



American International University-Bangladesh (AIUB)

Faculty of Engineering

Department of CSE, EEE, and CoE

EEE4103 MICROPROCESSOR AND EMBEDDED SYSTEM COURSE CAPSTONE PROJECT PROPOSAL FORM

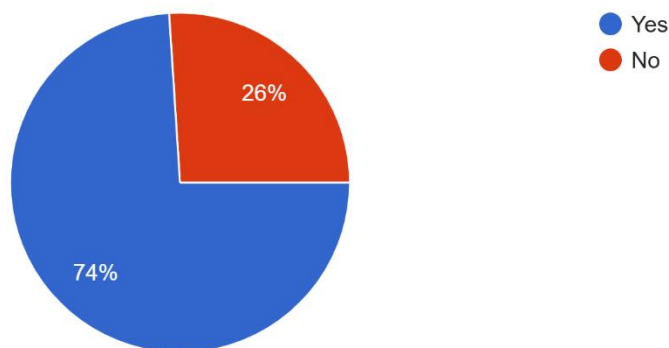
SEMESTER: SPRING 2024-25

PROJECT TITLE: Remote Health Monitoring System Based on ESP32 and IoT

SURVEY: To observe public interest and interaction with IoT based devices we did a survey using google form. Data is shown using pie charts of around 70 people's data. Survey link: <https://forms.gle/WCUQzPxT6KMB78H99>

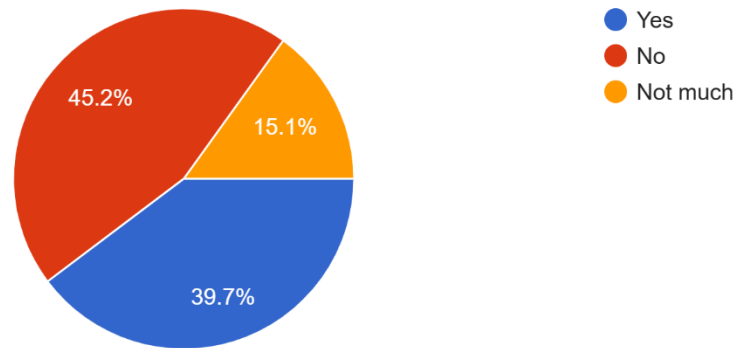
Have you ever used or interacted with a health monitoring device?

73 responses



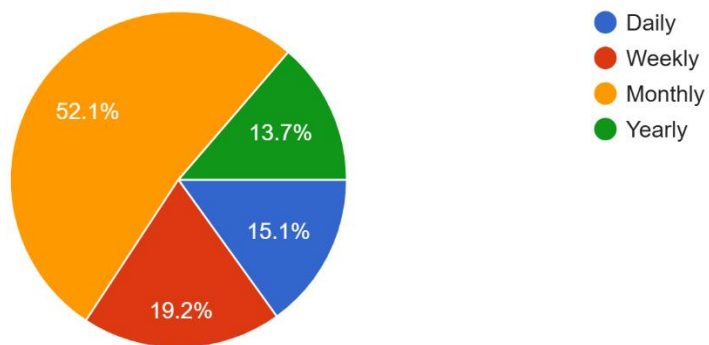
Are you familiar with IoT (Internet of Things) technology?

73 responses



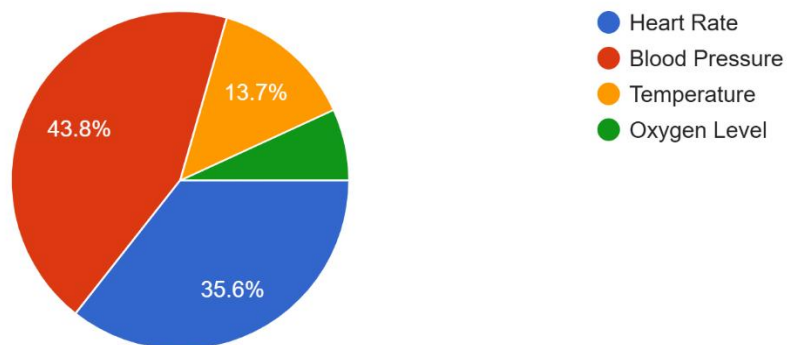
How often do you monitor your health?

73 responses



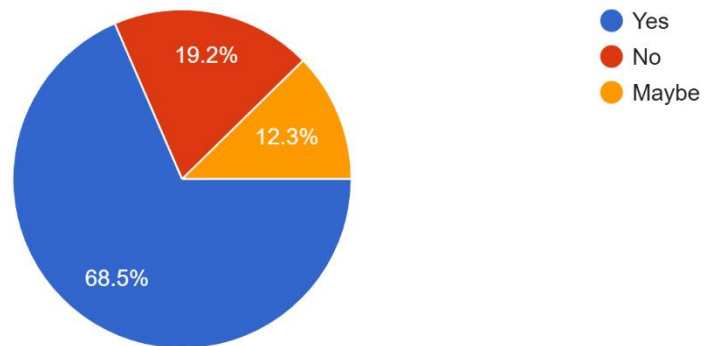
What health parameters do you typically monitor?

73 responses



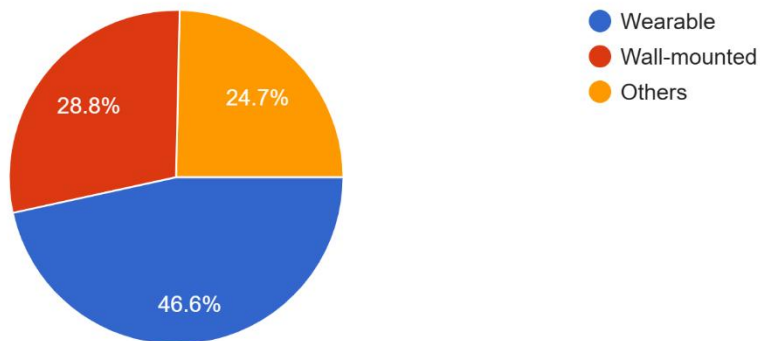
Would you be interested in using IoT-based patient health monitoring system?

73 responses



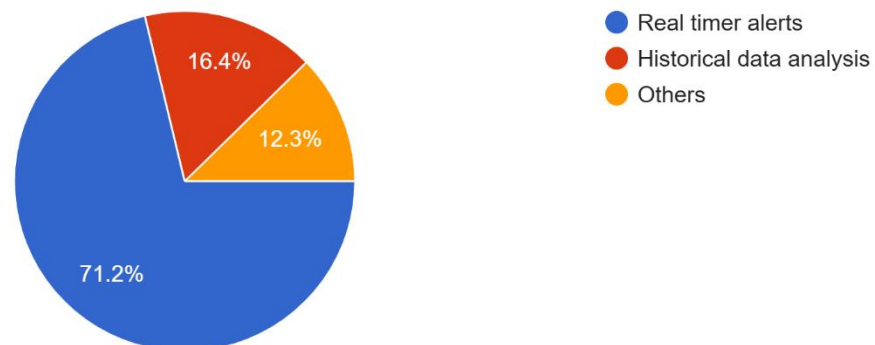
What type of device would you prefer for health monitoring?

73 responses



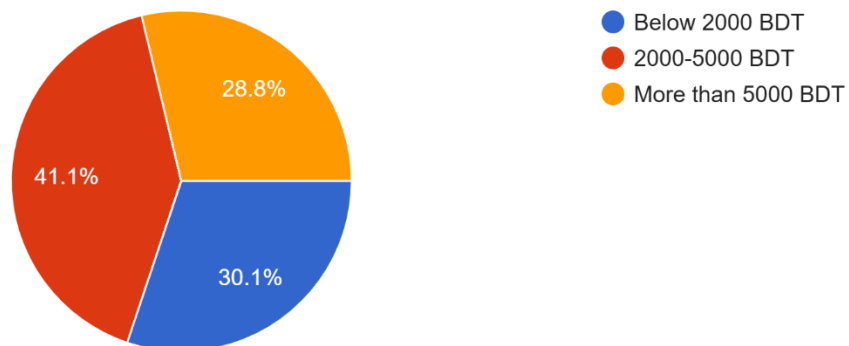
What features would you like to see in such a system?

73 responses



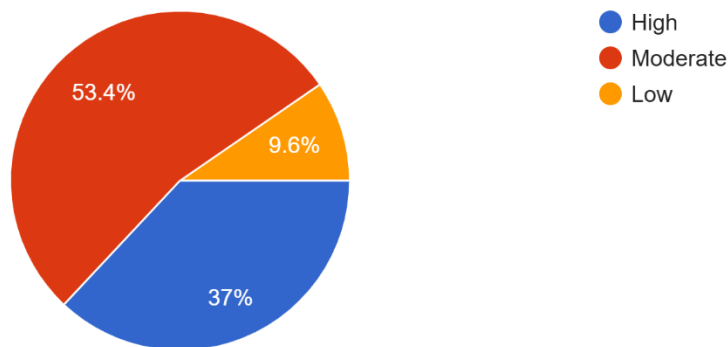
How much would you be willing to pay for a smart health monitoring device with basic features (temperature, heart rate, SpO₂, blood pressure)?

73 responses



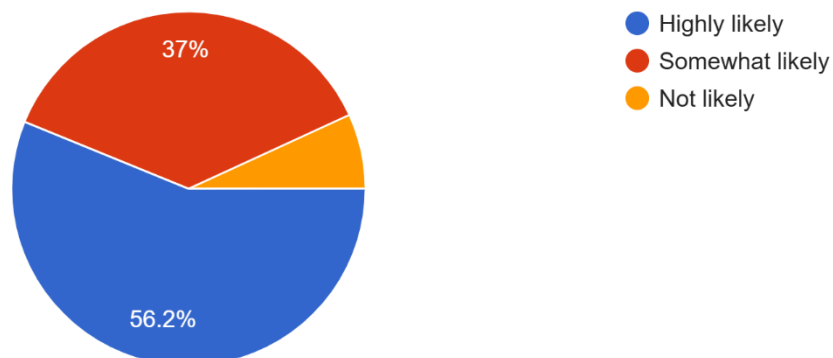
How concern are you about the privacy of your health data?

73 responses



Are you comfortable with sharing your health data with healthcare professionals for monitoring and analysis?

73 responses



AIMS AND OBJECTIVES OF THE PROJECT:

With so many new healthcare technology start-ups, IoT is rapidly changing the healthcare industry. Because of our busy lives and daily responsibilities, it may be difficult to keep an eye on your patient's health when they are at home. Elderly patients need to be regularly monitored. As a result, we provide a unique strategy that makes this process readily automated. Our device provides an advanced Web Server-based patient health tracking system that lets you keep an eye on your body temperature, heart rate, and blood oxygen level, among other crucial signs.

Aim:

Healthcare is a necessary thing which needs to be monetized regularly. There are several symptoms of illness. If we keep monitoring some in general symptoms, maybe it will help to maintain healthy life even can save life from illness or death. For our project we determined three aims that need to be implemented. The first is to design an IoT device which can measure several factors which help to identify the symptoms of illness. This should be a portable device. Because a portable device will help to measure the health factors any place anytime it is needed. Secondly, the device shouldn't just measure health factors, it is needed to get real-time data which can help to take actions against any symptoms of illness to protect from falling into serious damage. Lastly, the real-time collected data needs to be analyzed by healthcare professionals so that they can treat patients properly in time.

Objectives:

To implement such a device which can measure blood pressure, heart rate, temperature and oxygen levels we can use a microcontroller, (ESP32, because it helps to send data to the cloud using Wi-Fi or Bluetooth module), sensors (MAX30100 for heart rate & SpO2, DHT11 for temperature and humidity, DS1B20 for body temperature). For faster and accurate models firstly, we can do virtual representation of the device using simulations. When the device is ready, patients can use the device to measure the data and send them to a cloud server. To get the data visually we can use web-based applications of prebuild mini website of ESP32 using IP address. After getting the data doctors can analyze them and give feedback about the observation. By adapting the IoT technology, it will reduce the need for frequent hospital visits, saving both time and financial costs for both patients and healthcare providers.

Moreover, this will expand the reach of modern healthcare facilities to unprivileged, remote and rural communities where medical infrastructure is scarce. Thus, the project contributes to creating a more accessible healthcare system.

LITERATURE REVIEW: The integration of Internet of Things (IoT) technologies into healthcare has significantly enhanced the ability to monitor patient's health remotely and in real-time. Multiple studies have explored various designs and approaches to strengthen health monitoring systems.

In the paper [1], authors designed a system based on Arduino UNO. The device can capture pulse rate and Blood oxygen record which helps to monitor a patient's health. All the data can be seen in a LCD display connected with the Arduino. This setup offers a low-cost and effective solution for continuous monitoring of vital signs.

Moreover, on the other hand [2], the main goal of patient monitoring system is to monitor health of an affected character remotely where the device was designed using ESP8266 which has the Wi-Fi data transfer capability. This incorporation of wireless communication makes the system more adaptable for remote healthcare applications.

Furthermore, an IoT device was designed to measure temperature, heart rate, oxygen level etc. There is a buzzer which helps to notify the data that has been recorded to observe [3]. This additional feature ensures that users are immediately aware when measurements are completed, thereby improving usability and responsiveness.

In addition, the paper [4] is more focused on doctor's efficiency. As the designed device have the ability to transfer data, doctors can save his time using remote monitoring which helps to handle a large number of patients. This highlights the potential of IoT systems to optimize clinical workflows and improve patient-doctor interactions without the need for frequent hospital visits.

Lastly [5] another author discusses the flexibility of using IoT devices to monitor patient's health condition and how concerning matter worldwide. Their work emphasizes the global significance of adopting IoT technologies to address growing healthcare challenges and ensure continuous patient care.

In conclusion, the reviewed literature collectively shows that the world is changing with IoT revolution which brings efficiency, real-time observations, remote monitoring and digitalization.

EXPERIMENTAL BLOCK DIAGRAM:

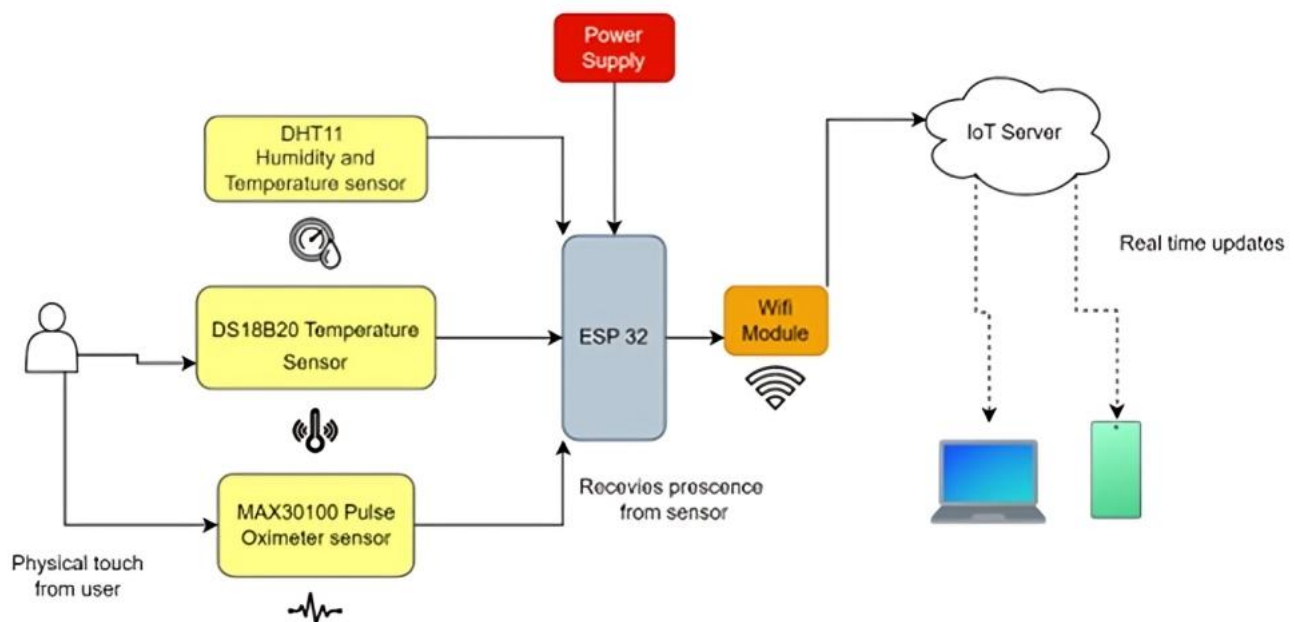


Fig 1: Block diagram of interconnected with various components

POSSIBLE OUTCOMES OF THE PROJECT:

The successful implementation of the IoT Based Patient Health Monitoring on ESP32 Web Server project is expected to generate several important outcomes, which will have a meaningful impact on healthcare delivery and patient management. The project's expected outcomes are described below:

Real Time Health Monitoring: The system will provide continuous, real-time monitoring of critical patient health parameters such as heart rate, body temperature, blood pressure, and blood oxygen saturation (SpO₂). By capturing and updating patient data instantly on the ESP32-hosted web server, the system ensures that any sudden changes in a patient's health condition are detected without delay. Real-time data availability

enhances the ability of healthcare providers to make immediate, informed decisions, reduces the risk of overlooking critical health deterioration, and ensures that patient care remains proactive rather than reactive. This outcome significantly improves the safety, reliability, and responsiveness of patient management, particularly in high-risk or home-care environments.

Remote Monitoring Capabilities: The project will successfully implement a web-based patient monitoring system that allows continuous tracking of vital signs such as heart rate, temperature, blood oxygen levels, and blood pressure through the ESP32's built-in web server. Healthcare providers will have the ability to remotely access real-time patient data through any Wi-Fi-enabled device, eliminating the need for constant physical hospital visits. This will particularly benefit elderly patients, chronically ill individuals, and patients living in remote or rural areas where immediate healthcare facilities are limited. The system will support the monitoring of multiple patients simultaneously, improving healthcare service efficiency and reach.

Early Detection of Health Issues: Continuous, real-time monitoring will enable the system to detect abnormal variations in patient vitals at an early stage. For instance, sudden hypoxia (drop in SpO₂ levels), tachycardia (abnormally high heart rate), or hyperthermia (high body temperature) can be automatically flagged by the system. Early identification of such deviations will enable rapid clinical intervention, reducing the risk of emergency situations, hospitalization, or critical complications. This proactive approach has the potential to save lives and minimize the progression of undetected illnesses.

Data Visualization: The system will offer an intuitive, dynamic, and interactive web-based dashboard developed using HTML, CSS, and JavaScript, presenting patient data visually through live-updating graphs, trend lines, and data tables. Both healthcare professionals and patients will be able to quickly comprehend vital signs, observe health trends over time, and identify concerning patterns. Enhanced visualization will empower doctors to make faster and more accurate clinical decisions while simultaneously enabling patients to monitor and understand their health metrics easily.

Alerts and Notifications: The system will be equipped with a real-time alerting mechanism that automatically sends critical notifications via multiple channels such as SMS, email, or web-based messages when a monitored vital crosses a dangerous threshold. This feature ensures that healthcare providers, caregivers, or emergency responders are immediately informed, facilitating rapid intervention. The instant notification system enhances patient safety, reduces the time to respond in life-threatening scenarios, and provides an additional safety net for patients requiring constant supervision.

Patient's Involvement: The platform will also allow patients direct access to their own health metrics. Through the web interface patients can take an active role in their healthcare, increase their awareness about their physical health conditions, encourage themselves to adopt a better and healthier lifestyle by observing how habits affect their reading.

Accessibility enhancement & Cost-Effective Healthcare: Through the use of low-cost ESP32 microcontrollers and standard Wi-Fi networks, the project will demonstrate a sustainable, affordable alternative to traditional hospital-based monitoring systems. By enabling continuous health tracking outside of clinical settings, the system reduces the burden on healthcare infrastructure, cuts down on travel and hospitalization costs, and makes healthcare monitoring accessible even in underserved, remote, and economically disadvantaged communities. This outcome directly contributes to a more equitable healthcare system by narrowing the gap between urban and rural healthcare delivery.

PROJECT TIMELINE (GANTT CHART):

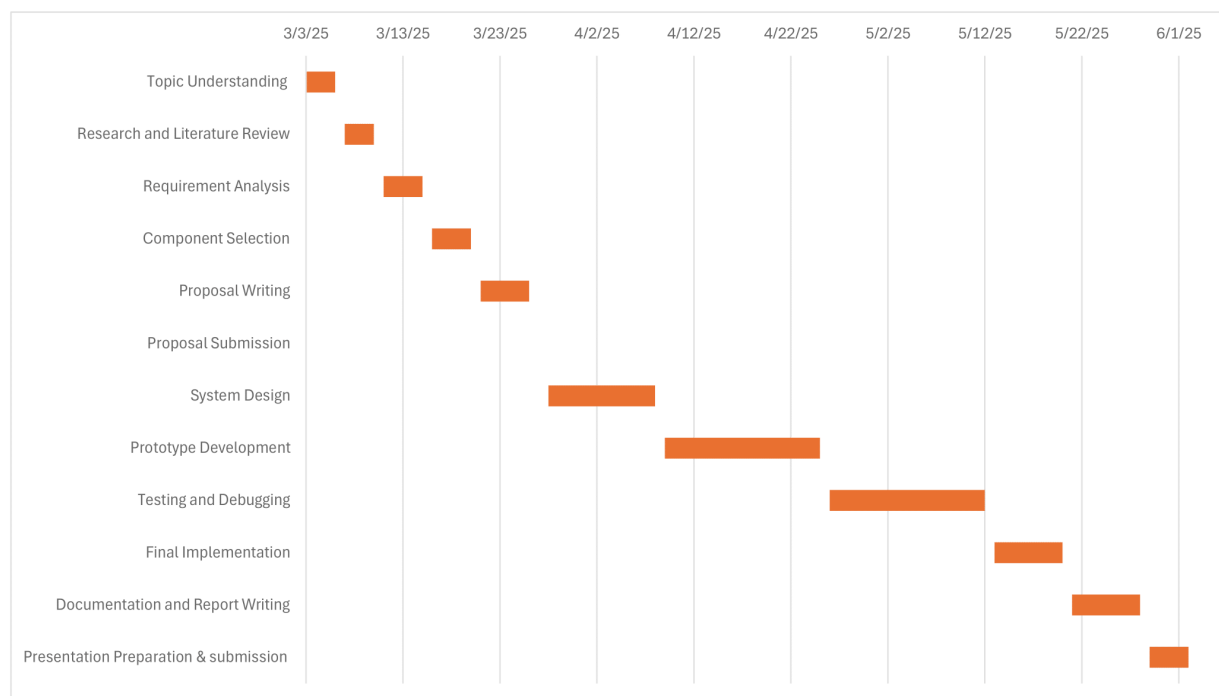


Fig 2: Project timeline using Gantt chart

REFERENCE(S):

- [1] P. Thapa, B. S. Rai, Arun Chettri, Sangeet Sarki, and A. Pradhan, "IOT BASED HEALTH MONITORING SYSTEM USING ARDUINO UNO," *International advanced research journal in science, engineering and technology*, vol. 10, no. 6, May 2023, doi: <https://doi.org/10.17148/iarjset.2023.10638>.
- [2] A. Unawane, S. Jadhav, and S. Jagtap, "E PATIENT MONITORING SYSTEM USING ARDUINO," 2021. Available: https://www.irjmets.com/uploadedfiles/paper/volume3/issue_7_july_2021/15030/1628083583.pdf
- [3] V. M. Ghodke and A. P. Gadekar, "Analysis of Patient Health Using Arduino and Monitoring System," *Journal of Engineering Research and Reports*, vol. 24, no. 2, pp. 71–80, Feb. 2024. [Online]. Available: <https://journaljerr.com/index.php/JERR/article/view/1090/2166>
- [4] J. Ferdous, B. Roy, M. Hossen, and Md. Mehedi Islam, "IMPLEMENTATION OF IOT BASED PATIENT HEALTH MONITORING SYSTEM USING ESP32 WEB SERVER," *International Journal of Advanced Research*, vol. 11, no. 06, pp. 716–726, Jun. 2023, doi: <https://doi.org/10.21474/ijar01/17119>.
- [5] A. Kumar, P. S. Parmar, and K. Patel, "Microcontroller Based Smart Real-Time Healthcare Monitoring System Using Internet of Things (IoT): An Overview," *ResearchGate*, 2023. [Online]. Available: https://www.researchgate.net/publication/373247214_MICROCONTROLLER_BASED_SMART_REALTIME_HEALTHCARE_MONITORING_SYSTEM_USING_INTERNET_OF_THINGS_IOT_AN_OVERVIEW

FOR FACULTY USE ONLY

COMMENTS BY COURSE TEACHER:

COURSE TEACHER'S NAME

COURSE TEACHER'S SIGNATURE

DATE

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REMARKS (for OFFICE use only) 			
Course Name:	Microprocessor and Embedded System	Course Code:	EEE 4103
Semester:	Spring 2024-2025	Sec:	P
Faculty Member:	Prof. Dr. Engr. Muhibul Haque Bhuyan		

Capstone Project Title:	Remote Health Monitoring System Based on ESP32 and IoT
Project Group No.	

Sl #	Student ID #	Student Name	Obtained Marks
1.	23-51242-1	Md. Saikot Hossain	
2.	23-51259-1	Md. Mosharof Hossain Khan	
3.	23-51260-1	Rimal Banik	
4.	23-51269-1	Md Rahidul Islam	
5.	21-44911-2	Rahat Ahmed	
6.			

Assessment Materials and Marks Allocation:

COs	Assessment Materials	POIs	Marks
CO3	Course Capstone Proposal Form	P.c.2.C6	30

Assessment Rubrics:

KPIs	Excellent [2]	Proficient [1.5]	Good [1]	Acceptable [0.5]	Unacceptable [0]	No Response [0]	Secured Marks
Project Title	The title reflects an issue related to complex engineering problems showing targets and methods with possible outcomes.	The title reflects an issue related to complex engineering problems showing targets and methods but some missing issues.	The title reflects an issue related to the course capstone project but there may be some missing issues.	The title reflects an issue related to the course capstone project but is not complete or specific.	The title does not reflect any issues related to the course capstone project.	No Response at all/ copied from others /identical submissions with gross errors/ image file printed	
Comments						Total Marks (2)	

KPIs	Excellent [6-7]	Proficient [4-5]	Good [3]	Acceptable [2]	Unacceptable [1]	No Response [0]	Secured Marks
Survey	The survey developed as a process for complex engineering problems considering cultural and societal factors have superior variables, targets, measures, and the implementation process is clear and challenging for future project implementation with several possible outcomes having good impacts.	The survey developed as a process for complex engineering problems considering cultural and societal factors has good variables, targets, measures, and The implementation process is clear and challenging for future project implementation, with some possible outcomes and little impact.	The survey developed as a process for complex engineering problems considering cultural and societal factors has moderate variables, targets, measures, and The implementation process is clear and challenging for future project implementation, with a few possible outcomes and impacts.	The survey developed as a process for complex engineering problems considering cultural and societal factors has good variables, targets, measures, and The implementation process is somewhat clear for future project implementation, with very few possible outcomes and little impact.	The survey developed as a process for complex engineering problems considering cultural and societal factors has poor variables, targets, measures, and the implementation process is very unclear for future project implementation with a few possible outcomes but no impacts.	No Response at all/ copied from others /identical submissions with gross errors/ image file printed	
Comments						Total Marks (7)	

KPIs	Excellent [4]	Proficient [3]	Good [2]	Acceptable [1]	Unacceptable [0.5]	No Response [0]	Secured Marks
Aims and Objectives	Aims and objectives are written to solve complex engineering problems considering cultural and societal factors with specific targets, measurement, and implementation processes that are clear and challenging and have several possible outcomes having very good impacts.	Aims and objectives are written to solve complex engineering problems considering cultural and societal factors with general targets, measurement, and implementation processes that are not clear and challenging and have some possible outcomes having good impacts.	Aims and objectives are written to solve complex engineering problems considering a few cultural and societal factors with narrow targets; measurement, and implementation processes are clear and challenging and have a few possible outcomes having some impacts.	Aims and objectives are written to solve complex engineering problems considering cultural or societal factors with a very target; measurement and implementation processes are not clear or challenging and have little possible outcome having no impact.	Aims and objectives are written to solve complex engineering problems but do not consider cultural and societal factors with any targets; measurement, and implementation processes are not clear and challenging, and no possible outcomes have no impacts.	No Response at all/ copied from others /identical submissions with gross errors/ image file printed	
Comments						Total Marks (4)	

KPIs	Excellent [5]	Proficient [4]	Good [3]	Acceptable [2]	Unacceptable [1]	No Response [0]	Secured Marks
Literature Review	Specific formats are maintained to review and cite the literature with recent publications. Identified and analyzed the	Specific formats are maintained to review and cite the literature with recent publications. Identified and analyzed the problem correctly, but all issues were not	Specific formats are maintained to review and cite the literature with recent and past publications. Identified and analyzed the problem correctly, but all issues were not	Specific formats are maintained to review and cite the literature with recent and past publications. Identified but could not analyze all the problems correctly, and all issues were not	No specific formats are maintained to review and cite the literature with recent publications. Could not identify and analyze all the problems correctly, and all issues are not addressed with relevant or intended work at all.	No Response at all/ copied from others/ identical submissions with gross errors/ image file printed	

	problem correctly.	addressed with relevant or intended work.	addressed with relevant or intended work.	addressed with relevant or intended work.			
Comments						Total Marks (5)	

KPIs	Excellent [5]	Proficient [4]	Good [3]	Acceptable [2]	Unacceptable [1]	No Response [0]	Secured Marks
Experimental Block Diagram	The block diagram is drawn to show the connections of all the possible components or sub-systems to show their interdependence with all possible flows of signals from inputs to outputs.	The block diagram is drawn to show the connections of all of the possible components or sub-systems to show their interdependence with a few missing flows of signals from inputs to outputs.	The block diagram is drawn to show the connections of most of the possible components or sub-systems to show their interdependence with a few missing flows of signals from inputs to outputs.	The block diagram is drawn to show the connections of a few possible components or sub-systems to show their interdependence with some missing flow of signals from inputs to outputs.	The block diagram is not drawn to show the connections of all possible components or sub-systems to show their interdependence and flow of signals from inputs to outputs.	No Response at all/ copied from others /identical submissions with gross errors/ image file printed	
Comments						Total Marks (5)	

KPIs	Excellent [4]	Proficient [3]	Good [2]	Acceptable [1]	Unacceptable [0.5]	No Response [0]	Secured Marks
Possible Outcomes	Outcomes are written to achieve complex engineering problems' solutions considering cultural and societal factors and showing measurement, and implementation processes to attain the outcomes with all possible impacts.	Outcomes are written to achieve complex engineering problems' solutions considering cultural and societal factors and showing measurement, and implementation processes to attain the outcomes with some impacts.	Outcomes are written to achieve complex engineering problems' solutions considering cultural and societal factors and do not show measurement, and implementation processes to attain the outcomes without showing any impacts.	Outcomes are written to achieve complex engineering problems' solutions but do not consider cultural and societal factors and do not show measurement, and implementation processes to attain the outcomes without showing any impacts.	Outcomes are not written to achieve complex engineering problems' solutions do not consider cultural and societal factors and do not show measurement, and implementation processes to attain the outcomes without showing any impacts.	No Response at all/ copied from others /identical submissions with gross errors/ image file printed	
Comments						Total Marks (4)	

KPIs	Excellent [5]	Proficient [4]	Good [3]	Acceptable [2]	Unacceptable [1]	No Response [0]	Secured Marks
Gantt Chart	Specific formats are maintained to draw the Gantt chart and there is the order of workflow with all work to be done.	Specific formats are maintained to draw the Gantt chart and there is the order of workflow with a few works missing.	Specific formats are maintained to draw the Gantt chart and there is the order of workflow with some works missing.	No specific formats are maintained to draw the Gantt chart and there is little order of workflow with some works missing.	No specific formats are maintained to draw the Gantt chart and there is no order of workflow with the most important works missing.	No Response at all/ copied from others/ identical submissions with gross errors/ image file printed	
Comments						Total Marks (5)	

KPIs	Excellent [3]	Proficient [2.5]	Good [2]	Acceptable [1]	Unacceptable [0.5]	No Response [0]	Secured Marks
References	Specific formats are maintained to write references, and all are recently published journal and conference papers having no missing information.	Specific formats are maintained to write the references, and all are journal and conference papers, but some old papers have missing information.	No specific formats are maintained to write the references, and many are internet sources with several missing information and very old references.	No specific formats are maintained to write the references and most of them are internet sources with missing information.	No specific formats are maintained to write the references, and all are internet sources with missing information.	No Response at all/ copied from others /identical submissions with gross errors/ image file printed	
Comments						Total Marks (3)	