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A NOVEL DESIGN OF HEALTH CARE SYSTEM AND ANDROID APP DEVELOPMENT FOR STORING REALTIME DATA AND ACCESSING PREVIOUS RECORDS

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Abstract— The goal of this project is to design a mobile IoT patient heath monitoring device that can be given to patients by their doctors. This device will be different from typical smartphone health apps in that it will be much more secure and much easier to use for the average user. The device will be controlled by a Raspberry Pi 3 model B unit and powered by a battery pack. Raspberry Pi's use the operating system "Raspbian" to control all its internal functions. The device will connect to Max30102 sensor via ATmega328p to and receive 3 different health parameters: Blood oxygen, heartbeat, and body temperature. The data collection from the sensors will be programmed using Python and compiled used an integrated development environment (IDE) on the Raspberry pi itself. The data will then be sent off via internet connection to the patient's doctor's personal mobile for their own patient records. This data can be used for long-term analysis on any major issues that could be arising in the patient's overall health. This device should allow patients to visit their doctor much less frequently. The 3 health parameters is shown in the user friendly software application that can be accessed by anyone who wants to see the patient health condition just by simple downloading the app and also this app allows patient to store his/her medical reports.

Index Terms-- Raspberry Pi, Internet of Things, ATmega328P, MAX30102, Software application, Twilio

I. INTRODUCTION

Now a days the people are stepping towards the healthcare because we know the term called precaution is better than cure. The population is increasing day by day and the new chronic diseases are also coming into existence. so, we have to be more cautious about our health and the only way to overcome this, by monitoring our health daily to know more about our health condition. In recent developments, the internet of things (IoT) creates an interconnected network for all things. The healthcare sector will get more advantage because of this technology. Health problems in cardiovascular diseases, some viral fevers, heart attacks are increasing day by day. These problems require monitoring the vital parameters continuously. A modern concept of combining the technology and health sector is a big improvement in the field of medical science. A doctor can constantly monitor the patient health without physically interact with the patient. Doctors can diagnose the patient's condition with the doctor's mobile about his / her health condition from the patient's device, this will reduce the number of the patient's presence in the hospital, also it provides the time for better treatment to the other patients. Therefore, doctors are able to save human lives by providing fast services to them. In this paper, IoT is the best platform for various application services. Here, Raspberry Pi used to develop this, because it works as a personal care taker which does both monitoring and sending messages to the doctor about the patient health condition. In this paper, a simple health monitoring system has been proposed to monitor the patient while the doctor sitting in the hospital and also patient relatives /guardian can check the health condition of the patient while on the work.

The proposed system monitors the patient health by taking the vital parameters from the finger of the patient through the sensor Max30102, here the sensor has the photodetectors, optical elements, and low-noise electronics with ambient light rejection. The internal red led light will penetrate into the finger it can also try at any place where thickness of the skin is less. This way of measuring the pulse is known as photoplethysmogram. The arterial blood has a characteristic of absorbing the IR light. The more the light is absorbed that will define the amount of oxygen levels in the blood. Max30102 has the inbuilt temperature sensor that will give the temperature of the patient. After the parameters are taken from patient it will communicate to the ATmega328P using the I2C communication protocol to send the analog data. The analog data from the sensor is converted into digital data through the ATmega328P which is microcontroller has the ability to convert the analog voltage into a 10-bit number from 0 to 1023 or an 8-bit number from 0 to 255 and also it has 6 single ended multiplexed analog input channels. After the conversion of analog to digital, the data sent to the raspberry pi. the raspberry pi process that outputs by writing the efficient python code. After that run the code

in the python idle compiler that sent the patient vital parameters to the cloud i.e thing speak. In the we will write the condition that the parameters change to critical then the raspberry pi will send messages to doctor through Twilio account. Twilio is a online platform which will help to send messages to the recipient without using the GSM module.

The key contributions of the paper include:

- Continuously Health monitoring using raspberry pi which help to look over their health condition regularly.
- Make the patient to meet the doctor less frequently.
- Easier for doctor to monitor the patient health and also it alerts the doctor if the condition becomes critical through Twilio.
- Software application allows anyone to see the patient health condition in their mobile only when the user know the login credentials, this app helps the patient to store their medical reports for the future reference.

Now here we can discuss about the Twilio and Thing speak Platforms:

Twilio is an American company based in San Francisco, California, which provides programmable communication tools for making and receiving phone calls, sending and receiving text messages, and performing other communication functions using its web service APIs.

The Internet of Things provides access to a broad range of embedded devices and web services. Thing speak is an open data platform and API for the Internet of Things that enables you to collect, store, analyse, visualize, and act on data from sensors or actuators, such as Arduino, Raspberry pi, Beagle Bone Black, and other hardware. For example, with Thing speak you can create sensor-logging applications, and a social network of things with status updates, so that have you could at your home thermostat control itself based on your current location. For sending data into cloud, we have to use open cloud i.e., THINGSPEAK.com
The primary element of things speak activity is the channel, which contains data fields, location fields, and status field. After you create a Thing Speak channel, you can write data to the channel, process and view the data with MATLAB code, and react to the data with tweets and other alerts.

BLOCK DIAGRAM

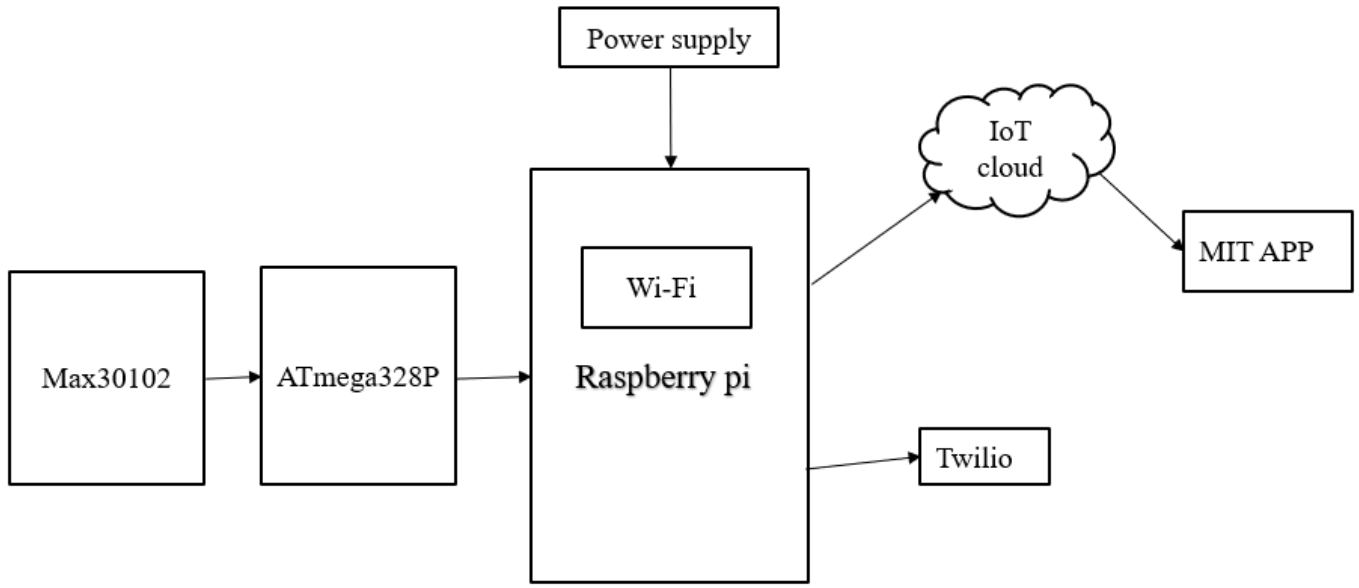

Fig 1: Block diagram of Health monitoring system using Raspberry pi.

II. MOTIVATION

Many types of research have been done in the past and now about to overcome the health-related problems and also to reduce the human error to predict the health condition of the patient correctly and to help people to take concern of their health. Here the raspberry pi acts as a personal care taker of the patient health. The sensor Max30102 will give the vital parameters approximately to predict the patient condition. The user-friendly app to access the patient vital parameters and to store the patient medical records/reports. This will make the healthcare system easier to access and will make the user comfortable.

III. METHODOLOGY

The project is for the health monitoring. It consists of three components Max30102, Raspberry pi, ATmega328P. Max30102 is used to acquire the vital parameters from the patient, Raspberry Pi is used to process the data that has been given by the Atmega328P to send the messages to the doctor if the patient condition becomes critical. The raspberry pi will send the vital parameters to the cloud and then from the cloud the data will acquire from the cloud to show in the app. ATmega328P will give the Digital input to the raspberry pi which is previously Analog data from Max30102 that is converted to Digital format.
Step 1: connect UART Cable to the Raspberry Pi. The pi will ON.
Step 2: open VNC viewer and open the python IDLE to write the code to activate the raspberry pi to process the data.

Step 3: Now after writing the code, run the code to execute.
Step 4: After the execution of code now the parameters seen in the python shell.
Step 5: Now in the shell the uploading is seen while it showing vital parameters. Uploading indicates the data will writing in the thing speak.
Step 6: After writing the data in the cloud the app will read the outputs from the cloud.
Step 7: If the vital parameters of the patient vary from the normal condition, then Twilio will send messages to the doctor.

IV. HARDWARE SETUP

Fig 2: Hardware Implementation of Health Care system using raspberry pi

V. SIMULATION

Booting the Raspberry Pi for the first time

- insert SD card in to raspberry pi b+ board
- On first boot you will come to the Raspi-config window
- Change settings such as timezone and locale if you want
- Finally, select the second choice: expand_rootfs and say 'yes' to a reboot
- The Raspberry Pi will reboot and you will see raspberrypi login:
- Type: pi
- You will be asked for your Password
- Type: raspberry
- You will then see the prompt: pi@raspberry ~ $
- Start the desktop by typing: startx
- You will find yourself in a familiar-but-different desktop environment.
- Experiment to start a new python project.

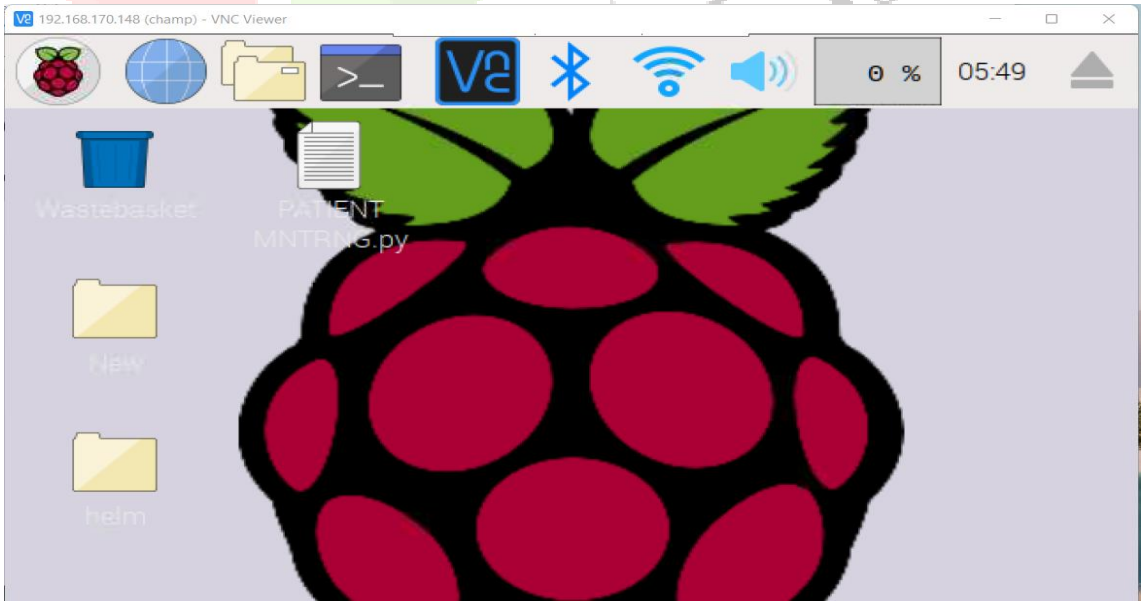

Fig 3: Raspberry Pi desktop through VNC viewer

VI. RESULTS

Proposed Health care system is designed using Python software tool, Max30102, ATmega328p, Raspberry Pi3b and many results has been extracted for the Health monitoring system. The below shown figures are the results that has been extracted for the implemented design.

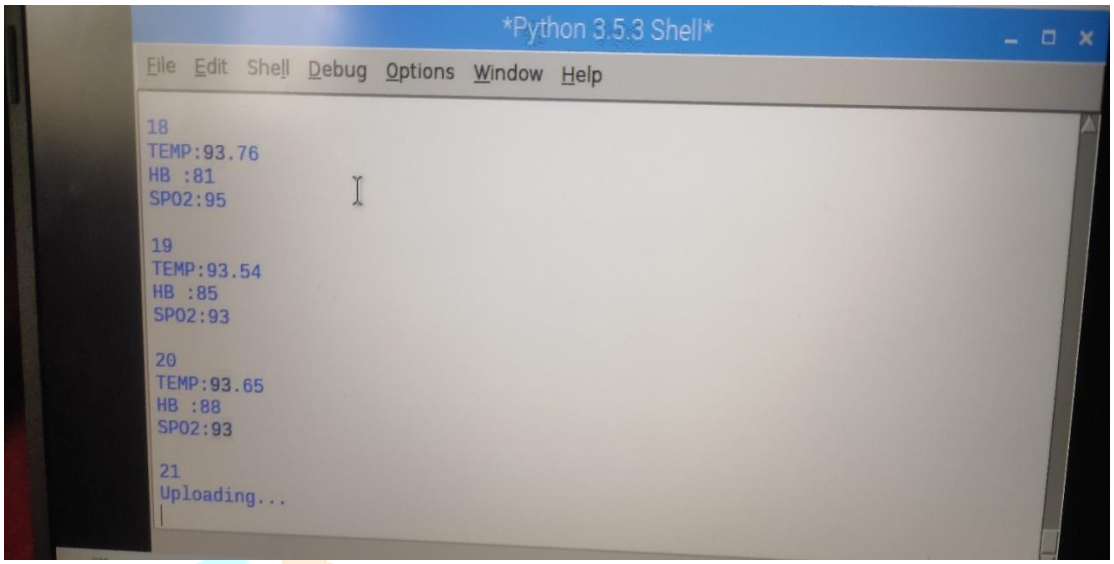

Fig 4: Sensor outputs in the Python Shell

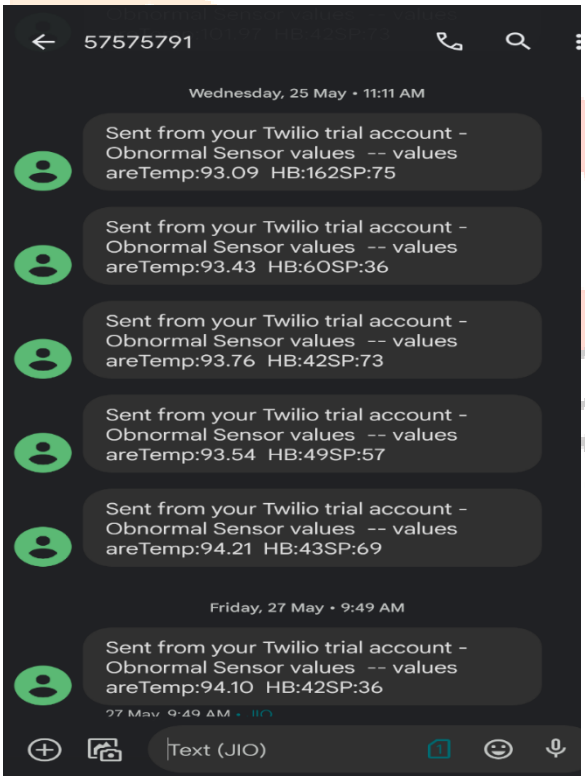

Fig 5: The messages received to the Doctor during Health Abnormality of the Patient

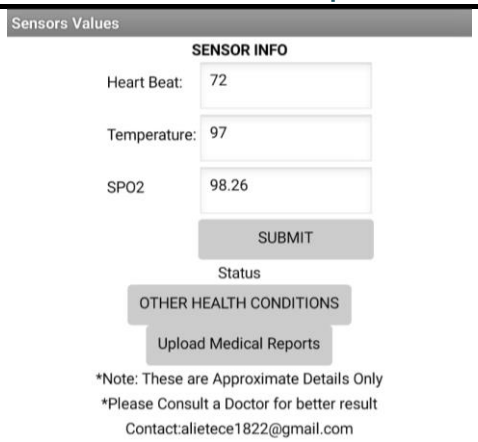

Fig 6: Sensor values displayed in the app

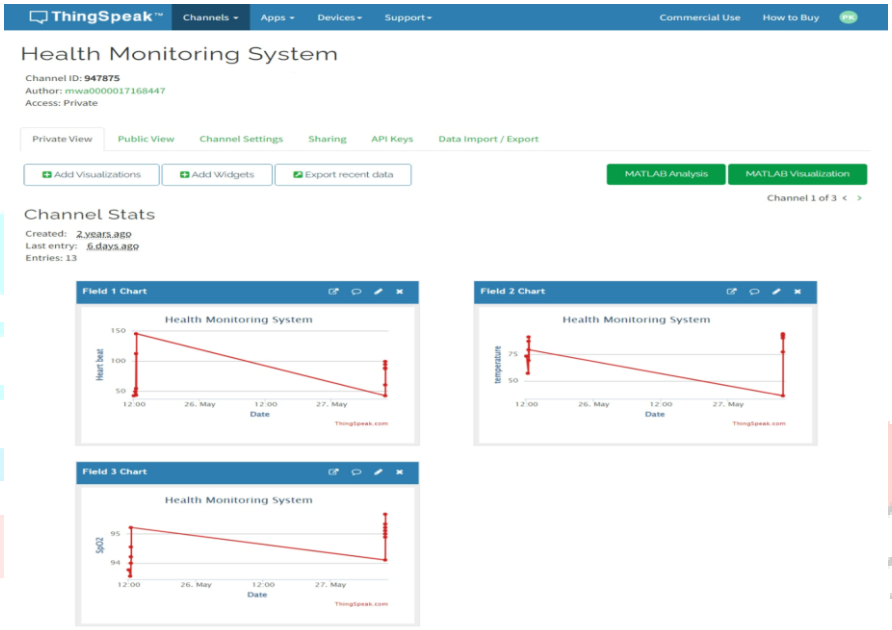

Fig 7: Raspberry Pi transmitting sensor outputs to the Thing Speak Cloud

VII. CONCLUSION AND FUTURESCOPE

The main objective of the project was successfully achieved. The Parameters (temperature, Heartbeat, SPo2) monitored simultaneously with a high success precision. An online platform "www.thingspeak.com" was utilized to access the readings on the internet by a Doctor or even the patient, if with the necessary logging details. The app shows the temperature, SpO2, Heartbeat values. The constructed device helps in bridging the gap between a doctor and his patients. The use of Raspberry Pi, a microprocessor with Wi-Fi embedded in it made it easy to reduce the size since there was no need for an external Wi-Fi module to transfer the readings gotten to the cloud (thing speak). The user-friendly app will give easy to access the vital parameters of the patient and also to store patient records/reports.

The Future Scope of the project is that, the more sensors to can be added and more parameters can be measured, which can enable the people to manage health conditions and also Health Management. The app will also to be developed for further usage in order to provide more options to the MIT App, that will Design more user- friendly Health Monitoring App

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