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A Smart Heart Rate Sensing System in the Internet of Things

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ABSTRACT

The rapid development of Internet of Things (IoT) technology makes it possible for connecting various smart objects together through the internet. Recent research shows more potential application of IoT in information intensive industrial sectors such as healthcare services. This paper proposes to monitor and control the environment condition and patients' health care condition using the smart hospital system. The patients' health condition can be monitored by spark kit. It monitors the temperature and heart rate sense of the patients. In environments condition we can monitor room temperature and normal and abnormal condition of air conditioner by sensors using RFID kit. RFID system consists of readers and tags. When RFID tag is ON it sends the patients information and status to the local user. The information should be in graphical view in structure. For every patient there is a patient ID. Using the patients ID the doctor can sense the patient status and he prescribe the medicine in graphical and text view.

Index Terms: RFID KIT, WSN, Healthcare, Smart environment, SPARK KIT.

1. INTRODUCTION

Advancements in Internet of Things (IoT) technologies present enormous potential for the high quality and more convenient healthcare servicing. Healthcare infrastructure is a goal for challenging modern society. The nurse shortage is the primary issue. The health care cost is also reduced for the patients and it is the quality care. As highlighted in [1] in fact monitoring and tracking of patients, personnel, and biomedical devices within hospitals and nursing institutes. In internet of things the recent advances is improving health care conditions of patients and bio medical related processes. The few examples are tracking of people/ patients, automatic identification of patient, monitoring of patients in real time.

In smart health care system the implementation needs three technologies like RADIO Frequency Identification (RFID), Ultra High Frequency (UHF), Wireless sensor network. RFID is the wireless use of electromagnetic fields to transfer data for the purpose of automatically identifying and tracking tags attached to objects. The tag contains electronically stored information. RFID is one method for automatic identification and data capture. The classification of RFID system is the type of tag and reader. The reception range of passive reader active tag can be adjusted from 1-2000 feet allowing flexibility is application such as protection and supervision. An active reader passive tag system has an active reader which transmit interrogator signal and also receives authentication replies form passive tags. RFID is a tracking system that uses the intelligent bar codes to track items in a hospital. The main drawback of the RFID system is it reader coverage region is 15m to 25m.

WSN are spatially distributed autonomous sensor to monitor physical or environmental condition such as temperature, blood pressure, etc. The most modern network is bidirectional also enabling control of

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sensor activity. In WSN each node is connected to one sensor. Multi hop fashion is used to monitor and provide functionalities in industry, military applications. IOT device can be remotely accessible through the internet from anywhere of the world for automatic monitoring and tracking of patients personnel devices within nursing institute uses smart health care system. But in a Smart Heart Rate Sensing System in The Internet of Things the automatic monitoring and controlling of patients environmental condition and patients healthcare condition. In patients health care condition we sense the heart rate of the patients. In patients environmental condition we can monitor temperature and blood pressure of the patient. The augmented gen2 reader is used to store the sensor data and patient information. RFID gen2 reader is delivered to a control center, by which the advanced monitoring application makes easily accessible for both local and remote user via representation state transfer web service. The WSN is used to reduce the power consumption and impacts of network. The WSN based transmission is used in emergency situations that inform the nursing staff via notification message on the mobile application. Even the doctors can connect their smart phone to a portable UHF RFID reader with the help of mobile application. The doctor can send the medical report to the patient id.

The recent advances in micro electro mechanical system has been developed several sensors in medical fields such as heartbeat, body temperature, blood pressure, etc. The UHF RFID technology was used to tracking patients in hospitals and nursing institute. In [3] the author said that we can use ambient tag and wearable tags for night care of patients. Night care is mostly used for elderly person and disabled person. In [4] passive technology is used for equipment localization. In [2], WSN providing patient location, monitoring and tracking of patients within nursing institute. Souza[5] et al. reported that the wireless localization network is able to track the patients and monitor the physical status. Chandra sekaran et al[6] reported a ranging algorithm with WSN to track patients. The monitoring and tracking of patients using WSN4QOL is reported in [7]. In [8] the 6 LOWPAN and smart mobile communication techniques are combined together to provide monitor of patients. In [9] the constrained application protocol is used for connecting and monitoring the medical sensor. In real time both environmental condition and patients health care condition is monitored and send the message to the nursing staff through mobile application. The table has shown the Typologies of Resource and Related Coap Path.

2. SYSTEM ARCHITECTURE OVERVIEW

The main aim is to Integrate IoT (Internet of Things) aware architecture to enhance Smart Healthcare Systems for automatic environmental monitoring of hospital and patient health monitoring. In case of emergency the advanced monitoring application send the alert message to the nurse and doctor. In environmental condition we can monitor and track the temperature and body pressure and ambient light. In patients' health care condition we can monitor and track the sense of the heart beat. The architecture diagram is shown in fig. 1.

The HT node is very important because it can detect the physiological parameter like heart beat movement and motion. Sensed data are periodically stored in the RFID GEN 2 reader. A monitoring application receives the data and stores them into the database.

Table 1
Typologies of Resource and Related Coap Path

Node	*Resource*	*Resource Path Examples*
6LR	Ambient sensor	Coap://[bbbb::2]/ambient light Coap;//[bbbb::2]/ambient temperature
6LRR	Ambient sensor Rfid reader	Coap://[bbbb::3]/ambient/temperature Coap;//[bbbb::3]/RFID/reader
HT	Ambient sensor Health sensorRFID tag	Coap://[bbbb::4]/ambient/pressureCoap://[bbbb::4]/health/ motion Coap://[bbbb:4]/RFID/tag

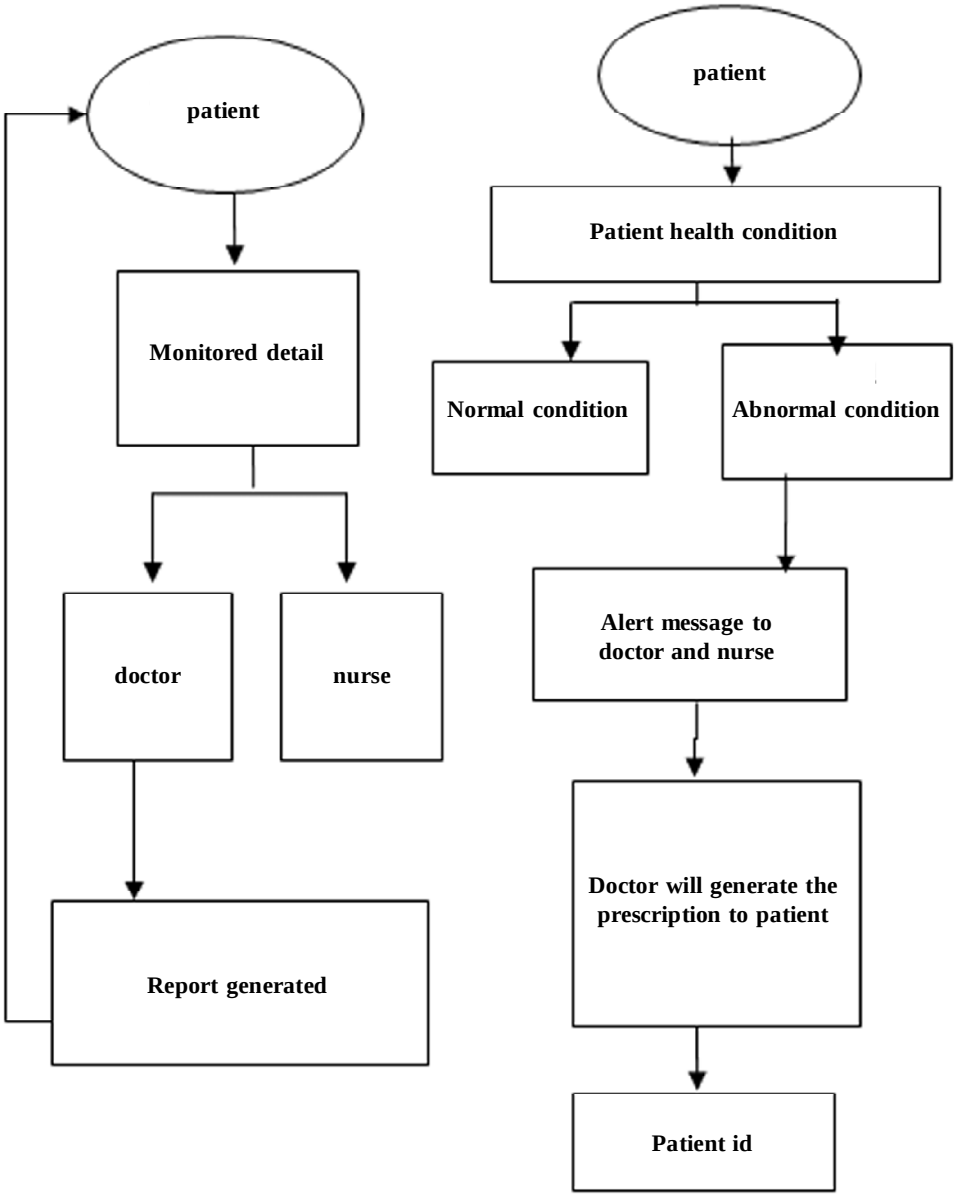

Figure 1: Architecture diagram

Medical app should be stored into the smart phone. Through this application the doctor can directly interact with the patient and he can generate the medical report. The patient must worn the HT node. The ht node will take all the patient condition and send to the database. This historical information is stored in the control databases. The doctor can check the patient condition through the web application on his smart phone.

3. AN EXPERIMENTAL STUDY

The hospital consists of a different type of wards, in an each ward sensor are planted and sensor are used to sense the environmental condition i.e. is (temperature, humidity, ambientlight.etc of that ward. Each sensor has its own tag id. Once the sensor starts sensing data, each sensed data will be updated in that particular ward. Each patient should be required to fill out a patient details form. Each patient should describe the description of their disease in that patient details form, based on the patient description the patient id will be automatically updated to the ward.

In a hospital, each ward has a specialist doctors and a nurses. Each doctor and nurse should be register with the hospital web application. Each nurse has its own specialist doctor identity. List of patient id are

updated in the nurse page. The local users in the hospital are responsible for tracking the ward environmental conditions. The local users have a unique login and local user should be login to see the details of environmental condition of each ward. All the sensed ward details are continuously update in a local user main page.

In nurse main page, list of patients id are displayed. Then nurse click on the patient id to monitor the patient details, now the patients monitoring information which is temperature and the heart rate are updated in the nurse page. If the nurse wants to monitor some specific data either temperature or heart rate, that specific information only monitored for that patient. When monitoring the patient values the dynamic chart will be updated based on the sensed value of the patient. The abnormal status of the hospital ward is maintained separately and once abnormal values detected it will be automatically informed to that particular ward. The dynamic chart will be updated based on the monitored value of the temperature and heart rate. In the local user main page, monitored sensed ward data are continuously displayed. The query process which is the local user query different wards of data. Based on the values of the sensed data, the dynamic chart will update and it will be monitored by the local staff. The table 2 has shown the Comparison between the Proposed System and the existing system

Table 2
Comparison between the Proposed System and Existing System

Reference work	*Technologies RFID*	*WSN*	*MOBILE*
[1]	YES	YES	YES
[2]		YES	YES
[4]	YES		YES
[15]		YES	
[16]		YES	YES
[20]	YES	YES	YES

The nurse will send the monitored details to the doctor. After the patient details are analyzed the doctor will generate the image chart based on the values of a heart rate and the temperature. Based on the condition of the patient, the doctor will give the prescription, and the details of the prescription and an image chart are integrated and generated as a PDF document. The generated report will be send to the patient by the doctor. The mobile based application for a doctor and patient. The feature of that application is

1. Patient has the option to see the report.
2. The doctor can provide prescription and generate a report for a patient from any location.

Patient and environment monitoring would be considered as a individual application system in healthcare automation environment. Integration of environment and patient monitoring does not exist. Doctor has to generate the patient report in a hospital only. In case of any emergency the doctor must be in hospital to generate a prescription. If a doctor in some other location apart from hospital, doctor may send report via messages or by call may lead to conflicts. So a mobile based application of a patient is mandatory to the doctor, so that a doctor can provide prescription from any location.

4. CONCLUSION

In this work, A Smart Heart Rate Sensing system in The Internet of Things for automatic monitoring and tracking of patients within the nursing institute. We are monitored patients healthcare condition and environmental condition. The UHF RFID is used to store the sensed data. It is able to collect in real time application the patients health care condition is sensing of heart rate using spark kit. Both the local and

remote users are used to collect the patient conditions. The achieved result shows the appropriateness of the proposed system to perform monitoring and tracking of patients in environmental and healthcare condition within the hospital and nursing institute.

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