phones and intelligent gadgets like smart watch and such have great impact on our lives. Various types of Sensors like for ECG Monitoring, measuring systolic pressure and diastolic pressure & pulse rate measuring sensors are being used in the gadgets. Immensely successful work has been done in health examination using Raspberry Pi as well as IoT. Here, in our paper, we are givingembedded concept of both. By using combination of these, the proposed model will be more effective. In this paper, we investigated recent papers related to health examination systems &IoT. The concept of IoT is connection of devices which will automatically fetch and process to generate

intelligent data which will be useful toprovide a better life. This paper will show the progress in medical science technology, and wouldbe beneficial in saving patients from arising health issues and also help doctors in taking necessary actions at a right time to make sure patient's health is not deteriorated.

India is the second most populous country in the world. Despite several growth-oriented healthcare policies adopted by the Government, economic and regional disparities result in inadequate distribution of healthcare services in rural areas **(Janakiram, 2017).** The low socio-economic status that prevails in such areas prevents those people from affording good quality medical services. Lack of awareness about proper health practices and inadequate access to medical facilities are two additional factors that lead to an increased mortality rate in rural areas. Furthermore, Public Health Centers (PHCs) in rural and remote areas have insufficient medical practitioners and medical infrastructure. The ratio of medical practitioners to patients is alarmingly low compared to that in urban areas. It has been noted that common ailments often lead to serious health conditions in these areas. Thus, there exists an urgent need to offer comprehensive awareness regarding health **(S. Udayan, 2014),** preventive care, self-monitoring and proper sanitation and hygiene **(James, 2017)** in order to elevate health standards among the rural poor.Empowering citizens and patients to manage their own health conditions would result in a more effective healthcare system in rural India. The recent past has witnessed substantial increases in adoption of technology in healthcare due primarily to technological breakthroughs in the field of low-cost sensors, advancements in the field of Body Area Networks (BAN) **(Otto, 2015)** and introduction of the Internet-of-Things (IoT). Research and significant investment of resources have led to the development of products that help monitor personal health maternal health **(Megalingam R K, 2015)** and body fitness. Wearable low-cost sensors and healthcare platforms are now readily available for personalized use and have been trending for quite some time **(Lan M, 2012).** Data recorded by these sensors is collected in the cloud and users are provided with useful insights via online systems. These medical devices have proven to be effective in improving health through constant monitoring, timely intervention of qualified doctors and easy access to health-related services. Furthermore, they have the power to transcend geographical barriers, offering several practical health service applications in rural areas. One such application is the remote health monitoring of patients, which assists health workers in better monitoring their patients and helps reduce escalation of medical issues even in locations with reduced access to distant medical facilities. Remote monitoring allows medical practitioners to instantly access current or historical health data anytime, enabling improved diagnosis and appropriate treatment in a timely fashion. An innovation of this kind has the potential to transform the entire healthcare industry as it reaches areas that have little access to health centers. The rate that such platforms have been adopted in medical/ clinical sectors is lower in rural areas than in urban areas. Many factors, including affordability, lack of health-related skills and awareness, illiteracy, and low penetration of technology, contribute to these low adoption rates. This explains why such systems have thus far had minimal influence in medical/clinical sectors of rural India. This paper describes the concept of AmritaJeevanam, which aims to provide a one-of-a-kind healthcare platform that targets the needs of rural populations. The sections that follow present an easyto- use system which can be used for personal health monitoring in areas that have limited or zero access to healthcare services. The platform not only attends to healthcare needs, but also offers patients significant education and awareness regarding diseases, treatments, and personal hygiene. Internet-of-Things (IoT) offers the possibility of connecting multiple objects on this planet to a single global network. In the IoT paradigm, data can be accessed via the Internet from every connected entity. An entity can be anything with a sensor that can provide information about its physical surroundings when connected to a network, thus transcending geographical boundaries and making data globally accessible. In the healthcare context, IoT is able to access data from sensors that measure vital health-related parameters such as blood pressure, and blood glucose level **(Hu F, 2013) (C, 2013)**. Health sensors connected to the patient's body will stream data live to the network. Huge volumes of data accumulated in this way over a period of time can be used to provide meaningful insights for doctors and medical experts miles away **(Mao Y, 2011)**. AmritaJeevanam leverages the power of IoT, offering a platform for remote health monitoring and medical intervention. Low-cost health sensors are used to collect vital data from

patients, which are then processed by a Medical Interface Unit. This intelligence is then used to predict the presence of any pathological conditions in the patient's body. These predictions lead to provision of personalized medical guidance to the patient for overall improvement of health as well as improved awareness and prevention of future complications. Thus, AmritaJeevanam is specifically designed to be an easy-to-use health platform, which can be operated by the semi-literate rural population in India.

Which can be described as interconnection of uniquely identified smart objects and devices. IoT is surrounded by many objects which are invisibly embedded in the environment around us. Moreover, IoT provides desired solutions to vast applications such as traffic congestion, industry management, emergency service, and health care. To effectively monitor remote patient health, IoT based healthcare applications are gaining impetus day by day. With the continuous development in Information and Communication Technology (ICT), medical sensors provide a solution to many medical applications like patient activity monitoring at remote side, diagnosing chronic diseases, and providing elder health care. Moreover, the availability of medical IoT devices led to a better way for diagnosis the diseases. Also, the use of medical devices, sensors, and diagnostic devices can be viewed as smart devices forming a medical IoT environment. IoT clubbed with cloud computing becomes a powerful platform for monitoring patients at remote site providing continuous health information to doctors and caretakers.Cloud storage offers huge amount of storage and processing capabilities in a scalable form. Cloud computing advancements can handle resource sharing, parallel processing, data service integration with scalable data storage, and security problems easily. Moreover, in the present scenario, monitoring based cloud centric architectures can be used for the development of applications and services useful in smart environment.

REVIEW OF LITERATURE

While the network of connected devices are growing and expanding, Internet of Things (IoT) is stepping into every aspects of life. IoT provides a competent and structured approach to improve health and wellbeing of mankind. The consequences of IoT technologies entering to medical and healthcare sectors are forming a new structured communication route between caregivers and patients. In such systems, a set of connected wearable or implantable sensors continuously read patient's vital signs enabling caregivers to access the data through the Internet. IoT-enabled health monitoring systems often work in a way that wireless body area network (WBAN), which is a set of medical sensors attached to patient's body, records physiological parameters and vital signs and sends them to a cloud server for further processing and storage. Considering each sensor in WBAN as an IP-based connected node, an IoT-enabled healthcare system o ers the opportunity to serve patients needing continuous monitoring outside hospital environment. It has been reported that the number of critically ill patients is growing and many patients leaving hospital are still at the risk of deterioration at home. Several of those patients might encounter health deterioration when there are some abnormal changes appearing in their vital signs. In order to predict health deterioration, a technique called Early warning score (EWS) has been proposed. In this system, nurses record the patients' vital signs in an observation chart at certain time intervals and assign a score to the value of each sign in its range. The overall patient score, which is the sum of all individual scores, is then used to decide whether the patient is deteriorating or not. The process of recording and calculating EWS is usually still paperbased and manual in hospitals. Paper-based and inaccurate data collection leads quite often to incorrect calculation of warning score making health experts to misdiagnose the situation. Furthermore, manual paper-based approach is slow and requires work-time resources form the caregivers. Recently, early warning systems have begun to move toward automated electronic platform. IoT-enabled wearable sensor networks can help the process of EWS automation to be extended for in-home use cases.

Health monitoring platforms integrated with IoT/BAN take advantage of remote sensing capabilities and are successfully revolutionizing the healthcare domain **(Benharref. A, 2014)(Paradiso. R, 2005)**.Wearable sensors are used in conjunction with such platforms to measure vital parameters **(Pantelopoulos. A,2010)** and stream data to an acquisition tool using wireless technologies such as Bluetooth, BLE, and Wi- Fi. Medical/measurement data, collected by an

intermediate device such as a gateway, is often transmitted to a remote server **(Babu. S, 2013).** Transmitted data is stored in the remote server ensuring anytime availability and accessibility. Similar platforms are implemented using cloud-based systems to store the collected medical data **(Rolim. C,2010)**. Such health monitoring platforms provide a variety of applications. One such application, for example, performs analytics on the medical data stored in servers to identify patients with high-risk heart conditions **(Zhao. W,2011). (Lee et al, 2012)** described another example involving bio-signal monitoring using smart mobile devices. Medical analytics helps identify characteristic patterns or trends based on the collected data. Big data medical analytics in health platforms **(Darrel, 2014) (Mao. Y, 2011)** provides meaningful insights to practitioners that help identify suitable diagnoses. Medical data analysis can also identify variations in medical patterns or predict the possibility and probability of imminent danger. Such an application, using a health platform and ubiquitous mobile technology as an alert system, has been explored in some systems **(Fong. E.M,2013).** These platforms depend on Internet technologies and make direct intervention by qualified medical practitioners possible. In the context of remote and rural Indian populations that have low literacy rates, lack technology, have little access tomedical centers and are digitally cut off from rest of the world because of no or inconsistent internet service, use of such a health system has, until now, not been viable. The primary aim of this project is to address this challenge by implementing a low-cost solution for rural health monitoring and awareness. AmritaJeevanam is an integrated, patient-centric, healthcare system that empowers rural communities and improves overall health of villagers by offering them accessible preventive care, health awareness, and self-monitoring. It facilitates a system and method for collecting health information of patients, interpreting diagnostic readings and providing personalised health feedback. This health-monitoring platform is a combination of multiple low-cost health sensors, a Medical Interface Unit, and associated multi-lingual, intelligent software. It serves as a peripheral healthcare system that can offer information on common medical conditions. The system supports community health workers in the diagnostic, management, and reporting of rural patients, and functions well even with only intermittent access to Internet. Key advantages of AmritaJeevanam include that the public has unlimited access to the system and that regular monitoring of health can detect symptoms of various common conditions even at an early stage. Furthermore, it allows patients to learn about their health, track their conditions periodically and wirelessly record and transmit the data to their physicians. It also allows patients to access their recorded health profile in case they have lost prescriptions and/or instructions.

(Shah Tushar, 2017), In this development provides ease to the patientshaving various diseases. As a result, visit of patients to the doctors constantly has lowered because various types of reports can be generated remotely and wirelessly at doctor's end at regular interval of time. Because of this recent development in scientific technology, doctors are saving several lives.

(Yang Yang, 2018),Here authorpropose a lightweight break-glass access control (LiBAC) system that supports two ways for accessing encrypted medical files: attribute-based access and break-glass access. In normal situations, a medical worker with an attribute set satisfying the access policy of a medical file can decrypt and access the data. In emergent situations, the break-glass access mechanism bypasses the access policy of the medical file to allowtimely access to the data by emergency medical care or rescue workers. LiBAC is lightweight since very few calculations are executed by devices in the healthcare IoT network, and the storage and transmission overheads are low. LiBAC is formally proved secure in the standard model and extensive experiments are conducted to demonstrate its efficiency.

(Nedungadi Prema, 2018),Here author presenta wearable health devices has made it easier to monitor health conditions and to connect doctors and patients in urban areas. However, existing initiatives have not succeeded in providing adequate health monitoring to rural and low-literate patients, as current methods are expensive, require consistent connectivity and expect literate users. Our design considerations address these concerns by providing low-cost medical devices connected to a low-cost health platform, along with personalized guidance based on patient physiological parameters in local languages, and alerts to medical practitioners in case of emergencies. This patient-centric integrated healthcare system is designed to manage the overall health of villagers with real-time health

monitoring of patients, to offer guidance on preventive care, and to increase health awareness and self-monitoring at an affordable price.

(Chao. Li, 2017), Here author present a system is mainly composed of two parts: the data acquisition part and the data transmission part. The monitoring scheme (monitoring parameters and frequency for each parameter) is the key point of the data acquisition part, and we designed it based on interviews to medical experts. Multiple physical signs (blood pressure, ECG, SpO2, heart rate, pulse rate, blood fat and blood glucose) as well as an environmental indicator (patients' location) are designed to be sampled at different rates continuously. Four data transmission modes are presented taking patients' risk, medical analysis needs, demands for communication and computing resources into consideration. Finally, a sample prototype is implemented to present an overview of the system.

(Verma. Prabal, 2018),In this framework computes the student diseases severity by predicting the potential disease with its level by temporally mining the health measurements collected from medical and other IoT devices. To effectively analyze the student healthcare data, an architectural model for smart student health care system has been designed. In our case study, health dataset of 182 suspected students are simulated to generate relevant waterborne diseses cases. This data is further analyzed to validate our model by using k-cross validation approach. Pattern based diagnosis scheme is applied using various classification algorithms and then results are computed based on accuracy, sensitivity, specificity and response time.

(Naser, 2018), Here author present the real-time remote monitoring of patients is an important issue in telemedicine. In the provision of healthcare services, patient prioritisation poses a significant challenge because of the complex decision-making process it involves when patients are considered 'big data'. To our knowledge, no study has highlighted the link between 'big data' characteristics and real-time remote healthcare monitoring in the patient prioritisation process, as well as the inherent challenges involved. Thus, we present comprehensive insights into the elements of big data characteristics according to the six 'Vs': volume, velocity, variety, veracity, value and variability. Each of these elements is presented and connected to a related part in the study of the connection between patient prioritisation and realtime remote healthcare monitoring systems.

(Ananm, 2018), This paper focuses on the development of a novel, rapid and cost-effective tele-monitoring architecture based on an Arduino device hardware system. The prime goal was to design a prototype that could serve as a reliable patient monitoring system, so that healthcare professionals can monitor their patients in real-time, who are either hospitalized in critical conditions or unable to perform their normal daily life activities. In this work we have presented an Arduino based cost effective Tele-monitoring system that can provide real-time information about physiological conditions of a patient.

(Karthik. B.N., 2018), Here author discuss about the increased use of Mobile Technologies and Smart Devices in the area of health has caused great impact on the world. Health experts are increasingly taking advantage of the benefits these technologies bring, thus generating a significant improvement in health care in clinical settings and out of them. Likewise, countless ordinary users are being served from the advantages of the M-Health (Mobile Health) applications and EHealth (health care supported by ICT) to improve, help and assist their health. The aim of this paper is to develop an architecture based on an ontology capable of monitoring the health and workout routine recommendations to patients with chronic diseases.

(Manogaran, 2018),Here author proposed architecture consists of two main sub architectures, namely, Meta Fog-Redirection (MF-R) and Grouping and Choosing (GC) architecture. MF-R architecture uses big data technologies such as Apache Pig and Apache HBase for collection and storage of the sensor data (big data) generated from different sensor devices. The proposed GC architecture is used for securing integration of fog computing with cloud computing. This architecture also uses key management service and data categorization function (Sensitive, Critical and Normal) for providing security services. The framework also uses MapReduce based prediction model to predict the heart diseases. Performance evaluation parameters such as throughput, sensitivity, accuracy, and f-measure are calculated to prove the efficiency of the proposed architecture as well as the prediction model.

WHY THERE IS NEED

As per the current era every things is smart but still our medical domain is not smart in terms of real time patient tracking system in terms of parameters like ECG, SPO2, temp, blood Oxidation %. In this field many research work on this but there is lots of research gap which needs to be solved , those research gap are followings:

- Connectivity issue due to use of GPRS technology as GPRS is work on 2G which is not good for this kind of application
- In Existing system, there is need of GPRS based connectivity.
- Mistake on hardware selection
- Heavy hardware:
- Cost is very high
- Accuracy is very poor
- Proper live tracking facility is not available
- No any emergency alert message send to doctor

OBJECTIVES

As per the all previous problems here we are targeting these points as our objectives for this work:

1. Reduction in Device Cost
2. Reduction in Hardware complexity
3. Reduction in Device Form factor complexity
4. Improvement in patient monitoring parameters through calculation of other parameters by using of real parameters.
5. Fast data transfer rate
6. We will use web platform
7. Our system will not face the connectivity issue.
8. Emergency alert message send to doctor
9. We will use WiFi Connectivity so power consumption will be less and it can work on the 4G technology
10. Blood pressure measurement through SPO2 parameters

EXPECTED OUTCOME

In this work we are expecting to solve the current problem which is lack of real time monitoring of patient. So here we are try to implement that system which is able to track the medical data like pulse rate, Oxidation level, ECG, Temperature, Blood pressure. Here we are not using any sensor for calculation of blood pressure. Here we will try to reduce the connectivity issue of this kind of system. Here we are also expecting to reduce the cost factor. We expect this system will resolve the most of the issues which will affect by current existing systems.

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