

# SMART PATIENT MONITORING OVER A M2M FRAMEWORK

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## Abstract

Machine to Machine (M2M) technologies allow pivotal data to be exchanged without human intercession, making it possible to provide low cost, proficient and dynamic services to customers. M2M is widely deployed in health-care domain. The aim of this paper is to develop a complete patient monitoring application which includes sensing of vital parameters of patients, storage of electronic medical records, anomaly detection, notification generation and providing information to respective doctors for patient's assistance. Using this system doctors can continuously monitor patients out of clinical settings.

## 1. Introduction:

In case of industrial instrumentation, Machine to Machine (M2M) comprise a gadget to capture an event which is handover through a network to software program that translates the captured event into purposeful information for necessary action. [1]

Remote Patient Monitoring (RPM) is a technology that empower monitoring of patients outside of typical clinical settings. RPM increases access to low cost healthcare services.

Smart patient monitoring is a way of using patient's Smartphone for the transmission of necessary parameters and signs from the sensing devices to distant server. The doctor can monitor the patient's data from his own wireless smart device sitting at distinct location from a patient using android application or web portal.

Body Area Network (BAN) also referred as wireless body area network (WBAN) is wireless network of low weight wearable computing devices which can be implanted or surfaced mounted on body of patient. BANs have huge

application in the health-care domain. [2]

The availability of low power integrated circuits, highly accurate sensors and high-speed wireless communication has enabled us to develop cost effective and tremendously efficient next generation of Wireless Sensors Network (WSN).

This paper purposes an architecture to develop a complete autonomous patient monitoring application from sensing of vital parameters of patients; to reports and alert generation for the doctor.

Rest of the document is formulated as follows. Section 2 will give system model followed by problem Statement in section 3. Section 4 mention some application of the system and in section 5, we will conclude our research work.

## 2. System Model:

Light weight and compact wearable sensing devices are connected to patient's body which continuously read vital parameters and transmit it to android application on patient smartphone over Bluetooth at

preset rate as purposed in [3] and [4]. The readings are stored in SQLite database of android application. This information is used to generate reports, anomaly detection, notification or alarm generation for caregivers and patients if necessary.

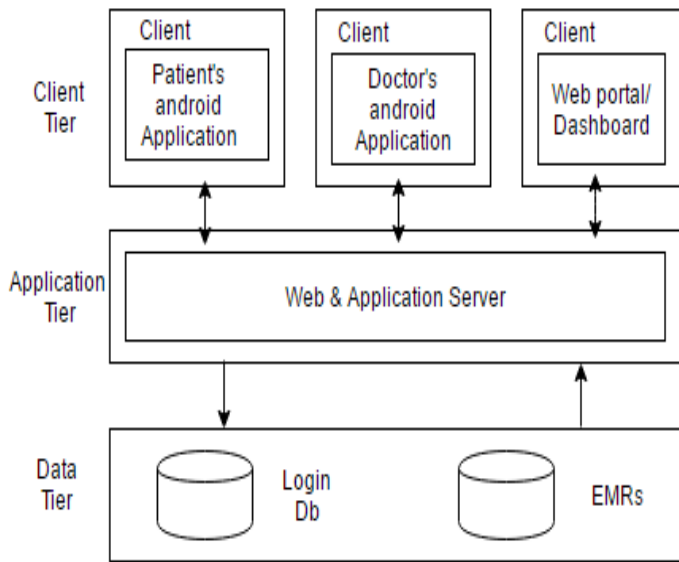


Fig 1: Tier model

The information from SQLite database is further synchronized to database at the central server of healthcare provider over 3G or Wi-Fi. The database saves Electronic Medical Records (EMRs) as well as general information of patient and doctors for login and record purpose.

At the central server, data is used to keep record of patient's history, corresponding caregivers, anomaly detection, pattern and trend detection as well as notification generation. The same data is used for web dashboard to provide visual interface to patients and caregivers. An android application is made for convenience of doctor for prompt monitoring of patients. A notification and alarm system is integrated to both web portal and android applications to handle emergency cases.

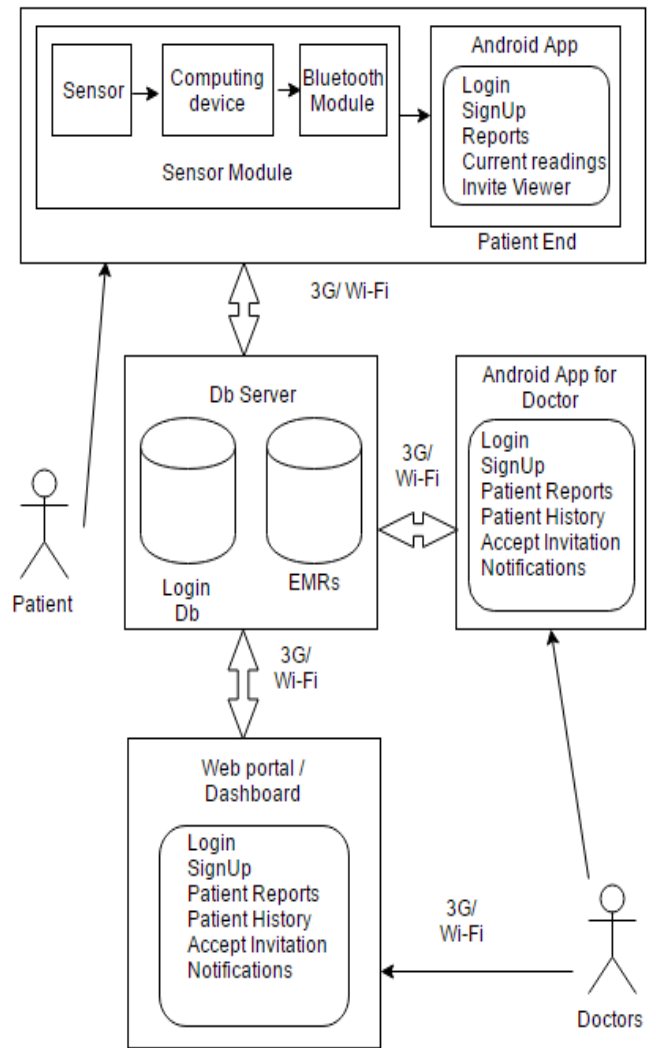


Fig 2: System model for remote patient monitoring

### 3. Problem Statement:

It is challenging era for Healthcare sector to provide to the masses a platform which ensures on time and quality service to health-conscious people and patients. Development of such a system is the need of time which ensures timely diagnosis of disease, secure digital storage of electronic medical records and an interactive User interface for report generation, anomaly detection, notification alert for the patients as well as caretakers and doctors.

#### 4. Applications of system:

Machine 2 Machine (M2M) and Wireless sensor network (WSN) is a kind of technology that integrates several advanced technologies including sensors, embedded systems, modern networks and wireless communication technologies. The WSN has profound influence on areas of medical practice. Following are potential custom applications of system

- Athletes monitoring system: This system can be used for autonomous monitoring of vital signs like heart rate, temperature and speed of athletes during training and actual performance. The monitored data can be used to improve health and performance of athletes.
- Autonomous monitoring of patients' vital signs in hospitals can also be done using the system. Using this system, the problem of lack of nursing staff can be tackled in a cost effective and time efficient way.
- Autonomous monitoring system can be used for monitoring of soldiers during their training for better performance or in warzone to prevent life loss.
- Personal wellness analysis: Since all data measured and sensed is sent to a central server where it is logged and stored. A doctor can open a patient's profile and then by observing the trends in vital signs of patient, the doctor can prescribe a diet plan, exercise and workout plan and necessary precautions for patient.

#### 5. Conclusion and Future Work:

Healthcare industries around the world have the same objective that is provide healthcare services to maximum patients at minimum cost. Machine 2

Machine (M2M) based Telemedicine can decrease the expense of costly doctors' visits by enabling remote communication between specialist and patients.

Remote patient monitoring can reduce or eradicate hospital stays, freeing up rare hospital beds for more severe cases. Machine to Machine technologies and Remote Patient Monitoring have a vast domain. The concept projected in this paper can be greatly improvised by the addition of the more features.

The main problem faced is that electronic medical records have high privacy, security and confidentiality concerns. If security and privacy concerns are taken care of the public can be influenced to use smart patient monitoring system.

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