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Secured Smart Healthcare Monitoring System Based on Iot

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Abstract:- Technology plays the major role in healthcare not only for sensory devices but also in communication, recording and display device. It is very important to monitor various medical parameters and post operational days. Hence the latest trend in Healthcare communication method using IOT is adapted. Internet of things serves as a catalyst for the healthcare and plays prominent role in wide range of healthcare applications. In this project 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 and hence provides real time monitoring of the health care parameters for doctors. The data can be accessed anytime by the doctor. The controller is also connected with buzzer to alert the caretaker about variation in sensor output. But the major issue in remote patient monitoring system is that the data as to be securely transmitted to the destination end and provision is made to allow only authorized user to access the data. 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. Hence quick provisional medication can be easily done by this system. This system is efficient with low power consumption capability, easy setup, high performance and time to time response.

Keywords:- *Internet of Things, PIC microcontroller, ESP8266 Wi-Fi module, Temperature sensor, Pulse oximeter sensor*

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I. INTRODUCTION

Today Internet has become one of the important part of our daily life. It has changed how people live, work, play and learn. Internet serves for many purpose educations, finance, Business, Industries, Entertainment, Social Networking, Shopping, E-Commerce etc. The next new mega trend of Internet is Internet of Things (IOT).

Visualizing a world where several objects can sense, communicate and share information over a Private Internet Protocol (IP) or Public Networks. The interconnected objects collect the data at regular intervals, analyse and used to initiate required action, providing an intelligent network for analyzing, planning and decision making. This is the world of the **Internet of Things (IOT).**The IOT is generally considered as connecting objects to the Internet and using that connection for control of those objects or remote monitoring. But this definition was referred only to part of IOT evolution considering the machine to machine market today. But actual definition of IOT is creating a brilliant, invisible network which can be sensed, controlled and programmed. The products developed based on IOT include embedded technology which allows them to exchange information, with each other or the Internet and it is assessed that about 8 to 50 billion devices will be connected by 2020. Since these devices come online, they provide better life style, create safer and more engaged communities and revolutionized healthcare. The entire concept of IOT stands on sensors, gateway and wireless network which enable users to communicate and access the application/information. Be that as it may, among all the regions no place does the IOT offer more prominent guarantee than in the field of health awareness. As a saying goes "Health is wealth" it is exceptionally crucial to make utilization of the innovation for better wellbeing. Consequently it is obliged to add to an IOT framework which gives secure health awareness checking. So outlining a savvy medicinal services framework where client information is gotten by the sensor and sent to the cloud through Wi-Fi and permitting just approved clients to get to the information.

II. PROBLEM DEFINITION

In today's social insurance framework for patients who stays in home during post operational days checking is done either via overseer/ medical caretaker. Ceaseless observing may not be accomplished by this system, on the grounds that anything can change in wellbeing parameter inside of part of seconds and amid that time if guardian/attendant is not in the premises causes more noteworthy harm. So with this innovation created period where web administers the world gives a thought to add to another keen health awareness framework where time to time constant checking of the patient is accomplished.

III. PROPOSED SYSTEM

The main idea of the designed system is to continuous monitoring of the patients over internet. The Proposed System architecture for IOT Healthcare is as shown in the Figure.3 The model consists of PIC18F46K22 Microcontroller, Temperature sensor(DS18B20), Pulse Oximeter Sensor(TCRT1000), Liquid Crystal Display(16x2), GSM MODEM, Piezo Electric Buzzer, Wi-Fi Module, Max232, GSM Modem, Regulated Power Supply. In this system PIC18F46K22 Microcontroller collects the data from the sensors and sends the data through

Wi-Fi Protocol. The Protected data sent can be accessed anytime by the doctors by typing the corresponding unique IP address in any of the Internet Browser at the end user device(ex: Laptop, Desktop, Tablet, Mobile phone).

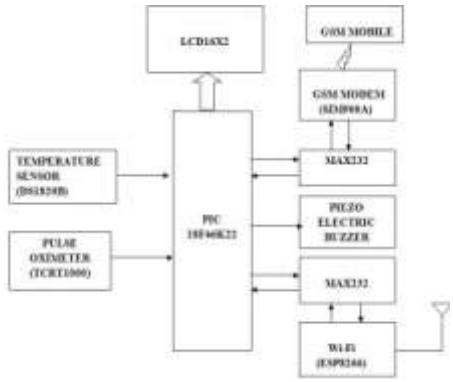

Figure3 : Proposed Block diagram of IOT based healthcare system.

The Microcontroller is connected to GSM Modem which provides information to doctor/caretaker when the heart rate is greater than 90 or less than 60 and when the temperature is less than 20 or greater than 35. During this time the buzzer turns on and alerts the caretaker. LCD is connected to microcontroller to display the transaction process and healthcare data. And the user interface html webpage will automatically refresh for every 15 seconds hence patient health status is continuously sent to the doctor. Hence continuous monitoring of patient data is achieved.

IV. IMPLEMENTATION METHODOLOGY

Hardware Description

A) PIC18F46K22 microcontroller

The PIC18F46K22 is a PIC family microcontroller from Microchip Company. It has 64Kbytes of Flash memory and 1024 bytes of EEPROM. The key element of the PIC18F46K22 microcontroller is Low-control because of proficient XLP innovation joined and provides high-performance hence best suited microcontroller for embedded applications.PIC18F46K22 is 40pin plastic dual-in-line package. The main feature is high performance RISC CPU, Adaptable oscillator structure, and Extreme low power management with XLP.

B) 16X2 Liquid Crystal Display (LCD)

Liquid crystal display is very important device in embedded system. Now days it is very common for screen industry to use LCD replacing Cathode Ray Tubes (CRT). Pixels are used for most flexible ones.

C) GSM Modem

GSM MODEM operates by accepting the SIM card to the subscribed mobile operator. i.e., just like a cellular phone. When GSM MODEM allows PC to communicate over the mobile network when connected to the computer. It operates over network to send and receive message. In order to control modems computer use AT commands similarly GSM uses AT commands in order to send, receive, write or delete messages.

D) Wi-Fi Module (ESP8266)

ESP8266 offers a self-standing Wi-Fi networking with TCP/IP protocol stack which can give Wi-Fi connection to any microcontroller.. ESP8266 when connected on-board it has storage and processing capabilities hence can be easily connected to the sensors based on the application.

E) Temperature Sensor (DS18S20)

DS18S20 is 1-wire digital thermometer which gives measurement of 9-bit Celsius temperature and incorporates alert capacity with client programmable trigger focuses. It contains central processor with only one data line for establishing communication. Operates at the temperature range of -10^0C to $+85^0$C.

F) Pulse Oximeter Sensor

Pulse oximetry is a simple technique to monitor the amount of haemoglobin that is oxygen saturated. Oximeter measures number of hearts beat per unit of time which is usually conveyed in bits per minute(Bpm). In the project MCP6004 based pulse oximeter is designed and TCRT1000 reflective IR optical sensor is used for photoplethysmography (PPG). Using TCRT1000 simplifies the process since both emitter and detector are arranged side by side. This technique is used to measure heart rate since change in blood volume is synchronous to heart beat.

G) MAX232

Max232 is a dual driver/receiver which converts TTL level to RS232 level. These receivers usually as the threshold of 1.3v and can accept +/- 30v of supply. When Max-232 IC receives the TTL level it converts it in to voltage levels i.e. logic0 changes to voltages between +3 and +15v and logic1 changes to voltages between -3 and -15v.

H) Piezo Electric Buzzer

Buzzer is an electronic device used to produce sound. In the project the buzzer is used to alert the caretaker during extreme condition. This sound indicates that the patient health is in risk.

Software Description

A) Embedded C Programming

The language extension of C Programming is Embedded C, which was developed in order to address the common issues between C extensions for different embedded systems.

B) MPLAB IDE v8.92

MPLAB Integrated development environment is a software program runs on the Personal Computer for embedded microcontroller design.

C) Proteus 7.0 ISIS Professional

Proteus 7.0 is a Virtual System Modelling grew by Labcenter Electronics this was basically developed to co-simulate the microcontroller based designs which integrate animated components, circuit simulation and microprocessor models.

D) DIPTRACE

Dip trace is an advanced design tool for schematic diagrams and printed circuit boards. It offers several modules like schematic design editor PCB layout editor, component editor, pattern editor and shape-based auto router for easy design.

E) Hi-Tech C Compiler

HI-TECH C Compiler provides denser code and excellent performance on PIC family Microcontrollers by implementing a whole program compilation method (Omniscient Code Generation). This compiler integrates the Microchip MPLAB Integrated development environment and also compatible with debuggers & emulators of Microchip.

F) Hyper text mark-up language

Html is an institutionalized framework for labelling content documents to accomplish text style, shading, realistic, and hyperlink consequences for World Wide Web pages. The paged developed using this language acts has a doctor interface where the Patient heart rate and temperature readings can be visualized in real-time.

V. RESULTS

Figure5(a): Designed system as with reference to block diagram proposed has shown in Figure3.

The Designed system is as shown in the Figure5 (a).Following process goes on step by step when hardware is powered.

Step1: SIM detection process is performed and SIM detected is indicated on LCD display has “SIM PRESENT”.

Step2: Configuring of Wi-Fi is done and is indicated on LCD display has “CONFIGURE WIFI” on first line and after configuration process done is indicated by “OK” message on second line of LCD display.

Step3: IP address and port number is requested and displayed on LCD display has “ip : 192.168.4.1” on 1st line and “port is :80K” on 2nd line.

Step4: Then configuration settings is complete and system comes to online and LCD display changes to “IOT HEALTH CARE”.

Step5: Temperature is measured and indicated on second line of LCD display has “TEMPERATURE NO DEG” where NO indicates corresponding value.

Step6: Next step is synchronizing of heart rate and it is indicated on LCD display has “SYNC HEARTRATE”.

Step7: Then Pulse count start for 15seconds and indicated on LCD display has “PULSE: NO” in first line and total calculated heart rate in second line “HEARTRATE NO BPM” NO indicates measured value.

Step8: Now the message has to be sent to the doctor through Wi-Fi cloud which is indicated has “OK” in second line of LCD display.

The data sent will be viewed on html webpage with unique ID is has shown in snapshot of Figure5 (b) and message sent to the doctors mobile phone is as shown in the figure5(c).

Figure5(b): Html webpage displaying patient data

Figure5(c): Message sent to the doctor cell phone when system online and during extreme conditions

VI. CONCLUSION and FUTURE WORK

With the wide use of internet this work is focused to implement the internet technology to establish a system which would communicate through internet for better health. Internet of things is expected to rule the world in various fields but more benefit would be in the field of healthcare. Hence present work is done to design an IOT based smart healthcare system using a PIC18F46K22 microcontroller. In this work the MCP6004 based Pulse oximeter is designed and DS1820B temperature sensor is used to read the temperature and heart rate of the patient and the microcontroller picks up the data and send it through ESP8266 Wi-Fi protocol. The data is also sent to the LCD for display so patient can know his health status. During extreme conditions to alert the doctor warning message is sent to the doctor's cell phone through GSM modem connected and at the same time the buzzer turns to alert the caretaker. The doctors can view the sent data by logging to the html webpage using unique IP and page refreshing option is given so continuously data reception achieved. Hence continuous patient monitoring system is designed.

The Future work of the project is very essential in order to make the design system more advanced. In the designed system the enhancement would be connecting more sensors to internet which measures various other health parameters and would be beneficial for patient monitoring i.e. connecting all the objects to internet for quick and easy access. Establishing a Wi-Fi mesh type network to increase in the communication range.

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