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Review on Health Care System using Internet of Things Technology

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ABSTRACT: This paper focus on review of IoT based Smart Healthcare System. The main objective of this proposed system is to transmitting the patient's health monitoring parameters through wireless communication. These input data are uploaded in cloud server and transmitted to the computer and mobile for family and doctor's reference. Advances in information and communication technologies have lead to the emergence of Internet of Things (IoT). In the modern health care environment, the usage of IoT technologies brings convenience of physicians and patients, since they are applied to various medical areas (such as real-time monitoring, patient information management, and healthcare management). The body sensor network (BSN) technology is one of the core technologies of IoT developments in healthcare system, where a patient can be monitored using a collection of tiny powered devices. This system will also give timely necessary alerts and instructions to nurses and cleaning staff. In this paper, the gateway is designed to act as a central monitoring system, which provides worthy addition to present hospital management systems.

KEYWORDS: Healthcare, Internet of Things (IOT), Internet, Sensors, GUI

I.INTRODUCTION

A health care system includes an institution or an organization of people that delivers health care services to meet the health needs of patients. In hospitals, number of patients is increasing rapidly every day. Due to overcrowding in hospitals, patients fail to get proper treatment on time due to shortage of doctors, nurses, cleaning staff and sometimes also due to lack of resources like non-availability of bed, electricity etc. The Indian Express newspaper states that India is having just 1 doctor per 1700 people. And this ratio is decreasing day by day due to which, it is becoming increasingly difficult for a doctor to focus properly on patients which turns out to be a major reason for poor health care. As per the Indian Nursing Council, 3 nurses per patient should be there. But as per statistical survey, only one nurse was found available for 40 patients in Bangalore, which is one of the most developed city in India. Most of the people misunderstand that only doctors play the role in patient-care life cycle. In fact, nurses, cleaners, maintenance, almost the whole hospital management plays vital role in a patient-care life cycle in hospital industry. This system will monitor patients' body parameters and generate the request like nurse service, SOS, cleaning etc. by keeping the record of all requests at peak hours we can plan the resources for patients in advance. To manage it efficiently, the system requires skills like operational efficiency, Internet of Things (IoT), RF Technology, Data Analytics, Knowledge engineering, etc. Various kinds of Hospital management Systems are available in market as follows: Software based hospital management; Hardware based solution like Nutans H treatment hotline etc. Some hardware based systems also exist in market to monitor the patients' condition. But all such systems lack in scheduling properties and managing the hospital's resources and they do not convey patients' on-demand requirements to the hospital ward/nursing station automatically. Current problem demands a system which gives a solution for monitoring the vital body parameters as well as patients' on-demand requirements to the hospital staff. Through such system the patient will be able to convey a message to care-giver, by pressing a button of their requirements like cleaning, nursing etc., at any instant of time. The message (generated because of the abnormal body parameters and patients' on-demand request) must reach to the care-giver without any delay. In parallel, these demands/ requirements of patients must be stored in a database, in order to perform data analytics, to generate a management report. This report will have information on how many patients require cleaning, how many patients require nursing along with the requirement's time stamp. This report will help in predicting the requirement of services needed for the patients in appropriate time.

II.LITERATURE REVIEW

The reviews from different papers are taken and studied.

A some of them are given below.

Swapnil Vir Lal, Ravishankar Palaniappan, V.Prakash [1] expressed the gateway designed to act as a central monitoring system, which provides worthy addition to present hospital management systems. RF Remote and



watches are used to provide communication between patients and nursing care. Both hardware and software design of gateway is discussed briefly with series of outputs, which proves that proposed systems is feasible and efficient in real-time scenario. The work provides base to many possible applications dedicated to serve the problem discussed.

Vandana Milind Rohokale, Neeli Rashmi Prasad and Ramjee Prasaddiscusses about Internet of Things (IoT) concept that enables the possibility of information discovery about a tagged object or a tagged person by browsing an internet addresses or database entry that corresponds to a particular active RFID with sensing capability. This paper proposes a cooperative IoT approach for the better health monitoring and control of rural and poor human being's health parameters like blood pressure (BP), hemoglobin (HB), blood sugar, abnormal cellular growth in any part of the body, etc.

Byung Mun Lee, Jinsong Ouyang [3] has been proposed that an intelligent service model for healthcare which gives an effective feedback to an individual. In order to do this, the collaboration protocol which transfers risk factors between IoT personal health devices has been introduced. In addition to this, intellectualized service application algorithm which will be operated in the personal health device has been proposed. Finally, based on the findings of the experiment, the effectiveness was confirmed on proposed model.

Charalampos Doukas, Ilias Magiogiannis [4] discusses pervasive healthcare applications utilizing body sensor networks generate a vast amount of data that need to be managed and stored for processing and future usage. Cloud computing among with the Internet of Things (IoT) concept is a new trend for efficient managing and processing of sensor data online. This paper presents a platform based on Cloud Computing for management of mobile and wearable healthcare sensors, demonstrating this way the IoT paradigm applied on pervasive healthcare.

Sara Amendola, Rossella Lodato, Sabina Manzari [5] discusses about the current evolution of the traditional medical model towards the participatory medicine can be boosted by the Internet of Things (IoT) paradigm involving sensors (environmental, wearable, and implanted) spread inside domestic environments with the purpose to monitor the user's health and activate remote assistance. RF identification (RFID) technology is now mature to provide part of the IoT physical layer for the personal healthcare in smart environments through low-cost, energy-autonomous, and disposable sensors.

Punit Gupta et al [6] the design and implementation of an IOT-based health monitoring system for emergency medical services which can demonstrate collection, integration, and interoperation of IoT data flexibly which can provide support to emergency medical services like Intensive Care Units (ICU), using a INTEL GALILEO 2ND generation development board. The proposed model enables users to improve health related risks and reduce healthcare costs by collecting, recording, analyzing and sharing large data streams in real time and efficiently. The proposed system is enough intelligent to monitor the health parameters of patient. In the hardware they used 2nd generation Intel Galileo, a 32-bit Intel Pentium processor system on chip. It is considered as the brain of the given model. As it provides Linux platform with high processing and computer power, it prefers over Arduino. This collects the data from all the sensors which are connected to the patient and upload this data on the web page through Ethernet. Here they used XD-58C pulse sensor for measuring heart beats, it takes +3.5v to +5v at VCC, 50Hz to 60Hz frequency. For temperature calibration they have used LM-35 temperature sensor and Xampp based data base server used for patient's timely record.

Kasim M. Al-Aubidy et al [7] The main objective of this research is design and realization of real-time monitoring and alarming system for patient health, especially for patients suffering from diseases during their normal life. The proposed system has an embedded microcontroller connected to a set of medical sensors (related to the patient case) and a wireless communication module (Bluetooth). Each patient is considered as a node in a wireless sensor network and connected to a central node installed at the medical center through an internet connection. The embedded microcontroller checks if the patient health status is going well or not by analyzing the scanned medical signals. If the analysis results are abnormal, the embedded unit uses the patient's phone to transmit these signals directly to the medical center. In this case, the doctor will send medical advice to the patient to save his/her life.

Bhoomika B. K. et al [8] the PIC18F46K22 microcontroller is used as a gateway to communicate to the various sensors such as temperature sensor and pulse oximeter sensor. The microcontroller picks up the sensor data and sends it to the network through Wi-Fi. The controller is also connected with buzzer to alert the caretaker about variation in sensor output. The security issue is been addressed by transmitting the data through the password protected Wi-Fi module ESP8266 which will be encrypted by standard AES128 and the users/doctor. can access the



data by logging to the html webpage. At the time of extremity situation alert message is sent to the doctor through GSM module connected to the controller.

Ullah, Munam Ali Shah [9] This presents the model named as „k-Healthcare“ makes use of four layers, sensor layer, network layer, internet layer and service layer. There are different sensor used like RTX-4100, Arduino, Raspberry Pi, pulse oximetry and smart phone sensors. Communication between layers is done through IEEE 802.15.4, 802.15.6, IEEE 802.11/b/g/n, Zigbee etc. For data storage management the system used cloud storage. The proposed system support different protocols and like HTTP, HTTPS, RESTful and Javascript web services.

III. METHODOLOGY

The system architecture of IOT health care system shown in Figure 1 is divided into three parts.

- Patient healthcare module
- Cloud server (Think Speaks) and
- Doctor / hospital staff interface module.

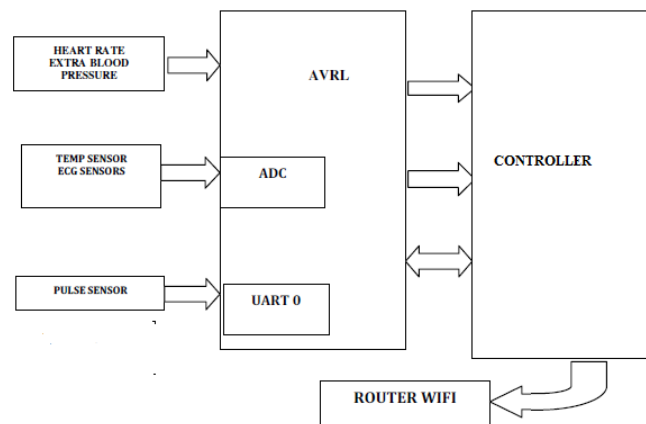


Fig. 1. Proposed System

A. Patient healthcare module

In the Patient healthcare module medical parameters are recorded by wearable sensors. Sensors are categorized into three groups based on their data conversion rate and their function. The first group of sensors includes high data rate sensors used for streaming-like real-time parameters (e.g., ECG signal). The second group comprised of sensors that read and record data at a lower data rate such as body temperature (DS18B20) and environment sensors. The last group includes sensors which are not fully automated and are periodically used by patients or home caregivers. The values read by these sensors (e.g., blood pressure) are added to the system manually. This data is collected by a System on Chip (SOC) microcontroller ESP8066, which has in build ADCs, digital IO, Wi-Fi and also supports communication protocols like I2C, SIP, and UART etc. As ESP8266 is small in size it is the best choice for a wearable device.

B. Cloud Server

On server side, every patient, doctor and hospital staff will have their user accounts. The data collected from the patient's body i.e. patient's body parameters are stored into the patient's database. This data will be visible to doctor and some part of the data can be made visible to hospital staff. Processing unit in server will process the patient's data and thus assists doctors for the treatment of the patient. Then the treatment and prescription given by the doctor will also get stored in the patient's database for further analysis of the patient's condition. Along with this, processing unit will also generate alerts if there is any abnormal condition found in the patient's body parameters. Server will also receive the patient's request either for any medical assistance or cleaning and forward it to the respective staff.

C. ThingSpeak to record Patient Data online

ThingSpeak provides very good tool for IoT based projects. By using ThingSpeak site, we can monitor our data and control our system over the Internet, using the Channels and webpages provided by ThingSpeak. ThingSpeak 'Collects' the data from the sensors, 'Analyze and visualize' the data and 'Acts' by triggering a reaction. We have previously used ThingSpeak in Weather station project using Raspberry Pi and using Arduino,



check them to learn more about ThingSpeak. Here we are briefly explaining to use ThingSpeak for this IoT Patient Monitoring Project.

We will use ThingSpeak to monitor patient heartbeat and temperature online using internet. We will also use IFTTT platform to connect ThingSpeak to email/message service so that alert message can be sent whenever the patient is in critical state.

D. Doctor/Hospital Staff Interface Module

This can be a personal computer or smart phone. For hospital staff it can be a small wearable device like smart watch as they have very limited privileges. Doctor can login his user account through his computer and see the status of the patients by using patients' IDs.

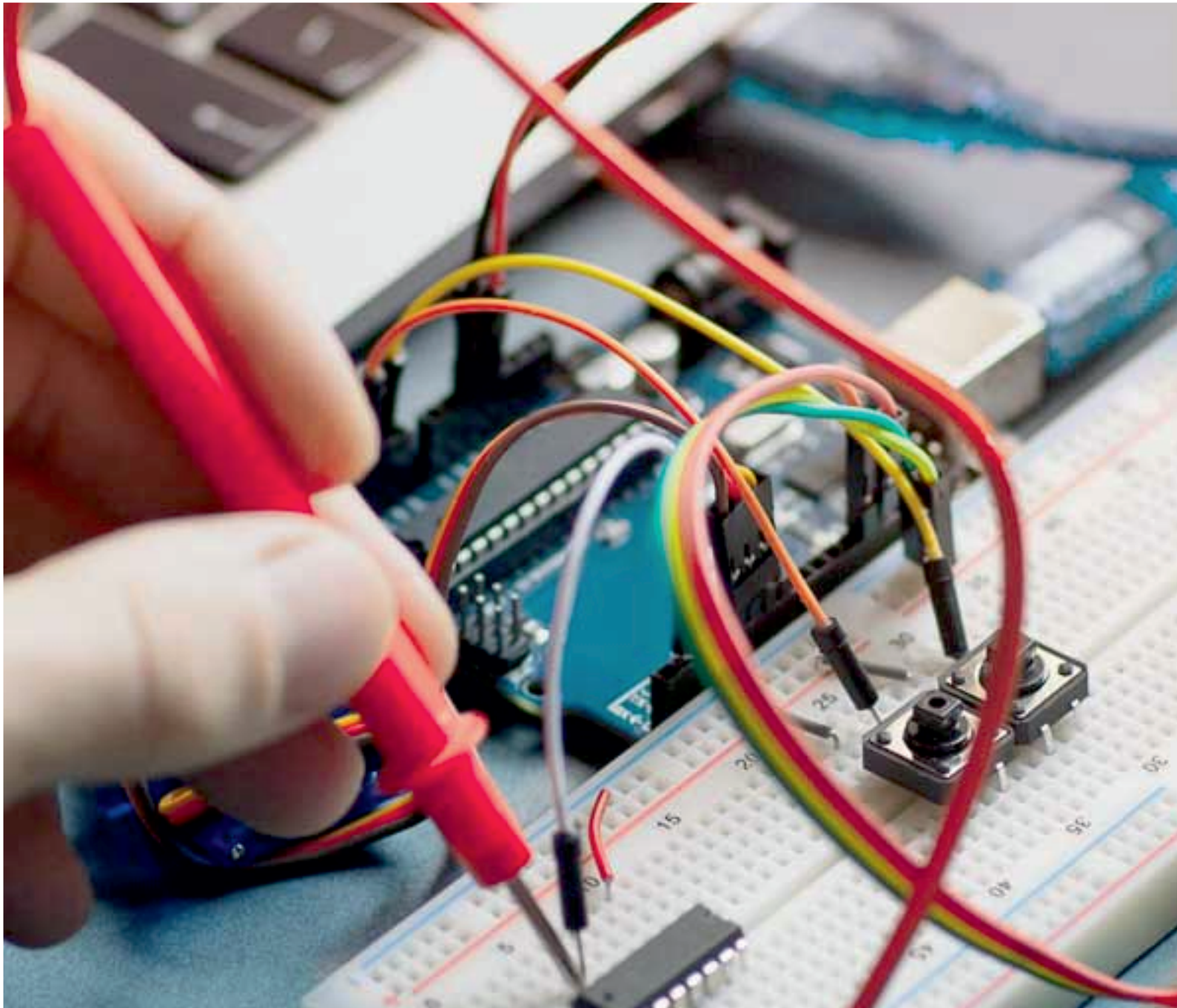
IV. EXPECTED OUTCOME

Internet of Things has many applications in different areas. IoT has been already designed for Wireless sensor network (WSN). It will be developed for health monitoring. This system presents the architecture of IoT and architecture of Smart health monitoring using IoT. There are some problems found in IoT and existing health monitoring. New technologies could help to minimize them by achieving the better quality as well as web based security concept. This system presents the problems and challenges that could come.

In future, the project is being expanded using own cloud, which is under development to include the data analytics report in form GUI for the hospital management staff. Mobile based APIs are to be interfaced to this system in order to monitor through phone. Security issues will also be considered in future work.

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