Medical Health Care Chain Systembased on IoT

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***Abstract*—This project proposes an automated medicine box tracking, study, and control system. To associate medical healthcare providers with a patient, IoT (Internet of Things) technology is used. A medical kit will be provided to the patient, which will include various sensors, a smart medicine box, and a mobile application. This device tracks the patient's health using temperature, pulse, and oxygen sensors, which are all linked to the ESP 8266 WiFi module. This allows the patient to communicate with the doctor, chemist, and other clinicians. The chain system allows a patient to receive medical attention from anywhere in the world, eliminating the need for the patient to suffer due to the distance and time taken to see a doctor on a regular basis.**

Keywords—IoT;Wifi Esp;Sensors;Medicine Box;Health

I. INTRODUCTION

Various biomedical parameters of the patient will be monitored by the doctor from his/her clinic/hospital in this project. During the pandemic, this initiative is useful because we were running out of beds and treatment equipment. Body temperature, heart rate and oxygen level and as well as other parameters are checked. Will be tracked using sensors linked to a node, which will wirelessly transmit the data to the doctor through a mobile app. Using the same mobile app, the doctor can give an e-prescription to the patients as well as a nearby chemist after studying these parameters. The chemists will deliver the necessary medications to the patient's pharmacy box, from which the patient will be able to receive the medication as prescribed (automatic dispensing using servo mechanism). The doctor will receive a report on the medications that the patients have taken at that time.

II. LITERATURE REVIEW

"Smart Medicine Reminder Box" in this paper they have made a smart medicine box that solves medical problems by the RTC module saves the current time, and the EEPROM saves the notification time. As a result, when it's time to take medication, the machine plays a warning sound and illuminates those pillboxes with a bright light. As a result, the patient is aware of the precise number of boxes from which medications must be removed. This project is based on the Arduino-Uno, which makes use of real-time clocks. Since the system detects whether the patient has taken his medicine or not, he cannot postpone his medication. If the patient does not take pills from the box on time, the system will begin to make a noisy noise until the medication is removed from the box. [1]

"Smart Pill Box Health Care System," this paper combines the principles of an alarm clock with light-based slot sensing on a standard pillbox. It is equipped with a GSM module to warn the patient and the pharmacist at the appropriate time. The system also uses GSM to send a medication warning to the patient via SMS. The system will ask you to "Check the alarm time set for all three alarms" after the message has been shown. If yes, then reset the alarm settings; otherwise, set the system's current time. They can choose from three different warning times ranging from 0 to 24 hours. The device also gives the LED indication for specified medicine from the pillbox during the LED indication stage. [2]

"An Internet of Things Approach for Managing Smart Services Provided by Wearable Devices" present an autonomous physical condition performance system based on a WSN that allows for the integration of several elements in an Internet of Things scenario, including a smartwatch, a physiological tracking unit, and a smartphone, in this paper. These wearable devices have been linked using Bluetooth, wireless sensor networks, and smart services. The unit collects physiological data from a commercial Bluetooth device. When an unsafe level of any vital parameter (e.g., heart rate) is reached, the user is warned to stop performing the workout. This alarm can be sent to a smartphone or a wearable smartwatch, as well as the emergency services via the ESB if activated. [3]

"Smart Medicine Box" has individual compartments that can be filled with medicines and is constructed in such a way that the compartments can be filled with medicines when they are empty. When it's time to take drugs, the medicine box drops the pills and sounds a warning to remind us to take them. To provide the warning, the setup is connected to a servo motor and a GSM module. This involves making a user manual, selecting a larger LCD display, encasing the entire circuitry in a metal or plastic case, and using larger pillboxes.[4]

III. SCOPE

This IoT-based medical health care chain system can be used in both hospitals and homes where there is a lack of manpower in a population of patients. This device is helpful and will make the nurse's job easier, in addition to making patients happier to be in the hospital. Healthcare, like other sectors, will eventually change at a fast rate. Since their primary goal is to prevent, diagnose, and cure illnesses, the healthcare industry has remained stagnant in terms of new technologies and discoveries. Patients no longer have to choose between living alone and remaining healthy in the event of amedical emergency due to this IoT-based healthcare chain system. Even if the patient wants to be at home, the continuous monitoring and real-time alerts provided by IoT technology provide a sense of security to patients and their families.

IV. METHODOLOGY

A. Block Diagram:

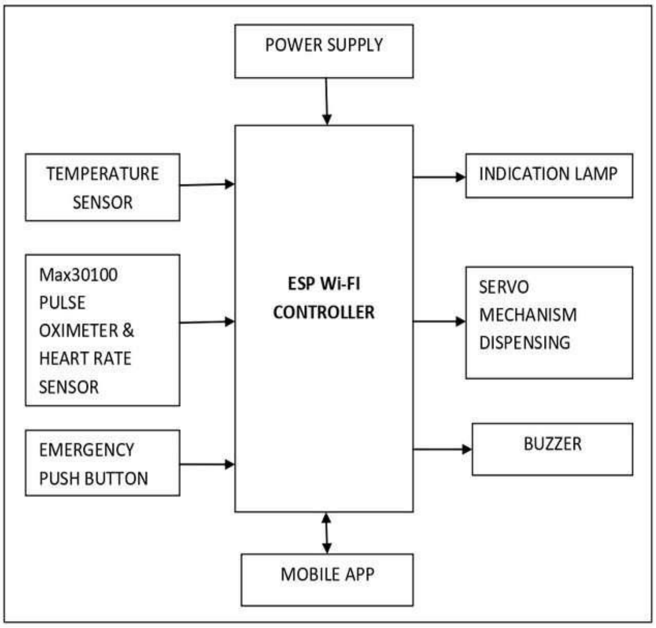

Fig. 1. Block diagram of Medical Health Care Chain System based on IoT

1) ESP8266 -12E WiFi Module

The ESP 8266 micro-controller (Fig. 2.) is programmed using Embedded C in Arduino IDE. All sensors and other small components are connected to the ESP8266 -12E WiFi module (Node MCU). It has 128 KB RAM and 4MB of Flash memory with 80 MHz clock speed. It is a LoLin style NodeMCU. It has a Built-In WiFi 802.11 b/g/n. It has 1 analog pin and 11 digital I/O pins.

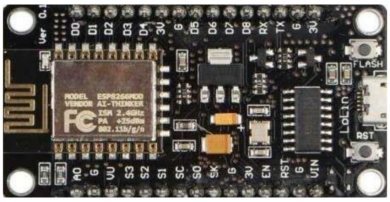

Fig. 2. ESP8266 WIFi Module

2) Temperature Sensor

Theoutput voltage of the LM35 temperature sensor, which is linearly proportional to the degree Celsius temperature. It is connected to an A_0 analog pin on the node MCU.If the temperature goes above 38 (ºC) a fever alert with sound notification will be triggered. Fever alert will be displayed on the Blynk screen as shown in Fig. 3.

Fig. 3. Fever Alert

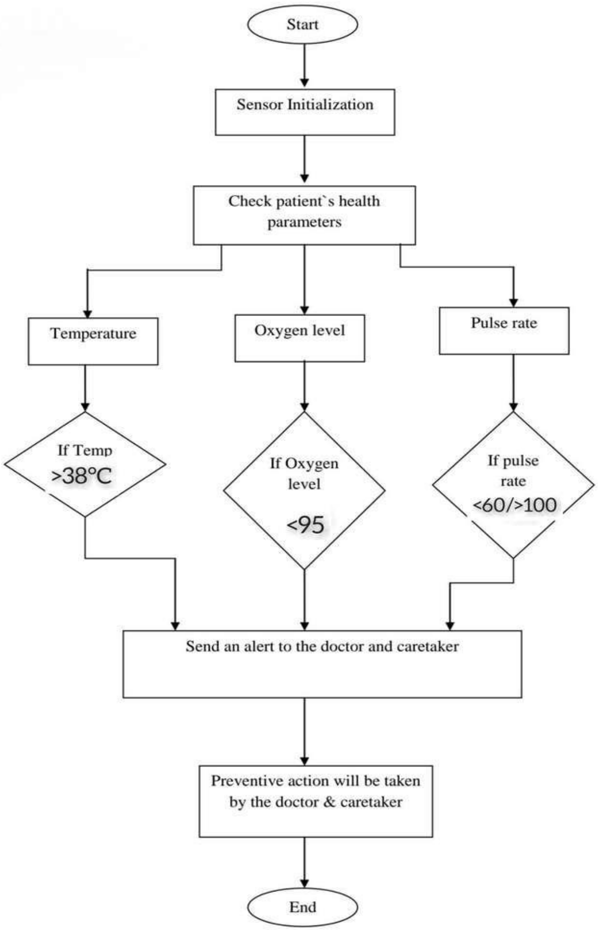

Fig. 4. Flowchart of patient's health parameters

3) MAX30100 Pulse Oximeter and Heart Rate Sensor

The MAX30100 is an integrated sensor for pulse and oximetry and a heart rate monitor. It detects pulse oximetry and heart rate signals using two LEDs, a photodetector, calibrated optics, and low-noise analog signal processing. If the heart rate goes below 60 or above 100 and if the Oxygen level falls below 95 percent an alert will be shown with sound notification as depicted in Fig. 5.

Fig. 5. BPM or SpO2 Alert

4) Emergency Push Button

It will be used in case of emergency. It will alert the doctor and caretaker. Fig. 6. demonstrates an emergency alert.

Fig. 6. Emergency Alert

5) Buzzer

A piezo buzzer is used for audio signals indicating sound notifications. It is attached to digital pin D_3 of node MCU.Since a sound alert is generated on abnormal vitals, it will also help blind and senior citizens having a low vision or eye-sight problems.

6) Power Supply

A small 5V dc power supply is used to power the controller and servo mechanism. The Node MCU operates on 3.3V. The power supply unit can be plugged with a USB cable. The power supply unit and sensor arrangement are shown in Fig. 7.

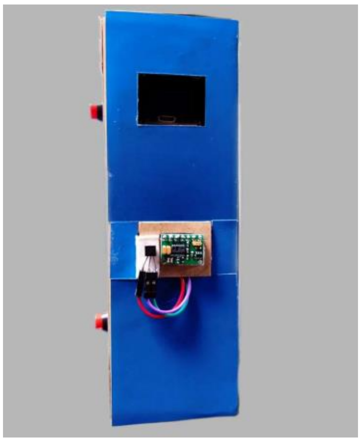

Fig. 7. Power supply unit and sensor arrangement

7) Servo Mechanism for Dispensing

A Servo Mechanism is used in this Medicine box. It makes the process smooth to serve medicines in a fixed amount. It has a push-button which could be used for dispensing medicine.

- This box can be provided to the patient once he visits the doctor or hospital.
- It will be supplied with the proper medicines, mobile application, login Id and password.
- Once the box is powered on, the doctor can monitor the patient's temperature, heart rates and oxygen level.
- If the parameters are unusual a specific alert will be sent to the doctor and the caretaker.
- An emergency button is provided to the patient if he is feeling uneasy, he can alert the doctor by pressing it.
- The patient can always press the medicine dispense button and the medicine will be dispensed according to the prescription.

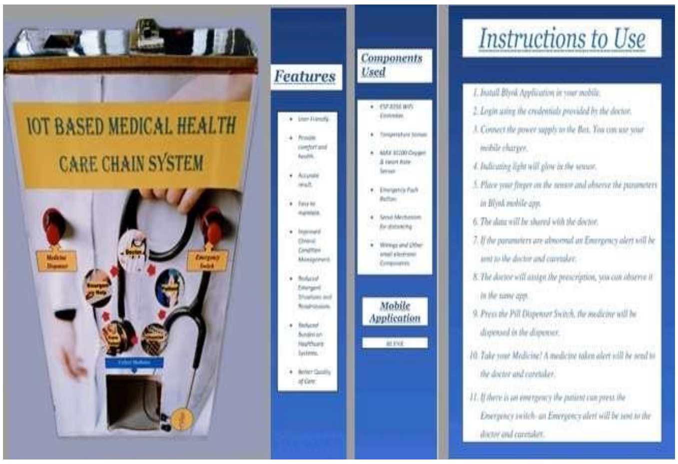

Fig. 8. Hardware Implementation

8) Mobile App

To monitor the patient from anywhere in the world Blynk Application is used. For the Internet of Things, Blynk was created. It has the ability to control hardware remotely, display sensor data, store and visualize data, and perform a variety of other tasks.

This platform is made up of three main components:

*a) Blynk Apps:*With the help of the Blynk App a Patient-oriented interface is created.

*b) Blynk Server:*It is used for all the communication between the doctor and patient.

c) Blynk Libraries: It provides a hardware platform that allows communication with the server and handles all of the commands that come in.

V. RESULT

The model for an IoT-based Medical Health Care Chain System has been developed. The program has been installed and checked, and it checks the parameters before dispensing the drug in a predetermined amount. Patients that will be tracked on a regular basis will benefit greatly from it.

To check the accuracy of the results, the parameters of a single patient have been monitored at different intervals and the same parameters were observed for three different patients. The readings are observed on the serial monitor of Arduino IDE and the screenshots are attached below. It is mentioned in tabular form.

1) Parameters monitoring of the single (normal) patient for a number of times: as shown in TABLE I.

TABLE I. PARAMETERS MONITORING OF THE SINGLE PATIENT FOR A NUMBER OF TIMES:

Sr. No.	Patient Parameters		
	Temperature (ºC)	***BPM***	***SpO2***
1.	33.52	74.34	97
2.	33.52	78.64	97
3.	33.84	78.64	97

2) Parameters monitored for number of normalpatients: as shown in TABLE II.

TABLE II. PARAMETERS MONITORED FOR NUMBER OF PERSONS:

Patient	Patient Parameter		
	Temperature (ºC)	***BPM***	***SpO2***
1st	33.52	70.54	97
2nd	34.16	83.49	97
3rd	35.77	77.48	96

For accuracy analysis purpose normal patient 1, parameters were observed on the serial monitor of arduino IDE it is shown in Fig. 9.

Fig. 9. Serial Monitor Readings: Patient

The parameters monitored of normal patient 2nd and 3rd can be observed in the serial monitor of arduino IDE. It is as shown in
Fig. 10. and Fig. 11.

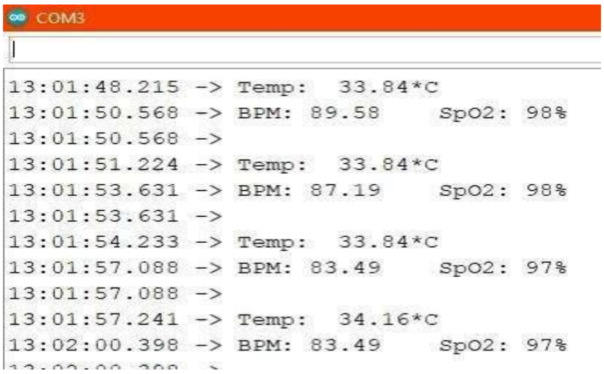

Fig. 10. Serial Monitor Readings: Patient 2nd

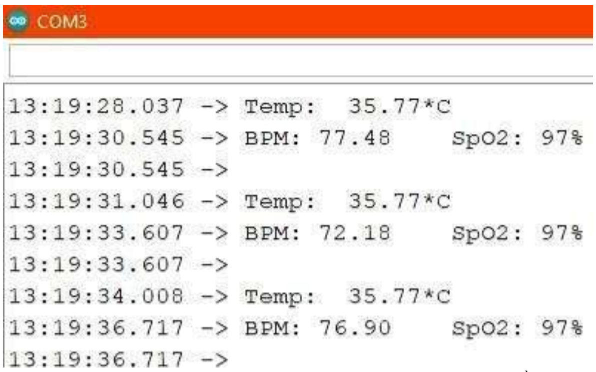

Fig. 11. Serial Monitor Readings: Patient 3rd

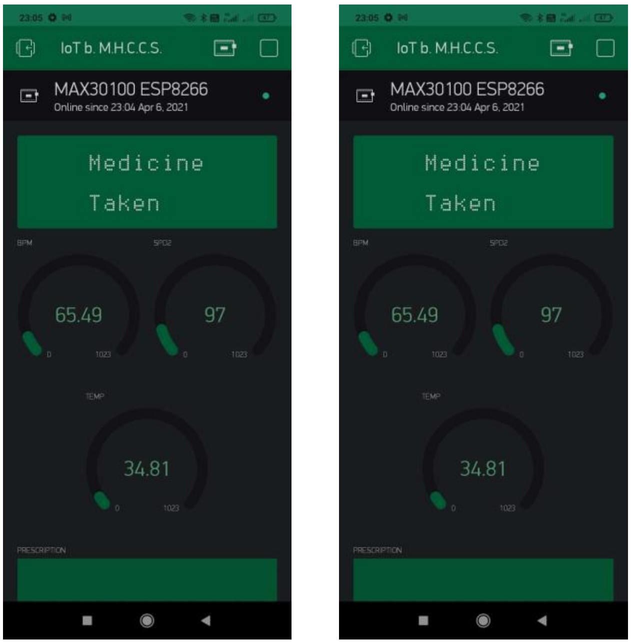

Fig. 12. Doctor's and Patient's Blynk App Dashboard

Fig. 13. Medicine Dispenser output

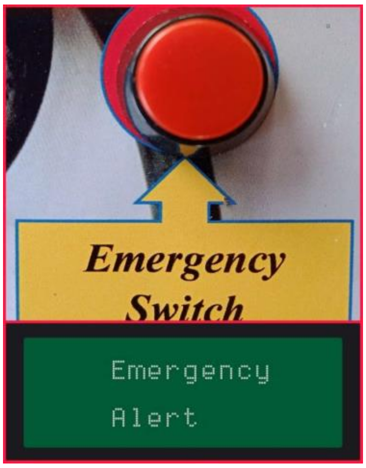

Fig. 14. The Output of Emergency push button

VI. CONCLUSION

The proposed scheme is appropriate for all patients. It effectively keeps track of human condition indicators. It also saves both the doctor and the patient time. If these issues are diagnosed and addressed in a timely manner, they can be solved to a large extent. Wireless networking advances and wearable sensor technology have paved the way for real-time health tracking systems.

Limitations of the model are:

- Risk failures:Failure or bugs in the hardware or even power failure can impact the performance of sensors and connected equipment placing healthcare operations at risk. In addition, skipping a scheduled software update may be even more hazardous than skipping a doctor check-up.
- Security and privacy: Security and privacy remain a major concern deterring users from using IoT technology for medical purposes, as healthcare monitoring solutions have the potential to be breached or hacked. The leak of sensitive information about the patient's health and location and meddling with sensor data can have grave consequences, which would counter the benefits of IoT.

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