A Secure IoT based Modern Healthcare System

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Abstract— The proposed system involves inter-communication between devices which will identify emergency situations and accordingly process to provide treatment effectively to needy one in shorter span of time. IoT encourages the communication between devices also famously known as machine to machine communication, Due to physical objects getting connected and controlled digitally and centrally with wireless infrastructure there is a large amount of automation and control in the workings. It also monitor exact quantity of supplies and perform necessary action. Amount of time is saved because of IoT. The biggest advantage of IoT is saving money.

Key words: IoT, Wi-Fi, BPM, GPS, GSM, ICU, LCD

I. INTRODUCTION

The Internet of Things (IoT) is the internet-connection of physical and other items embedded with electronics, software, sensors actuators and network connectivity which enable these objects to collect and exchange information. The basic idea behind implementation of modern healthcare system is to place all necessary information related with patient in link with registered hospitals. This information then can be retrieved efficiently in no time as and when required by hospital or in emergency situations. The project mainly comprised of controlling devices at patient end and at healthcare system which will do the functionalities like monitoring of health conditions, retrieval of data associated with registered patient, acting upon the inputs received form sensors like heartbeat sensors linked to patient, managing resources at healthcare side including admission of patient in emergency wards, appointment of related physicians and doctors. The overall functioning of the system thus lead to avoid delays in assigning necessary assistant to patient in emergency situations and so consequently helps to reduce loss of lives which is majorly happening due to unstructured functionalities of healthcare system.

In the system heartbeat sensor linked with patient senses the heartbeat of patient. If the rate of heartbeats exceeds the normal value i.e. 72 beats per minute (bpm) then the controlling device at patient end, Arduino Uno sends the emergency message to the data storage and retrieval system, ThingSpeak cloud through IoT module (ESP8266). The ESP8266 is a Wi-Fi module for sending and receiving data through ThingSpeak.

For sending the data to the cloud write API key is used. On the hospital side the controlling device, Node Mcu will read the data from cloud using read API key. With the emergency message, the location of the patient is also received at hospital side using GPS system and a message is sent to patient's relatives through GSM module. The location information received from GPS system is then used by healthcare system to provide ambulance in time. The personal in ambulance then can retrieve patient data through biometric sensor to avoid delay in getting necessary details of patent. This is achieved since the patient here is registered with healthcare system and so healthcare system is assumed to have health history of patient

At the patient side, patient is identified by scanning his fingerprint by using fingerprint sensor. Once the patient is identified his data is send to the cloud and through cloud it is received to the hospital side. Hospital side will analyze the data and ICU unit is allotted to the respective patient.

II. PROBLEM DEFINITION

If an emergency situation in health like heart attack occurs then it is necessary that urgent help should be provided to that person from nearby hospitals. Number of people lose their life because of not getting the required treatment in time. So it is necessary to give proper treatment to that person in time. Proposed system is a solution for this problem and helps to handle such emergency situations.

Nearly 27% of the total deaths in India happen with less medical attention at the time of death, according to the recent survey of 2013 civil registration data released by the Census directorate.

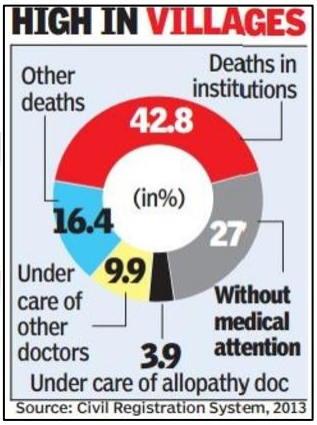

Fig. 1:

III. METHODOLOGY

A. Block Diagram

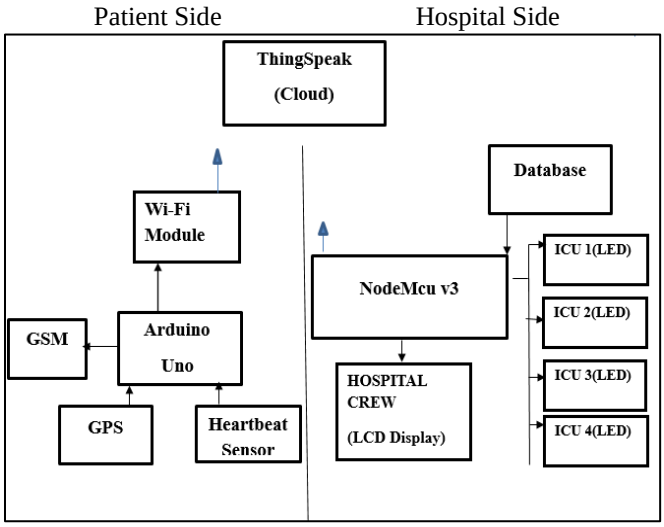

Fig. 2:

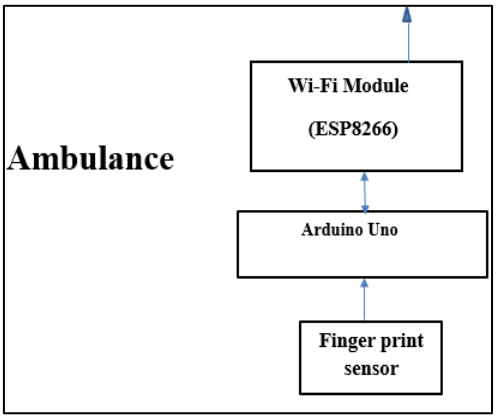

Fig. 3:

B. *Explanation of Block Diagram*

1) *Arduino Uno*

Arduino Uno is used to get the signal from various sensor, process these signals and send the commands to the peripherals connected to it.

2) *Node MCU*

In this system Node MCU reads the message from ThingSpeak cloud and it also manages the ICU unit and doctors at hospital side.

3) *ThingSpeak (Cloud)*

In this system for writing and reading the health related data, ThingSpeak as a cloud is used. ThingSpeak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network.

4) *Heartbeat Sensor*

Here heartbeat sensor senses the heartbeat of patient and send the signal to Arduino Uno. For proper output signal, signal conditioning circuit is used.

5) *GPS Module*

GPS module senses the location of patient in the form of latitude and longitude and gives it to the Arduino Uno. The GPS gives the location to the Arduino in the form of latitude and longitude. For example, N40° 44.9064', W073° 59.0735.

In this N indicates latitude and W indicates longitude. This location is also sent to the mobile number of patient's relatives and also to the hospital in the form of link.

6) *GSM Module*

GSM module is used to send the emergency signal to the patient's relatives and hospital. It will send the message as soon as heartbeat is abnormal. GSM will send emergency message and exact location of patient also.

7) *Finger Print Sensor*

Here finger print sensor is used to identify the patient and get his data. Here finger print of the patient is matched with the registered finger print in the hospital database.

Once the patient is identified the data is sent to hospital. The doctors will analyze the data and according to that ICU unit is allocated.

C. *Flowchart*

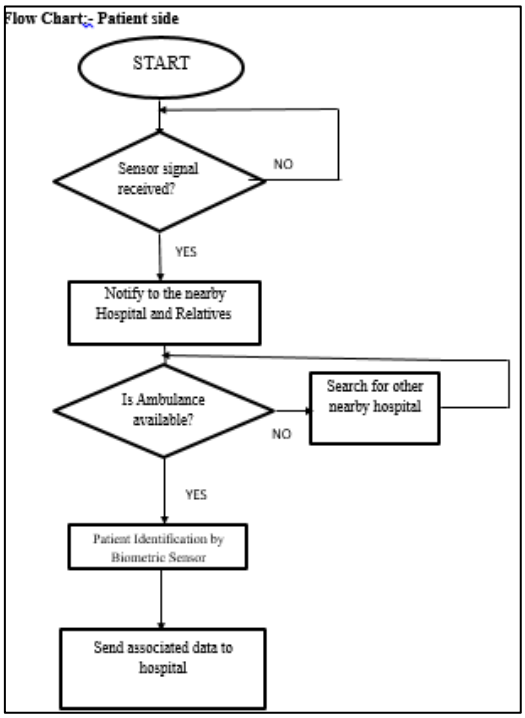

Fig. 4: Patient Side

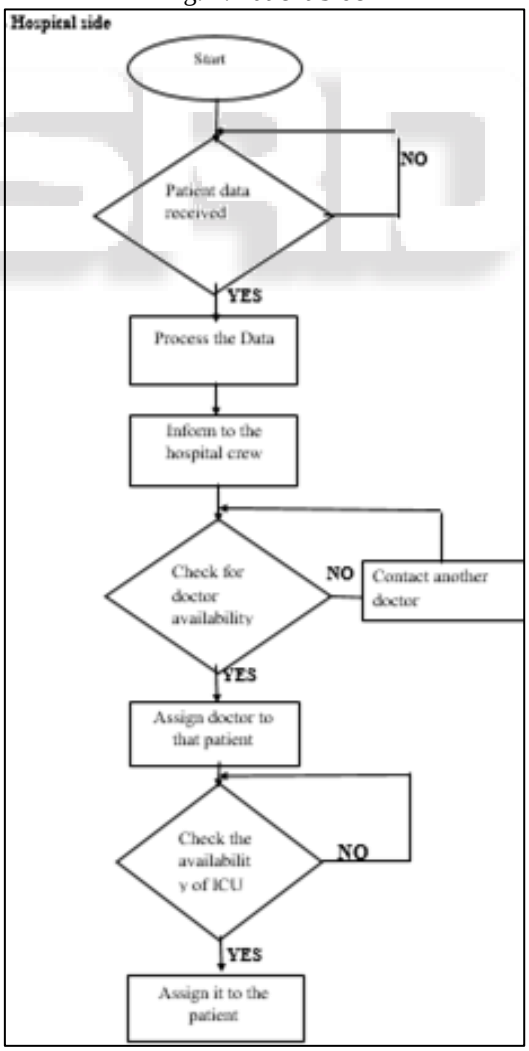

Fig. 5: Hospital Side

1) Algorithm (Patient Side)

1) Step 1: The system will monitor the rate of heartbeat using heartbeat sensor.
2) Step2: The system will check if the heartbeat is abnormal or not.
3) Step 3: If it is abnormal then the emergency message will sent to the hospital.
4) Step 4: Hospital will send the ambulance to patient's location.
5) Step 5: Patient is identified by finger print sensor and send related data like record of health history of patients to the hospital.

D. Algorithm (Hospital Side)

1) Step 1: Patient data is received at hospital side.
2) Step 2: Process the received data and check for doctor availability and assign related doctor to the patient.
3) Step 3: IF not available then check for another doctor and assign him to the patient.
4) Step 4: Check for the ICU unit, other required resources and assign it to the patient.

IV. HARDWARE & SOFTWARE REQUIREMENTS

1) Controller at patient Side: Arduino Uno
2) Controller at hospital side: Node MCU
3) ThingSpeak (Cloud).
4) Heartbeat Sensor
5) GPS
6) GSM
7) Finger Print Sensor
8) Arduino IDE.

V. HARDWARE RESULTS

A. Hardware Results

1) Patient Side

Heartbeat sensor reads the patient's heartbeat and if it is not normal then a message is sent to hospital side. Also location is also sent to another side.

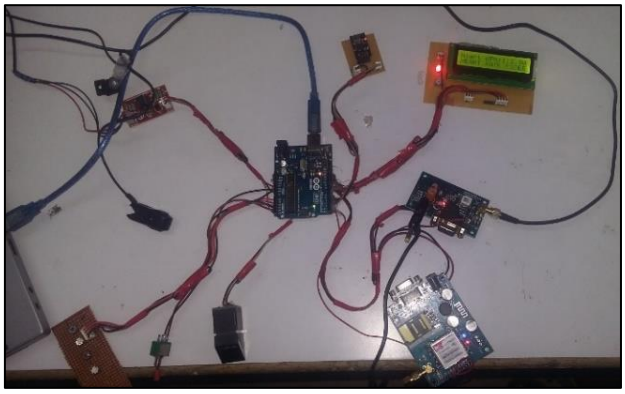

Fig. 6: Hardware at Patient Side

2) Hospital Side

Data received from the ThingSpeak and displayed on the LCD.

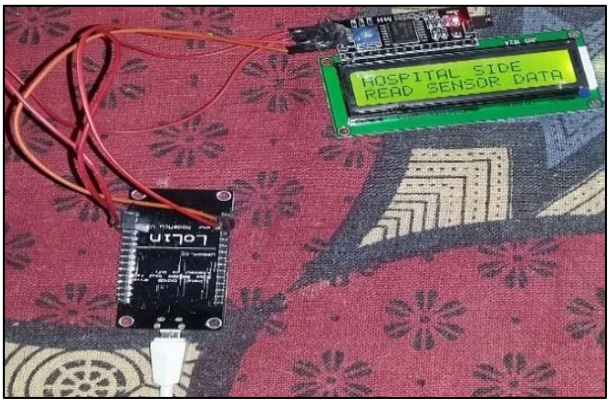

Fig. 7: Hardware at Hospital Side

VI. CONCLUSION

The proposed system automatically identifies the emergency situation related with health of person such as heart attack. It also provides quick solution to this situation by connecting various components of healthcare system to each other thereby reducing time consumption dealing in transportation of patient to hospital, admission and assignment of doctors to patient through exchange of the data through IoT. If this proposed system is implemented in real scenario it will reduce the death rate by providing proper treatment in time, thus increases the productivity of healthcare sector.

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