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IOT Based Remote Health Check Up System

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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 STM32 NUCLEO 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, STM microcontroller, ESP8266 Wi-Fi module, Temperature sensor, sensor modules**

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 the availability of the doctors in the developing countries like India has very less ratio to the population and the social economy of the people makes them hardly afford for the private hospitals. As per the WHO guidelines for age group of above 60 age should undergo an general health check up. In spite of government various schemes the reach is very minimal due to various reasons. The Social insurance framework for patients who stays in home during post operational days checking is done

by either the patient has to go to the hospital where he has undergone the operation or to have an medical caretaker which is economically not feasible. 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 this is to design an automated system which will measure the important parameters that are done by a doctor for general health check up and to record all the data in an webpage which can by accessed by the doctor at any point of time . The Proposed System Module ESP 2366, Regulated Power Supply. In this system STM32F401 Nucleo Microcontroller collects the data from the sensors and sends the data through architecture for IOT Healthcare is as shown in the Figure.The model consists of STM32F401 NUCLEO Microcontroller, Temperature sensor(LM 35), Sethescope with electret microphone, Liquid Crystal Display(16x2), sphygmomanometer coupled with an pressure sensors , WiFi 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).

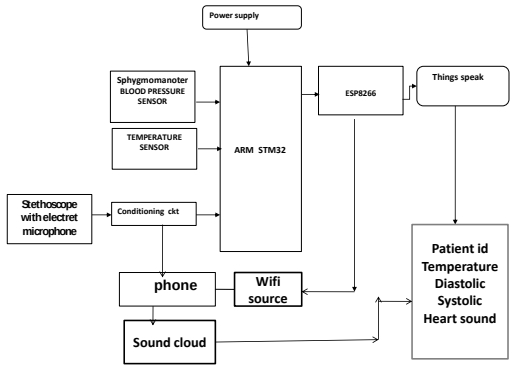

Figure1 : Proposed Block diagram of IOT based healthcare system.

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) STM32F401 microcontroller

Core ARM Cortex-M4F core at a maximum clock rate of 84 / 168 / 180 MHz's The working VDD range for the microcontroller is from 1.7 V to 3.6 V. It Has the 512 KB Flash memory which ranges from 128KB and it has a 96 KB SRAM. It is one of the most power efficient microcontroller in this series the power consumption can be as low as 9 µA. The package ranges from 49 to 100 pins. It has GPIO (50) with external interrupt capability. 12-bit ADC with 16 channels. The interface can be done USART/UART with 3 ports and an USB 2.0 OTG FS

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) 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.

D) Temperature Sensor (LM 35)

LM 35 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.

E) Stethoscope with Electrets microphone

The stethoscope is an instrument which is used to listen to the heart beat sounds. It plays an major role in the medical field. We have redesigned the stethoscope by adding an microphone at the output of it by doing this we perform two major roles. First by using the microphone we can record the heart beat by connecting it to the external speaker. Second use of it is by connecting to an microcontroller it converts the analog signal into the digital signal and the pulse is determined this is a simple technique to monitor the amount of hemoglobin that is oxygen

saturated. It measures number of hearts beat per unit of time which is usually conveyed in bits per minute (Bpm). In the project we have designed the module which is highly cost effective and have multiple usages. Using this it 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.

F) Sphygmomanometer module

The measurement of the blood pressure is performed by this instrument. We can measure the two important parameter which is systolic and diastolic pressure. The inflated cuff which is applied to the hand and connected to the pressure gauge and enabling the determination of systolic and diastolic pressure by increasing and gradually releasing the pressure in the cuff. In this module we have re designed the system with inclusion of pressure sensor and the data is given to an conditioning circuit which is connected to the STM 32 and the data is sent through wifi module to the webpage.

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➢ 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) ARM Mbed compiler

This is an integrated system platform and an OS for the IOT connected devices which is based on 32 bit ARM Cortex-m controller. This is an free online code editor and compiler in which the program is written and compiled in web browser. The main advantage of using mbed compiler is highly verasatile. The program code which is written in this complier can be accessed through any ARM based microcontroller.

C) 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

Figure 2: Designed system as with reference to block diagram proposed has shown in Figure 1.

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

Step1: Creation of an webpage by using google.sites and designing of different widgets for user details.

Step 2: Creating an think speak server domain and a soundcloud account. In this both the servers the data which are uploaded have to be fetched and then embed to the required output webpage.

Step3: The microcontroller is first given with a regulated power or with a 10v battery. The power is also given to the conditioning circuit. The STM controller has an inbuilt transformer which converts the

Step2: Configuring of Wi-Fi is done and the data is sent to the server think speak where the sound is recorded then sent to the sound cloud.

Step3: IP address and tcp connection is established between the user and the server. when the connection is done data will be stored in the server and updated in the webpage.

Step4: Then configuration settings are complete and system comes to online and data transfer is indicated in the blue light in wifi module.

Step5: Temperature is measured and the green light is indicated in the arm board the user blue button should be pressed where data of the user will be stored in the webpage..

Step6: Next step is synchronizing of heart rate where stethoscope is placed in the heart. In this the pulse rate is obtained which is done by converting the output from the microphone and then giving to a condition circuit through which the data is given to the controller and it calculate the pulse rate.

Step7: In the next step the blood pressure is taken in which the cuff is inflated to pressure above 140 and then the read

button is pressed in this duration the pressure has to be released gradually during this period the systolic pressure is acquired by the microcontroller then the pressure should be fully release to get the diastolic pressure value. After this procedure the read button has to be again pressed which sends the data to the server.

Step8: The data which are obtained are embedded to the webpage which is accessed by the doctor with an particular domain address. This data can be assessed by the doctor and can give precautionary measure to the user or to the patients. The webpage can be integrated with any server and the use of Iot can be implemented by combining various parameter s in an one confined server which can be maintained by the government or by any nonprofit organization.

Step9: For taking values of multiple user the STM controller can be restarted and then the above steps to be repeated again to obtain the value from the user or a patient.

The output of the system is obtained in the webpage which is depicted in the figures.

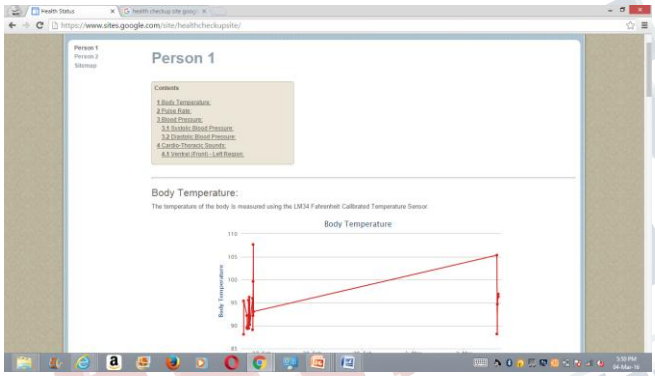

Figure 2: Output for the temperature

Figure 3: Output for the Pulse rate

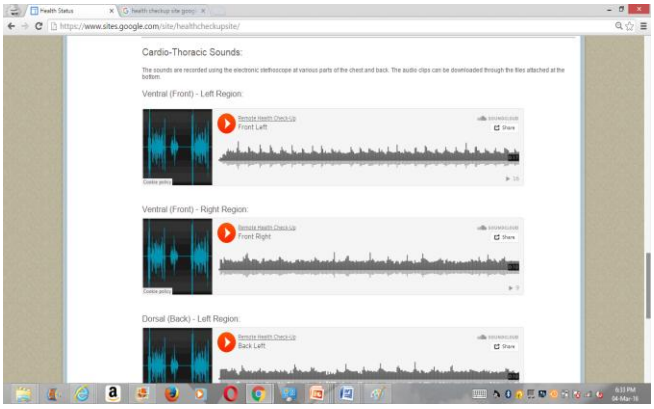

Figure 4: Heartbeat sound

As shown in the figure we are able to get the person temperature in the webpage in this the data is stored in the things speak server which maintains the complete database of the activities of the user.

The representation of the output is done in the graphical chart manner in which the past history of temperature are shown in the graph which is varied with the time.

In the next figure the pulse rate are showed of the user. It is also similar to the temperature widget in this the accurate pulse rate is obtained. The data which is uploaded to the server takes only 3-4secs in order get displayed in the webpage. As the transfer of data takes place in highly encrypted way it can also be used for the emergency purposes also.

The figure shows the Cardio thoraces sound which is recorded with the help of an microphone. The cardio thoraces sound can be highly useful for the post operational patients. In this four sound recording are performed which is front and back ventral similarly front and back dorsal. The sound is recorded with the phone and it is filtered for noise which is then uploaded to the sound cloud server. The server maintains the recording of all the heart sound which are taken this sound is embedded to our webpage and can be listened by a doctor. This is an manual process and for the future work we have planned to make it completely automated by adding an mp3 encoder which filters out the sound and then automatically upload to the sound cloud server without any manual intervention.

Similarly the blood pressure which is measured is divided into two parameter which is systolic and diastolic. An individual measuring graph is made which represents the two details. As the response time of updating the server is very fast the blood pressure can be monitored very easily. If the user or patient has an abnormal blood pressure range then the doctor can immediately reach to the person.

V. CONCLUSION AND FUTURE WORK

With the 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 STM32 microcontroller. In this work the electrets stethoscope is designed and LM35 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 the doctor can visualize the data and inform the status of the user. 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 health chekup 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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