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A Design of COVID-19 Wearable Health Monitoring System Based on IoT

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ABSTRACT:

An infectious illness called Covid-19 severely damages the patient's lungs, which lowers the blood's oxygen levels. Therefore, it is necessary to often check the case's heart rate and Saturation of Peripheral Oxygen (SPO2). In the event of an emergency, prompt care may be given to the case by monitoring these characteristics. In order to solve the scarcity of healthcare workers, this project offers a useful paradigm in which a doctor may effectively utilize technology to monitor a patient's health from a distance. Temperature, heart rate, SPO2, and body movement are all measured by the model and presented on the LCD (liquid crystal display). The presented numbers may be seen on a doctor's smart phone through an app, allowing him to learn the patient's current condition without having to visit them in person. The information can also be utilized for further analysis and visualizations.

Keywords: IoT, COVID-19, Microcontroller, LCD, Sensor, data visualization, Arduino.

INTRODUCTION:

The COVID-19 pandemic is currently one of the most important global issues facing healthcare organizations. The global spread of the COVID-19 pandemic has drastically changed people's lifestyles. Delays in the production and distribution of vaccines are placing a heavy burden on health systems in developing and developed countries. COVID-19 patients often experience fever, shortness of breath, decreased atomic number 8 saturation levels; there are numerous symptoms, including body aches, a dry cough, irregular vital signs, vomiting, diarrhoea, sore throats, headaches, and loss of style or smell indicators [1-3]. Of these symptoms, high fever, desideration of atomic number 8, and abnormal vital signs are considered serious. Low atomic number 8 saturation and shortness of breath cause hypoxemia and drive separately. Patients with hypoxemia or problems with vital signs have a lower chance of survival. Patients without hypoxemia in nursing may find that their pulse rate increases and that they are dying without proper treatment. Therefore, COVID-19 patients frequently need to know their health status, especially vital signs, heart rate and atomic number 8 saturation (SpO2) [4, 5]. Observation of her COVID-19 infected and recovered patients on the ward is therefore an important concern for health authorities/departments.

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Thus, COVID-19 diagnosis and interference can be made with the support of sensor element technology and its integration with sounds embedded in machine learning formulas to process a wide range of information from patients. COVID-19 infection rates have been found to increase during the winter months as survival conditions for the SARS-CoV-2 virus become much more favorable. The Web of Things is one of the new technologies that is becoming integrated into every part of human life. The most common uses of IoT are sensitive homes, machine-driven industries, schools, oil refineries, environmental monitoring systems, sensitive cities, and more.

As a person approaches maturity, it becomes increasingly important to have regular check-ups. IoT-based arrangements can help people for regular health checkups because pushing them for regular health checkups is tedious and cumbersome for many people [4, 5]. IoT technology has become a major innovation with applications in a wide range of fields. It specifically refers to a collection of hardware components that communicate data wirelessly without human intervention [6, 7]. With her active COVID-19 cases increasing significantly during the second wave, all countries face the challenge of providing adequate treatment to their patients. Heart rate and vital signs square measure the most important basic indicators of human health. Heart rate, also called heart rate, is the range of beats per minute. A normal human heart rate is 60 to 100 beats per minute.

Adult males and females have an average resting heart rate of approximately 70 and 75 per minute, respectively [8, 9]. In general, women over the age of 12 have a higher heart rate than men. However, COVID-19 patients have abnormal heart rates. Paramedic assistance is required for nursing associates. A healthy adult's body temperature ranges from 36.5 °C (97.8 °F) to 37.2 °C (99 °F) [10-11]. Vital signs can fluctuate due to various factors such as infections, cold physiological conditions, and other illnesses. Fever is a common symptom with her COVID-19, as is most illness. Therefore, it is important to live vital signs frequently. Saturation of chemical elements is also a very important issue for COVID-19 patients. The traditional flame chemistry (SpO2) has a saturation range of 95-100%. A COVID-19 patient needs urgent care if her SpO2 (oxygen saturation) level is below 95. The SARS-COV-2 corona virus creates silent propulsion, so there is no shortness of breath. Quiet driving is diagnosed by monitoring her SpO2 with a heart rate monitor.

If COVID-19 patients have significantly lower chemical element saturation levels, they may die. It's crucial to monitor early signs of COVID-19, such as fever, coughing, heart rate, and SpO2, in order to treat it. These values are now enjoyed by many different sorts of gadgets. For example, peak heart rate monitoring systems are commercially available in most countries and are used to measure SpO2 and heart rate lives [12]. There are also deluxe handheld heart rate monitors on the market that can measure SpO2 and heart rate. However, the price is around 299 USD [13]. A wrist-worn heart rate monitoring system is provided via the meter with Live SpO2 and rate. Like the devices mentioned above, does not offer a temperature activity option. At $179, the wrist-worn heart rate monitor is expensive. Analog

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and digital there are thermometers on the market right now [14], but the most of them are pricey. The aforementioned device doesn't seem to support his IoT. Some of them show value, but getting measurements from completely different devices is tedious. It is therefore difficult for doctors to get up-to-date information directly from every patient. Her COVID-19 patients, who are critically ill, require prompt monitoring. A patient can receive her COVID-19 treatment at home with the aid of technology by having her mobile phone spied on [15]. Patients who have fever, low chemical element saturation, and erratic heart rates benefit from this treatment. Age, height, heart health, and emotional stability all affect a person's heart rate [16]. Chemical element saturation and pulse range units are linked because a decrease in the level of the chemical element increases the patient's heart rate.

A good IoT-based healthcare system can become a modern patient monitoring system. Recently, IoT-based health devices have attracted attention from an optical perspective. The reviewed literature includes the activities of top healthcare monitoring systems in IoT environments by Associate in nursing [18]. This investigation made use of the associate's in nursing student's Android-based heart rate monitoring device, which is normally furnished with a temperature probe, a SpO2 probe, and a heart rate probe. In [19], sensor elements for SpO2 measurement were not used and measured knowledge was shared over a network. [20] predicted an IoT-based respiratory monitoring system for patients with asthma attacks without affecting body temperature, SpO2, and pulse. Arduino, Android, and microcontroller based pulse monitoring systems are designed. This system is based on the Arduino Uno and cloud computing where only the hardware paradigm was created. However, it does not provide actual testing skills. The mobile application based heart rate monitor was impeccable. As the patient's pulse was measured with a pulse sensor element in this system, the Arduino abuse findings were analyzed. The measured data were delivered to a humanoid application. In this study, the number of sensors used was limited. Very Different His outstanding IoT-based system has yet to be awarded. This analyses' major goal is to develop and deploy a special Internet of Things-based health monitoring system for COVID-19 patients that can track temperature, pulse, and SpO2. The system displays measured mold temperatures, element saturation levels, and vital signs in a mobile application, and is designed to help patients seek medical care even when specialists are not physically available. To treat COVID-19 patients, physicians need the patient's factor saturation level and vital signs. The appointment system allows patients to communicate their health status to their doctors. In addition to COVID-19 patients, the device will also help patients with other illnesses such as: B. Chronic obstructive pulmonary disease (COPD) and respiratory disease. In 2005, COPD caused her five deaths worldwide and will become a global health problem in the future. Therefore, this method is useful for such patients. If the patient's elemental saturation and vital signs are abnormal, the system will directly generate a beep sound to alert the patient. Via a mobile application, the patient thus analyzes the saturation, pulse rate and temperature of the measured elements to avoid critical health conditions. This method was tested on 5 subjects. Patient and doctor scan information throughout her day using her mobile

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application. This method has the added flexibility of live temperature not included in other analyses.

LITERATURE SURVEY:

N. El-Rashid, S. El-Sappagh, S. M. R. Islam, H. M. El-Bakry, and S. Abdelrazek[1], Corona virus (COVID-19) may be a new virus of viral infection. It erupts around the world through human-to-human transmission. Many healthcare companies offer collaborative monitoring systems, but these solutions falls short of providing end-to-end treatment of the disease. The main aim of the planned it is intended to close the technological and bidding system gaps. Wireless body-space networks, cloud computing, fog computing, and clinical call web are integrated to provide a comprehensive and complete model for disease detection and monitoring. By observing COVID-19 patients in real time, doctors can guide patients in making the right choices. The planned framework has three main layers: patient layer, cloud layer and hospital layer. Within the patient layer, patients are semi-tracked by a series of wearable sensors and a mobile her app. Fog specifications are projected into the cloud layer to solve storage and knowledge transfer problems. At the hospital level, we tend to propose deep-her learning models based on convolution neural networks for COVID-19 detection, patient her X-ray scan image support, and transfer learning. The proposed model achieved promising results compared to the prior art (ie 97.95% accuracy and 98.85% specificity). Our framework may have useful applications if the COVID-19 epidemic has a greater impact and is expected to significantly reduce healthcare costs.

M. Pourhomayoun, N. Alshurafa, F. Dabiri et al.,[2] This paper is a systematic review to validate this study conducted on hourly activity or follow-up volume intravenous fluid (IV) in a saline bag and to observe patient defecation rate and body temperature levels. . This technology provides medical services to patients, especially by United Nations agencies in the Medical Support Unit (ICU). Among the various treatments, saline medical supplies, pulse and temperature monitoring are among the most critical treatments many patients receive from hospitals. According to this document, the output of a hardware system consisting of a node MCU and a pulse detector and a temperature detector can be used to monitor heart rate and temperature and track the amount of IV fluid levels, primarily for his IoT The base system has been enhanced. Additionally, a relevant warning system is added. It stops when the IV fluid level drops below the tolerance level specified by the algorithm developed.

Alarm Notification notifies the physician with an audible alarm with an activated buzzer, plus a sun flashing on the monitor confirms the patient's severity when the heart rate or temperature goes above or below acceptable levels. Through this instance, physicians can access patient heart rate, temperature, and IV fluid level data from anywhere. A hospital nurse or attending physician can monitor the above data of the patient on the serial monitor over the time of the observation system. Time to complete the observation through the

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Google platform. This platform is safe to save most points. This data and all other personal patient data is stored in the cloud and can be used for future research on patient health. The instance is a complete use of Node MCU, Pulse Detector, Load Cell, Temperature Detector and Google Platform.

T. S. Arulananth and B. Shilpa, More recently, technological innovations in the areas of fatigue interventions and patient wellness have enabled the development of areas such as monitoring systems. Pulse is a very important health parameter it has a direct bearing on how well the human circulatory system is functioning. It is measured by sensing electrocardiogram ripples or heartbeats (pulsatile dilation associated with the constriction of arteries as blood is pushed out by regular contractions of the intestine). The heartbeat is felt at the point where the arteries prepare to touch the skin. This article describes Spike and his method of measuring gut ratio with an Arduino. This is consistent with the ikon Phelthysmo Graphy (PPG) principle, which is a non-invasive method of monitoring changes in blood volume in tissue using light and detectors. Blood is circulated throughout the body as the bowel moves, and the blood volume in the arteries of the fingers changes as well. This blood fluctuation is sensed by an optical sensing system located around the tip. Using port communication, the signal is amplified and transferred to the Arduino. The process software package is used for pulse monitoring and counting.

M. M. Khan, A good health monitoring system, largely based on the Internet of Things (IoT), could be the new plan. Almost 70% of people live in rural areas. Getting the right attention instantly can be incredibly tedious for farmers. MBBS doctors and related medical facilities are not usually available in rural areas. People in our country's rural areas suffer a lot from getting proper attention services. IoT-based attentive services are very important for our country, especially for rural areas. This paper presents and analyzes the current status and challenges of IoT. It is primarily based on excellent care services for disadvantaged rural residents. Providers of IoT-based attention services are presented and their current importance in this area is recognized and mentioned. Mobile and web application-based telemedicine services are also being introduced. According to the analysis, his IoT-based attention service providers in this field face several challenges introduced.

M. M. Islam, A. Rahmanand, and M. R. Islam, Health monitoring systems in hospitals and many alternative medicine centers have seen significant growth since ancient times, and today mobile health monitoring systems using new technologies have become very important in many countries around the world. The advent of Net of Things (IoT) technology is driving advances in healthcare delivery from face-to-face consultations to telemedicine. In this paper, we propose a rational healthcare system for her IoT atmosphere that monitors patients' basic health characteristics based on local conditions wherever they are currently located. In this system, her five detectors—heart rate sensor, temperature detector, temperature detector, CO sensor, and carbon dioxide detector—collect information from the hospital atmosphere. The error rate of developed themes is kept within limits

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PROPOSED SYSTEM:

The planned system consists of a robust microcontroller model containing numerous live sensors that are familiar with the user's organs, such as pulse, SpO2, and temperature.

- The acquired information is sent to the microcontroller (Arduino-UNO) responsible for forwarding the information to the connected Wi-Fi module (Nodemcu).
- nodeMCU gets information from Arduino and sends it to mobile application.

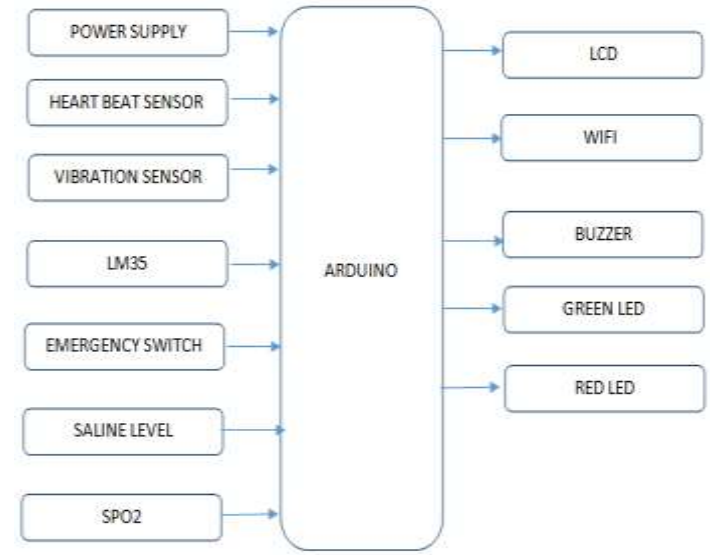

Fig. 1 Block diagram

Assurance we tend to make systems economically viable to provide answers. The system basically involves using dedicated sensors to collect the user's organs and uploading them to his server in the cloud via a Wi-Fi module. It is then stored in SQL information for various types of manipulation and analysis (Hasan MW, 2021).

We planned a powerful health monitoring system intelligent enough to observe the patient's mechanical sacrifice IOT. It collects certain information through these systems. This includes patient pulse, temperature, SPO2, vibration to nurse and stream to patient. Doctors wake up and send complete medical information. This makes it easier for doctors to monitor their patients from anywhere, and even allows patients to send their health status directly when they don't go to the hospital. Our models are used in various hospitals and medical institutions. The system uses intelligent detectors that generate data information collected from each sensor and send it to an information server. Information servers analyze and statistically manage information for use by coroners. Maintaining an information server so that patient history can also be tracked is essential, allowing for stronger and improved investigations. A temperature sensor in the circuit can sense temperature from the environment and display the temperature in degrees Celsius (degrees). The LM35 can be a

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low voltage IC that consumes only about +5 VDC power. The information of the heart rate detector shows the regularity of the heart rate and can also reproduce the activity of the heart muscle. Such sensors are typically used to monitor patients with heart problems. A heart rate detector allows a simple examination of heart function. Monitor blood flow through the earlobe. The volume of blood in the ear changes over time because the heart pumps blood to the earlobe's blood vessels. A detector shines a beam of light (a small bulb) through your ear and measures the transmitted sunlight. The Schematic document contains the basic schematic of the system circuit for the United States. The system's hardware includes the components indicated in the table below (Table 1).

Table 1 Sensors Used

S. NO.	Component	Use
1	MAX30100	Detect heart rate SpO_2
2	LM35	Detect Temperature
3	Arduino-Uno	Brain of the System
4	Nodemcu	Sending data to a server

The coding for the aforementioned system used Arduino, which was also used to configure the Nodemcu module to connect to Wi-Fi and broadcast the data. The Arduino-Uno microcontroller was programmed to record the data from the sensors.

IMPLEMENTATION HARDWARE:

The hardware and the smartphone app are the two components that make up the system. The system depends on both of these components. The body temperature, pulse rate, and oxygen saturation of the blood can all be measured by the health monitoring system. The implementation of this multifunction system calls for the use of numerous components. The implementation process is completed by carrying out the tasks outlined in a work arrangement. Design implementation is crucial for the system to be successful. The following is a quick description of the parts needed to operate this system. The necessary hardware components, their quantities, and the prices of the goods are listed in Table

A. Arduino Uno

There are numerous Arduino boards available on the market, including the Arduino Uno, Arduino Due, Arduino Mega, and Arduino Carver. The Arduino Uno contains 20 I/O pins, 14 of which are digital and 6 of which are analogue. There are 54 digital I/O pins, 12 analogue input pins, and 2 analogue output pins on the Arduino Due. The Arduino Mega features 54 digital I/O pins, 16 analogue input pins, and no output pins. The Arduino Carver features 20 digital I/O pins, 12 analogue input pins, and no output pins. To install the system, we typically utilise an Arduino Uno since the pin configuration of this module matches the needs

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of the system and serves as the system's main controller. This is one of the most popular ASCII text file microcontroller boards that support ATmega328p. This microcontroller is the programmable Exploitation Associate of the Nursing Arduino IDE. Nursingd's Associate plays a key role in this system, acting as an interface between sensors and various IoT devices. Figure 2 shows the Arduino Uno model.

Fig. 2 Arduino controller

B. Pulse Sensor (MAX30100)

The MAX30100 sensor measures both pulse rate and blood oxygen saturation level. The SpO2 Pulse Sensor prototype is depicted in Figure 3. (MAX30100). Calculating blood vessel oxygen saturation, or the volume of oxygenated haemoglobin in the blood, is known as saturation of peripheral oxygen (SpO2). Normal SpO2 levels in a human organism range from 90 to 100%. A MAX 30100 pulse oximeter was appropriate for this setup. Precise results are provided by a synchronised beat oximeter and heart rate sensor combination. This sensor is suited for this system because it uses two LEDs, a photo detector, better optics, and low-noise analogue flag processing to distinguish between beat oximetry and heart rate inputs.

Fig. 3 Pulse Sensor (MAX30100)

C. Node MCU

We chose the ESP8266 microcontroller for our system because it has Wi-Fi functionality and the node MCU has a wireless system that can transport data to a server. The node MCU can communicate with the Bluetooth module via an asynchronous receiver-transmitter serial

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communication module. The Node MCU ESP8266 microcontroller can be powered by 3.3 V working voltage and 7 to 12 V input voltage. It has a 4 Mb flash memory and a 64 Kb SRAM. It has one analogue input pin and 16 digital input and output pins. Moreover, the node MCU has a PCB antenna.

Fig. 4 Node MCU ESP8266

The node MCU wireless module sends the detected temperature, oxygen saturation, and pulse rate to the server. This component was chosen because it connects the server IP address to the node MCU, allowing the measured data to be retrieved by a mobile application. The node MCU is an open-source development board with Lua-based firmware. This component, which was designed exclusively for IoT-based applications, is critical to our system. Figure 4 depicts the prototype of the node MCU ESP8266 microcontroller.

D. LCD Display

A well-known alphanumeric LCD display module, or liquid crystal display (LCD), can display both letters and numbers. It has two rows and 16 columns, making it useful in a variety of systems.

Fig. 5 LCD display

This display represented the measured temperature, oxygen saturation, and pulse rate. Each character is displayed in this case as a pixel matrix. The LCD display's working voltage ranges from 4.7 to 5.3 V. If there is no background light, it uses 1 mA of current. The LCD display prototype is shown in Figure 5.

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RESULTS AND DISCUSSION:

In this study, we employed sensors like as temperature, cardiac rate, and spo2 to analyse the patients' health status. The buzzer rings and warns the doctor if the patient's temperature exceeds the preset limit of 99 degrees Fahrenheit, enabling him to save the patient's life in an emergency. The doctor will be informed that the patient's condition is normal if the patient's temperature drops below the cutoff point of 95 degrees Fahrenheit. If the patient's heart rate is higher or lower than the normal range of 60 to 100 beats per minute, they are in danger, and the doctor needs to act right away. So that they can be examined later, we can now know the values of variables like temperature, heart rate, and oxygen levels. The data will be seen on mobile application.

Table -2 Hardware components

S. NO	INPUT	OUTOUT
1	12V Current To LCD	It Display the Values On LCD
2	12V To WIFI MODULE	It Shows Parameter Values On Smart Phone
3	Node MCU ESP8266	Communicate with the Bluetooth module
4	LCD Display	used this display to show the measured pulse rate, oxygen saturation, and temperature
5	Pulse Sensor (MAX30100)	MAX30100 is a sensor that can measure blood oxygen saturation level and pulse rate.
6	Arduino Uno	The Arduino Leonardo has 20 digital I/O pins, 12 analog inputs, and zero output pins
7	Smart Phone	It Shows All The Parameter Values

Fig.6 Hardware implementation kit

The above figure has shown the hardware implementation of proposed project IoT based health monitoring system

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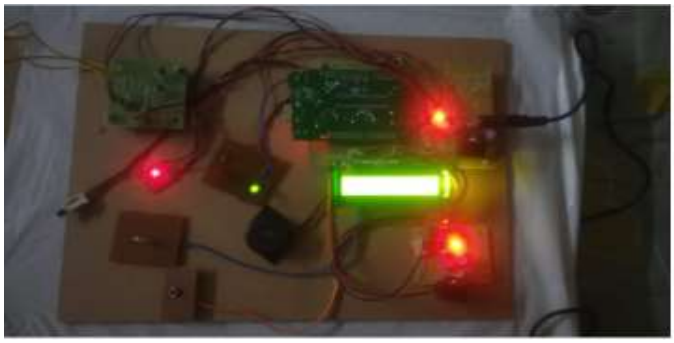

Fig. 7 Prototype of the system

Fig. 8 Measured parameters displayed in LCD

Figures 7 and 8 above illustrate how the proposed project would gather data from temperature and pulse sensors and display it on an LCD as well as a mobile device.

Fig. 9Measured value of user in mobile application

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As seen in the aforementioned data, patient problems can be quickly and readily identified and resolved when compared to current approaches.

CONCLUSION:

The suggested smart health monitoring system makes it simple for doctors to identify each patient's information on a display monitor right there at their office. Assistive paradigms require the real-time health and activity identification provided by wearable sensors. This project provides a quick review of current wearable IoT-based options for monitoring behaviour and health. As it exemplifies a novel health monitoring system framework called WISE that enables real-time monitoring of patients or elderly users and allows information to be accessed from the cloud, a developed IOT smart health monitoring system can be used to track and treat COVID-19 patients without the need for contact.

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FUTURE SCOPE:

In conclusion, this system is crucial for the medical field because it has the potential to extend people's lives all over the world. This system can be upgraded in the future to monitor more physiological aspects of the human body.

REFERENCES:

1. P. Cedillo, C. Sanchez, K. Campos, A. Bermeo, “A systematic literature review on devices and systems for ambient assisted living: Solutions and trends from different user perspectives”, Int. Conf. eDemocracy eGovernment (ICEDEG). 1(1), 59–66 (2018).
2. A.E murabet, A. Abtoy, A. Touhafi, A. Tahiri, and “Ambient assisted living systems models and architectures: A survey of the state of the art”, J. King Saud Univ. Comput. Inf. Sci.1(1), 1–10 (2018).
3. M.W Woo, J. Lee, K. Park, “A reliable IoT system for personal healthcare devices”, Futur. Gener. Comput. Syst.78:, 626–640 (2018).
4. F. Aktas, C. Ceken, Y.E Erdemli, “IoT-based healthcare framework for biomedical applications”, J. Med. Biol. Eng.15:, 1–12 (2017).
5. C. Lin, N. Xiong, J. H. Park, T. Kim, “Dynamic power management in new architecture of wireless sensor networks”, Int J Commun Syst. 22(6), 671–693 (2010).

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved,** **UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022**

6. L. Shu, Y. Zhang, Z. Yu, L. T. Yang, M. Hauswirth, N. Xiong, "Context-aware cross-layer optimized video streaming in wireless multimedia sensor networks", J Supercomput. 54(1), 94–121 (2009).

7. W. Guo, N. Xiong, A. V. Vasilakos, G. Chen, H. Cheng, "Multi-source temporal data aggregation in wireless sensor networks", Wirel. Pers. Commun.56 (3), 359–370 (2018).

8. Y. Qiu, M. Ma, "Secure group mobility support for 6lowpan networks", IEEE Internet Things J.5(2), 1131–1141 (2018).

9. R.S Sinha, Y. Wei, S.-H Hwang, "A survey on lpwa technology: Lora and NB-IoT", ICT Express. 3(1), 14–21 (2017).

10. J. Wan, M O'Grady, M li, M Alaqi, "Time-bouned Activity Recognition for Ambient Assisted Living", IEEE Trans. Emerg. Top. Comput.3 (1), 1–14 (2018).

11. N.G Hallfors, M. Alhawari, M. Abi Jaoude, Y. Kifle, H. Saleh, K. Liao, M. Ismail, A.F Isakovic, Graphene oxide: Nylon ECG sensors for wearable IoT healthcare—nanomaterial and SOC interface. Analog Integr. Circ. Sig. Process.1:, 1–8 (2018).

12. R. Varatharajan, G. Manogaran, M.K Priyan, R. Sundarasekar, "Wearable sensor devices for early detection of alzheimer disease using dynamic time warping algorithm", Clust. Comput.6:, 1–10 (2017).

13. L.E Romero, P. Chatterjee, R.L Armentano, "An IoT approach for integration of computational intelligence and wearable sensors for Parkinson's disease diagnosis and monitoring.",Health Technol.6 (3), 167–172 (2016).

14. D. Dubey, A. Amritphale, A. Sawhney, N. Amritphale, P. Dubey, A. Pandey, "Smart phone applications as a source of information on stroke", J Stroke. 16(2), 86–90 (2014).

15. A. Pal, A. Visvanathan, A.D Choudhury, A. Sinha, in 29th Annual ACM Symposium on Applied Computing. Improved heart rate detection using smart phone (ACMNew York, 2014), pp. 8–13.

16. V. Pigadas, C. Doukas, V.P Plagianakos, I. Maglogiannis, in 4th International Conference on PErvasive Technologies Related to Assistive Environments. Enabling constant monitoring of chronic patient using android smart phones (ACMNew York, 2011), pp. 63–1632.

17. E.Z Piraniy, F. Bulakiwala, M. Kagalwala, M. Kalolwala, S. Raina, "Android based assistive toolkit for alzheimer", Procedia Comput. Sci. 79:, 143–151 (2016).

18. K. Özgür, S. Bromuri, M. Sindlar, T. van derWeide, E.A Pelaez, U. Schaechtle, B. Alves, D. Zufferey, E. Rodriguez-Villegas, M.I Schumacher, K.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

Stathis, COMMODITY 12: A smart e-health environment for diabetes management. J. Ambient. Intell. Smart Environ.5 (5), 479–502 (2013).

19. P. Verma, S.K Sood, S. Kalra, “Cloud-centric IoT based student healthcare monitoring framework”, J. Ambient. Intell. Humanized Comput.116:, 1–17 (2017).

20. S. Sareen, S.K Sood, S.K Gupta, “IoT-based cloud framework to control ebola virus outbreak”, J. Ambient. Intell. Humanized Comput.9:, 1–18 (2016).