1. INTRODUCTION

1.1 Introduction to Internet of Things

The internet of things (IoT) is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), 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." The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit.[6] When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020.

"Things," in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring or field operation devices that assist firefighters in search and rescue operations. Legal scholars suggest to look at "Things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include home automation (also known as smart home devices) such as the control and automation of lighting, heating (like smart thermostat), ventilation, air conditioning (HVAC) systems, and appliances such as washer/dryers, ovens or refrigerators/freezers that use Wi-Fi for remote monitoring.

As well as the expansion of Internet-connected automation into a plethora of new application areas, IoT is also expected to generate large amounts of data from diverse locations, with the consequent necessity for quick aggregation of the data, and an increase in the need to index, store, and process such data more effectively. IoT is one of the platforms of today's Smart City, and Smart Energy Management Systems.

Medical and healthcare

IoT devices can be used to enable remote health monitoring and emergency notification systems. These health monitoring devices can range from blood pressure and heart rate
monitors to advanced devices capable of monitoring specialized implants, such as pacemakers, Fitbit electronic wristbands or advanced hearing aids. Specialized sensors can also be equipped within living spaces to monitor the health and general well-being of senior citizens, while also ensuring that proper treatment is being administered and assisting people regain lost mobility via therapy as well. Other consumer devices to encourage healthy living, such as, connected scales or wearable heart monitors, are also a possibility with the IoT. More and more end-to-end health monitoring IoT platforms are coming up for antenatal and chronic patients, helping one manage health vitals and recurring medication requirements.

FIGURE: 1.1.1 Remote Patient Monitoring

In the Internet of Things (IoT), devices gather and share information directly with each other and the cloud, making it possible to collect, record and analyze new data streams faster and more accurately. That suggests all sorts of interesting possibilities across a range of industries: cars that sense wear and tear and self-schedule maintenance or trains that dynamically calculate and report projected arrival times to waiting passengers. But nowhere does the IoT offer greater promise than in the field of healthcare, where its principles are already being applied to improve access to care, increase the quality of care and most importantly reduce the cost of care.[10] At Freescale, we're excited to see our embedded technologies being used in applications like telehealth systems that deliver care to people in remote locations and monitoring systems that provide a continuous stream of accurate data for better care decisions.
As the technology for collecting, analyzing and transmitting data in the IoT continues to mature, we’ll see more and more exciting new IoT-driven healthcare applications and systems emerge. Read on to learn what’s happening now—and what’s on the horizon—for healthcare in the age of the IoT.

1.2 EMR based Monitoring System

An Electronic medical record (EMR) refers to the systematized collection of patient and population electronically-stored health information in a digital format [1].

These records can be shared across different health care settings. Records are shared through network-connected, enterprise-wide information systems or other information networks and exchanges.

But here main focus will be shared these records across cloud so doctors & patient can be access any time anywhere and from any devices.

EMRs may include a range of data, including demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images, vital signs, personal statistics like age and weight, and billing information.[2]
1.2.1 ECG (electrocardiogram)

An electrocardiogram (EKG or ECG) is a test that checks for problems with the electrical activity of your heart. An EKG shows the heart's electrical activity as line tracings on paper. The spikes and dips in the tracings are called waves. The heart is a muscular pump made up of four chambers.

In a conventional 12-lead ECG, 10 electrodes are placed on the patient's limbs and on the surface of the chest. The overall magnitude of the heart's electrical potential is then measured from 12 different angles ("leads") and is recorded over a period of time (usually 10 seconds). In this way, the overall magnitude and direction of the heart's electrical depolarization is captured at each moment throughout the cardiac cycle. [1] The graph of voltage versus time produced by this noninvasive medical procedure is referred to as an electrocardiogram.
During each heartbeat, a healthy heart has an orderly progression of depolarization that starts with pacemaker cells in the sinoatrial node, spreads out through the atrium, passes through the atroventricular node down into the bundle of His and into the Purkinje fibers, spreading down and to the left throughout the ventricles. This orderly pattern of depolarization gives rise to the characteristic ECG tracing. To the trained clinician, an ECG conveys a large amount of information about the structure of the heart and the function of its electrical conduction system. [2] Among other things, an ECG can be used to measure the rate and rhythm of heartbeats, the size and position of the heart chambers, the presence of any damage to the heart's muscle cells or conduction system, the effects of cardiac drugs, and the function of implanted pacemakers. [3]

Using ECG sensor, we can monitor patient’s health condition and if patient suffer from critical condition then at that time it will sent message to the doctor with actual number so that doctor can do a faster treatment.
2. AIM AND OBJECTIVE OF THE STUDY

2.1 Problem Statement

An Electronic medical record (EMR) refers to the systematized collection of patient and population electronically-stored health information in a digital format [1]. These records can be shared across different health care settings. Records are shared through network-connected, enterprise-wide information systems or other information networks and exchanges. And Using ECG sensor, we can monitor patient’s health condition and if patient suffer from critical condition then at that time it will sent message to the doctor with actual number so that doctor can do a faster treatment.

So, the Problem Definition is “i-HealthNXT: Developing an Intelligent remote Medicare system for enrichment of India’s Smart HealthCare based on Internet of Things to reinforce MAKE-IN-INDIA Campaign.” to help to reduce unwanted test because the patient record is already in cloud the doctor is access that data and helps to take faster treatment.

2.2 Motivation

The EMR application is used by physicians to collect and store patients’ medical data in a digital format. It is typically installed at hospitals and physicians’ clinics, and may contain complete medical information of patients including their demographics, medical history, diagnosis, treatments, lab results and payment information. [4] Computerizing medical records improves overall efficiency in terms of storage and tracking medical history.

2.3 Objective

Application provides great conveniences to both patients and health care providers. For the patients, the foremost advantage is to reduce the waiting time of diagnosis and medical treatment, as they can deliver the emergent accident information to their doctors even if they are far away from the hospital or they don't notice their health condition.[5] Here this data can be access by Hospitals & Doctors as well. Then For Generate leads Promoting these application to Healthcare industries worldwide using Social media, AppExchange and other emerging technologies for digital marketing via Hub & Spoke Amplification[5].
### 3. REVIEW OF LITERATURE

#### 3.1 Literature Review

<table>
<thead>
<tr>
<th>Paper ID</th>
<th>Publication &amp; Year</th>
<th>Description / summary</th>
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| [1].     | IEEE, 2016          | • Main focus on effective ways to deploy IoT in the field of medical and smart health care & propose a new semantic model for patients’ e-Health.  
• Proposed Model: ‘k-Healthcare’ makes use of 4 layers; the sensor layer, the network layer, the Internet layer and the services layer. All layers cooperate with each other effectively and efficiently to provide a platform for accessing patients’ health data using smart phones.  
• Result: providing different services remotely, such as prevention and diagnosis against disease, risk assessment, monitoring patient health, education and treatment to users. |
| [2].     | IEEE, 2014          | • Main focus on enabled health workers to digitize the patient's data and ask questions to doctors. Doctors could see the questions along with the data and give appropriate answers.  
• Proposed Model: ICT based, Pre & Post natal care delivery method  
• Result: Performance of the application increased drastically |
| [3].     | IEEE, 2014          | • Main focus on Human Health for automating some of the healthcare functions such as monitoring and diagnosis for mass deployment.  
• Proposed Model: automating medical diagnosis using text mining techniques & Semantic web  
• Result: Information Retrieval and Text Mining kind of approach to the medical diagnosis problem is quite feasible. |
| [4].     | Elsevier, 2015      | • Main focus on comparing several predictive models, some of which have never been applied to this task and which outperform the regression methods that are typically applied in the healthcare literature.  
• Proposed Model: Using logistic regressions, deep learning offer a simple framework for determining which conditions are most cost effective to target.  
• Result : logistic regressions, and deep neural networks have significantly better predictive performance than other methods that have been previously applied to this problem. |
[5]. IEEE 2015

- Main focus on test a research model to investigate the compliance behavior of patients supported by a mobile healthcare system.
- Proposed Model: Rational Choice Theory (RCT) and Theory of Planned Behavior (TPB) for key theoretical foundation to assess patients’ compliance behavior
- Result: Display different compliance behaviors during different stages of their treatment processes.

[6]. IEEE 2015

- Main focus on the ease of Event Sequence Diagram (ESD) to capture the dynamics of risk scenarios
- Proposed Model: DPRA approach for use of a Probabilistic Model Checking (PMC) technique to perform quantitative analysis of risk scenarios.
- Result: Identify risk scenarios allows to reveal the connections between causes and effects of risks

[7]. IEEE 2014

- Main focus on Governance, Risk, compliance, GRC
- Proposed Work: Regulatory compliance , ERM (Enterprise Risk Management)
- Result: GRC is an Integrated approach to corporate governance, risk and compliance ensuring that an organisation acts in accordance with its self-imposed rules, its risk appetite and external regulations.

### TABLE: 3.1.1 Research Paper Summary
3.2 Existing System & Limitation

The EMR application is used by physicians to collect and store patients’ medical data in a digital format[2]. It is typically installed at hospitals and physicians’ clinics, and may contain complete medical information of patients including their demographics, medical history, diagnosis, treatments, lab results and payment information. Computerizing medical records improves overall efficiency in terms of storage and tracking medical history[2].

FIGURE: 3.2.1 Existing Technology
These records can be shared across different health care settings. Records are shared through network-connected, enterprise-wide information systems or other information networks and exchanges.
4. METHODOLOGY: METHODS & IMPLEMENTATION

4.1 Proposed Work

The proposed work is to implement EMR based E-Healthcare product on cloud that is help to reduce unwanted test because the patient record is already in cloud the doctor is access that data and helps to take faster treatment. & Using ECG sensor, we can monitor patient’s health condition and if patient suffer from critical condition then at that time it will sent message to the doctor with actual number so that doctor can do a faster treatment.

ADVANTAGES

1. Time Saving Concept

2. Patient Cost Reduce

3. Digitalization

4. High Availability

5. Reduce Waiting Time
4.2 Flow Diagram

FIGURE: 4.2.1 Scenario-1
Algorithm 1: The Process of Create Unique ID & then adding Patient’s Medical Data in Database.

**Input:** $\sigma$ is Patient’s unique ID where $x$ is patient & $y$ is Doctor,

$N$ is valid proof of record,

$L$ is Login with unique ID.

**Output:** Adding to the Database about patient medical information.

**Begin,**

1. Patient will Initiate task.
2. Patient will arrive hospital for medical checkup.
3. Administrator of hospital will ask to patient whether he/she has registered unique ID or not. (Unique ID will be Adhar number, Voter ID, License number)
   
   If $\sigma \in x$,
   
   Then $L, \text{Login} \xleftarrow{x} \text{(Patient)}$
4. **(YES Case)** – Directly move to LOGIN step.
5. **(NO Case)** – Firstly Patient need to add some general data like Blood Group, Allergy, Blood Pressure, Any Disease in Past, Any Running Medicine. If patient has valid proof of record of the same then they can move ahead with daily checkup, otherwise he/she need to check at a time.
   
   If $x \geq N$,
   
   Then, Move ahead with daily checkup.
   
   Otherwise he/she need to check at a moment.
6. Doctor will get to know about current disease of patient after checkup. And as per that Doctor will give prescription to patient and give valid proof.
7. Add to Database
8. END
Algorithm 2 : The Process of verify whether added record of patient true or not.
Higher authority will takes these task to verify.

Input: $\rho$ is Authorization process where $x$ is patient & $y$ is Doctor,
  H is Higher Authority,
  A is enterd record by $x$,$y$
  L is Login with unique ID.
Output: Approving of given data whether correct or not.

Begin,

1. User Initiate task (Star / Perform Task).
   Where User $\leftarrow x,y$

2. System will check whether user is authorised or not.
   If (x,y) $\leftarrow \rho$, authorised,
   Then, go to step 3,
   Otherwise go to step 1.

3. (YES Case) – Patient can view/ edit their personnel information but can not edit
   Approved Reports & Doctor can view some medical Diseases information and can be
   edit Disease Accordingly.

4. (NO Case) – Notify User to invalid ID/ Password and take appropriate action. And if
   User missed more than 5 times then automatically information sent to higher authority
   with access information.

5. Then Higher Authority will check the data whether enterd record is correct or not and
   Approved accordingly.

6. If the approvar not approve that record then it will be automatically sent notification to
   Doctor/ Patient about modification of data.
   If $H \notin A$, Then sent notification to x,y about remodification of data.

7. If the approval approve its record then that data will automaticly upload in the system
   and notify to users about data is succesfully updated.
   If $H \in A$, Then notify to x,y about data is succesfully updated.

8. END
Algorithm 3: Check Patient’s Health Condition using Remote Monitoring System.

**Input:** \( \rho \) is ECG sensor where \( x \) is patient & \( y \) is Doctor,
- \( N \) is Normal Case,
- \( C \) is Critical Case,
- \( A \) is Available.

**Output:** Approving of given data whether correct or not.
Begin,

2. If ECG sensor shows Patient’s condition within the range then No action need to be taken.
   If $\rho = N$
   Then, No Actions required,
3. If ECG sensor shows Patient’s condition Out of the range then Sent Alert Message to the doctor with Exact number.
   If $\rho \neq N$ That is $\rho = C$
   Then, Sent Alert Message to the doctor with Exact number.
4. Doctor will Initiate the Task then.
5. If Doctor Available at the time then they will immediately start the required treatment.
   If $y = A$
   Then, Start Treatment.
6. If Doctor will not Available at the time then they will Consult other Doctor/ Caretaker to the Patient.
   If $y \neq A$
   Then, they will Consult other Doctor/ Caretaker to the Patient & start the treatment then.
7. Update/ Add above info to the Database.
8. END
4.3 Implementation

4.3.1 Screenshots:

FIGURE: 4.3.1 Login Page

FIGURE: 4.3.2 Home Page
i-HealthNXT: Developing an IoT based iNTELLIGENT Medicare system for Real-Time Remote Health monitoring.

FIGURE: 4.3.3 Doctor’s info Page

FIGURE: 4.3.4 Lab Result Page
i-HealthNXT: Developing an IoT based iNTELLIGENT Medicare system for Real-Time Remote Health monitoring.

FIGURE: 4.3.5 ECG Result Page

FIGURE: 4.3.6 Alert Message sent to Doctor’s Phone
4.4 Advantages of Proposed Work

The major benefits are:

1. Time Saving Concept
2. Patient Cost Reduce
3. Digitalization
4. High Availability
5. Reduce Waiting Time
5. CONCLUSION

I have concluded that this Application Provides great conveniences to both patients and health care providers & reduce the waiting time of diagnosis and medical treatment also Using ECG sensor, we can monitor patient’s health condition and if patient suffer from critical condition then at that time it will sent message to the doctor with actual number so that doctor can do a faster treatment.

More and more end-to-end health monitoring IoT platforms are coming up for antenatal and chronic patients, helping one manage health vitals and recurring medication requirements.
6. REFERENCES

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