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Arduino Based Wireless Health Monitoring System for covid-19 Patients

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ABSTRACT

Traditional sensor based finding in average field requires more number of sensors and human endeavors on the off chance that it is prepared in a huge scope. It is a troublesome assignment because of the lack of clinical experts and framework arrangement. To beat this issue an IoT based medical care application is proposed in the examination work. The proposed framework comprises of the web and versatile application dependent on ceaseless remote observing of patients. The goal is paper is to execute a minimal expense framework and send the patient essential signs in crisis circumstances. Sensors are being utilized for estimating the patient fundamental signs by utilizing the remote organization. The sensors information are gathered and sent to the cloud for capacity by means of Wi-Fi module associated with the regulator. The information is handled in the cloud and criticism steps are taken on the dissected information which can be additionally investigated by a specialist distantly. Far off review lessens weight to specialists and gives the specific wellbeing status of patients. Assuming the patient requirements earnest consideration, a message is shipped off the specialist.

Keywords - IOT, Wi-Fi module, Arduino, Sensor.

I. INTRODUCTION

In the consistently expanding total populace, individuals are experiencing persistent illnesses at a high rate. The principle purpose for this is day by day utilization of tobacco, liquor utilization, over pressure, no active work and so on As per the world wellbeing association (WHO), a great many individuals pass on because of expanded cholesterol levels, overweight, high and so on The individual who is influenced by ongoing infection should deal with his life appropriately with at most consideration and ought to be dealt with and checked by a specialist constantly. The significant boundaries for the constant sicknesses are the pulse, internal heat level, measure of oxygen in the blood and so on The patient checking framework permits specialists to regulate numerous patients all at once. The pulse shows the adequacy of the heart. Pulse for grown-up guys on a normal is 70bpm and for grown-up females on a normal is 75bpm. With the assistance of these qualities, the heart condition can be followed. The internal heat level tells the body condition. The typical human internal heat level is 98.6 ° F ± 0.7°F. Any variety in the upsides of internal heat level can hazard inappropriate human wellbeing. The measure of oxygen in the blood is determined by the Spo2 sensor which is an extremely fundamental boundary for human wellbeing. The ordinary oxygen level in the blood differs between 75 to 100mm of mercury. The measure of oxygen underneath 60mm of Hg is considered as low. It is likewise a significant boundary for human wellbeing.

The ordinary checking of these fundamental boundaries is vital for better wellbeing and incredible wellbeing. For the estimation of these indispensable boundaries, a computerized framework should be intended for persistent observing. In this paper, an Arduino based robotized checking framework for licenses is planned and executed. This can screen the state of being effectively at a lower cost. The proposed framework can be coordinated as a pack and can be provided for minimal expense to all individuals for the significant boundaries oversight. The outcomes be confirmed for some patients and exactness should be determined. The holding up time and disappointment can be decreased for the patients if very good quality sensors are being utilized. The information assortment increments as the quantity of patients increment. To deal with this enormous information with distributed computing strategies can be utilized.

II. LITERATURE SURVEY

Vani Yeri, Dr.Shubhangi D C "IoT based Real Time Health Monitoring" Proceedings of the Second International Conference on Inventive Research in Computing Applications (ICIRCA-2020) IEEE Xplore Part Number: CFP20N67-ART; ISBN: 978-1-7281-5374-2.

The proposed system is implemented for wireless health monitoring of the patients. The vital parameters are measured by the sensors such as pulse sensor, temperature sensor and SpO2 sensor. The proposed model allows the doctors to monitor patient health from anywhere. The proposed system helps people to consult the specialist all over the world. The system uses IoT and wireless sensor technology for efficient health monitoring. The data from sensors is taken every 30 seconds. The data is stored and can be visualized on the webserver. The system is implemented in such a way that if the sensor data exceeds the threshold values, a message is sent to the doctor. The main advantage is in case of emergency the intervention time between doctor and patient is reduced. The objective is achieved by proposing a low-cost system for saving human lives so that human lives will be comfortable. The limitations are the doctor's availability and the proposed model doesn't include the blood pressure monitoring system. Conventional sensor based diagnosis in medial field requires more number of sensors and human efforts if it is processed in a large scale. It is a difficult task due to the shortage of medical professionals and system setup. To overcome this issue an IoT based health care application is proposed in the research work. The proposed system consists of the web and mobile application based on continuous wireless monitoring of patients. The objective is paper is to implement a low-cost system and transmit the patient vital signs in emergency situations. Sensors are being used for measuring the patient vital signs by using the wireless network. The sensors data are collected and transmitted to the cloud for storage via Wi-Fi module connected with the controller. The data is processed in the cloud and feedback steps are taken on the analysed data which can be further analysed by a doctor remotely. Remote viewing reduces burden to doctors and provides the exact health status of patients. If the patient needs urgent attention then a message is sent to the doctor [1].

Sachi Marathe, Dilkas Zeeshan, Tanya Thomas, Dr. S.Vidhya "A Wireless Patient Monitoring System using Integrated ECG module, Pulse Oximeter, Blood Pressure and Temperature Sensor" International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN) 2019.

The vital parameters were picked up using the system developed. The data collected from the sensors were sent to a WiFi module called NodeMCU ESP8266, through which the data is uploaded on cloud, which will allow the healthcare provider to view it. We verified the results obtained from the sensors to mercury thermometer, pressure measuring system, pulse oximetry system and an ECG system. We found that the values varied only by a ± 3 factor. Hence will allow the health-care providers to get an estimate of the patients vital signal measurements. If our patient-monitoring system is integrated with the ambulatory-monitoring system, it will help prepare the healthcare-providers prepare in advance for the arriving trauma. In this author exhibits the design and development of a mobile patient-monitoring system by using four sensors in one system. In earlier times, in areas of large disasters, healthcare service providers conducted vital signs measurements manually, recorded them on papers and communicated over the radio, but when the number of patients drastically increased it led to chaos among the healthcare providers. The advancements in technology has led to increasing expenses in the healthcare sector, so the proposed mobile sensor based system will not only be technologically advanced but will also be cost effective. The system consists of mainly four sensors: Electrocardiogram (ECG) module, blood pressure sensor, temperature sensor and a pulse oximeter module. The sensors will be integrated into one system using Arduino. The data collected from the sensors will be sent to a WiFi module called NodeMCU ESP8266, through which the data will be uploaded on cloud, which will allow the healthcare provider to view it. In this paper we have measured the four vital parameters for 10 different patients and presented it [2].

S. P. McGrath, I. M. Perreard, M. D. Garland, K. A. Converse, and T. A. Mackenzie, "Improving Patient Safety and Clinician Workflow in the General Car Setting With Enhanced Surveillance Monitoring," *IEEE J. Biomed. Heal. Informatics*, vol. 23, no. 2, pp.857–866, 2019, doi: 10.1109/JBHI.2018.2834863.

Clinical monitoring systems have been implemented in the inpatient hospital setting for decades, with little attention given to systems analysis or assessment of impact on clinician workflow or patient care. This study provides an example of how systemlevel design and analysis can be applied in this domain, with specific focus on early detection of patient deterioration to mitigate failure to rescue events. Wireless patient sensors and pulse oximetry-based surveillance system monitors with advanced display and information systems capabilities were introduced to 71 general care beds in two units. Nursing workflow was redesigned to integrate use of the new system and its features into patient assessment activities. Patient characteristics, vital sign documentation, monitor alarm, workflow, and system utilization data were collected and analyzed for the period five months before and five months after implementation. Comparison unit data were also collected and analyzed for the same periods. A survey pertaining to staff satisfaction and system performance was administered after implementation. Statistical analysis was performed to examine differences in the before and after data for the target and control units. The enhanced monitoring system received high staff satisfaction ratings and significantly improved key clinical elements related to early recognition of changes in patient state, including reducing average vital signs data collection time by 28%, increasing patient monitoring time (rate ratio 1.22), and availability and accuracy of patient information. Impact on clinical alarms was mixed, with no significant increase in clinical alarms per monitored hour [3].

III. PROPOSED SYSTEM

The customary checking of these imperative boundaries is vital for better wellbeing and incredible wellbeing. For the estimation of these indispensable boundaries, a mechanized framework should be intended for ceaseless checking. In this paper, an Arduino based robotized observing framework for licenses is planned and carried out. This can screen the state of being effectively at a lower cost.

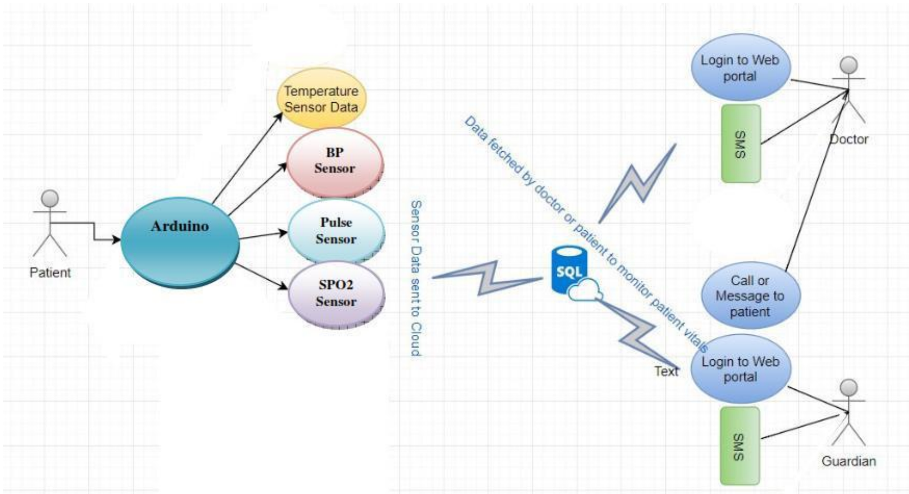

Fig.1. Iot Based System

The framework comprises of the fundamental crucial sensors interfacing with the cloud and versatile application as demonstrated in figure 1. The information is caught by sensors are shipped off the processor Arduino where the information is gained and handled. The information gained by the processor is contrasted and the limit upsides of the ideal sensors. On the off chance that the sensor esteems move equivalent or over the limit, a crisis message or alarm is passed to the specialists in the versatile application through a Wi-Fi module with the subtleties of every sensor. This information is additionally passed to the cloud for subtleties changes of the previous few hours information. The previous few hours can be gotten to on the site and the information is put away in the cloud.

The proposed framework utilizes the sensors like heartbeat sensor (for estimating the pulse), Temperature sensor (for estimating the internal heat level) and SpO2 sensor (for estimating the SpO2 admission) as demonstrated in figure1. The framework estimates the boundaries continuously and shows on the LCD and in the cloud which empowers observing of patient wellbeing when the specialist is with the patient or remote checking for any spot. The proposed framework constant observing of the patient. The sensors information is shipped off the cloud through the Wi-Fi module, on the off chance that the sensors information are not in adequate reach, an alarm message is sent onto the portable application. The specialist can make the move very soon for aiding the patients.

Arduino Micro controller: An Arduino Board is a mini-computer and also an open-source platform used for building electronics projects. An Arduino consists of both a physical programmable circuit board (often referred to as a micro-controller as well as a piece of software or an Arduino IDE (Integrated Development Environment) that runs on your regular computer. The Arduino IDE is used to create and write then upload that computer code to the physical board.

The Arduino platform has become very popular over the last 10 years because the code is quite easy to learn, plus you do not need a separate piece of hardware (called a programmer) in order to load new code onto the board - you simply use a USB cable to connect the Arduino board to your PC and transfer the files directly onto the board.

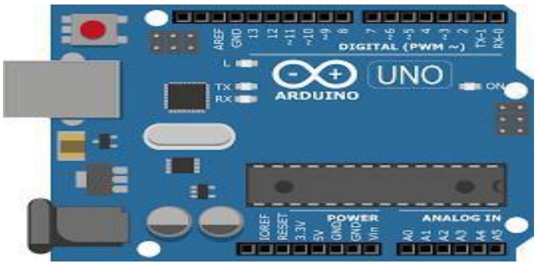

Fig 2 Arduino Micro controller

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, contains everything needed to connection, a power jack, an ICSP header and a reset to support the microcontroller; simply connect it to with a USB cable or power it with a AC with a AC-to-DC adapter or battery to get started.

Pulse sensor: It measures the heart rate. It has circuitry for noise cancellation. A finger is placed on the sensor; it calculates the amount of blood in the capillary tube based on the amount of light reflected. The difference in the amount of light transmission and reflection is the result of the sensor.

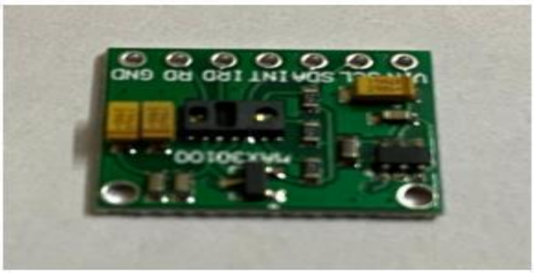

Fig. 3 Pulse Sensor

An alternate name of this sensor is heartbeat sensor or heart rate sensor. The working of this sensor can be done by connecting it from the fingertip or human ear to Arduino board. So that heart rate can be easily calculated. The pulse sensor includes a8 inches color code cable, ear clip, Velcro Dots-2, transparent stickers-3, etc. A color code cable is connected to header connectors. So this sensor is easily connected to an Arduino into the project without soldering.An ear clip size is the same as a heart rate sensor and it can be connected using hot glue at the backside of the sensor to wear on the earlobe. Two Velcro dots are completely sized toward the sensor at the hook side. These are extremely useful while making a Velcro strap to cover approximately a fingertip. This is used to cover the Sensor around the finger.

Temperature sensor: The sensor measures the body temperature from -55 degree celsius to +150 degree Celsius. For every 10 degrees rise in temperature, the output changes by 10mv.

Fig. 4 Temperature Sensor

SpO2 sensor: This sensor measures the oxygen content in the blood. A little beam of light passed through the blood within a finger. It measures the amount of change in light absorption. SPO2 is measured using a sensor, usually attached to the patient's finger. There are two methods of SpO2 technology: transmissive and reflective. The Trans missive method is the more commonly used of the two. The system measures the parameters in real-time anddisplays on the LCD and in the cloud which enables monitoring of patient health when thedoctor is with the patient or wireless monitoring for any place. SpO2 is measured at the periphery, usually a finger, and is one measure of the health of the cardiovascular and respiration systems. A pulse oximeter noninvasively measures the oxygen saturation of a patient's blood. This device consists of a red and an infrared light source, 2hoto detectors, and a probe to transmit light through a translucent, pulsating arterial bed, typically a fingertip or earlobe.

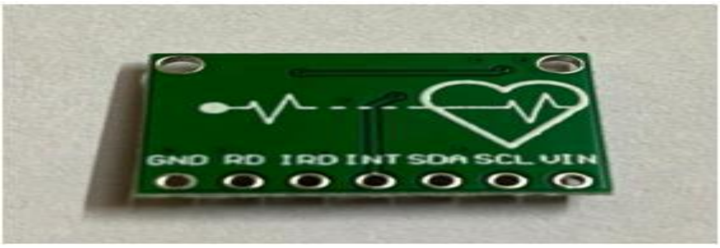

Fig. 5 SpO2 Sensor

Oxygenated hemoglobin (OHb) and deoxygenated hemoglobin (HHb) absorb red and infrared light differently. The percentage of saturation of hemoglobin in arterial blood can be calculated by measuring light absorption changes caused by arterial blood flow pulsations.

BP sensor: Blood pressure is measured using a sphygmomanometer, or blood pressure monitor. It consists of an inflatable cuff that's wrapped around your arm, roughly level with your heart, and a monitoring device that measures the cuff's pressure. The monitor measures two pressures: systolic, and diastolic. Systolic pressure is higher, occurring when your heart beats and pushes blood through the arteries, and diastolic pressure is measured when your heart is resting and filling with blood. So, for example, your blood pressure might be 120 over 80.

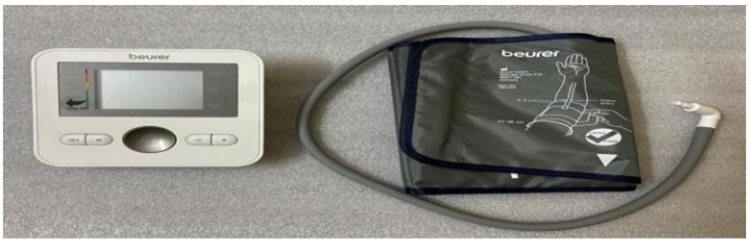

Fig. 6 BP Sensor

Blood pressure monitors may be manual or digital, but home monitors are usually digital and the whole measurement process is automatic apart from placing the cuff around your arm. The cuff then inflates until it fits tightly around your arm, cutting off your blood flow, and then the valve opens to deflate it. As the cuff reaches your systolic pressure, blood begins to flow around your artery. This creates a vibration that's detected by the meter, which records your systolic pressure. In a traditional analogue sphygmomanometer, the blood sounds are detected by the doctor using a stethoscope. As the cuff continues to deflate, it reaches your diastolic pressure, and the vibration stops. The meter senses this, and records the pressure again.

Wi-Fi module (ESP8266): This module allows connectivity of the internet with the embedded applications. It uses the communication protocol. It transmits the values of sensors to the mobile application. The ESP8266 module enables microcontrollers to connect to 2.4 GHz Wi-Fi, using IEEE 802.11 bgn. It can be used with ESP-AT firmware to provide Wi-Fi connectivity to external host MCUs, or it can be used as a self-sufficient MCU by running an RTOS-based SDK. The module's Wi-Fi antenna enables embedded devices to connect to routers and transmit data.

Fig. 7. Wi-Fi module

Includes processing basic inputs from analog and digital sensors for far more complex calculations with an RTOS or Non-OS SDK. Create direct communication between ESPs and other devices using IoT P2P connectivity. Smart security devices, including surveillance cameras and smart locks. Smart energy devices, including HVACs and thermostats. Smart industrial devices, including Programmable Logic Controllers (PLCs) Smart medical devices, including wearable health monitors.

IV. RESULT

Initially the main objective of the project was to develop a portable Pulse Oximeter unit that receives data from a probe and processes it in order to return the values of heart rate and oxygen saturation in blood, thus allowing a continuous monitoring of these parameters. As already mentioned in this thesis, the project gained new guidelines and thus the main objectives become the development of an oximeter probe whose data is acquired by Arduino module, which communicate with a platform that would have implemented algorithms in order to perform the signal processing. At this moment, it is available an efficient probe prototype constituted by economic components which is sensitive to the changes of light that occurs during the arterial pulse. Different measuring conditions such as a situation of physical activity are also detected by the oximeter probe. The oximeter probe developed is able to acquire biological signals to determine the heart rate and Sp02. The functional modules i.e. LED driving circuit, that allow the LED driver and switching and the detection of light are also designed, developed and tested. The results show that these circuits are efficient, but still needed several improvements. The Arduino is ready to acquire data from the probe but it is necessary to adjust acquisition frequency. This module communicates via USB with the processing platform, whose the firmware to board initialization and communications protocols was already developed and operational. The signal processing algorithms were developed in C. They have the ability to apply a filter to the signal in order to reduce noise and then apply a criterion of detection that allows the separation of the spectra, the detection of peaks and thus determine the values of heart rate.

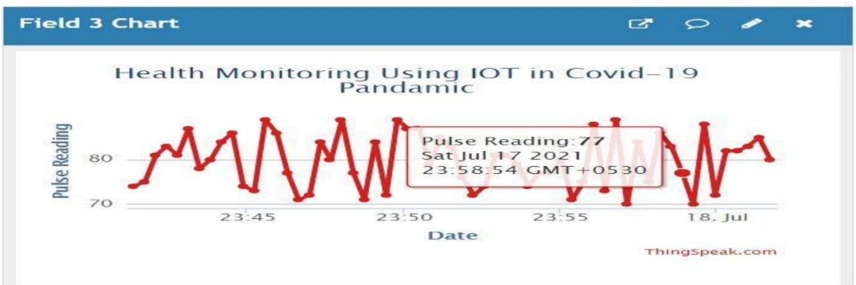

Fig 8. Pulse Reading Graph

Fig 9. Monitoring Pulse & SpO2 Reading On LED Display

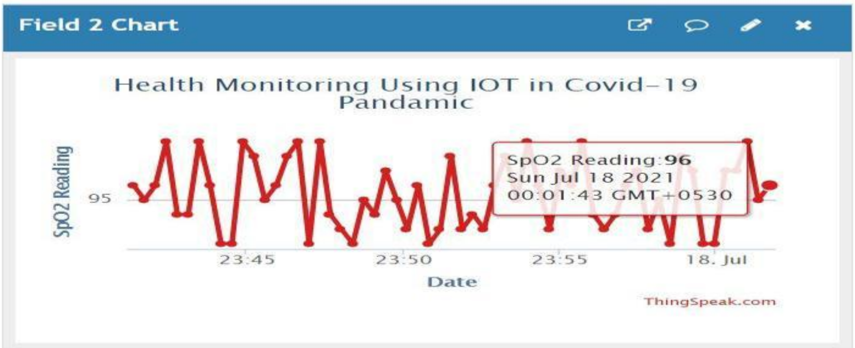

Fig 10. SpO2 Reading Graph

This project is to develop a Wireless Blood Pressure Monitoring System that is capable of measuring a vital sign of health and communicating with the end device using chosen wireless connectivity option. The identified results of the study are expected to be acceptable measurements of the blood pressure and other sensors' data.

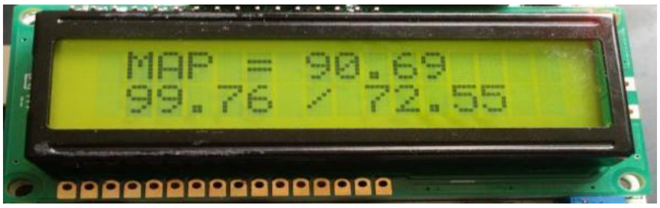

Fig 11. Monitoring Blood Pressure Reading

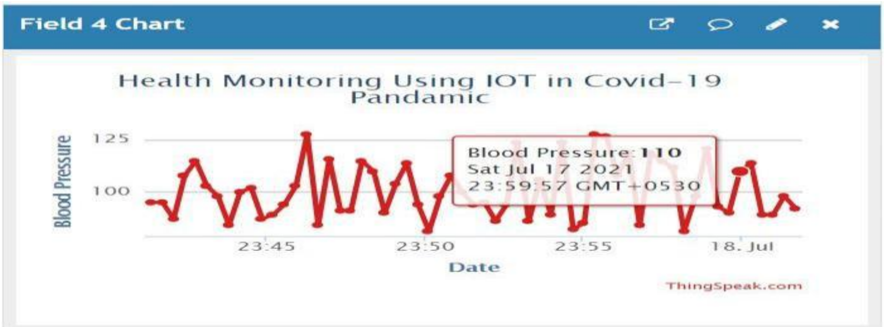

Fig 12. Blood Pressure Graph

This project focuses on the wireless heart rate and body temperature monitoring system which is able to monitor the heart rate and body temperature reading of patient at any time. The system determines the pulse rate beat per minute and body temperature in which the physiological data are displayed on Tera Term window. The data then is manually log into Microsoft Excel to see the pattern of the reading easily on the graph. Hence, by having the system, the healthcare professionals can monitor and diagnose their patients from a laptop at any time. They can easily monitor their patients from their workstation especially for the emergency case. In contrast to other conventional medical equipment, the system has ability to save data with timestamp for future reference. Functionality of this monitoring system also has been tested on a respondent who is a young adult with fever. It is successfully functioning with minimal percentage of error when compared the value with conventional devices; thermometer and digital pulse monitor. Further work into it should be done such as provide data for more respondent with the information of ward and bed number to make it more practical to be used in the hospital.

Fig 13. Monitoring Temperature Reading

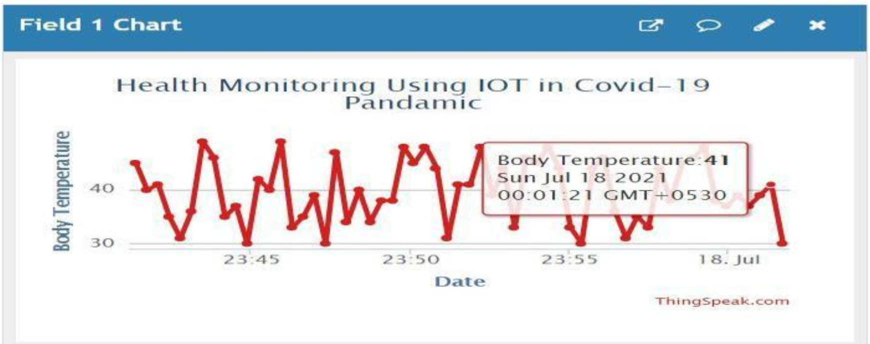

Fig 14. Body Temperature Graph

The research work presented will establish a base for such healthcare monitoring environments after real-time implementation of the project with this prototype system, more features can be added such as functionalities to monitor Electrocardiogram graphs of a person. With the further attachments of the different medical sensors with remote monitoring system this project will have an enormous application in the human health care field.

V. CONCLUSION

The proposed framework is executed for remote wellbeing checking of the patients. The imperative boundaries are estimated by the sensors, for example, beat sensor, temperature sensor and SpO2 sensor. The proposed model permits the specialists to screen patient wellbeing from anyplace. The proposed framework assists individuals with counselling the expert everywhere on the world. The framework utilizes IoT and remote sensor innovation for proficient wellbeing observing. The information from sensors is required at regular intervals. The information is put away and can be pictured on the webserver. The framework is carried out so that if the sensor information surpasses the edge esteems, a message is shipped off the specialist. The principle advantage is in the event of crisis the intercession time among specialist and patient is decreased. The goal is accomplished by proposing a minimal expense framework for saving living souls with the goal that living souls will be agreeable. The constraints are the specialist's accessibility and the proposed model does exclude the pulse checking framework.

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