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Survey on Smart Hospital using Narrowband IoT (NB-IoT)

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Abstract: ***In the Smart Hospital System, the hospitals are managed collecting data from various sensors. Monitoring the sensors information and controlling the system accordingly. In addition, the system can notify the user if any anomaly occurs in the system and can automatically correct the problems. We have proposed an smart hospital management system using NB-IoT. In addition , this System uses the Narrowband IoT that is low power wide area wireless protocol that works virtually anywhere. In advantages of this is low cost & low power consumption , which provides a new way for connecting devices that requires small amounts of data , over long periods. NB-IoT is use to connect all intelligent things in smart hospitals , which takes the advantages of the higher capacity, wider coverage, lower power consumption, and lower cost of NB-IoT.***
Keywords: Internet of Things(IoT) , Narrowband IoT (NB-IoT) , smart hospital.

I. INTRODUCTION

Many mobile applications were already developed such that patient's registration, their diagnosis on decease, etc. Also our blood pressure, blood glucose meter, sugar level are monitor. Some work is done in this field.

We have proposed a new methodology of smart hospital system at the hospital/patient level through the connecting the intelligent things. Using NB-IoT technology, system can control/detect hospital for patient. Narrowband IoT(NB-IoT), is a new IoT system built fron existing LTE functionalities. The target of NB-IoT includes low-cost devices, high coverage, long device battery life and also high capacity .

Since NB-IoT design is based on existing LTE functionalities, it is possible to reuse the same hardware without any issue. This allows for a low cost and fast deployment of NB-IoT using existing infrastructure. We proposed four modules for implementation of Smart Hospital System using NB-IoT : Intelligent parking, Ambulance detection system, ward care, and outdoor patient monitoring.

1) *Intelligent Parking:* parking spaces in hospitals also controlled by websitte. A patient can reserve a parking slot through the monitoring of admin. Also patoient's realtives can occupied same parking slot at the time of when they gets enter in hospital.
2) *Ambulance Detection:* When an ambulance comes in hospital, authentication of that ambulance using wearable devices is done. One backdoor is always created of hospital for emergency purpose. If the authentication is successful, the door will open.
3) *Ward Care:* In the ward, the patient's real time physical condition is monitored through some sensors like temperature and pressure sensor, heart beat sensor, etc. This data can be collected by wearable devices or smart sensors. These data are then transmitted to monitoring center by wireless communication. Ward care/boy or doctor get message to monitor that particular patient. So patient gets time to time treatment.
4) *Telemedicine Monitoring:* some of the discharged patient need to being monitored at home. In this system, website is designed for storing or retrieving data of the patient's. This is done for improve the efficiency of doctor's diagnosis, and save patient's time. Patient's reporting time, appointment date, and their physician can informed to that patient.

II. LITERATURE SURVEY

1) *Title of Paper:* Connecting Intelligent things in Smart Hospitals using NB-IoT.
a) *Author:* Haibin Zang, Bo Wen, Jianpeng Li.
b) *Description:* The widespread use of Internet of Things (IoT) smart devices will play important role improving the quality of medical care, bringing convenience for patients and improving management level of hospital. In this, proposed an architecture to connect intelligent things in Smart Hospital.
2) *Title of Paper:* NB-IoT Deployment Study for Low Power Wide Area Cellular IOT.
a) *Author:* Nitin Mangalvedhe, Amitava Ghosh, Rapipat Ratasuk.
b) *Description:* In this paper, the concept of Narrowband IoT(NB-IoT) is used. NB-IoT is a new Narrowband system that built from existing LTE functionalities deployment study of NB-IoT using existing LTE infrastructure is done.The main goal of NB-IoT devices is to support for low cost and fast deployment off the devices.

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3) *Title of Paper:* Mobile Health (m-health) System in the context of IoT
a) *Author:* Sultan H. Almotiri, Murtaza A. Khan, Mohammad A. Alghamdi.
b) *Description:* The mobile health (m-health) System in the context of Internet of Things is described. Also fundamental characteristics of m-health devices such as compactness, IP connctivity, low power consumption and security is described. Acquisition of mobile health data via medical devices and gadgets and application in this data various health condition such as blood sugar level, ECG, blood pressure, asthma, etc.

III. MATHEMATICAL MODEL

Let's H be the main system as Hospital System.
H= { A,P,O,W}
Where,
A is a number of Ambulance that registered to particular Hospital.
A= { A1,A2,A3……,An}
Here, unique RFID code/number assigned to each ambulance.
P is number of parking slots.
P={P1,P2,P3,….Pn}
O is the number of outdoor patients.
O={011,02,03,….,0n}
W is ward boy/lady for ward care of patients.
H=Ai+Pi+Oi+Wi.

IV. ARCHITECTURE

The architecture of Smart Hospital System using Narrowband IoT (NB-IoT) is a part of IoT architecture which connecting all wearable or devices of Hospital's. Each part is collectively participate in system which responsible for their work.
Patient's medical data and also doctors information is stored on website through sensors. The data can be access by admin only and modify. Ambulance data is also stored in database.

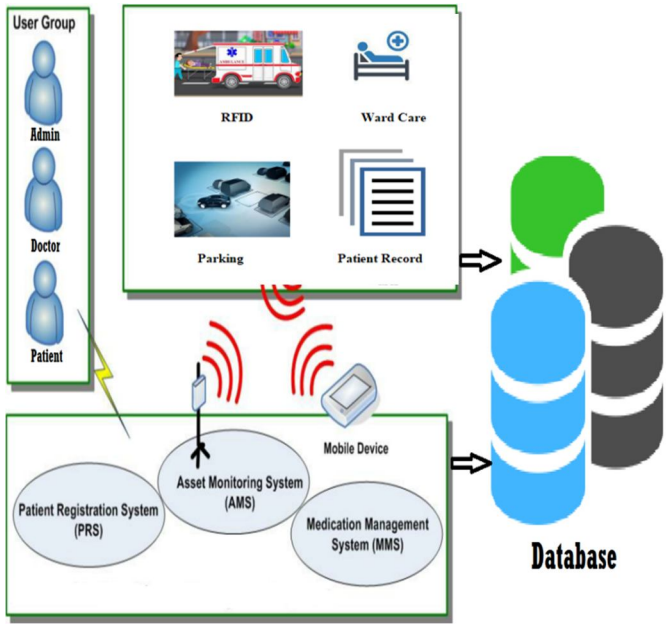

Fig. 1) Architecture of Smart Hospital

V. CONCLUSION

The smart hospital containing all the things of hospital's are become advance. In this proposed application, we are trying to connect all things with low cost, high coverage of modules. Various applications are already invented but this one is for advancing the LTE coverage modules. We successfully developed ambulance module for going forward to become a smart hospital.

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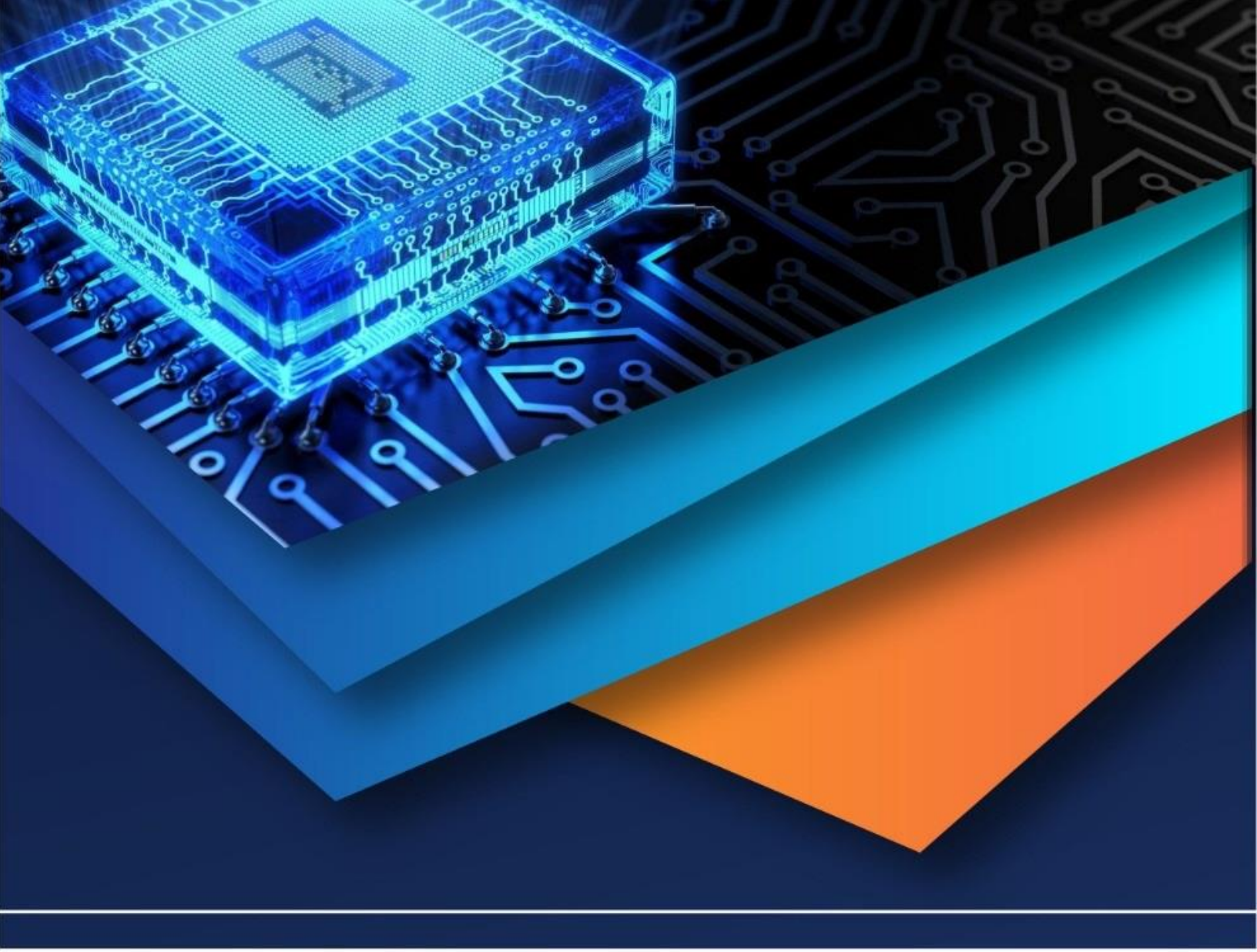

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