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Swasth Suvidha: An IOT Based Health Monitoring System

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ABSTRACT:The use of internet is widespread in our daily lives and has been spread in every sector. Nowadays people in India use online mobile application for buying electronic equipment, books and beauty products and so on. There hasn't been much improvement of IoT in the health sector. This paper brings light to the IoT device we have proposed to monitor patients. This device monitors patients pulse rate, temperature and oxygen saturation in blood (Spo2).

KEYWORDS: Internet of Things (IOT), Arduino UNO, ESP8266 and Pulse rate, Healthcare, Oxygen Saturation (Spo2).

I. INTRODUCTION

Internet of Things (IoT) is the implementation of integrating of physical devices and embedded systems along with the help of sensors and actuators which communicates to share information and helps in achieving precision in various fields. Internet of things has seen development in many domains. IoT in healthcare is one of the most trending domains of today's generation. It has had a great impact on the medical discipline. It is basically integration of microcontroller like the Arduino (many versions are available), ESP8266 and so on with various sensors that collect data and send to the microcontroller. It plays a vital role in providing assistance to doctors in decision making in the case of emergency. It will also improvise the traditional measures taken to observe pulse rate, temperature, oxygen saturation (Spo2) and similar related parameters.

II. DESCRIPTION

In our project, we are basically providing services to the patient who has been given discharge from the ICU and is transferred to LTCU(long term care unit). Here we will be integrating various sensors such as temperature sensor, pulse rate sensor and the SPO2 sensors to the arduino/Esp8266. These sensors will collect data at determined regular intervals of time and will pass that data to the arduino, the arduino then in turn sends the data to the ESP8266.The ESP8266 has the temperature sensor connected to it. The code in the arduino will cause functioning of the sensors.

The data collected from the sensors is sent to the cloud for storage. On insertion of data to the Thingspeak cloud if any abnormal/critical values an alert is sent to the doctor.

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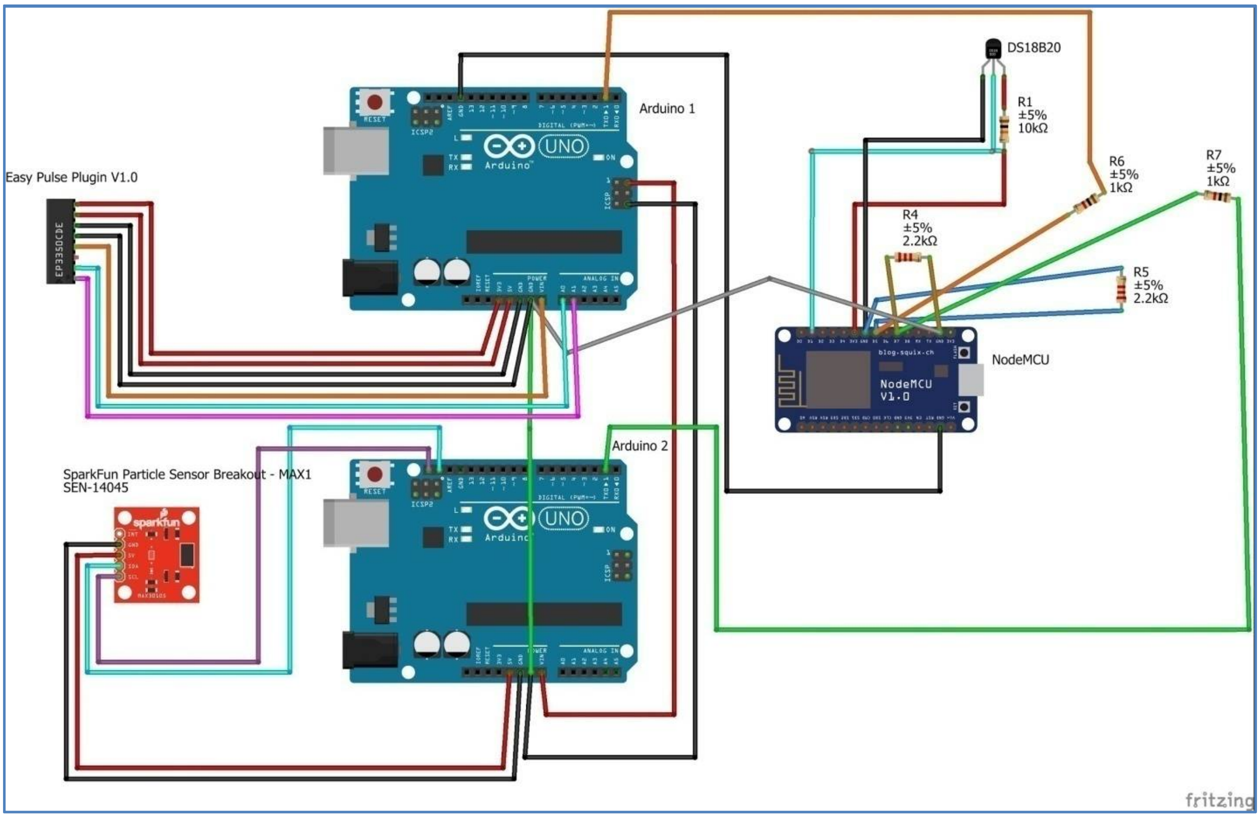

Fig. 1: Circuit Diagram

Two arduinos are used in the device and ESP8266 along with different sensors. The pulse rate sensor is connected to the first arduino and the spo2 sensor is connected to the second arduino, temperature sensor is connected to the ESP8266. Power supply for the ESP8266 and first arduino are supplied through USB supply and as of the second arduino the power supply is given through the first arduino. The data collected from the two arduino and the ESP8266 is collected at the ESP8266 itself which in turn sends the data to the Thingspeak cloud. We have created a channel on Thingspeak server which has three fields to store our data. So the data that comes from the patient's respective sensors will be finally stored in the cloud storage. This data can also be accessed by the doctor to keep a track on the patient's health. Dynamic graphs are created on the Thingspeak cloud for temperature, pulse rate and spo2.
We have created a website that renders the graphs created on the thingspeak cloud to our website. The patient and staff/doctor can register/login to our website. Graphs can be seen created by taking the readings and storing them in the thingspeak. List of the latest 5 readings is also provided.

ESP8266 :
The ESP8266EX integrates a Tensilica L106 32-bit RISC processor, which achieves extra low power consumption and reaches a maximum clock speed of 160 MHz The Real-Time Operating System (RTOS) and Wi-Fi stack allow 80% of the processing power to be available for user application programming and development. ESP8266EX is designed with advanced power management technologies and intended for mobile devices, wearable electronics and the Internet of Things applications. The low-power architecture operates in three modes: active mode, sleep mode and Deepsleep mode. ESP8266EX consumes about 20 µA of power in Deep-sleep mode (with RTC clock still running) and less than 1.0 mA (DTIM=3) or less than 0.6 mA (DTIM=10) to stay connected to the access point.

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Arduino:
The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature (Tstg max). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Temperature Sensor:
The DS18B20-PAR digital thermometer provides 9 to 12–bit centigrade temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points. The DS18B20-PAR does not need an external power supply because it derives power directly from the data line ("parasite power"). The DS18B20-PAR communicates over a 1-Wire bus, which by definition requires only one data line (and ground) for communication with a central microprocessor. It has an operating temperature range of –55°C to +100°C and is accurate to ±0.5°C over a range of –10°C to +85°C. Each DS18B20-PAR has a unique 64-bit identification code, which allows multiple DS18B20-PARs to function on the same 1–wire bus; thus, it is simple to use one microprocessor to control many DS18B20-PARs distributed over a large area. Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment or machinery, and process monitoring and control systems.

Pulse Sensor:
Easy Pulse Plug-in is an Arduino compatible and breadboard friendly pulse sensor based on the principle of photoplethysmography. It operates at both 3.3V and 5.0V power supply and can be easily plugged into Arduino Uno, chip KIT Uno32, or any other compatible boards for rapid prototyping. With a two-stage filtering and amplification on board, the output of Easy Pulse Plug-in is a clean PPG waveform that can be fed to the A0 or A1 analog input pin of Arduino Uno through a user-configurable shunt jumper on board. There is a application example: Arduino Pulse Meter.

SpO2 Sensor:
The SparkFun MAX30105 Particle Sensor is a flexible, powerful sensor enabling sensing of distance, heart rate, particle detection and even the blinking of an eye. The MAX30105 has been equipped with three LEDs as well as a very sensitive photon detector. The idea is to pulse the different LEDs, then detect what shines back. Based on the reflected signature it's possible to detect different types of particles or materials (such as oxygenated blood or smoke from a fire).
The MAX30105 utilizes a red LED, a green LED, and an IR (Infrared) LED for presence sensing, heart-beat plotting and heart-rate monitoring among its multitude of uses, including Pulse Oximetry. The MAX30105 is designed to operate at 5V and can communicate with both 3.3V and 5V microcontrollers. We've also written an Arduino library for the MAX30105 Breakout which takes care of all of the I C communication, bit shifting, register writing and sample reading.

Outputs and Screenshots
On opening the Swasth Suvidha website the homepage will load. The doctor/staff will first register on the Swasth Suvidha website. They have to enter their details, choose a password and username to sign in with. The below image shows the registration page. There is also a provision for the entry of patient's history. This will help the doctor with better diagnosis and faster judgment on the patient's condition. This can be seen in the next image.

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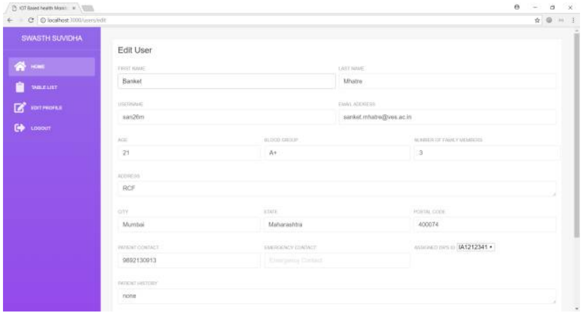

Fig 2: Website UI

The doctor/staff will login with their valid credentials and gain access to the patient data and charts. The charts display the graph of the patient's heart beat rate, temperature and oxygen saturation.

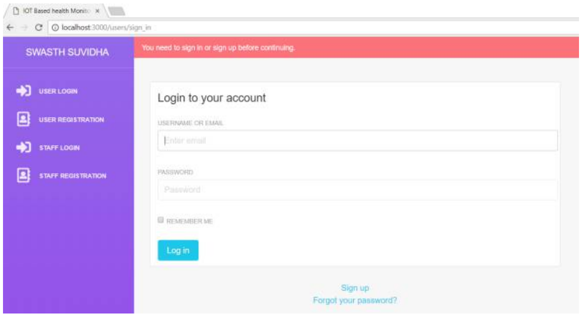

Fig 3: Website UI

The following images show the graphs for heartbeat rate, temperature and oxygen saturation of the patient. They help in better judgment of the patient's condition because it is visually easy to read and analyze.

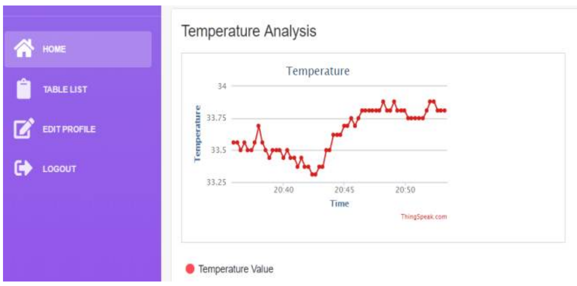

Fig 4: Website UI

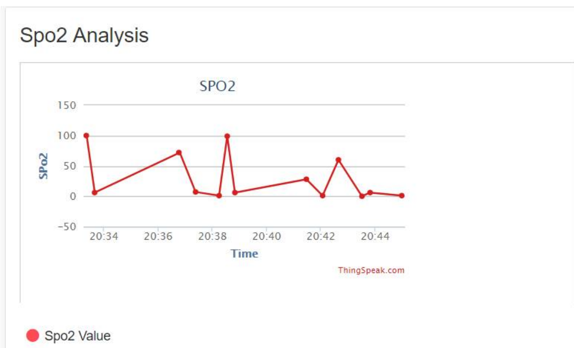

Fig 5: Website UI

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The below image shows the top 5 heartbeat and temperature readings for a patient. They get updated from time to time in order to display the most recent readings.

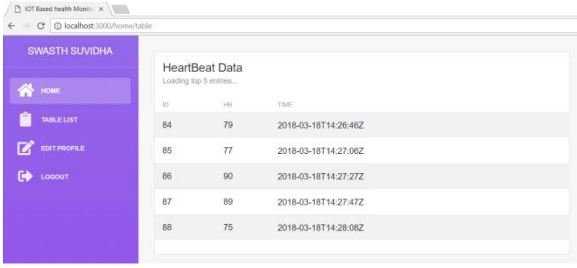

Fig 6: Website UI

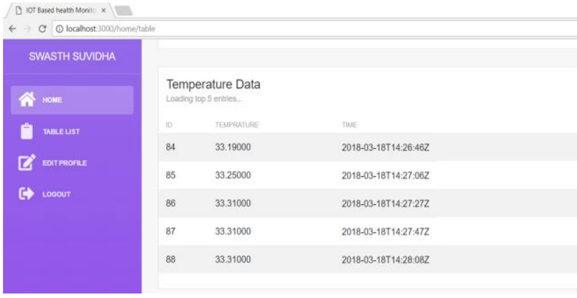

Fig 8: Website UI

Sr No.	Element	Quantity
1	Temperature Sensor(DS18B20)	1
2	Pulse Sensor(Easy Pulse Sensor V1.0)	1
3	Arduino UNO	2
4	Spo2 Sensor(MAX30105)	1
5	Wi-Fi Module(ESP8266)	1
6	Resistors and Wires	-

Table 1: List of Components Required

III. TESTING

In this stage of testing every user interface was individually build and after a successful build it was run as a website. The errors reported were fixed back and the testing was performed recursively until the application gave result as per specified in the requirements document by making the appropriate changes.
The IoT device and website were integrated through the use of Thingspeak. The modules work as expected together.

IV. FUTURE SCOPE

This project focuses on measuring accurate pulse reading, SPO2 reading and temperature. It also sends an alert if the reading cross their respective threshold value. This enhances the doctor and the staff ability of efficiently monitoring the patients. It overcomes the old manual method of monitoring the patients. This project can be further developed on

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Arduino Mega to make it more compact. It will also enable the ability of the three sensors to work on the same Arduino because Arduino Mega supports large RAM. It will also overcome power supply issues.

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