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DESIGN AND IMPLEMENTATION OF SMART MONITORING SYSTEMS IN HOSPITAL WAGON USING IOT TECHNOLOGY

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Abstract—This paper presents a wearable sensor network system for Internet of Things (IoT) connected safety and health applications. Safety and health of patients are important; therefore, an IoT network system which can monitor both environmental and physiological can greatly improve the life time of the patient. The wearable sensors on different subjects can communicate with each other and transmit the data to a gateway via a Local Area Network which forms a heterogeneous IoT platform with Wi-Fi based medical signal sensing network. It consists of two sections: the basic information and condition of patient is collected in the wagon by the means IoT (Internet of Things) and make it available to hospital before the emergency vehicle reaches the hospital. On the base of such data, the system is able to detect anomalous situations and provide information about the status directly and exclusively to the hospital. The second path is control of traffic lights from the wagon and makes free for its path automatically. This project is to save the time of major late time aspects in more efficient manner and save the life.

Index Terms-Wearable sensors; Wi-Fi; Connected health condition

I. INTRODUCTION

In developing countries like India occurrence of accident mortality rate is especially due to unavailability of fully equipped hospitals and delayed reach to available facilities in rural areas. The role of existing Wagon – emergency service has shown a significant change in the death rate
due to accidents. Most of the people died are from rural areas because they are not able to reach the hospital in right time. Otherwise they did not get proper treatment due to unavailability of doctor, lack of information and inadequate services. The mortality rate of accident due to delay of the wagon and inadequate medical information. To overcome this situation we designed this project to enhance the life time of the every human being by

reducing the delay of wagon and prior information
of the hospital. Utilization of modern technology to overcome the delay in timely service and communication of information to the respective experts & facilitators to enhance the process of saving the lives of the patients. The proposed Method Monitors the

patient health parameters and provides automated response of the measured details from the patient's treatment can be prepared before handedly. The generation of shortest route to nearby hospital, and the clearance of traffic signal along the path to reach the hospital are also possible.

Emergency cases [1] like heart attack, accidents, pregnancy, fever, unconscious, paralysis, inflation and all types of emergencies are handled by hospital wagon services. The hospital wagon can reach the site and rush the victim to the nearest hospital within 20 minutes in urban areas and 40 minutes in rural areas, approximately. This services works on the paradigm of Sense, Reach and Care supported by an efficiently trained team and state of the art equipment & software with GPS tracking systems [2].The system is fully automated using WIFI technology this technology appears as a promising solutions for IoT applications because of its effective transmission, coverage of areas, low power consumption and more number of end devices connected to gateways using a single hop .A recent research and Markets report predicted that the IoT healthcare market is expected to grow from USD 41.22 Billion in 2017 to USD 158.07 Billion by 2022, at a Compound Annual Growth Rate (CAGR) of 30.8% [3] Demonstrating how medical care and healthcare services represent one of the most attractive fields for the development of IoT. However, although novel healthcare services are expected to reduce costs and increase the quality of life of users, the more data organizations collect, from both fixed and mobile medical monitoring services, the more difficult is the effective use of a Cloud-based infrastructure from the local to the Cloud.

II.SYSTEM DESCRIPTION

The IoT paradigm is a viable solution to provide healthcare services to a large scale of patients; however, simplistic approaches in which the infrastructure between sensing devices and the Cloud is used only as a common communication infrastructure are not often feasible due to the presence of other healthcare challenges. For example, in some cases, to respect the patient's privacy, data cannot be stored in the public Cloud or, in other cases, for patient safety, data must be immediately available and any delay or failure introduced by the Cloud cannot be tolerated.

In the last few years, several solutions have been proposed to support healthcare services using standard Cloud-based solutions. Hassanalieragh *et al.* [4] proposed a mobile Android application for electrocardiogram (ECG) monitoring. This solution does not support Edge processing so health professional can take a decision only after Cloud processing and not at the time the health device collects the signal. In the same direction, the authors of [5] proposed an application based on the ECG as a service that allows collecting, processing, storing and analyzing ECG data streams generated by sensors worn by several individuals. Also, this solution needs Cloud processing and miss reactiveness. More and more other solutions exist but all highlight the needs to overcome specific healthcare challenges. With the advent of Edge Computing, the healthcare industry has evolved considerably due to its ability to store, process and analyze data closer to patients, hospitals, and clinics. In fact, the Edge Computing is permeating the industry so powerfully that doctors and physicians are starting to increasingly rely on it to support patient's treatment. In this context, many new research works have been conducted to demonstrate that standard Cloud-based services still face various issues related to unpredictable delays, high bandwidth requirements and security/safety concerns. These issues are very critical to healthcare and Active and Assisted Living (AAL) scenarios where a correct and timely reaction can also result in saving a life or drastically reducing a disability (*e.g.*, after a stroke). In [6], authors define the Edge Computing as the enabling technologies allowing computation to be performed at the edge of the network. Edge computing is often exchangeable with Fog computing [7], but Edge computing focus more closely to the Things side, while Fog computing comes closer to the Internet infrastructure side. Under the Edge computing paradigm, some application services are handled at the edge and some others are handled by a remote server in the Cloud. This type of distributed analytics Edge intelligence offers great potential to overcome healthcare challenges, improving the effectiveness and the efficiency of pervasive health monitoring. According to this modern vision, a flexible multi-level architecture based on a computing paradigm in which heterogeneous devices at the edge of the network collect data, compute a task with minimal latency, and produce physical actions meaningful for the user, has been proposed and tested in [8]. In the same direction, the authors of [9] proposed another IoT enabled healthcare system architecture which benefits from the concept of fog computing providing advanced techniques and services such as embedded data mining, distributed storage, and notification service at the edge of a network. Authors of [10] employed pervasive fall detection as a specific case study since fall is a major source of injury and mortality among stroke patients. They proposed a distributed fall detection system, named U-Fall, utilizing both Edge devices (*e.g.*, smart phones) and data center services(*e.g.*, server in the

Cloud) to achieve low miss rate and low false positive rate when compared to non-Edge state of-the-art systems. Many existing contributions use a gateway as an Edge intermediary between IoT devices and the Cloud. However, such solutions fail to satisfy some critical challenges of the healthcare area, particularly for nomadic health monitoring, availability, security, and privacy. The aim of our Body Edge solution is to overcome these domain-specific requirements by providing a solution that moves the Edge closer to end users.

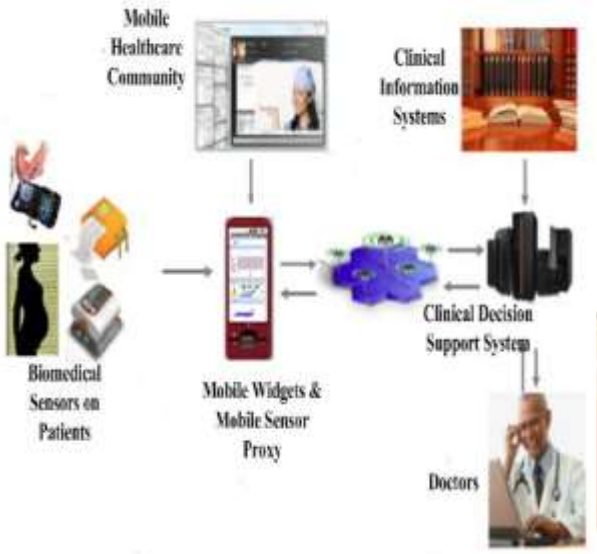

Fig.1: System Architecture to Support Mobile Health Care

III.DESIGN AND IMPLEMENTATION

The design and implementation of a proposed system is shown in the below figure [1.1]. The excited system consists of three stages they are sense, care and reach. The proposed system has the blocks of sensor unit, controller unit display unit. The sensor units sense the parameters such as Temperature, Pressure, Heart Beat, Blood flow & Brain wave of a patient. The measured parameters send to the controller unit, through Wi-Fi we can see the output in display unit. In tracking unit GPS is fixed to share the location of the wagon.

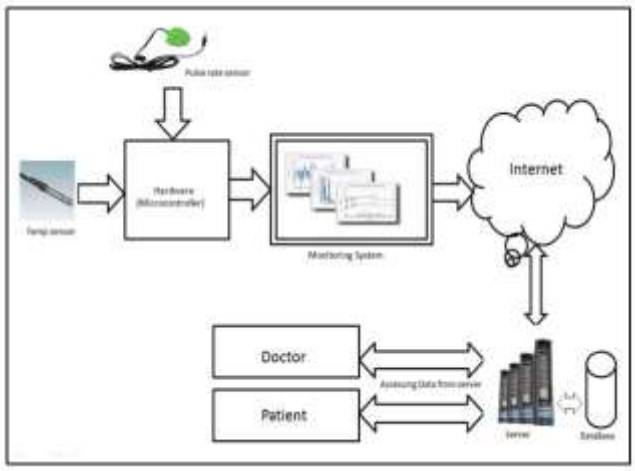

Fig.2: Block Diagram of Health care Unit

The traffic management system consists of RFID tag and RFID reader as shown in fig.2.2. The RFID tag is fitted in the wagon and the reader is fitted in the traffic light controller. The unique ID is taken from the RFID tag and stored in the microcontroller. Every time when the wagon reaches nearer to the traffic light controller unit, the reader in it reads the unique ID from the tag if it matches with the given ID, it clears the traffic in the stipulated path.

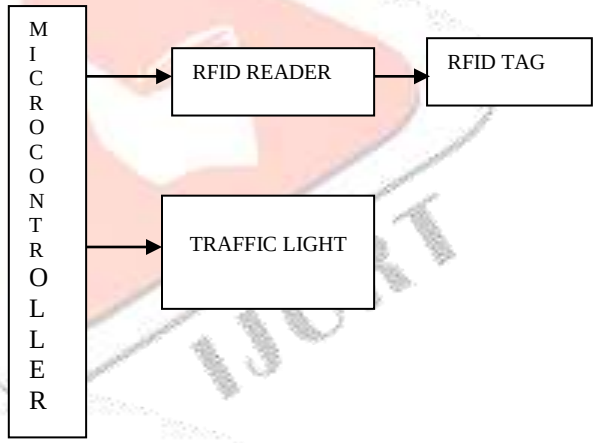

Fig.3: Block Diagram of TMS Unit

IV.HARDWARE COMPONENTS

1. ESP8266 Controller:

ESP8266 controller is in-build wifi module. The ESP8266 serial WIFI wireless Transceiver module is a self contained soc with Integrated TCP/IP protocol stack that can give any microcontroller access to your WIFI network. The ESP8266 is capable of either hosting an application or offloading all WIFI networking functions from another processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, about as much WIFI ability as a WIFI shield offers (and that's just out of the box). The ESP8266 module is an extremely cost – effective board with a huge, and ever growing

community.

Specifications:

Manufacture: Espressif systems
Type: 32-bit microcontroller
CPU: 80MHZ or 160 MHZ
Memory: 32 KB instruction, 80 KiB user data

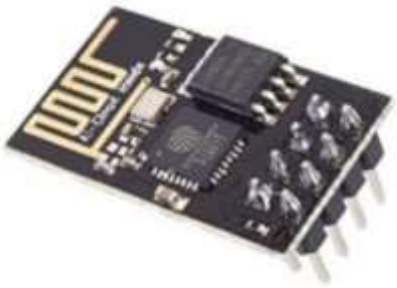

Fig.4: ESP8266 NodeMCU WIFI module

2. Temperature Sensor: AIA999
Range: -5 t0 +125 degree Celsius
Resolution: 2mc
Power: +12v 3,5mAmp

3. Heart beat sensor:

It works on the principle of optical principle. It gives the Pulse form of heart beat.

4. Electrodes:

The electrodes are used to retriew the data's from the brain. Here we are analyzing alpha, beta and theta waves.

5. RFID:

RFID is the radio frequency identification technology. A radio frequency magnetic field emitted from the RFID reader that is filled in the traffic light energizes the tag fitted in the wagon, then the tag responds to the reader's query via the radio waves by transmitting its unique identification number. This data is then decoded by the reader and passed to the back end system which performs a search for the matched identity code stored in the data base.

V.SOFTWARE IMPLEMENTATION

We use Arduino IDE software for as programming software for ESP8266. The reason we use Arduino software are:

1. Inexpensive- Arduino boards are relatively inexpensive compared to other microcontroller platforms.
2. Cross- platform: The Arduino software runs on windows, Macintosh OSX and Linux operating systems.
3. Open source and extensible software – The Arduino software is published as open source tools, available foe extension by experienced programmers.
4. Open source and extensible Hardware: The Arduino is based on Atmel's ATMEGA8 and ATMEGA168 Microcontrollers.

VI.PROPOSED WORK

The proposed system aims to cover an end-to-end smart, efficient and innovative health application that can be built up with two functional building blocks. However, the main function of the first building block is to gather all sensory data that are related to the monitoring of the patients, whereas the second block function is to store, process and present the resulted information on the server where the doctors can access health reports following the case of the monitored patients. As shown in Figure 1.1, which illustrate the overall model, the system consists of a robust health monitoring system that is intelligent enough to monitor the patient health automatically using IoTs. This would help the doctors to monitor patient's report from anywhere and at anytime. The system uses smart sensors that generate raw data information collected from each sensor and send it to a data server where the data can be further analyzed and converted into a graph analysis and statistically maintained at the server which can be used by the medical experts. The hardware is rightly and perfectly complemented with a right blend of software to form a highly evolving system in the field of health. Microcontroller ESP8266 is the 32-pin DIP which is the brain of the model which governs all the functions. It collects the input data from the sensor such as temperature sensor, a pulse rate sensor etc. and sends the data that is detected by the sensors while connected to the patients and this data is forwarded to the analog-to-digital converter which converts the analog data into digital data. This data is then uploaded to the web server. The uploaded data can be viewed by doctors as well as patients through a web page and android application.

In the proposed work we design a glove which is the brain of our project It consists of entire monitoring unit which is built with NodeMCU controller and sensor unit. In output section we have a tab with WIFI it is connected to the local area network to share the details of the patient. By this project the patients details will be stored in an database storage by the blinky software. It can be viewed by the authorized person for feature purposes.

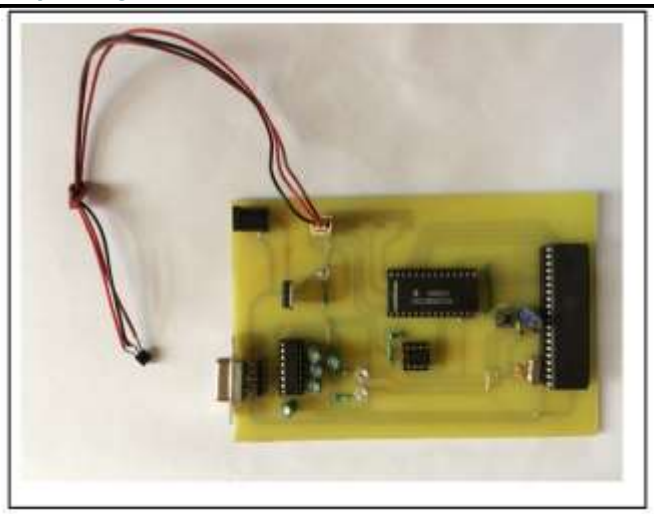

Fig.5: Experimental Circuit Setup

The proposed smart health monitoring system is being deployed and tested over a patient whose personal details are entered into the web portal. The patient is connected to the smart health monitoring system which consists of a heart rate sensor, blood pressure and a temperature sensor. The live graph of the patients heart rate, blood pressure and a temperature is being monitored on a Wamp based database server. The IOT device used here is Microcontroller ESP8266 and sensors. The system architecture of the proposed model is explained by the given figures which include a server connected Microcontroller ESP8266 that uploads the data received by the sensors onto the database and statistical graphs are being plotted for further analysis and records. The location of the wagon and the traffic monitoring is also done by the proposed system which having the capability of saving the life time of the patient .Also the medical details of the patient is stored in the data base storage for future reference.

Fig.6: Patient Server

In the ADD tab, the patient blood pressure, heart rate and temperature sensors are added into the database server with the unique user ID so as to maintain the records for further purpose.

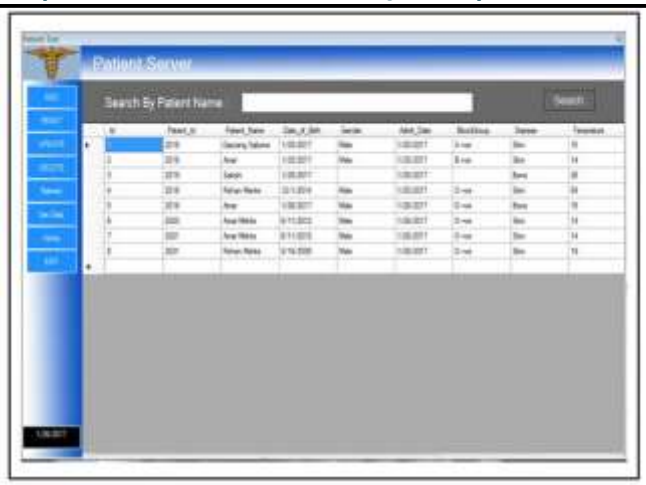

Fig.7: Data Base Server with Uploaded Data

VII.CONCLUSION

The internet has immediately changed the way we live, intercommunicating between people at a virtual level in several contexts spanning from professional life to social relationships. The IoT has the potentiality to add a new dimension to this process by establishing communication among smart objects, leading to the vision of anytime, anywhere, any media, anything communication. Ingenious use of IoT technology in healthcare not only benefits to doctors and managers to access wide ranges of data sources but also challenges in a mobile environment of real-time IoT application systems.

Considering the population status and the majority of the people live in villages which are remote places and with the growing technology and more importantly healthcare being the predominant issue of the nation this smart healthcare system using IoT technology plays an important monitoring tool at levels in the larger interest of the global as a whole.

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