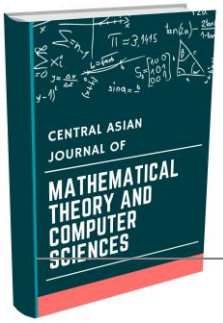

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Improvement of Data Transfer Reliability in IoT-based Coronavirus Patients' Health Monitoring System using by IoT Analytics Expert Systems

D. Ibrahim

Computer Engineering Department, Islamic Azad University (Isfahan branch), Isfahan, Iran,

Eng_douaaalsaady@yahoo.com

N. Majma

Computer Engineering Department, Naghshejahan Higher Education Institute, Isfahan, Iran,

negar.majma@gmail.com

Abstract

Recently, the Corona pandemic has swept the entire world and has led to many deaths, as monitoring the health of patients has become very difficult for the medical staff, with IoT technology has become the monitoring of patients' health remotely, and this facilitated a lot of work for physicians.

In this research, connecting medical sensors, including blood oxygen sensors, temperature sensors, as well as pulse sensors) to patients, obtaining vital parameters and sending data to the IoT platform, used the technology of monitoring the health of corona patients remotely using the Internet of things. The ubidots platform was used where it is considered one of the easiest platforms to deal with sensors, as well as providing free and permanent data storage.

High results were obtained in quickly transferring sensor data to the IoT platform, where the data transfer rate ranged between (10 - 15) seconds for each new data, and this is an excellent transfer rate.

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Introduction:

Remote monitoring technology has become one of the most important technologies currently used in many fields, including medical and agricultural, as well as for home monitoring and other fields.

Patients could only contact with doctors face-to-face, over the phone, or via text messaging prior to the Internet of Things. There was no practical way for medical staff or facilities to monitor patients' health over time and provide guidance.

Information may be transmitted more quickly and securely with the development of technologies like the Internet of Things, 5G, and cloud computing. The Internet of Things provides several opportunities for the field of e-health (IoT). This technique could improve healthcare and result in a number of advances. The monitoring of patients can be considerably improved by incorporating cloud computing and IoT into this procedure. In order to effectively monitor patient status via connected sensors, it is crucial to advance both the medical business and computer science. Hospitals and other healthcare facilities have seen a substantial increase in the use of healthcare monitoring systems, and many nations across the world are now very concerned about the use of portable healthcare monitoring systems with emerging technology. Telemedicine is becoming a viable option for in-person consultations in the healthcare industry thanks to the advancement of Internet of Things (IoT) technologies.

A patient screen is a gadget used to record, measure and show different biometric values, for example, pulse, circulatory strain, internal heat level, SpO2 and that's just the beginning. The patient checking gadget can be utilized to screen the ailments of babies as well as grown-ups, by the sensors that associated with the patient's body convey the data that is shown on the patient screen, and can peruse the boundaries showed on the machine, patient observing is significant in light of the fact that it provides us with an advance notice of right on time or perilous decay of a patient's wellbeing so specialists can roll out the vital improvements in their treatment in like manner. The constant information assists specialist with focusing on their patients and give dire consideration to the people who need the most risk accordingly saving lives.

A far off persistent observing framework is utilized to screen patients beyond the emergency clinic i.e., from a distance. It is additionally alluded to as home patient checking framework. It empowers medical services suppliers to screen a patient's wellbeing beyond the clinic. It assists them with following ongoing changes in a patient's wellbeing information from a good ways and use it in arranging treatment for the patient.

The most popular method of sending computerized or straightforward information to at least one registering, organization, correspondence, or electronic device is information transmission. It enables device exchange and communication between single-point, multiple-point, and multipoint environments.

Although it is typically reserved for delivering and receiving complex information, information transfer can be straightforward and mechanized. It operates when a computer or other device, such as a server or PC, intends to convey a piece of information or a document to one or more recipients. The source device emits discrete indications or computerized piece streams that are the beginning of the advanced information. These information streams or signals are sent through a communication medium, such as actual copper wires, remote relays, or optical fiber, for delivery to the target/beneficiary device. Every visible indicator can also be baseband or passband.

There are many of techniques that used in data transmission and may solve the problem of transmission data like (two tier data reduction technique, adaptive non-linear filtering technique, random access technique and so on), and there is another problem that faced the previous work Real-time data collection is required to enhance user experience, effectively manage risks and SLAs, and boost operational effectiveness.

We require stream processing in order to get real-time data. Batch processing and stream processing are the two primary data processing paradigms.

- Batch processing: At the conclusion of the day, data is routinely pulled from databases, saved to disk for transformation, and then put in batches into a data warehouse.

- Stream processing: Data is continuously gathered, processed, and distributed to lower-level systems; stream processing is processing that occurs very instantly.

Real-time data mobility is the focus of streaming integration, also known as streaming-first data integration. Data must migrate in a scalable and reliable manner between

Continuous real-time capture and delivery to corporate and cloud destinations. In order to provide data real value through transformations and enrichment, processing typically needs to be done on it while it is in motion. Every step of the route involves architectural and technological choices, not just during design but also throughout operation.

Best practices for real-time stream processing include adopting a streaming-first approach to data integration, using streaming SQL to analyze data in real-time, moving data at scale with low latency by minimizing disk I/O, optimizing data flows by using real-time streaming data for multiple purposes, avoiding the need for custom coding when building streaming data pipelines, and running data processing continuously.

IoT is a network of connected computing devices, automated machinery, and objects, the capacity to move information over an organization without the requirement for human or PC connection.

Things in IoT mean an individual with a heart screen, an animal on a ranch equipped with a transmitter, or on the other hand whatever other normal or man-made object that has a protocol address and can send data over the Internet.

IoT system consists of savvy gadgets that support the Internet, such as CPUs, sensors, and communication tools, to gather environmental data and upload it to the Internet.

IoT devices share the data they get from the sensors connected to them by connecting to the IoT gateway or any other device, and then the information is shipped off the cloud for analysis, and sometimes these devices communicate with other similar devices and deal with them based on the information they get from Each other, where these devices work without human intervention in some cases.

The Internet of Things is perhaps of the main innovation that have been proposed in the beyond couple of years, as it has been used in numerous areas of scientific life, For instance, its use in a wide variety of networked products, systems and sensors that take advantage of these technologies to offer new capabilities that were not possible before.

The widespread use of Internet of Things devices in our daily lives has a great impact, as it has transformed many aspects of the lives we live in.

IoT devices such as wearable health and fitness monitors and networked medical devices facilitate the way health care services are provided, and this technology is useful for people with disabilities and the elderly, which provides them with great services at a low cost. using it in the fields of health care, and IoT has solved numerous problems facing medical services in terms of proposing the appropriate treatment For the patient or improving a specific disease or monitoring patients remotely, etc.,.

Research literature:

Hooi Min Lim et al in (2021) they used The Universe framework, which incorporates a calculation driven chatbot application, to be practical and valuable by the two patients and specialists for Coronavirus side effects checking. was led from April 24 to May 21, 2020. Widespread inspecting was utilized to select every one of the patients and specialists who have involved Universe for 14 days at home on side effect observing utilizing Universe on day 15. The top to bottom meetings and beta testing involved a total of 15 participants, including 11 patients and 4 specialists. Each of the 11 patients completed the 14 days of using Universe for observation.

The calculation-based Wire bot categorizes patients according to their side effects, comforts them if they remain stable, or alerts patients and medical professionals when the side effects alter or worsen. Information about patients is also sent from a focused Universe dashboard at the emergency clinic., where the specialists screen every patient's condition continuously. Subsequent to utilizing Universe to screen patients for three month, the meetings were led eye to eye.(Lim et al., 2021)

Strength point is to share of doctors and patients to discover viewpoints and experiences from both sides and they got good data.

The limitation of this study is if any patient refuses to try the CoSMoS system, they didn't meet with those patients in light of the fact that these meetings were by means of calls and it is for the most part being more limited than up close and personal meetings and needed visual and nonverbal signals.

The subsequent restriction is that the vast majority of the patients are from more seasoned age gatherings and various races.

In our research, we will take these limits into record to further develop the well-being results of Coronavirus patients, improving the utilization of medical services assets.

Nizar Al Bassam et al in (2021), they used IoT and Deep learning technology to screen the expected tainted patient in isolation as gathering, checking, making due, and dissecting the illness side effects in a far off way, because of these advances the basic issues in clinical consideration have been successfully tackled in a solid way. The The model was tested by recording signals (both hack and commotion) for 10 s, and then anticipating the hack from the most recent test signal recorded. Each 2s outline is given a result by the model. The model displays excellent performance, and the disarray network displays 96.9% for real positive and 98% for genuine negative results negative cases showing that the model has prepared very well without even a trace of under or over preparing.(al Bassam et al., 2021)

The strength point is, measure the well-being side effects, track, and screen the patient during isolation, keep up with the information to anticipate what is going on and alert the experts on a convenient reason for productive checking, and utilize an android stage to keep refreshed about the well-being status of the patient.

The limitation of this study, it can incredibly affect making clinical specialists aware of from the geological information of likely contaminated individuals to foresee and examine what is happening.

Mainak Adhikari et al in (2021), they used the iCovidCare model, utilizing information combination, highlight choice, and eRF order model in edge organizations to work on the exactness of Coronavirus illness forecast.

The got results proposed that the Coronavirus dataset without information combination does not give higher exact outcomes to all arrangement models. Several data prepos-sessing procedures have been applied to wipe out unessential and repetitive information and select significant ones without commotion. At last, the eRF arrangement model is utilized to prepare the proposed iCovidCare model for the Coronavirus sickness expectation. The proposed model is assessed with an engineered Coronavirus dataset and contrasted and the conventional order models in light of different execution measurements to show its viability. The eRF grouping model for iCovidCare has accomplished 95.13% exactness, which is higher than the standard order models.(Adhikari & Munusamy, 2021)

Strengths point are:

This model provides the best solution about exactness, accuracy, review and predicts the Coronavirus illnesses even more precisely.

Kill immaterial and repetitive information and select significant ones without clamor.

The limitation of this study is that, the model requires more computational exertion for preparing the dataset as contrast with different arrangements due with inborn higher intricacy.

Our research will use different techniques to improve the accuracy of datasets.

Suoli Li et al in (2021), they used the principles of systematic literature reviews; The gathered writing is examined following thorough qualification models speculated around an extensive examination convention group the most recent full-text and companion explored distributions covering the extent of current advanced innovations and man-made consciousness during Coronavirus, they used four information bases like (google scholar, IEEE Xplor, pubmed, fatima college of health science, the review adopted four phases, first originated from google researcher The pursuit distinguished 53 articles that communicated a propensity of assortment in the obtained list items, after that yield 40 distributions zeroing in on man-made brainpower commitments in the medical care industry during Coronavirus, third stage the chose information integrated 2 papers from the FCHS learning focus data collection, 3 articles from IEEE Xplore, and 12 publications from PubMed , lastly, from 110 articles the efficient writing survey incorporated a sum of 54 that satisfied the consideration standards.(Li et al., 2021)

The strength of this study is that

The system is used weekly measurement methods furthermore, used ZigBee to transmit sensor data during data transmission that worked to achieve precise observation and practical data transmission.

The limitations of this study are:

In the event that the quantity of patients is little, the exactness of various strategies is near one another.

Assuming that the quantity of patients is expanding, the likelihood of blunders can increment in various techniques.

Therefore, in our research we will take the quantity of patients to work on the precision of observing.

In Himadri Nath Saha et al(2017) .'s study, they concentrate on developing a nursing companion humanoid stage that is mostly based on portable applications for the guide space that make use of the Web of Things (IoT) and distributed computing. With the aid of design partners knowledgeable about the nursing field, for example, ECG humanoid Application, that gives the representation of the ECG wave for the patient and information on work common sense inside the foundation.

They use temperature and heartbeat sensors and collect the data from patients to the system, because of large information it will be refreshed throughout the previous 3 days that will be seen through the portable application, and the essential sign inside the waiter is refreshed every sixty seconds.(Saha et al., 2017)

The limitation Coordination of temperature, circulatory strain, and heart rate sensors in a single framework has not been attempted. IOT-based frameworks don't analyze data; they just provide values or charts. Two-way communication is not considered.

Fan Wu et al in (2019), they utilized a half breed wearable sensor network framework with edge figuring for an IoT-based modern wellbeing checking application to work on safe work spaces and lessen wellbeing gambles in the development business, and utilized LoRa inside the LPWAN functions as a nearby server for edge processing to show information and, setting off cautions when crisis caused, and capacity the information in cloud server.(Wu et al., 2018)

The limitation of this study is the inertness and the productivity of the organization framework isn't awesome, and the protection and security are bad.

In our research we will utilize new methods and calculations to work on the precision of organization framework and work on the protection and security of frameworks.

Ali Kadhum M. Al-Qurabat et al in (2019), They made use of the Two-tier data reduction (TTDR) method. The sensor hubs and the door represent the two organizational levels that are intended to be addressed.

They included simple and appropriate information pressure tactics for required IoT sensor hubs at the sensor hub level. The solutions use Run-Length Encoding after Delta Encoding to take advantage of the global connectivity of sensor data (RLE).

At the passage level, For informative collections obtained from sensor hubs subject to the Base Depiction Length (MDL) rule, they employ progressive bunching. If the MDL rule can pack any sets of obtained informative indexes, they will be combined into a single group. The quantity of informational collections is then gradually reduced, and the convergence of sets into a bunch is stopped if it is impossible to disclose any matches between sets into a pack. Finally, the TTDR execution is evaluated using an OMNeT++ test system using actually concrete data. The obtained findings show how effective the suggested framework is at transmitting information and converting energy. Additionally, the outcome they receive is as follows:

The pressure strategies utilized in TTDR while applying will diminish the leftover information to a limit of 20.53%, though ATP convention while applying collection will diminish the excess information to a limit of 31.68%, on the opposite side, without utilizing conglomeration/pressure techniques, the excess information equivalent to 100 percent as the instance of PFF.

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The pressure proportion using the MDL standard with encoding exceeds (98%), whereas the pressure proportion using the MDL standard without encoding decreases from 96% to 96.5%, demonstrating the efficiency of the suggested method in the two-level organizational structure (Al-Qurabat et al., 2019)

Strengths are:

Transmitting data is reduced very much.

The consumed energy at the GW level is the energy utilization of the got informational indexes along with the consumed energy of the communicated information to the cloud and registered.

The precision of datasets coming from sensor hubs after decompression is 100 percent in light of the fact that the pressure strategies utilized lose no information and each uncompressed information read is addressed by 64 pieces, while the exactness of uncompressed datasets at the GW level is above 90%, (in view of the utilization of 3 bits for k).

There is a compromise between energy saving and the unwavering quality of de-pressurized information.

Mohamed Elhoseny et al in (2018), they utilize a medical services security model for getting clinical information transmission in IoT conditions.

For a medical care-based IoT environment, a reliable patient's symptomatic information transmission model has been presented, using both variety and dark scale images as a cover transporter. The suggested paradigm uses a hybrid of AES and RSA cryptographic techniques plus either 2D-DWT-1L or 2D-DWT-2L steganography.

The model consists of four tasks: scrambling confidential patient data using a proposed half-breed encryption scheme derived from both AES and RSA encryption calculations, covering the encoded data in a covering using either 2D-DWT-1L or 2D-DWT-2L and delivering a stego-picture, removing implanted data, and decoding the separated data to recover the original data.

As a result, they had a higher PSNR value and a more modest MSE value, and they had the opportunity to obfuscate the patient's information in a transmitted cover image with high impalpability, limit, and little crumbling in the obtained data. stego-picture.(Elhoseny et al., 2018)

The strengths are:

DWT-2L gives better PSNR and MSE results contrasted and DWT-1L on account of both variety and dark scale pictures.

It had a high accuracy compared with other approaches.

In order to continuously monitor his cardiovascular health, Guangyu Xu in 2020 used an IoT-enabled electrocardiogram (ECG) observing structure with secure information transfer.

The ECGSSA technique, a new framework for IoT-assisted signal analysis with quality ECG for cardiac health monitoring applications, automates the evaluation of the nature of obtained EKG signals in persistent sense and active work.

Using ECG sensors, Arduino, Android phones, Bluetooth, cloud servers, and the suggested IoT-aided ECG checking framework, the course of events and execution of a lightweight ECG Signal Strength Investigation for predetermined order and real-time execution. in order to transmit information securely.

The impact of actual labor on the nature of the ECG To examine how actual work affects the strength of the ECG signal, longer time periods of ECG signal observation are used. Four workouts are used to record the ECG signals: sitting, walking, reflecting, and body development.

The result is that the consistency of the observed EECG signals in sitting and routine walking scenarios is excellent. Additionally, if the ECG signals are obtained in conditions of concentrated energy, handling and transmission power may be fundamentally reduced.

The obtained ECG signal has demonstrated that it is more precise and reliable to distinguish clinical qualities.

When compared to the sign handling methods of the present methodologies, the Programmed SSA is fundamental and reasonable for the evaluation of the consistency of the ECG signals produced in the constant environment.(Xu, 2020)

The strengths are:

The proposed light-weight ECG Signal Strength Examination (SSA) reduces battery consumption; performing the SSA in conjunction with Heart Wellbeing Control has a significant potential to increase asset productivity, security, and unwavering quality; and using the Lightweight Secure IoT (LS-IoT) and Lightweight Access Control (LAC) has better security for ECG information transmission.

-An improvement in the recording of large ECG commotion with less phony problem.

Authors (Paganelli et al., 2022) in 2022, The global health system is struggling as a result of the coronavirus pandemic. By avoiding in-person interactions, enabling the early detection of extreme situations, and remotely monitoring patients' conditions, a workable framework for checking patients can advance the delivery of medical care.

Advances in the Web of Things (IoT) have been used to monitor patients' wellbeing with wearable sensors from a distance in a variety of circumstances and conditions, including non-transmittable and irresistible diseases. Combining IoT-related innovations with early-advance notice scores (EWS) frequently utilized in clinics may significantly improve the delivery of healthcare services. The NEWS-2 in particular has demonstrated exceptional results in identifying the wellbeing deterioration of Coronavirus patients. Although the writing offers a few remote checking methodologies, none of these analyses proposes a modified, comprehensive, and Integrated engineering that successfully incorporates a Coronavirus early-identification component and is sufficiently adjustable to be used in hospital wards and at home. The purpose of this study is to present a thorough IoT-based calculated engineering that addresses the essential requirements of adaptability, interoperability, network elements, setting disclosure, dependability, and security with regard to remote health monitoring of Coronavirus patients in emergency clinics and at home.

A consent the executives module was incorporated into the design to provide clarity and ensure information security since remote monitoring of patients at home, which is crucial during a pandemic, might lead to trust concerns with regard to get and moral information collection.

Therefore, they designed a theoretical IoT-based early-cautioning design for remote checking of Coronavirus patients in wards and at home. This article talked about how framework highlights could further develop versatility, interoperability, network elements, setting disclosure, dependability, and security. Compositionally delicate focuses and potential dangers were likewise examined, tending to the endorsement in a creation climate, overseeing heterogeneous gadgets, energy independence, admittance to a web association, and protection prerequisites. What's more, center around an assent the board module and a block chain-based stage for assent the executives. The proposed stage keeps up with patients' protection privileges by safely putting away individual assent and permitting the execution of methodology to make sure that they are not disregarded.

Authors (Baig & Gholamhosseini, 2013) in 2013, with the fast increment of the more established populace combined with that of its life expectancy, the quantity of patients who require checking likewise increments. This incorporates patients who endure sentinel occasions related with; mistaken prescription, measurements errors, contraindications or basic postpones in mediations bringing about hospitalization.

Hence, wellbeing checking frameworks (HMS) can assume a huge part in diminishing hospitalization, weight of clinical staff, discussion time, holding up records and generally speaking medical services costs.

Health observation systems can be divided into three categories, which are listed below. Remote health monitoring systems (RHMS) refer to systems having remote access or systems that can provide data to or from a remote location. This particular type of framework has a range of capabilities, from a single boundary to several ones that cover numerous side effects and can be applied in both private residences and medical facilities.

Therefore, they described an extensive variety of shrewd wellbeing checking frameworks, their applications, and their proficiency. It was found that a crucial signs transmission framework in For telemedicine applications, a proactive view of the Essential and DICOM concepts had been developed. It was acknowledged that good indicators free of antiquities are necessary for internet monitoring, continual transmission of bio flags, and related frameworks to be ready for use right now. A web-based observation system that uses wavelet decay and recreating techniques to sort ECG data was developed to overcome these issues. Another paradigm is the enhancement of a pattern discovery calculation for EEG verification. Such online or electronic observation frameworks play a big role in remote patient checking, producing excellent data and accuracy.

In order to monitor the COVID-19 health symptoms of potentially infected patients (PIP) during the quarantine period from remote locations, the authors [13] created a wearable gadget prototype in 2021. The 3D prototype design for an automated health care system reduces stress and provides a channel of communication between doctors, medical authorities, and family responses. It consists of a three-layer wearable body sensor, web API layer, and mobile front-end layer. Each layer performs a certain purpose. Temperature, heart rate, SpO2, and cough volume are all measured using the wearable sensor layer. Additionally, it notifies family members in real time to lessen stress and relays the patient's GPS position data to medical authorities.Authors (Javaid & Khan, 2021) in 2021, the ongoing situation, high level data advances have opened another way to development in our regular routines. Out of these data advances, the Web of Things is an emerging innovation that provides advancement and improved clinical arrangements, including proper clinical record-keeping, testing, integrating of devices, and causes of ailments. IoT's sensor-based innovation offers a remarkable capacity to reduce the risk of a medical operation in complicated circumstances and is helpful for pandemics of the sort caused by the Coronavirus. IoT's primary role in the therapeutic setting

is to help treat diverse Coronavirus patients effectively. By reducing risks and broadening the overall display, it facilitates the specialist's task. Using this technology, physicians can unquestionably identify changes in the patient's fundamental boundaries. As it advances toward the ideal technique for a data framework to alter a-list findings and as it enables improvement of therapy frameworks in the emergency clinic, this data-based assistance creates spectacular new opportunities for medical services. To separate the capabilities of this breakthrough, they focus on studies on IoT in healthcare and the 2021 Coronavirus pandemic. The review identifies sixteen crucial IoT clinical applications for the Coronavirus pandemic, with a brief description of each in the emergency room. It works on the legitimate administration in emergency clinics and the digitization of clinical cycles. The Web of Things empowers new applications in medication, as gadgets associated with the web are acquainted in different structures with all the more actually screen patient wellbeing and caution about general medical issues by following environmental change. It assumes a significant part in drug observing by giving approved data. This data can likewise help in the legitimate dispersion of the right hardware or gadget to the right understanding. This innovation can likewise forestall burglary of costly clinical gadgets.

Wireless communication technology, including more recently the Internet of Things, have proliferated in various facets of our lives in 2020 as a result of the ongoing decline in prices and rise in employment. One of the fastest-growing and most demanding industries is healthcare. The world of medicine will be impacted by the Internet of Things, starting with health services and remote monitoring, assisted living and old care to identify and manage chronic illnesses and provide tailored medication.

The authors [15] present a straightforward, easy-to-design, and extremely cost-effective methodology for monitoring patients' wellbeing in post-operative wards. The patient's blood oxygen level and pulse readings are shifted to a focused data set, and beat oximeter sensors on the patient's body are connected to remote hubs to frame a WSN. A variety of organizational geographies are examined for the framework's display.

Since commercially available components are employed, the total cost of the system is modest. The suggested structure is suitable for monitoring patients remotely during the post-usable or recuperation stages. Additionally, the system features an alarm feature that is easily configurable in the UI. When the observed benefits of any persistent are beyond the agreed-upon range, an alert message may be displayed on the screen or a warning can be sent to the medical services staff.

In 2020, the clinical industry is looking for new solutions to screen for and contain the Coronavirus (Covid) pandemic in light of this overall health emergency. One such breakthrough that easily tracks the progress of this virus, identifies the individuals who are at high risk, and aids in ongoing disease control is simulated intelligence. It can also predict the likelihood of mortality by thoroughly examining the patients' prior medical history. By populace screening, artificial intelligence can help us combat this virus, clinical support, a caution, and suggestions for preventing contamination

As a result, the authors [16] in this study conducted a quick audit of the literature using the keywords "coronavirus" or "Covid" and "man-made brainpower" or "artificial intelligence" in the databases of PubMed, Scopus, and Google Researcher. collected the most recent information on artificial intelligence for Coronavirus, then looked into a comparable topic to identify its potential use for this ailment. The researchers' findings have identified seven essential applications of artificial intelligence for the coronavirus pandemic. This technology plays a significant role in identifying the cluster of cases and predicting future locations where this infection will have an impact by gathering and analyzing all historical data.

Artificial intelligence has the ability to mimic human understanding. Additionally, it might play a crucial role in comprehending and suggesting the development of a coronavirus vaccine. This invention is outcome-driven and used for realistic present-day patient screening, examination, expectations, and follow-up. The

crucial applications are used to track data on cases that have been confirmed, recovered from, and have since passed.

In 2020, the whole world is impacted by the novel Covid (SARS-CoV-2) pandemic it is the quickest spreading irresistible infection, which is bringing about another hazard to general wellbeing internationally. Measurements of the pandemic are radically rising consistently; at present the clinical faculty and scientists are looking for new advances to screen and control the spread of Coronavirus pandemic. The speedy checking of the viral contamination is fundamental for medical services experts as well as from a bigger general wellbeing perspective to give reasonable patient disengagement to stay away from infection regulation.

In this exploration (Swayamsiddha & Mohanty, 2020), the clever use of mental radio (CR) based IoT explicit for the clinical space alluded to as Mental Web of Clinical Things (CIoMT) is investigated to handle the worldwide test. This idea of CIoT is the most appropriate to this pandemic as each individual is to be associated and checked through a huge organization that requires productive range the executives.

A broad writing study is directed in the Google Researcher, Scopus, PubMed, Exploration Door, and IEEE Xplore data sets utilizing the expressions "Coronavirus" and "Mental IoT" or "Covid" and "IoMT". The most recent information and contributions from true sites and reports are utilized for additional examination and investigation of the application regions. Where the outcomes were CR-based, powerful range designation innovation is the answer for oblige an enormous number of gadgets and countless applications. The CIoMT stage empowers continuous following, distant wellbeing observing, fast case analysis, contact following, assortment, screening and checking, in this manner decreasing the responsibility of the clinical business for disease anticipation and control.

The purposed method and simulation

The proposed solution for remote health monitoring has the ability to develop it to work on diseases other than corona patients, for example, heart failure, diabetes and other diseases that need remote monitoring and it is compatible with them. Work can be easily developed according to the requirements for these diseases.

In the following, the performance of the proposed solution is explained by providing details along with the flowcharts and the obtained dataset.

The proposed work consists of a wearable device that contains sensors (temperature, pulse, and blood oxygen content). The device is attached to the patient's wrist. The sensors measure vital parameters and through the Wi-Fi piece connected to the device, the data sent to the Internet of Things platform (ubid ots), this platform can monitor the patient's essential parameters from the computer where the platform's website (www.ubidots.com) can open, or the platform's application can install on the mobile device. This makes it easier for the clinical staff to monitor the patient's health from anywhere and at any time. The schematic of the proposed method with its operational components shown in Figure (1-1).

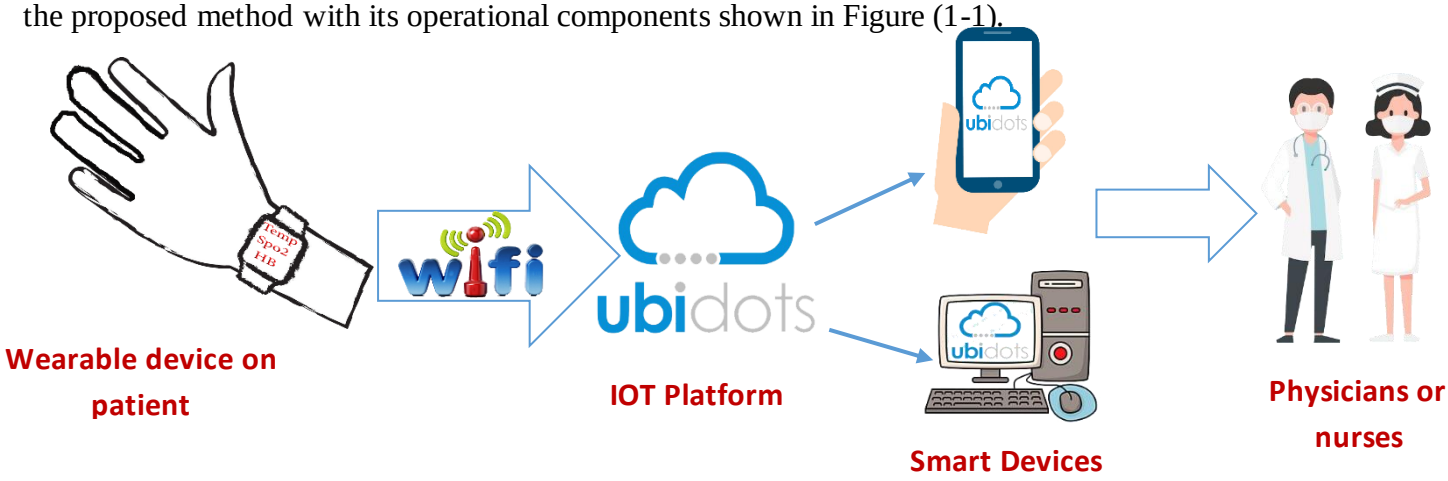


Figure (1-1) the proposed method with its operational components

3.1 The proposed method

The need for IoT to monitor patients' well-being remotely has increased, so a wearable device based on IoT has been planned that uses sensors that can measure SpO2 (blood oxygen), heart beat in BPM (beats per minute) and temperature. The sensor then attached to the ESP8266 microcontroller, which indicates vital check marks. The system will allow monitoring through the platform via Wi-Fi. Pulse oximeter and accelerometer sensors are expensive in the market, but with a low cost and straightforward pulse oximeter unit, we can make our own.

The design and development of this project area unit partitioned into two main components equipment and programming. At intervals, the equipment design, and the circuit planning created, and therefore the image of the project engineered. During the software code development process, the entire image was operated via programming codes. The materials used in the project include, a microcontroller and a group of sensors, thus collecting data. The (Max30102 Pulse Oximeter) sensor measures SpO2 (percentage of oxygen in the blood) and heart rate in BPM (beats per minute). The NTC temperature sensor measures body temperature. Furthermore, I used Ubidots IoT Cloud Platform to store and monitor data.

3.2 Methodology and Materials

The design and development of this project area unit partitioned into two main components equipment and programming. At intervals, the equipment design, and the circuit planning created, and therefore the image of the project engineered. During the software code development process, the entire image was operated via programming codes. The materials used in the project include, a microcontroller and a group of sensors, thus collecting data. The (Max30102 Pulse Oximeter) sensor measures SpO2 (percentage of oxygen in the blood) and heart rate in BPM (beats per minute). The NTC temperature sensor measures body temperature. Furthermore, I used Ubidots IoT Cloud Platform to store and monitor data.

3.2.1 The hardware that used in device

We-Mos D1 mini based Wi-Fi Module.

Spo2 sensor MAX30102 Pulse Oximeter.

NTC Temperature sensor

TP4056 Micro USB to Lithium LIPO Battery Charging Module.

3.2.1.1 We-Mos D1 mini based Wi-Fi Module

A 16Mb (megabit) flash memory and an integrated ESP-12F-based Wi-Fi CPU make up the Wi-Fi D1 small. The Wi-Fi D1 small board can be programmed using the Arduino IDE. Since the module has an embedded small USB interface and can be updated directly from the Arduino IDE (ESP8266 support must be added through board director), programming the D1 scaled down is practically no more complicated than programming any other Arduino-based microcontroller.

SPECIFICATIONS

Microcontroller: ESP-8266EX

Operating Voltage: 3.3V

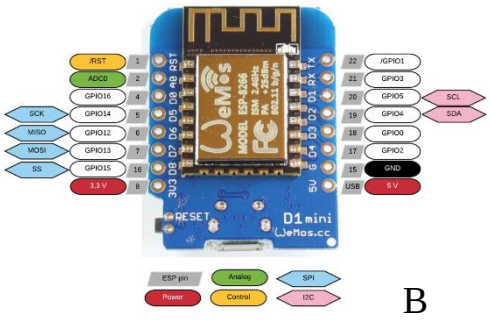
Digital I/O Pins: 11

Analog Input Pins: 1 (Max input: 3.2V)

Clock Speed: 80MHz

Flash: 4M bytes

A



B

3.2.1.2 Spo2 MAX30102 Pulse Oximeter sensor

The MAX30102 beat oximeter and pulse sensor is an I2C-based low-power attachment and-play biometric sensor. This sensor is used to gauge heartbeat/beat rate in BPM and blood oxygen fixation (SpO2) in rate.

The MAX30102, or any optical heartbeat oximeter and pulse sensor, comprises of a couple of extreme focus LEDs (RED and IR, both at various frequencies) and a photodetector.

The working of MAX30102 can be separated into two sections: pulse estimation and heartbeat oximetry (estimating the oxygen level of the blood).

The MAX30102 sensor is the further upgraded rendition of the MAX30100 sensor and is utilized as both a pulse screen and a heartbeat oximeter. These highlights are empowered by building this sensor, which comprises of two LEDs, a photodetector, streamlined optics, and low commotion signal handling parts. It is effectively utilized with microcontrollers like Arduino, ESP32, ESP8266 NodeMCU, and so forth to construct a proficient heartbeat and oxygen immersion gadget, as shown in Figure (1.3).

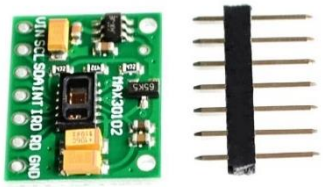


Figure (1.3) MAX30102 Pulse Oximeter

3.2.1.3 NTC Temperature sensor

The opposing qualities of earthenware or metal composites are used by an NTC thermistor, a type of temperature sensor, to measure the temperature. Our full range NTC sensors have excellent long-term steadiness, high exactness, and accuracy, among other advantages for measuring temperature.

Thermistors are temperature-detecting parts made of semiconductor material that has been sintered to exhibit dramatic variations in blockage in response to small temperature changes. There are numerous applications for NTC thermistors. NTCs are used in a variety of medical applications, such as patient monitoring, dialysis equipment, and catheters. NTC thermistors are used in appliances like coffee makers and dryers to measure temperature precisely. NTC sensors are used by air conditioning and refrigeration equipment to measure temperature in building controls and cycles, resulting in increased efficacy and control. NTC thermistors are used by the automotive and aviation industries for both creation and test purposes. Negative Temperature Coefficient is referred to as NTC. The opposition decreases with rising temperature since NTC thermistors are resistors with a negative temperature coefficient. They are mostly used as devices that limit current flow and resistive temperature sensors. In comparison to silicon temperature sensors (silistors) and opposition temperature locators, the temperature responsiveness coefficient is significantly more noticeable (RTDs). NTC sensors are frequently used in temperatures between 55 and +200 °C.

When using straightforward circuits to precisely measure temperature, the non-linearity of the relationship between opposition and temperature demonstrated by NTC resistors was a remarkable test. However, rapid advancements in computerized circuitry addressed this problem by making it possible to calculate precise characteristics by inserting query tables or by establishing parameters that predicted a typical NTC bend.

These strong state temperature sensors really carry on like electrical resistors that are temperature touchy as shown in Figure (3.4).

Figure (1.4) NTC sensor

3.2.1.4 TP4056 Micro USB to Lithium LIPO Battery Charging Module

The current insurance accusing module in this TP4056 1A Li-particle Lithium Battery - A tiny module, smaller than a standard USB, is perfect for charging single-cell lithium particle (Li-Particle) batteries with a voltage of 3.7V and a maximum capacity of 1 Ah, such as 16550s, which lack a built-in security circuit. This module will provide 1A charge current and then be deleted when wrapped up due to the TP4056 charger IC and DW01 battery assurance IC. Additionally, the security IC will turn the stack off when the battery voltage drops below 2.4V to prevent the cell from operating at an extremely low voltage. This protects against both over-voltage and the opposite extreme association (it will as a rule obliterate itself rather than the battery) but if it's not too much trouble, check you have it associated accurately the initial time.

fabricated using only hardware handling. Before shipping, every module from Robu.in is thoroughly tested, ensuring great dependability for the finest performance. It is an excellent design for charging a single lithium battery. TP4056 The continuing screen, under-voltage lockout, programmed re-energize, and two status pins to show charge end and the presence of an info voltage are among the additional components. Therefore, must check the associated accurately the initial time as shown in Figure (1.5).

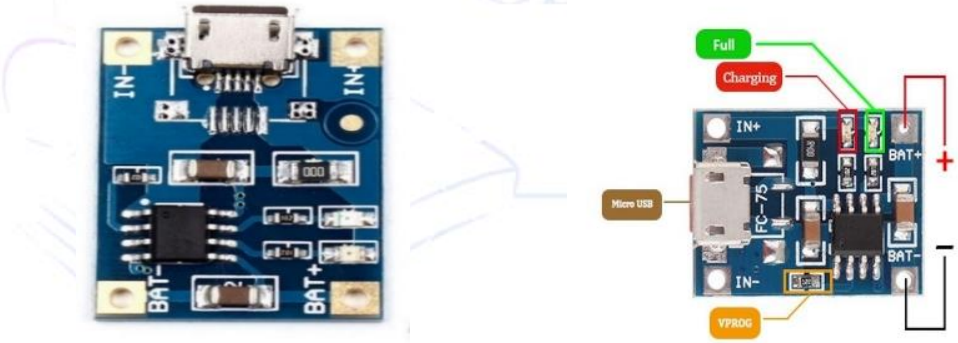


Figure (1.5) TP4056 LIPO Battery Charging Module

3.1.2.5 Volt Battery 3.7v 700mAh

Due to their light weight, high energy density, and superior long-term self-discharge rate, lithium polymer batteries are the most popular battery type used in small battery-powered products. They can be found in a variety of forms, including prismatic, cylinder, and pouch cells.

It is a lithium battery with a 3.7v apparent voltage and a 4.2v full charge voltage. It has a range of several hundred to several thousand mAh. It is widely used in a variety of instruments and meters, testing equipment, medical equipment, POS equipment, journal PCs, and other goods.

The limit of a 3.7V lithium battery is more obvious the more lithium batteries there are combined in an equal number, or the larger the volume of a single lithium battery.

A "protection board" is typically required for 3.7v lithium batteries to prevent overcharging and discharge. Because a lithium battery's ideal full charge voltage is 4.2 volts, any battery without a security board must be accused of 4.2 volts or higher to avoid damaging the battery. This method of charging requires constant monitoring of the battery's condition.

Actually, the security board battery may be charged using 5V (territory from 4.8V to 5.2V). As most of us are probably aware, USB devices like PCs and smartphones can generally be charged using a 5V charger.

The 3.7V battery has a 4.2V charging cut-off value and a 3.0V releasing cut-off voltage. Consequently, the battery should have the choice to charge when its open-circuit voltage is lower than 3.6V. It is wiser to use the 4.2V steady voltage-charging option so that you are not concerned with the charging time. In the event that 5V charging is utilized, cheating is not difficult to occur. as shown in Figure (1.6).

Figure (1.6) Volt Battery 3.7v 700mAh

3.2.1.6 The software that used in purposed method

3.2.1.6.1 Arduino IDE

The Arduino Programming (IDE), also known as the Arduino Integrated Development Environment (IDE), has a content manager for writing code, a message area, a message terminal, a toolbar with buttons for common features, and a succession of menus. In order to transfer programs and communicate with the Arduino hardware, it interacts with it.

To upload the code to our microcontroller, we use an integrated development environment (IDE) that deals with AVR-type microcontrollers, including Arduino and Esp32, which work in the same environment using the Arduino IDE, which is software available for various operating systems include, Windows, Linux and Mac.

It is accessible through the official Arduino website for download. By connecting the microcontroller to the PC, choosing the port on which the microcontroller is attached, and then swiftly uploading the code, the code may be immediately uploaded from the Arduino IDE to our microcontroller.

Outlines are programs created using the Arduino Programming (IDE) environment. These descriptions are created using the content tool and stored as file augmentation.ino files. The supervisor features text-searching and text-replacement highlights. When saving and transmitting messages, the message area receives input and also highlights errors. The command center displays messages generated by the Arduino Programming (IDE), together with total error messages and other information. The board is visible in the bottom right corner of the window.

and sequential port design. You may examine and transfer programs, create, open, and save pictures, and open the serial screen using the toolbar buttons.

Additionally, writing code and transferring it to a detached board is simple with the Arduino Software (IDE). For clients with weak or no web presence, we advise it. Any Arduino board can be used with this product.

The Arduino IDE is now available in two different versions: IDE 1.x.x and IDE 2.x. The IDE 2.x is a brand-new substantial release that is surprisingly faster and more amazing than the IDE 1.x.x. Along with a modern checker and a more rapid connection point, it has advanced features to help users with their coding and research.

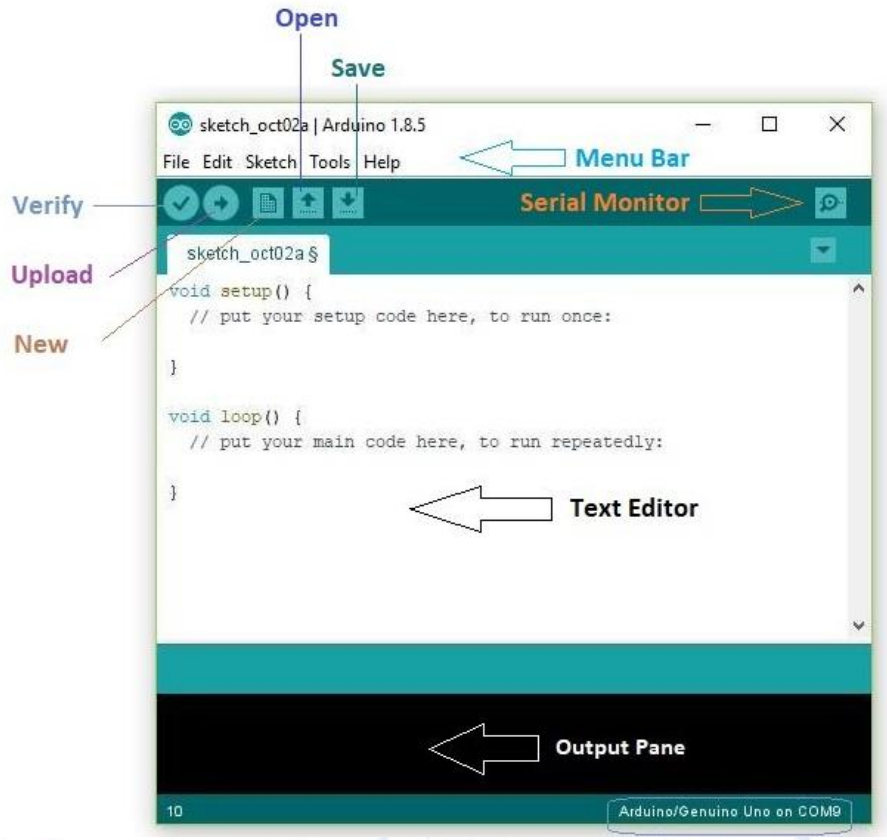
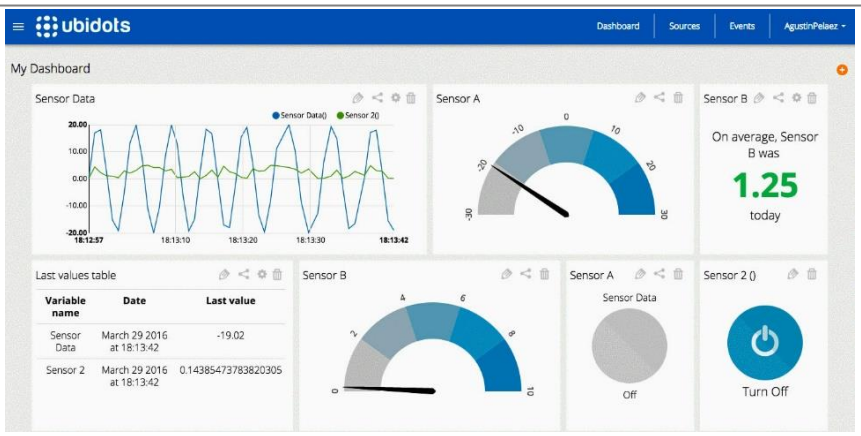


Figure (1.7) Arduino Software (IDE)

3.2.1.6.2 Ubidots IoT cloud platform. (https://ubidots.com/)

Ubidots is an IoT stage enabling pioneers and businesses to model and scale IoT ventures to creation. Utilize the Ubidots stage to send information to the cloud from any Web empowered gadget. Can then arrange activities and cautions in view of constant information and open the worth of information through visual apparatuses. Ubidots offers a REST Programming interface that permits perusing and composing information to the assets accessible: information sources, factors, values, occasions, and bits of knowledge. The Programming interface upholds both HTTP and HTTPS, and a Programming interface key is required.

Information will be safeguarded with two additional replications, encoded capacity and discretionary TLS/SSL information support. You can likewise modify authorization gatherings to every module of the stage, ensuring the right data is displayed to the right client. Gives a solid and simple method for building IoT answers for understudies, producers and specialists. It is utilized for sending information from any Web empowered gadget to the cloud, setting off activities and cautions in view of that information, and envisioning it. Ubidots platform is a client centered point-and-snap IoT Application developer with information investigation and cloud capability instruments, dashboard representations, gadget the executives apparatuses, BI occasions and caution motor, and end-client validation/admittance to give end-clients and administrators the information they need and that's it. With the Ubidots platform, clients gather, upgrade, and convey sensor, Actuator, and guide information that is important for organizations and clients to settle on information driven choices that further develop productivity and viability, as shown in Figure (3.8).



3.7 Block Diagram

The block graph of the proposed framework shows the connection of the Max30102 sensor, which is used to gauge oxygen and heartbeat, and all these sensors are connected to the ESP8266 controller. Then, this circuit connected to the Ubidots platform by connecting to Wi-Fi. It then sends data through this circuit to the cloud platform. The platform will store the data in a database in a protected manner to display and store the data for use. The block Diagram for the purposed method shown in Figure (1.9).

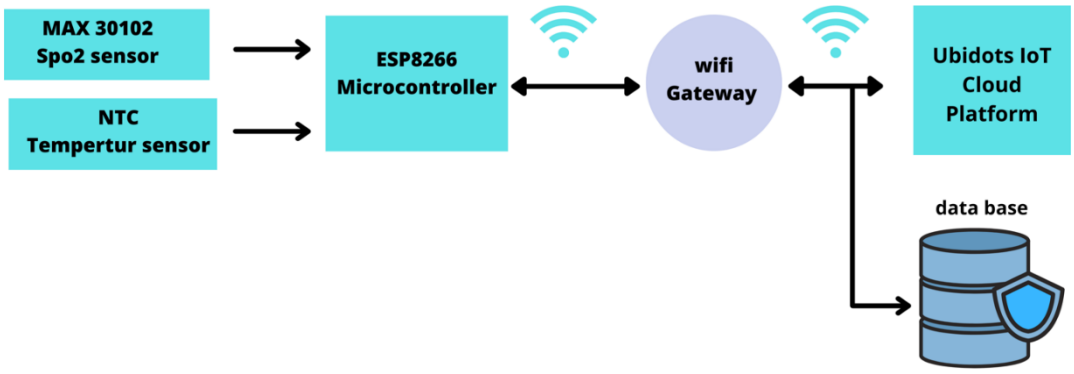


Figure (1.9) the block Diagram of purposed method

3.8 System Schematic Diagram

In Figure (1.10), we explain the System Schematic Diagram of the hardware components to complete the device that is used in the purposed method; we connected the pulse and oxygen sensor to the WeMos D1 mini as follows:

For max30102

SCL to pin D1

SDA to pin D2

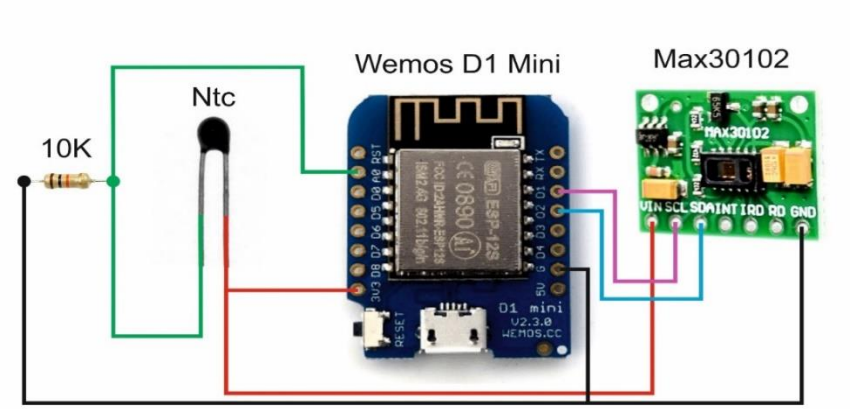
vin to the 3.3V power source

GND to GND

For NTC:

Positive pole to power source 3.3V

negative pole to pin A0.



Here are some photos of the device that is used after completing the connection as shown in Figures (1.11, 1.12, 1.13, and 1.14)

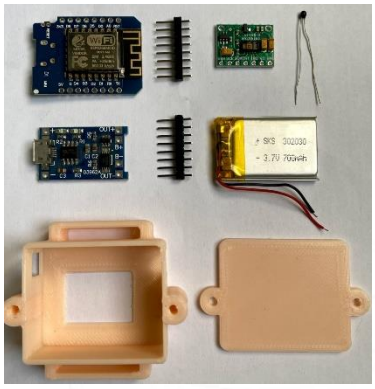


Figure (1.11) the components

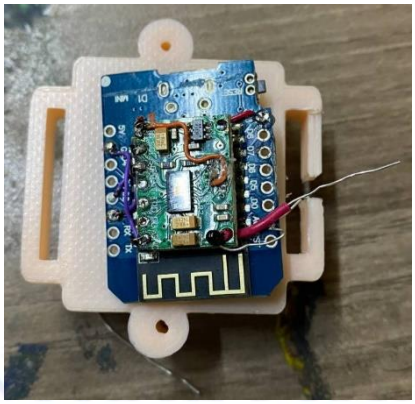


Figure (1.12) connect the components together

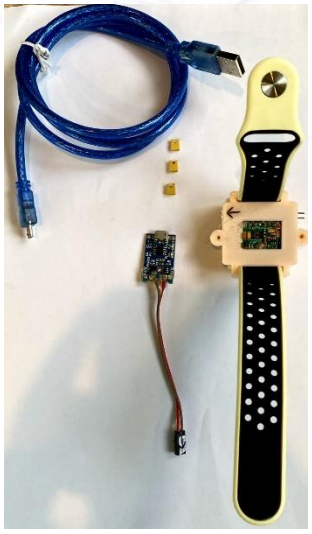


Figure (1.13) The Final Forms of the device

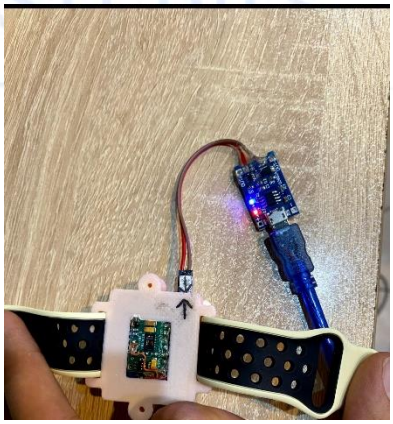


Figure (1.14) Charging the device

3.9 Result

At first I went to Al-Amal Hospital and got seven patients with Covid-19 virus. 4 of the patients were in very difficult condition in terms of blood oxygen rate and pulse, because they were suffering from chronic diseases such as heart failure, diabetes or pressure, and another had asthma. As for the rest of the patients, their condition was Good, but they suffer from strong flu symptoms, so they were diagnosed with Covid-19, I monitored the patients' condition for three days, the first two days I took data from the seven patients, but on the third day the patients were discharged, whose condition was good, and the patients whose condition remained critical, and when I spoke to the doctor The specialist to monitor patients said that he will discharge them within the next two days because their condition has begun to improve. During my stay in the hospital, especially in the isolation hall for Covid-19 patients, I found a good welcome from the doctors and nurses for the device that I designed because they saw how easy it is to use the device and how fast it transfers data to the platform within seconds and without any trouble from the staff, in addition, it does not There is a device in the hospital that checks three vital parameters for patients at the same time and on the same device, as well as storing the data on the platform and referring to it at any time, while one of the nurses said that we cannot read the data correctly and accurately in the devices they have because it gives more than one reading at the same moment, so they depend On any reading that has been observed, even if it is inaccurate, and this is one of the most important advantages of the designed device.

Figures (1.15, 1.16, 1.17, 1.18, and 1.19) show pictures of patients to whom the device was connected.

Figure (1.15) First Patient

Figure (1.16) Second Patient

Figure (1.17) Third Patient

Figure (1.18) Forth Patient

Figure (1.19) Fifth Patient

From the result that I got, the device is working very well without any problems and sending the information to the cloud quickly. The transmission rate to the sensors is between (10-15 seconds) for every new data point. That means every 10 seconds the device sends a new data point to the cloud. That is a very good time compared with previous work.

Here, explain the charts of (temperature, Spo2, Heart Rate) as you show the flow of any data that uploaded to the platform is plotted in the charts and show how the time between data is very low Approximately 10 seconds between two data.

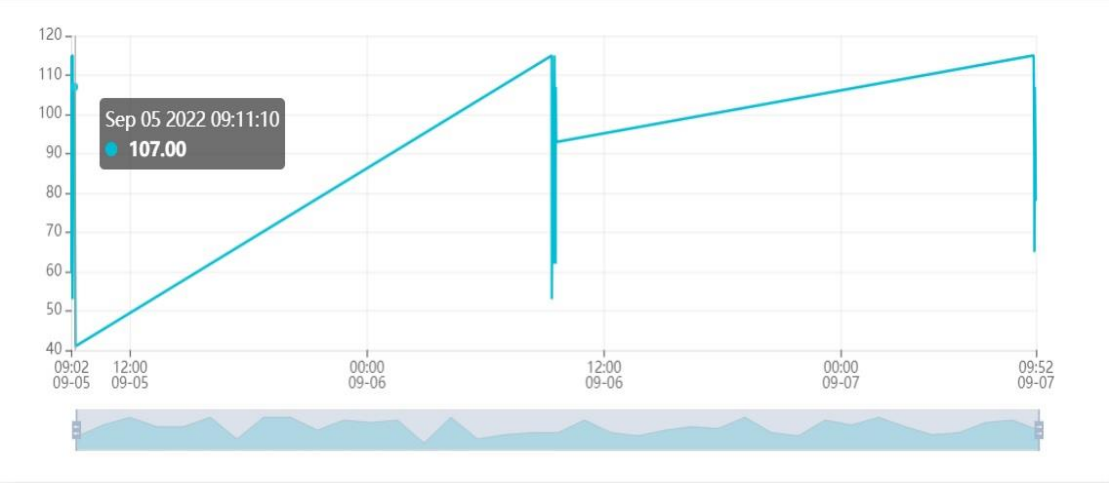


Figure (1.20) Heart-Rate Chart for the Values in ubidots cloud

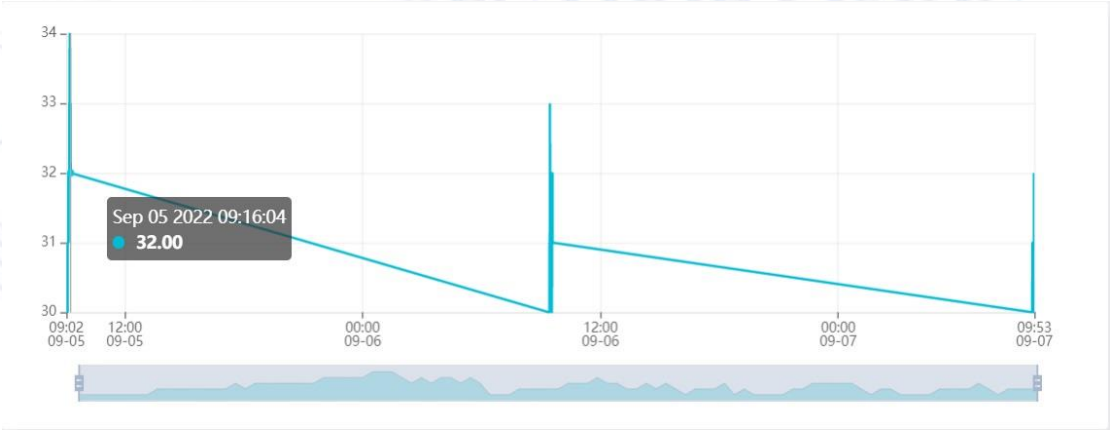


Figure (1.21) Spo2 Chart for the Values in ubidots cloud

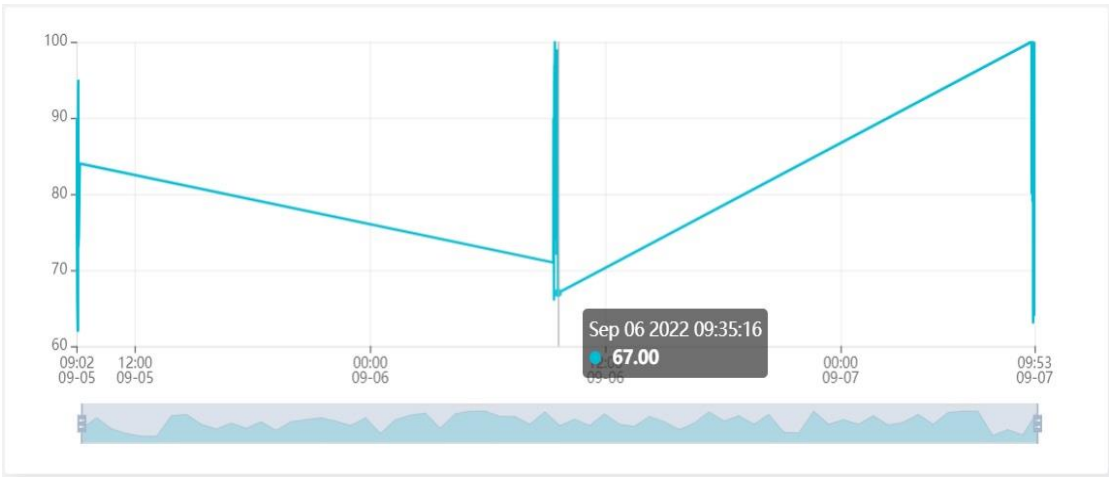


Figure (1.22) Temperature Chart for the Values in ubidots cloud

3.10 Conclusion

In the proposed method, a wearable device containing three sensors (temperature sensor, blood oxygen sensor, and heartbeat sensor) was used. The sensor is then attached to the ESP8266 microcontroller, which indicates vital check marks.

The design and development of this project area unit are separated into two main components equipment and programming. At intervals, equipment design and the circuit planning were created, and therefore the image of the project was engineered. During the software code development process, the entire image was controlled by programming codes. The materials used in the project include a microcontroller and a group of sensors, thus collecting data. The (Max30102 Pulse Oximeter) sensor measures SpO2 (level of oxygen in the blood) and pulse in BPM (beats per minute). The NTC temperature sensor measures body temperature. Furthermore, they used Ubidots IoT Cloud Platform to store and monitor data.

3.11 Future Work:

Based on the studies and research presented, the limitations of the research and the proposed future work, they are as follows:

1- Reviewing and analyzing the proposed method with patients with heart failure who need continuous care and because of their critical condition, this method is very effective.

2- Using other sensors can increase the speed of data transmission.

Acknowledgement

First of all, I thank God for his success in completing this research, and then I start by thanking my husband, my family, and everyone who stood by me.

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