



# 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 2023-2024**

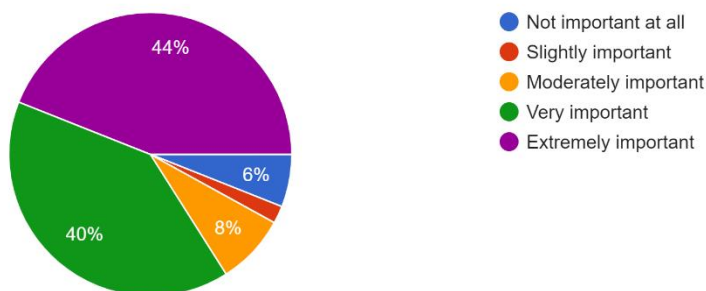
**PROJECT TITLE:** Smart Soil Moisture Management System with Automated Watering

### SURVEY:

1.

How important is sustainable agriculture in your culture or community in Bangladesh?

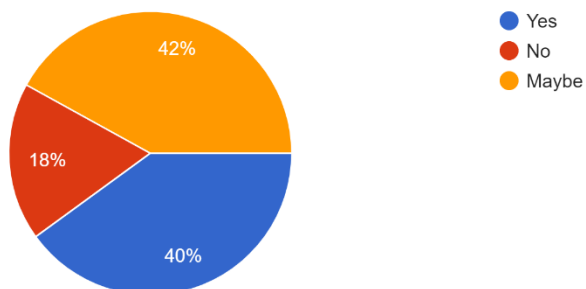
50 responses



2.

Are there any traditional or cultural practices related to soil moisture management in your community in Bangladesh?

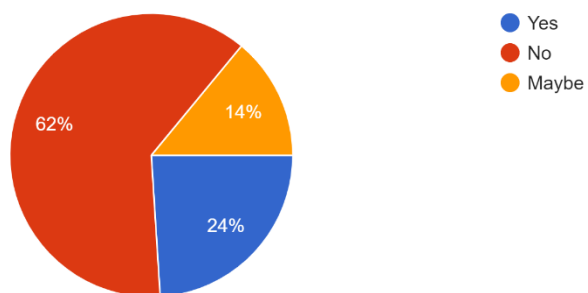
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3.

Do you currently use any automated systems for managing soil moisture or irrigation in your agricultural activities in Bangladesh?

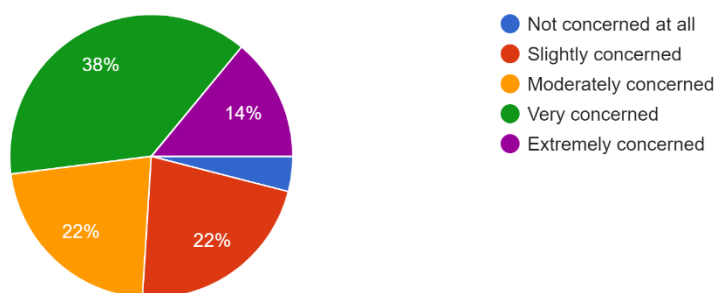
50 responses



4.

How concerned are you about water conservation in Bangladesh?

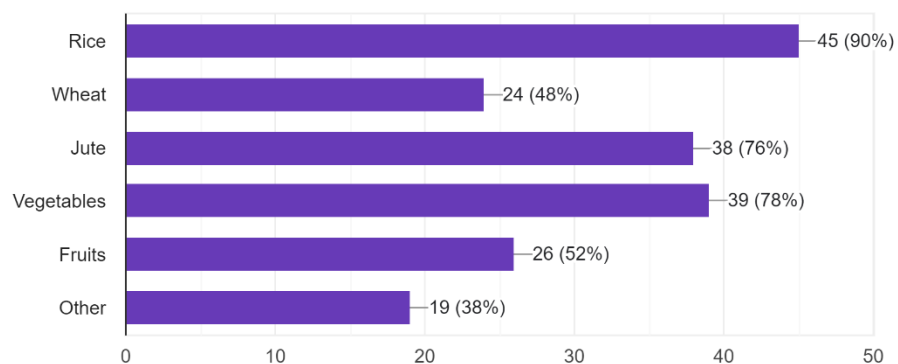
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5.

What types of crops are typically grown in your region in Bangladesh? (Please select all that apply)

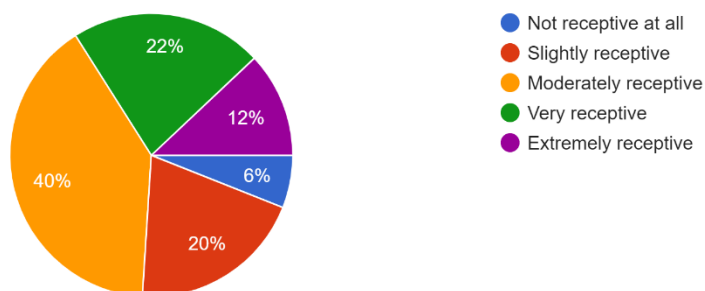
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6.

How receptive would you be to implementing a smart soil moisture management system on your farm in Bangladesh?

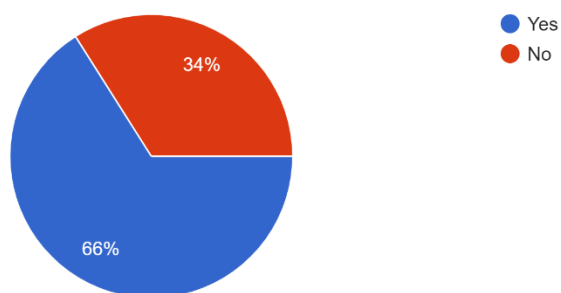
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7.

Are there any local regulations or restrictions related to water usage and irrigation practices that impact your farming activities in Bangladesh?

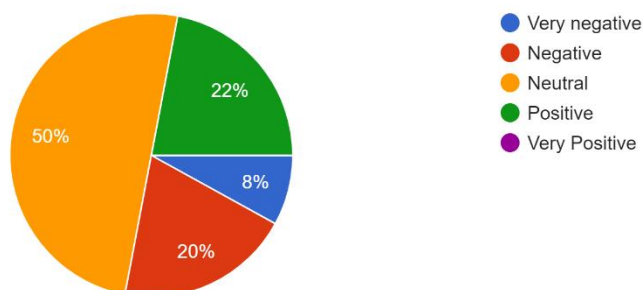
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8.

How do you perceive the environmental impact of traditional irrigation practices in Bangladesh?

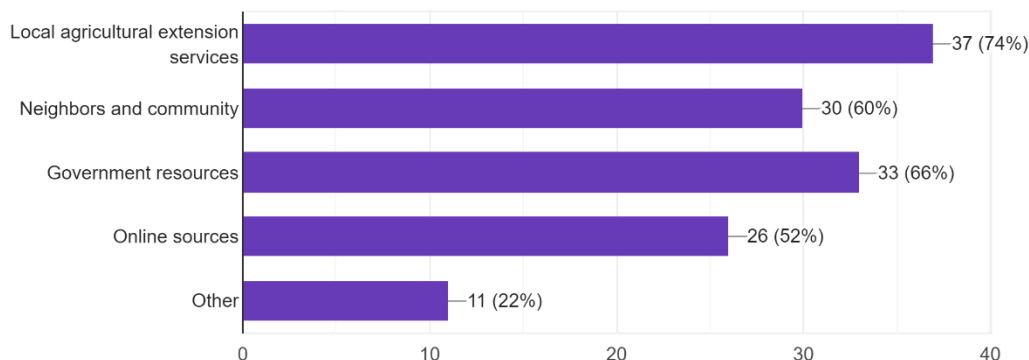
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9.

In your community in Bangladesh, how do you access information and knowledge about agriculture and farming practices? (Please select all that apply)

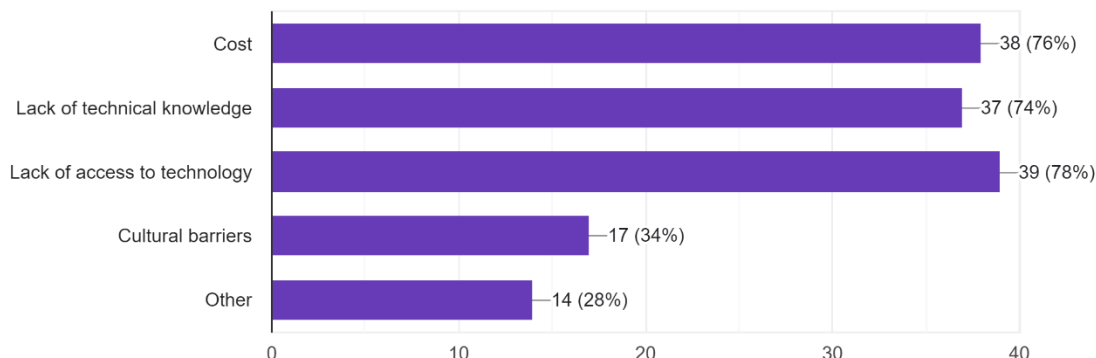
50 responses



10.

What are your primary concerns or challenges related to adopting new agricultural technologies like the Smart Soil Moisture Management System in Bangladesh? (Please select all that apply)

50 responses



## AIMS AND OBJECTIVES OF THE PROJECT:

### Aims:

- 1. Optimizing Agricultural Water Use:** The primary aim of this project is to develop a smart soil moisture management system that optimizes water usage in agriculture. It seeks to reduce water wastage and promote efficient irrigation practices.
- 2. Enhancing Crop Yield:** Another key aim is to enhance crop yield and quality by maintaining optimal soil moisture levels. By providing crops with the right amount of water at the right time, the project aims to maximize agricultural productivity.
- 3. Environmental Sustainability:** This project aims to promote sustainable agriculture by minimizing water usage and reducing the environmental impact of irrigation practices. It seeks to contribute to the conservation of water resources and minimize soil erosion.
- 4. User-Friendly Technology:** The project aims to create a user-friendly technology that is accessible to farmers in different regions of Bangladesh, making it easy for them to adopt and benefit from the system.

### Objectives:

1. **Develop a Smart Soil Moisture Management System:** Design and develop a cost-effective and efficient system capable of monitoring soil moisture levels in real-time and controlling irrigation based on these readings.
2. **Cultural and Societal Integration:** Assess the cultural and societal factors in Bangladesh that may influence the adoption of this technology and incorporate these considerations into the system's design and implementation.
3. **Water Conservation:** Implement the system with the specific objective of conserving water resources by minimizing water wastage through precise irrigation control.
4. **Crop-Specific Management:** Customize the system to suit the types of crops commonly grown in Bangladesh, taking into account their specific irrigation needs and practices.
5. **Information Dissemination:** Develop educational materials and training programs to disseminate information about the technology and its benefits to the farming community in Bangladesh.
6. **Monitoring and Evaluation:** Continuously monitor and evaluate the performance and impact of the system, gathering feedback from users and making necessary improvements.
7. **Cost-Effectiveness:** Ensure that the system is cost-effective and that the benefits outweigh the initial investment for farmers in Bangladesh.
8. **Environmental Impact:** Study and analyze the environmental impact of traditional irrigation practices and demonstrate how the new system can mitigate adverse effects.
9. **Regulatory Compliance:** Ensure that the system complies with any local regulations and restrictions related to water usage and agricultural practices in Bangladesh.
10. **Community Involvement:** Encourage community involvement in the project by collaborating with local agricultural extension services and involving farmers in the decision-making process.

### LITERATURE REVIEW:

According to a study, farmers in the past would calculate the ideal condition of their soil and utilize their control over the unknown to ensure its eventual restoration. They failed to consider the farmer's growing vulnerability to the effects of moisture, water levels, and other environmental factors. Using approaches like precision and functional farming, the Internet of Things (IoT) is equipping farmers to better deal with issues they encounter in the field. The Internet of Things (IoT) facilitates the collection of data on climate, moisture, temperature, and soil productivity. Researching plants online helps us learn about things like water levels, bug populations, animal incursions, agricultural progress, and more. Thanks to IoT, a farmer can check in on his house whenever he wants. Small-range controls are employed to manage and automate the home's architectural forms, while remote sensor structures monitor farmwide conditions. Remote electronic cameras have been used to capture both still images and moving videos of the environment. The growth of IoT may lessen the price of and boost the efficiency of even the most fundamental building [1].

**Discussion:** The passage highlights the limitations of traditional farming practices and the potential of Internet of Things (IoT) technology for smart soil moisture management. Traditional farming relied on intuition and experience, often leading to inefficient resource management and vulnerability to unpredictable environmental factors. IoT technology, in contrast, offers data-driven solutions by collecting real-time information on soil conditions, moisture levels, temperature, and more. This empowers farmers to make informed decisions, optimize resource usage, and mitigate vulnerabilities. It also provides remote monitoring and control capabilities, allowing farmers to oversee their farms and livestock from a distance. While implementing IoT may involve initial costs and technical challenges, it holds the promise of significantly improving agricultural practices, enhancing productivity, and reducing the impact of environmental factors. However, responsible adoption of IoT technology is crucial to address any environmental concerns and ensure sustainable and efficient agricultural practices.

According to another study, in the initial stages of conceptualizing this project, we engaged in a brainstorming process to identify the key functionalities that needed to be implemented. The following requirements were established as a result and guided us during the development of our solution.

- The system should collect data using multiple sensors connected to the microcontroller board(s).
- The system should provide a suitable algorithm that will determine further actions based on the collected data from the microcontroller board(s).
- The system should trigger action specified by the algorithm when a signal from the microcontroller board(s) is received.
- The system should send the processed data to a designated server using a standard protocol.
- The system should have a user-friendly interface to configure and monitor the system [2].

**Discussion:** While these guidelines guide the system's development, they also present potential challenges. Ensuring data accuracy and reliability from multiple sensors demands careful calibration and maintenance. The complexity and adaptability of the decision-making algorithm are key concerns. System responsiveness, data transmission security, and user-friendly interface design are pivotal for effective operation. Long-term maintenance and user support are essential to address issues post-deployment. Addressing these challenges is critical to ensuring the system's reliability, efficiency, and user-friendliness in practical agricultural contexts.

According to another study, the soil moisture sensor senses the moisture content of the soil. If the soil moisture is below a certain level, or it is “dry”, then, the output of the sensor is an analog voltage. It is converted into a digital signal by ADC. The Arduino controller has been coded to compare it with a set reference. If it is less, then, it actuates the single-channel relay. So, the motor starts to rotate and hence pump irrigates land. The land is thus being irrigated and moisture content increases. When moisture content is high, this level is also sensed by sensor. It gives signal in the form of analog voltage and it is converted again into digital signal by ADC. The Arduino compares it with reference and the as the signal is higher than set reference, it cuts off the single channel relay. The motor stops [3].

**Discussion:** The passage describes a Smart Soil Moisture Management System with Automated Watering, where a soil moisture sensor triggers irrigation when soil moisture falls below a certain level and stops when it's sufficient. Potential challenges include sensor accuracy and calibration, reliance on a single sensor, setting appropriate threshold values, addressing power interruptions, the absence of data logging, and considering the system's environmental impact. Ensuring sensor accuracy and redundancy, precise threshold settings and backup power solutions are crucial for effective automated irrigation. Additionally, recording data and assessing environmental effects contribute to responsible and efficient water management in agriculture.

According to one another study, the main objective of this research is to design an automatic plant irrigation system to control the amount of water using Arduino uno R3 and soil moisture sensors and control of the system continuously through the monitoring station and scheduling the irrigation system by selecting the type of plant from botanical library that was proposed and contribute to reducing all costs (water, labor) and increase the agricultural production. The majority of soil moisture sensors are used depending on the relationship between soil moisture and the electrical potential difference [4].

**Discussion:** The research seeks to create an Automatic Plant Irrigation System using Arduino Uno R3 and soil moisture sensors for efficient water management. Challenges include ensuring the precision and calibration of soil moisture sensors, the complexity of maintaining a botanical library for plant selection, and the need for energy-efficient monitoring stations. A user-friendly interface for plant selection and scheduling is vital, and the initial investment cost may pose a barrier for some users. Data security and privacy must be maintained in the remote monitoring station. Overcoming these challenges will be essential for the successful implementation of the system, which promises to boost agricultural production, reduce costs, and promote responsible water usage.

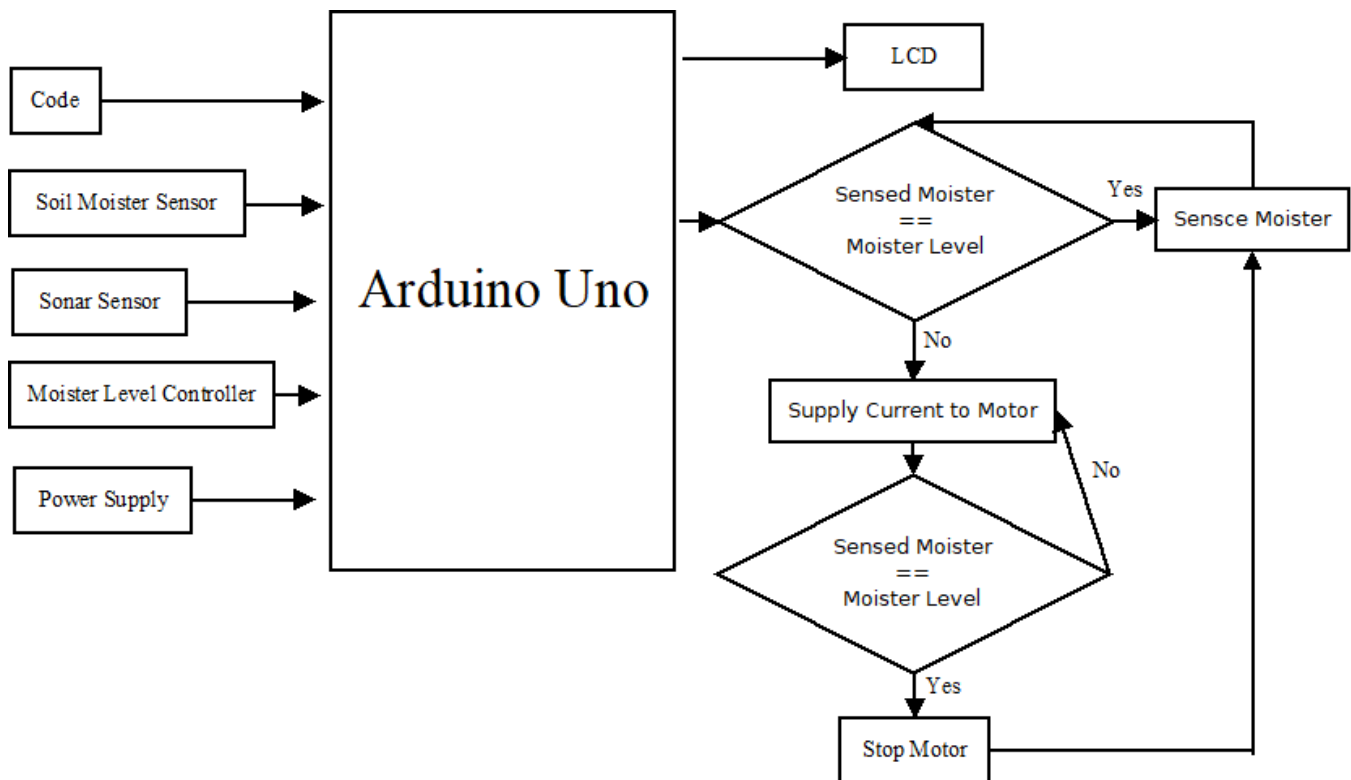
In other study, the implementation of the IoT and WSN in the proposed irrigation system consists of several parts. The sensor node starts by reading the soil moisture level data in order to identify the level of soil dryness. The node then sends the information by using radio transceiver to the base station. After that, the light exposed data from the light sensor is also read by the base station. The base station then sends both data, i.e., moisture level and light exposed to the storage server which is a cloud server. This proposed smart irrigation system can operate in two different scenarios, automatic and manual operation with and without internet connection. User also can manage and monitor both data on soil moisture and light exposed by browsing the cloud web server. In addition, the developed android application with user-friendly interface can be another platform to monitor the watering progress. In this android application, user can choose their own setting on the selected moisture threshold values at the sensor node. User can choose to manually perform the watering process by clicking the watering button on the android application. Once the watering process is finished, a display of moisture meter shows an increment level in real time.

Three new methods have been proposed and implemented in this work:

- sensor node packaging;
- monitoring and manually watering process using Virtuino.
- Wi-Fi routine checker using timer interrupt [5].

**Discussion:** The implementation of IoT and WSN in the proposed irrigation system holds great potential for efficient water management, but it brings certain challenges. Ensuring the accuracy and reliability of soil moisture and light sensors is critical, requiring proper calibration and addressing sensor failures. Consistent connectivity and reliable data transmission are essential, especially in remote agricultural areas. The system's operation depends on internet connectivity, which might not always be available. A user-friendly interface is crucial for the Android application and cloud web server, catering to users with varying technical expertise. Moreover, managing power consumption in sensor nodes is vital for long-term functionality. Addressing these challenges is key to realizing the system's potential for enhancing irrigation efficiency and user control.

## EXPERIMENTAL BLOCK DIAGRAM:



## POSSIBLE OUTCOMES OF THE PROJECT:

The "Smart Soil Moisture Management System with Automated Watering" has the potential to significantly benefit society and enhance the culture of agricultural practices in Bangladesh:

1. **Water Resource Conservation:** Bangladesh, like many other regions, faces water scarcity issues. This system optimizes water use in agriculture, reducing wastage and conserving a valuable resource. This conservation aligns with a culture of responsible water management, essential in a country prone to seasonal floods and droughts.
2. **Increased Crop Yields:** By ensuring optimal soil moisture levels, the system can enhance crop yields. This increased productivity not only improves food security but also contributes to the economic well-being of rural communities, aligning with the cultural importance of agriculture in Bangladesh.
3. **Reduced Labor Intensity:** Traditional farming is labor-intensive. The automation provided by this system can alleviate some of the manual labor burdens in agriculture, leading to improved working conditions and allowing for diversification of economic activities, thus promoting cultural and economic development.
4. **Environmental Sustainability:** The technology reduces over-irrigation and its associated environmental impact, supporting sustainable agricultural practices and safeguarding the environment for future generations, which is culturally significant in Bangladesh.
5. **Education and Awareness:** The introduction of advanced agricultural technology can foster education and awareness about modern farming practices, thus contributing to the cultural exchange of knowledge among farmers.
6. **Community Empowerment:** As this project is adaptable to various scales of agriculture, it empowers individual farmers and communities to take control of their agricultural practices, a cultural value in Bangladesh.

In summary, the Smart Soil Moisture Management System has the potential to conserve water, increase crop yields, reduce labor intensity, promote sustainability, and empower communities, aligning with the values and cultural aspects of responsible and efficient agriculture in Bangladesh.

## PROJECT TIMELINE (GANTT CHART):

	11th feb	17th feb	26th feb	11th mar	8th april
Smart Soil Moisture Management System	11th feb - 26th feb				
Project Proposal		26th feb - 11th mar			
Task 2			11th mar - 8th april		

## REFERENCES:

- [1] HARI, E. KRISHNA, and P. RAJA PRAKASHA RAO. "ARDUINO-BASED SMART IRRIGATION USING WATER FLOW SENSOR, SOIL MOISTURE SENSOR, TEMPERATURE SENSOR AND ESP8266 WI-FI MODULE AAKUTHOTA RACHANA." *Journal of Engineering Sciences* 14, no. 08 (2023).
- [2] Misheva, Despina, Matej Gorjanov, Ana Mladenovska, and Marija Stojcheva. "Design and implementation of an automated irrigation system using Arduino UNO, sensors and LAMP stack." (2023).
- [3] Pradeep, M., and E. Pon Esakki Muthu. "A NOVEL SMART IRRIGATION SYSTEM FOR AGRICULTURAL LANDS." *EPRA International Journal of Multidisciplinary Research (IJMR)* 9, no. 1 (2023): 121-125.



[4] Al-Obaidi, Mohanad Ali Meteab, Muna Abdul Hussain Radhi, Rasha Shaker Ibrahim, and Tole Sutikno. "Technique smart control soil moisture system to watering plant based on IoT with arduino uno." Bulletin of Electrical Engineering and Informatics 9, no. 5 (2020): 2038-2044.

[5] Kamaruddin, Fidaus, Nik Noordini Nik Abd Malik, Noor Asniza Murad, Nurul Mu'azzah Abdul Latiff, Sharifah Kamilah Syed Yusof, and Shipun Anuar Hamzah. "IoT-based intelligent irrigation management and monitoring system using arduino." *TELKOMNIKA (Telecommunication Computing Electronics and Control)* 17, no. 5 (2019): 2378-2388.

## FOR FACULTY USE ONLY

### COMMENTS BY COURSE TEACHER:

COURSE TEACHER'S NAME  
DATE

COURSE TEACHER'S SIGNATURE

## GROUP MEMBERS

(Maximum 6 students are permitted to carry out a single Project. However, depending on the capability of the students, 4 students may be allowed but not less than that)

NAME: MD JOBAER HOSSAIN ID #: 22-47116-1 PROGRAM: CSE EMAIL:	NAME: SAMIA SHARMIN DOLA ID #: 22-47126-1 PROGRAM: CSE EMAIL:
NAME: MD SAMIN YEASAR ID #: 22-47139-1 PROGRAM: CSE EMAIL:	NAME: RIFAH SANZIDA ID #: 22-47154-1 PROGRAM: CSE EMAIL:

<b>NAME:</b> SHAYAN ABRAR <b>ID #:</b> 22-47156-1 <b>PROGRAM:</b> CSE <b>EMAIL:</b>	
<b>REMARKS (for OFFICE use only)</b>	

<b>Course Name:</b>	Microprocessor and Embedded System	<b>Course Code:</b>	EEE 4103
<b>Semester:</b>	Spring 2023-2024	<b>Sec:</b>	E
<b>Faculty Member:</b>	<b>PROTIK PARVEZ SHEIKH</b>		

<b>Capstone Project Title:</b>	Smart Soil Moisture Management System with Automated Watering
<b>Project Group No.</b>	

Sl #	Student ID #	Student Name	Obtained Marks
1.	22-47116-1	MD JOBAER HOSSAIN	
2.	22-47126-1	SAMIA SHARMIN DOLA	
3.	22-47139-1	MD SAMIN YEASAR	
4.	22-47154-1	RIFAH SANZIDA	
5.	22-47156-1	SHAYAN ABRAR	

#### 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
<b>Project Title</b>	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	
<b>Comments</b>						<b>Total Marks (2)</b>	

KPIs	Excellent [5]	Proficient [4]	Good [3]	Acceptable [2]	Unacceptable [1]	No Response [0]	Secured Marks
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Survey	The survey developed as a process for complex engineering problems considering cultural and societal factors has 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 with 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 with 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 with 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 (5)	
KPIs	Excellent [3]	Proficient [2.5]	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 (3)	

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 problem correctly.	Specific formats are maintained to review and cite the literature with recent publications. Identified and analyzed the problem correctly, but all issues were not addressed with relevant or intended work.	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 addressed with relevant or intended work.	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 addressed with relevant or intended work.	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	
Comments						Total Marks (5)	

<b>KPIs</b>	<b>Excellent [4]</b>	<b>Proficient [3]</b>	<b>Good [2]</b>	<b>Acceptable [1]</b>	<b>Unacceptable [0.5]</b>	<b>No Response [0]</b>	<b>Secured Marks</b>
<b>Experimental Block Diagram</b>	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 (4)	
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KPIs	Excellent [4]	Proficient [3]	Good [2]	Acceptable [1]	Unacceptable [0.5]	No Response [0]	Secured Marks
<b>Possible Outcomes</b>	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
<b>Gantt Chart</b>	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 [2]	Proficient [1.5]	Good [1]	Acceptable [0.5]	Unacceptable [0]	No Response [0]	Secured Marks
<b>References</b>	Specific formats are maintained to write the 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 (2)	