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Medi Track: Centralize Appointment, Record and Wellbeing Tracking

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Medi Track: Centralize Appointment, Record and Wellbeing Tracking

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***Abstract*—This system can be used in hospital and even at home for regular maintenance of the patient's health. This allows early diagnosis of the disease. Medi-Track provides a web-based platform for centralized medical information storage and real-time patient monitoring, including hardware devices such as pulse and temperature. Diabetes is a common disease all over the world. Most people use the opposite method to measure blood sugar. This method is painful, contagious and expensive because it creates discomfort in the finger tissues due to frequent finger stinging. Non-invasive technology can detect blood sugar abnormalities. Our aim in this project is to ensure the accuracy of the noninvasive blood glucose meter. Rapid advances in technology have improved surveillance. The system was developed taking into account many factors such as ease of use of the application, cost, accuracy and data security. Additionally, the system was designed to act as an interface between patients and doctors, thus allowing two-way communication. The main purpose of this article is to provide the best healthcare services to people living in remote areas. This article describes a method for managing patient medication and data collection and non-invasive blood glucose monitoring. This paper proposes a method of maintaining the prescription and record of the patient along with an accurate non-invasive glucose measurement method [7].**

***Index Terms*—Health Monitoring, glucose, glucometre, back-end, SpO2.**

I. Introduction

One of the most important medical tests in medicine is measuring heart rate (HR) and blood oxygen saturation (SpO2), which can determine the physical condition of the human body. That's why keeping these medical records is so important. The status of HR and SpO2 level is very important not only for diseases such as COVID-19, but also for serious diseases that affect people's blood vessels and breathing. The development of effective health care monitoring systems taking into account this health information has recently attracted the attention of extensive research.[2] In this study, we design and implement a complete end-to-end system for real-time monitoring of patients' heart rate and SpO2 data; here we use pulse oximeter sensor MAX30102 to collect infrared (IR), beats per minute (BPM).) and SpO2 data taken from the patient's body. Diabetes is a serious and dangerous disease. This is a condition that occurs when the body cannot control blood sugar. Traditional methods of measuring blood sugar in the human body require the patient to prick the finger (prick the skin) to collect blood to determine blood sugar. This method creates problems for diabetics because they have to prick their fingers several times a day to control blood sugar and the pain is severe. Our proposed sensor model will be very simple and cost-effective, which can be used by all patients and non-patients. This paper develops and attempts to demonstrate the design of a non-invasive glucose monitoring device based on spectroscopy that measures glucose in human blood.[1]

II. Design

The model of the product has been tested on real people to determine the glucose level in the blood. user interface. We chose React as the frontend due to its simplicity and performance. At the same time, other members are also dealing with basic problems. We use Node.js and Express.js as maintenance on the backend. We use a database to store patient information. MongoDB accesses this data. We try to pay attention to the security of data when processing it. Security is important to protect a patient's sensitive medical information and ensure that only authorized users can access it. Let's do the disease prediction again. This disease prediction is made by algorithms. Python is the best tool for developing error algorithms. User authentication and authorization are important to ensure that only authorized users can access data. We implement this process using the Express.js middleware and JSON web tokens. Our main mission is to solve the problem of integration of hardware and software. One of the issues we are working on is reducing the error rate of interrupted and uninterrupted blood sugar measurements. We tried to analyze differences in blood glucose measurements and improve the performance of noninvasive blood glucose meters with the help of TCRT5000. To check the pulse and blood oxygen MAX30102 was used. This communication can be done using the ESP32 function. It can also store data for further analysis or transfer it to a backend server for storage and analysis. Backend servers receive data from multiple users (if necessary), aggregate it, and perform further analysis. This may include analysis, negative detection, or integration with other health-related data. .

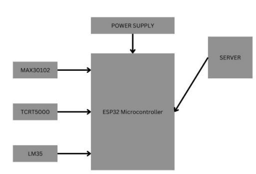


Fig. 1. Fig., Block Diagram

III. Materials and Methods

1. The TCRT5000 and MAX30102 sensors are placed on the fingertip or another suitable part of the body to detect pulse and blood oxygen levels.

2. The ESP32 continuously reads data from these sensors, including pulse rate, blood oxygen levels, and skin temperature.

3. The ESP32 processes this data, possibly performing signal processing and filtering to extract relevant information.

4. The ESP32 then sends this processed data to a software application, typically via a wireless communication protocol such as Wi-Fi or Bluetooth. This communication can be established using the ESP32's built-in capabilities.

5. The software application, running on a computer or mobile device, receives the data from the ESP32 and displays it to the user in a user-friendly format. It may also store the data for further analysis or transmit it to a backend server for storage and analysis. The backend server, if applicable, receives the data from multiple users, aggregates it, and performs further analysis. This could include trend analysis, anomaly detection, or integration with other health-related data sources.

6. The backend server may also provide additional services, such as generating alerts for healthcare professionals in case of abnormal readings or integrating with electronic health record systems.

IV. Proposed System

In this project, we measured the health parameters using sensors like heart sensor, SPo2 sensor in one sensor like MAX30102 sensor, Glucose sensor (TCRT5000), and Temperature Sensor. These sensors are connected to the microcontroller. The measured values are stored in a server. The stored data are retired and updated using the application made using Python, Node Js, CSS, Java script etc. MediTrack is an application used forInternet of Things. Monitoring of bpm, temperature, SPo2 levels and glucose levels of patients makes use of sensor with unique advantage. The system can monitor health parameteres regularly by placing finger on the sensors, and it is low in cost and does not require people on duty. So, the information can be sent conviniently. The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other patient parameters. The operation is simple. The system can be expanded to monitor ECG. It has widespread application and extension value. Proposed System is different than the previous system as it makes use of ESP32 instead of Arduino UNO or ESP8266. This provides proposed system an added advantage of use of more analog sensors as ESP8266 has only one analog pin and as far as arduino UNO is concerned it does not support IoT (Internet of Things). System can measure more parameters than the existing previous system and data is stored in cloud server i.e. in ThingSpeak to provide more methods of data analysis.Thus, given system has more advantages in terms of flexibility and future modifications such as addition of new sensors for more parameter measurement through application.

V. Working

Blood sugar meters currently require a finger prick to draw a blood sample. Non-invasive methods are actively being researched. In this project, the promising ideas utilize SpO2(blood oxygen saturation) data along with the measurements. Blood sugar concentration directly affects how much oxygen red blood cells can deliver to tissues. SpO2 measured by pulse oximeters reflects how well oxygen is binding to hemoglobin,but not necessarily blood sugar levels. In the proposed system, there are sensors like TCRT5000 and MAX30102. MAX30102 is used to measure the SpO2 and pulse. TCRT5000 is used to collect the data on the glucose level. The data is collected by both sensors is then processed in the microcontroller ESP32 which has the inbuilt Wi-Fi and Bluetooth. The data gets processed in the ESP32 by using Machine Algorithms. We observed that for the non-invasive glucometer factors like height and width of the finger as well as the skin color affect the efficiency.

The value of a non-invasive glucometer is measured by the formula :
val = (0.000009)*(sensorValue)*(sensorValue)+(0.1788)*(sensorValue)+49.454

The analog value of the glucometer is as:
Analog value = Normalized/Calibrated Equation

Using the above formula in the algorithm, helps to calculate the glucose value non-invasively.

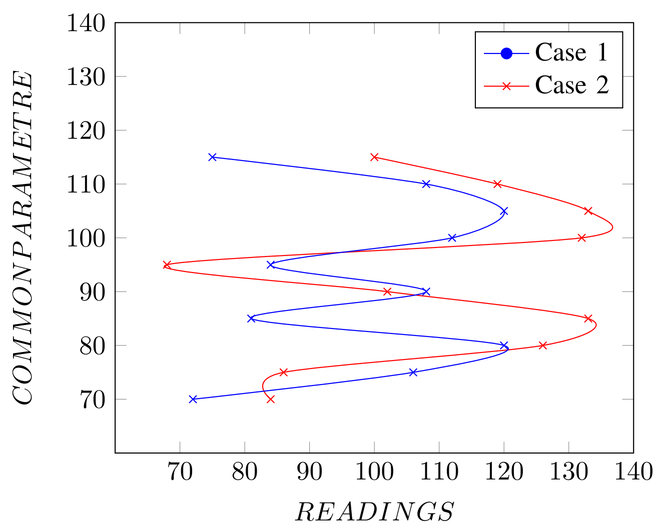
VI. Discussion

The health monitoring system is undoubtedly transforming healthcare. It puts the real-time health data and analyzes the disease. Early detection of potential health problems allows for prompt intervention and treatment and prevents potential serious complications. While working on the backend, we have to deal with the error. It took time to solve the error. When we built the AI module for the disease prediction, we had to search on the libraries of the python. After this, we started to work on machine learning. Software calibration and the Integration of the hardware has been the main task for us. It consumes our time to search for it. For the security of the user-sensitive medical records, User authentication is needed. We need to develop endpoints in the backend API to handle the uploading and storage of medical documents securely. To develop the disease prediction module, we had to deal with machine learning where the AI had to predict the disease of the patient based on the sensor data. After spending time researching, designing, and implementing the non-invasive glucometer. We succeeded in measuring the glucose level in a non-invasive way. When we compared it with the invasive method of glucose meter the difference between the results was greater. At this time, we are working to reduce the difference between the two to get efficiency.

VII. Result

Here, we have proposed a health monitoring system. We validated the system by using the database. This database comprises 10 entries, belonging to the diabetes patient in a non-invasive way. Again, different parameters like temperature, pulse, and heart rate are measured. This system is very helpful as it provides indications to the users about their heart condition, and thereafter they can take a fast action to prevent further complications. The results showed that the proposed system for monitoring different parameters was very effective and reliable, where it could differentiate between normal and abnormal cases. This system is very helpful as it provides indications to the users about their health condition. The data is displayed on the mobile application. This helps to store the patient data securely. Along with medical data, these apps also collect personal information like gender, age, address, and location on the web interface. Generally, glucose value ranges from 70 to 120 mg/dl.

S.No	Invasive method	Non-invasive method	Error
1	84 mg/dl	72 mg/dl	-13
2	86 mg/dl	106 mg/dl	+20
3	126 mg/dl	120 mg/dl	-6
4	133 mg/dl	81 mg/dl	-52
5	102 mg/dl	108 mg/dl	+6
6	68 mg/dl	84 mg/dl	+16
7	132 mg/dl	112 mg/dl	-20
8	133 mg/dl	120 mg/dl	-13
9	119 mg/dl	108 mg/dl	-1
10	100 mg/dl	75 mg/dl	-25



VIII. Future Scope

The scope of the Healthcare Monitoring System encompasses a comprehensive ecosystem designed to monitor and manage various aspects of patient health through the seamless integration of Internet of Things (IoT) technologies. The system's primary focus includes real-time monitoring of vital signs, such as heart rate, blood pressure, and oxygen levels, using medical sensors. Additionally, it extends to remote patient monitoring, enabling healthcare professionals to track patients' health status outside traditional healthcare settings. The system facilitates medication adherence by providing timely reminders and monitoring medication consumption, ensuring patients adhere to prescribed treatment plans. Furthermore, the scope encompasses the collection and analysis of patient activity data, fostering a holistic understanding of individuals' lifestyles and habits. Predictive analytics and machine learning algorithms are employed to anticipate potential health issues, allowing for proactive interventions. Emphasizing data security and privacy, the system complies with healthcare standards and regulations. Overall, the scope of this Healthcare Monitoring System is expansive, aiming to revolutionize healthcare delivery by providing continuous, personalized, and data-driven insights for improved patient outcomes and well-being.

IX. Conclusion

In this study, we proposed a real-time health monitoring system where an MAX30102 sensor was used to collect the IR, SpO2, and BPM data. In the past few decades, there has been an increase in the rate of heart disease, which is very concerning. The high cost of detection and diagnosis along with a lack of facilities are some of the primary reasons why people tend to neglect their heart condition. This situation is particularly bad for people living in remote regions that lack medical facilities. A delay in the diagnosis and treatment could lead to death, and hence, a timely diagnosis of heart conditions is very important. Along with this, Early detection of elevated temperatures in high-risk patients is critical for timely intervention and preventing any deterioration in clinical outcomes. Continuous temperature monitoring devices can enable healthcare professionals to continually track a patient's temperature in both clinical and at-home settings.[8] The main focus of the paper is to demonstrate various techniques with corresponding issues and solutions, along with advancements.

X. References

[1] Haxha, Shyqyri, and Jaspreet Jhoja. "Optical based noninvasive glucose monitoring sensor prototype." IEEE Photonics Journal 8.6 (2016): 1-11.

[2] Ahmed, Md Faisal, et al. "Design and implementation of an occ-based real-time heart rate and pulse-oxygen saturation monitoring system." IEEE Access 8 (2020): 198740-198747.

[3] Badawi, Hawazin Faiz, Fedwa Laamarti, and Abdulmotaleb El Saddik. "ISO/IEEE 11073 personal health device (X73-PHD) standards compliant systems: A systematic literature review." IEEE Access 7 (2018): 3062-3073.

[4] Barata, José Jorge Rodrigues, et al. "Internet of Things based on electronic and mobile health systems for blood glucose continuous monitoring and management." IEEE Access 7 (2019): 175116-175125.

[5] Jiao, Bin. "Anti-motion interference wearable device for monitoring blood oxygen saturation based on sliding window algorithm." IEEE Access 8 (2020): 124675-124687.

[6] Abd El-Hamid, Ahmed S., et al. "Design of digital blood glucose meter based on arduino UNO." International Journal of Software & Hardware Research in Engineering 3.8 (2015).

[7] Hussein, Ahmed Faeq, et al. "An automated remote cloud-based heart rate variability monitoring system." IEEE access 6 (2018): 77055-77064.

[8] Verma, Nishant, et al. "A novel wearable device for continuous temperature monitoring & fever detection." IEEE Journal of Translational Engineering in Health and Medicine 9 (2021): 1-7.

[9] Ahn, Wonsik, and Jin-Tae Kim. "Blood glucose measurement principles of non-invasive blood glucose meter: Focused on the detection methods of blood glucose." Journal of Biomedical Engineering Research 33.3 (2012): 114-127.

[10] Buda, Rose Anak, and M. Mohd Addi. "A portable non-invasive blood glucose monitoring device." 2014 IEEE Conference on Biomedical Engineering and Sciences (IECBES). IEEE, 2014.

[11] Saleh, Gameel, et al. "Design of non-invasive glucose meter using near-infrared technique." Journal of medical engineering technology 42.2 (2018): 140-147.

[12] Ogunsanya, Abiodun O., and Deborah O. Daramola. "Design and Development of a Non-invasive Glucometer System." West Indian Journal of Engineering 44.2 (2022).

[13] Paul, Brince, Melvin P. Manuel, and Zachariah C. Alex. "Design and development of non invasive glucose measurement system." 2012 1st international symposium on physics and technology of sensors (ISPTS-1). IEEE, 2012.

[14] Bachache, Lina Nasseer, Jamal Abduljabar Hasan, and Auns Qusai Al-Neam. "A review: non invasive sensing system for detection glucose level." Journal of Physics: Conference Series. Vol. 1963. No. 1. IOP Publishing, 2021.

[15] Alam, Md Mahbub, et al. "D-care: A non-invasive glucose measuring technique for monitoring diabetes patients." Proceedings of International Joint Conference on Computational Intelligence: IJCCI 2018. Springer Singapore, 2020.

[16] Rodin, Dmitry, et al. "Comparative accuracy of optical sensor-based wearable system for non-invasive measurement of blood glucose concentration." Clinical biochemistry 65 (2019): 15-20.

[17] Lin, Tamar, et al."Non-invasive glucose monitoring: a review of challenges and recent advances." Curr. Trends Biomed. Eng. Biosci 6.5 (2017): 1-8.