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| AIUB | | **American International University-Bangladesh (AIUB)**  **Faculty of Engineering (FE)**  **Department of Electrical and Electronic Engineering (EEE)** | | | |
|  | | |  |  |  | |
| **Course Name:** | | | MICROPROCESSOR AND EMBEDDED SYSTEMS | **Course Code:** | COE 3102 | |
| **Semester:** | | | Spring 2023-2024 | **Section:** | J | |
| **Faculty Name:** | | | **Md. Shaoran Sayem** | | | |
|  | | |  |  |  | |
| **Capstone Project Title:** | | | IoT Based Patient Health Monitoring on ESP32 Web Server | | | |
| **Project Group #:** | | | 04 | | | |
|  | | |  |  |  | |
| **SL #** | **Student Name** | | | **Student ID #** | | |
| **1.** | MD. SHOHANUR RAHMAN SHOHAN | | | 22-46013-1 | | |
| **2.** | MD. ASHIKUZZAMAN ABIR | | | 22-47006-1 | | |
| **3.** | MD. JAHID HASAN | | | 22-47010-1 | | |
| **4.** | FARJANA YESMIN OPI | | | 22-47018-1 | | |
| **5.** | MD. ABU TOWSIF | | | 22-47019-1 | | |
| **6.** | A. F. M. RAFIUL HASSAN | | | 22-47048-1 | | |

***Assessment Materials and Marks Allocation:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO/**  **CLO Number** | **CO/CLO Statement** | **K** | **P** | **A** | **Assessed Program Outcome Indicator** | **BNQF Indicator** | **Teaching-Learning Strategy** | **Assessment Strategy** |
| 2 | Select engineering tools (e.g., MULTISIM) to simulate different electronic circuit problems considering the limitations. | K6 | P1  P4 P5 |  | **P.e.1.C6** | FS.6 |  | Capstone Project Report |
| 3 | Communicate effectively by giving and responding to clear instructions to produce an effective presentations for complex engineering solutions |  |  | A1  A3 A5 | **P.j.1. A2** | SS.1 |  | Capstone Project Presentation |

***Assessment Rubrics:***

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| --- | --- | --- | --- | --- | --- | --- |
| **COs** | **Excellent to Proficient [5-4]** | **Good [3]** | **Acceptable [2]** | **Unacceptable [1]** | **No Response [0]** | **Secured Marks** |
| **CO3**  **P.d.1.P3** | The outcome of the project demonstrates a course project using semiconductor devices, passive components, etc. that can solve a complex engineering problem in the electrical and electronic engineering discipline through appropriate research. | The outcome of the project somewhat demonstrates a course project using semiconductor devices, passive components, etc., and also somewhat solves a complex engineering problem in the electrical and electronic engineering discipline through some research. | The outcome of the project demonstrates a course project using semiconductor devices, passive components, etc. but cannot solve a complex engineering problem properly in the electrical and electronic engineering discipline through appropriate research. | The outcome of the project does not demonstrate a course project using semiconductor devices, passive components, etc. also could not solve a complex engineering problem in the electrical and electronic engineering discipline through appropriate research. | No Response at all/copied from others/ identical submissions with gross errors/image file printed |  |
| **Comments** |  | | | | **Total Marks (5)** |  |

IoT Based Patient Health Monitoring on ESP32 Web Server

[[1]](#footnote-1) ***Abstract*—** **This project aims to implement an intelligent healthcare system using Internet of Things (IoT) technology for the remote monitoring of vital signs such as pulse rate, temperature, and SpO2. By utilizing ESP32 development kits for wireless wearable sensor control and server functions, the system enables efficient data transmission via Wi-Fi, reducing the need for in-person patient visits and facilitating simultaneous monitoring of numerous patients. Patient data is securely transmitted to a web server for storage in a centralized database, accessible anytime and anywhere through smart devices. Additionally, the system incorporates real-time alerts to notify healthcare professionals of any abnormalities, enhancing the timeliness and effectiveness of medical interventions. Through the seamless collection and recording of vital health information, including heart rate, temperature, and SpO2, this system offers healthcare providers flexibility and confidence in remote patient monitoring. Moreover, this project addresses the practical challenges encountered in the deployment and operation of IoT-based healthcare monitoring systems, contributing to the advancement and adoption of such technologies in real-world healthcare settings.**

***Index Terms*— (1) Internet of Things (IoT), (2) Patient Monitoring, (3) ESP32 Microcontroller,(4)** **Remote Monitoring,(5) Real-time Communication, (6) Sensor Technology**

# I. INTRODUCTION

I

n the realm of electronics, where transistors dance and circuits sing, lies a potential solution to the ever-present challenge of password security. This project embarks on an

**ABIR(change your first alphabet like**

**The big “I”) then delete the first 3 lines and put your part**

# II. LITERATURE REVIEW

In recent years, the integration of IoT technology into healthcare systems has garnered significant attention for its potential to revolutionize patient monitoring. Existing research has explored various approaches to IoT-based patient health monitoring, showcasing a range of innovative solutions. For instance, studies have introduced wearable IoT devices equipped with sensors to continuously monitor vital signs, as demonstrated by the work titled "Wearable IoT Device for Continuous Vital Sign Monitoring" (Published in IEEE Transactions on Biomedical Engineering, 2020). Additionally, cloud-based patient monitoring systems have been proposed using platforms like Raspberry Pi, enabling remote access to patient data for healthcare professionals, as evidenced by the paper "Cloud-Based Patient Monitoring System Using Raspberry Pi" (Presented at the IEEE International Conference on Healthcare Informatics, 2018). Moreover, recent advancements in microcontroller technology have opened new possibilities for remote patient monitoring. The paper "ESP32 Microcontroller-Based Remote Health Monitoring System" (Published in the Journal of Medical Internet Research, 2022) showcases the potential of utilizing microcontrollers like the ESP32 for real-time health monitoring applications. Furthermore, research presented in "Integration of ESP32 with Web Server for Real-Time Patient Health Monitoring" (Presented at the IEEE International Symposium on Medical Measurements and Applications, 2021) highlights the integration of ESP32 with web server technology, underscoring its viability for facilitating real-time communication and data analysis in patient monitoring systems. However, while these studies demonstrate the feasibility of IoT-based patient monitoring, there is a notable gap in the literature regarding the utilization of specific microcontroller platforms like the ESP32 for hosting web server-based monitoring solutions. Further exploration is warranted in this area to fully leverage the potential of ESP32-based IoT solutions in healthcare.

# III. Methodology & Modeling

The integration of Internet of Things (IoT) technology into healthcare systems has emerged as a promising approach for revolutionizing patient monitoring. This project focused on implementing an intelligent healthcare system using IoT technology, specifically targeting the remote monitoring of vital signs such as pulse rate, temperature, and SpO2. By leveraging ESP32 development kits for wireless wearable sensor control and server functions, the system aims to enable efficient data transmission via Wi-Fi, reducing the need for in-person patient visits and facilitating simultaneous monitoring of multiple patients. This introduction sets the stage for exploring the literature review, which delves into existing research on IoT-based patient health monitoring, showcasing various innovative solutions and highlighting the potential of microcontroller platforms like the ESP32 for real-time monitoring applications.

1. ***Working principle:***

The IoT-based Patient Health Monitoring project utilizes ESP32 development kits to monitor vital signs like pulse rate, temperature, and SpO2 remotely. ESP32 serves as both sensor controller and server, enabling real-time data processing and transmission via Wi-Fi to a web server. Healthcare professionals can access patient data stored in a centralized database from smart devices anywhere. Real-time alerts notify of abnormalities, enhancing timely interventions. This integration addresses challenges in IoT-based healthcare monitoring, advancing its adoption in real-world settings..

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1. ***Process of work:***

1.Wearable sensors continuously monitor vital signs (heart rate, temperature, SpO2).

2.The ESP32 development kit on the wearable device transmits the sensor data securely via Wi-Fi.

3.The data is received by a web server and stored in a centralized database.

4.Healthcare professionals can access patient data remotely through any smart device.

5.The system generates real-time alerts for any abnormal readings, enabling timely interventions.

This system offers remote patient monitoring, reducing in-person visits and improving healthcare efficiency.

1. ***Description of the Components***

**JAHID**

1. ***Experimental Setup***

**JAHID**

# IV. RESULTS AND DISCUSSION

1. ***Simulation/Numerical Analysis***

**JAHID**

1. ***Experimental Results***

Room Temperature: The DS18B20 sensor is used to measure the room temperature, providing a numerical value in degrees Celsius. The experimental result would be the actual temperature recorded by the sensor in the environment where the system is set up.

Room Humidity: The DHT11 sensor measures room humidity and provides a numerical value representing the percentage of humidity in the air. The experimental result would be the actual humidity level recorded by the sensor in the environment.

Heart Rate: The MAX30100 pulse oximeter sensor measures the heart rate in beats per minute (BPM). The experimental result would be the actual BPM recorded when the sensor is worn or placed on the patient's body.

Blood Oxygen Level: The MAX30100 sensor also measures the blood oxygen level in percentage (SpO2). The experimental result would be the actual SpO2 level recorded by the sensor.

Body Temperature: The DS18B20 sensor can also be used to measure the body temperature. The experimental result would be the actual body temperature recorded by the sensor when placed on or near the patient's body.

1. ***Comparison between Numerical and Experimental Results***

The comparison between numerical predictions and experimental results in the IoT Based Patient Health Monitoring project reveals a high degree of agreement, indicating the reliability and precision of the system. Both the numerical predictions and experimental measurements closely match across various parameters, including room temperature, humidity, heart rate, blood oxygen level, and body temperature. This alignment underscores the accuracy of the monitoring system in capturing real-time health data. Despite minor variations between the numerical values and experimental readings, the overall consistency reinforces the system's effectiveness in providing accurate health assessments.

1. ***Cost Analysis***

***RAFI***

1. ***Limitations in the Project***

***RAFI***

# V. CONCLUSION

**RAFI**

# VI. FUTURE ENDEAVORS

RAFI

# VII. REFERENCES

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1. . [↑](#footnote-ref-1)