UNIVERSITY OF ENGINEERING & TECHNOLOGYMARDAN
DEPARTMENT OF ELECTRICAL ENGINEERING

FINAL YEAR PROJECT PROPOSAL

To design Solar Powered Water Surface Garbage Collecting Boat
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Introduction:

Water is vital for humans and all living things. About 71% of the earth's surface is covered by water. It is important to maintain its cleanliness, as it is the basic need for all living organisms on Earth. Water gets polluted for many reasons, such as industrial waste, garbage waste, sewage waste, etc. According to reports, the INDUS River is the second-most plastic-polluted river in the world [1]. Most garbage is dumped or thrown into lakes, rivers, or other water resources. The garbage thrown into the water, such as lakes, rivers, and other water resources, is polluted, because of which we cannot use that water for our daily use, and the water will also get wasted.

This project is based on the design of a powered water surface garbage collector machine. In this project, the machine will use solar energy as a source to charge the battery connected to it for its operation. The machine will travel to different areas of the water surface to collect the waste that has been thrown. The machine will be a boat type that will be controlled through a remote to collect the garbage floating on the water's surface and save it to the collector tank of the boat.

Problem Statement:

Water is now a critical resource for all living things and the environment. The water is becoming gradually polluted due to industries and certain parties' irresponsibility. Water pollution is mostly caused by improper disposal of sewage and solid waste, excessive use of pesticides and fertilizers, and deteriorating pipeline networks along rivers, lakes, and seas. Furthermore, the lakes are important not just for the aquatic environment but also for the human tourism economy. For some years, the urban water bodies in Pakistan have been facing pollution. According to International research, over half of the world's lakes have shrunk [2]. To overcome these problems,

this project, "Solar-powered water surface garbage collector," is to remove garbage and solid waste from water bodies as a result of making them clean. The main focus of this idea is to reduce manpower and time consumption for cleaning the lakes. This project design also includes sustainable solar energy resources, with solar energy as the primary source.

Objectives of Project:

The wastes create water pollution, such as bottles, plastics, invasive aquatic plants, sticks, and other wastes, when they reach the waterbodies. As a result, the water quality is reduced.

The main objective of this project is:

- To design a prototype of solar powered garbage collection system for water bodies (like lakes and fish farms).

The Sub-objectives of this project is:

- To clean the waste that gets accumulated on the surface of water bodies.
- To minimize the pollution of lakes and other water-containing areas.
- To keep entertaining places clean, as they play a key role in the economy of any country.

Literature Review:

In [3], plastic is one of the main materials that are wasted. In 2013, 2.00% of a small fraction was burned and was successful in being recycled. Between 1.15 and 2.41 million tons of plastic are released from rivers into the ocean every year. As a result, this can disturb water quality and the ecosystem. Due to floods, water pollution increases from December to February in Malaysia. This article aims to build a machine that can independently suck dust from the water surface. The resultant prototype can be improved by using strong and waterproof materials for the collector.

This project focuses on lakes where the water does not flow anywhere. The process begins by removing the waste from the adjacent floating waste stream via a water pump. The concept also includes IoT technology, through which the users can control the devices with a wireless control system. People will be notified that the trash is completely full and ready to be removed. [3]

According to reports, the massive construction upstream is one of the main factors causing flooding in the Damansara River. Large amounts of debris like plastic, leaves, and bottles are often found in developing countries. Dry debris floating in water can block the water flow and cause flooding. In 2007, the Minister of Environment, B. Kambuaya, found that 33 cities produced 132,192 cubic meters or more of garbage per day in the country.

Malaysia is one of the most affected by plastic pollution in Asian countries. About 32% of the pollution found in Malaysian rivers is plastic waste. In Malaysia, the Klang River is the most polluted because this river is often used for appropriate landfills. Due to large-scale agricultural development along the rivers in Malaysia, there are 40,000 families in the Klang River alone, and settlements have sprung up along the rivers and

estuaries throughout the towns and cities in Malaysia. A Plymouth University report says that due to plastic waste, at least half of the 700 species of aquatic animals are threatened with extinction. Much research has been done on easier ways to collect dirt in water. Some garbage collectors are designed to be stationary and portable. Mr. Trash Wheel, a solar-powered water wheel, can efficiently collect trash from the estuary until it enters the open waters of Baltimore Harbor. Through solar panels, it collects garbage with the help of a water pump. In the first 22 months of service, it collected 420 tons of waste. However, moving the pedal scrubber takes a tremendous amount of energy. Due to its large size, it is effective at collecting large amounts of dirt. Another study uses the conveyor mechanism in the design of the garbage collector. It is a good design to reduce manpower as the debris is automatically loaded into the collector plate by motor control, but high power is required to maintain the movement of the motor as the dust piles up in the collector. [4]

In this article, the design of a robot to collect floating debris is described. Three important considerations for building a water robot are economy, robustness, and ability. Due to the nature of the cleaning process, we have developed a robotic structure with high stability, powerful movement, and a car-like mechanism that can quickly pick up debris floating on top of the water. In this scenario, plastic pipe doors work well and meet all structural stability standards. A motorized conveyor belt is installed to collect the waste and place it in a plastic box mounted on a platform. This design allows for simple and efficient disposal while also accommodating a very small amount of waste. The full weight of the dirt collector, conveyor, and equipment is supported on this light and strong frame. The electronic circuit and motor are mounted on the platform to keep them dry. Arduino, sensor, motor driver, GPS, and GSM

modules control the robot automatically. Testing the robot prototype successfully collected dust and returned it to the waypoint. The robot's maximum garbage load is up to 5 kg. The project's main objective is to optimize the process's time, energy, and speed. [5]

The main garbage collection method is to use a conveyor belt to lift the garbage from the water. Garbage is collected in a bin at the back of the boat. Three DC motors are used. The motor used for the continuous rotation conveyor is a 600 rpm, high-torque mini 12V DC gear motor. In contrast, the other two motors are used for ship propulsion: a 3 kW micro-DC 3-6 volt submersible pump and a mini water pump motor. The ship is controlled wirelessly. A L298N-based driver module is used to drive two motors. It consists of an H-bridge so that the ship can go forward and back easily. The RF module works on the principle of electromagnetic radiation used for wireless communication of serial data through its antenna connected to the ANT pin. The RF-module transmission rate varies between 1-10 kbit/s. When the ship is in the water, it is operated using a remote from the shore. Foam sheets are used to make boats easy to repair. Conveyor belts are kept thin and made of PVX material to prevent backlash. Conveyor belts are used for polyethylene, feed materials, etc., which can collect the debris. After the junkyard was filled, the boat was brought ashore. The waste container is pulled out to dispose of the dirt. After the waste is cleaned, it is attached to the boat, and the boat is sent to the water for cleaning. [6]

Lakes are an important feature of the land's landscape. It is a valuable ecosystem that provides a variety of goods and services to humanity. It is not best to provide precious water, but to provide valuable habitats for flowers and animals, manage hydrological extremes like floods, influence the microclimate, replace the natural beauty of the

landscape, and provide many recreational opportunities. Lakes have a special significance in India. In the past decades, pollution has increased drastically in the urban population without the proper development of civic centers, such as adequate infrastructure for waste disposal. Therefore, when the number of people moving to the city increased, the city's civil service decreased.

As a result, almost all urban water bodies in India lack pollutants. They are used for untreated waste and solid waste disposal in nearby areas, and in many cases, water bodies have been turned into landfills. Despite many policies and actions to protect and restore urban lakes and wetlands, our urban water bodies are in dire straits. The numbers are increasing rapidly. For example, Bangalore had 262 lakes in the early 1960s; today, it is in the top 10. Similarly, 137 lakes were registered in Ahmedabad in 2001, and more than 65 lakes were reported to have been built (Excreta Matters, 2012). In 2010–11, forty-four lakes were surveyed to investigate amendments in three catchments in Delhi, and 21 out of 44 lakes were found to have dried up due to rapid urbanization and a falling water table (Singh & Bhatnagar, 2012). [7]

Methodology for Implementation of Project:

The following four steps will be followed to finalize the project:

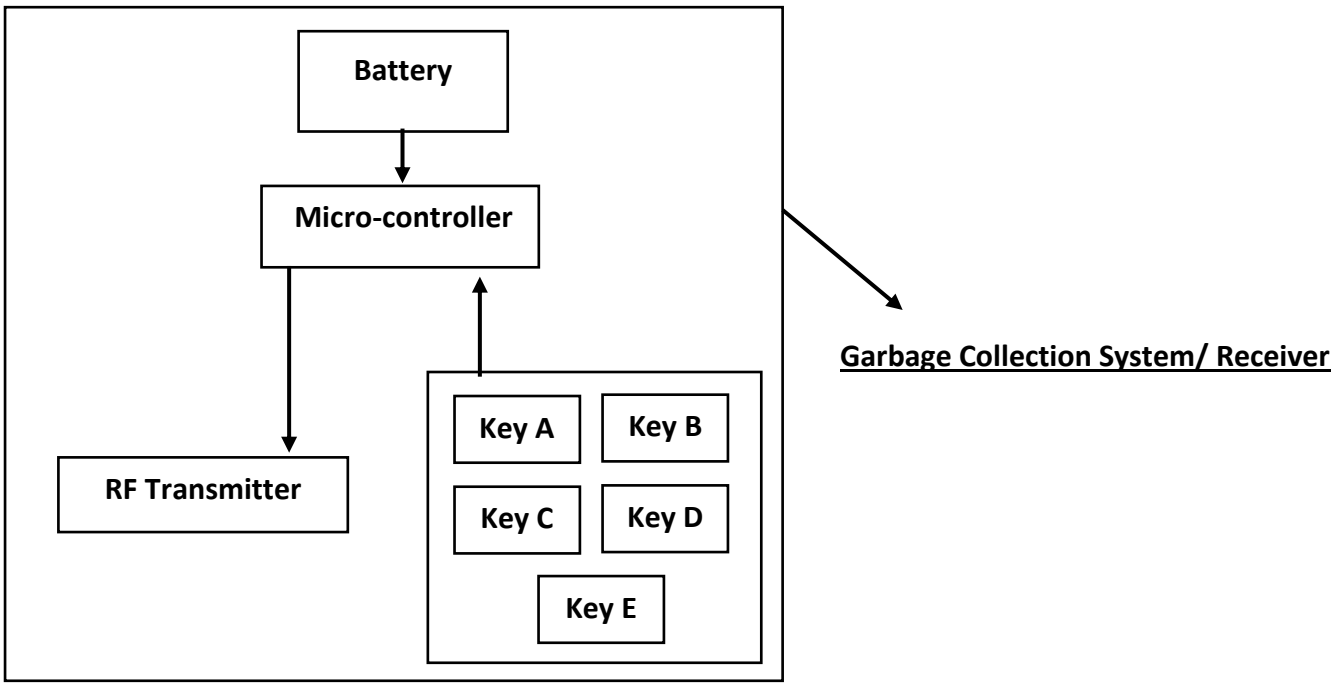
- **Coding:** Arduino will be programmed in C language to control the whole system.
- **Simulation:** Proteus/MATLAB will be used to simulate and analyze the project circuit and record the results.
- **Components Purchasing:** We will purchase the same components that are used in simulation.
- **Implementation:** The whole system will be implemented in a prototype afterwards.

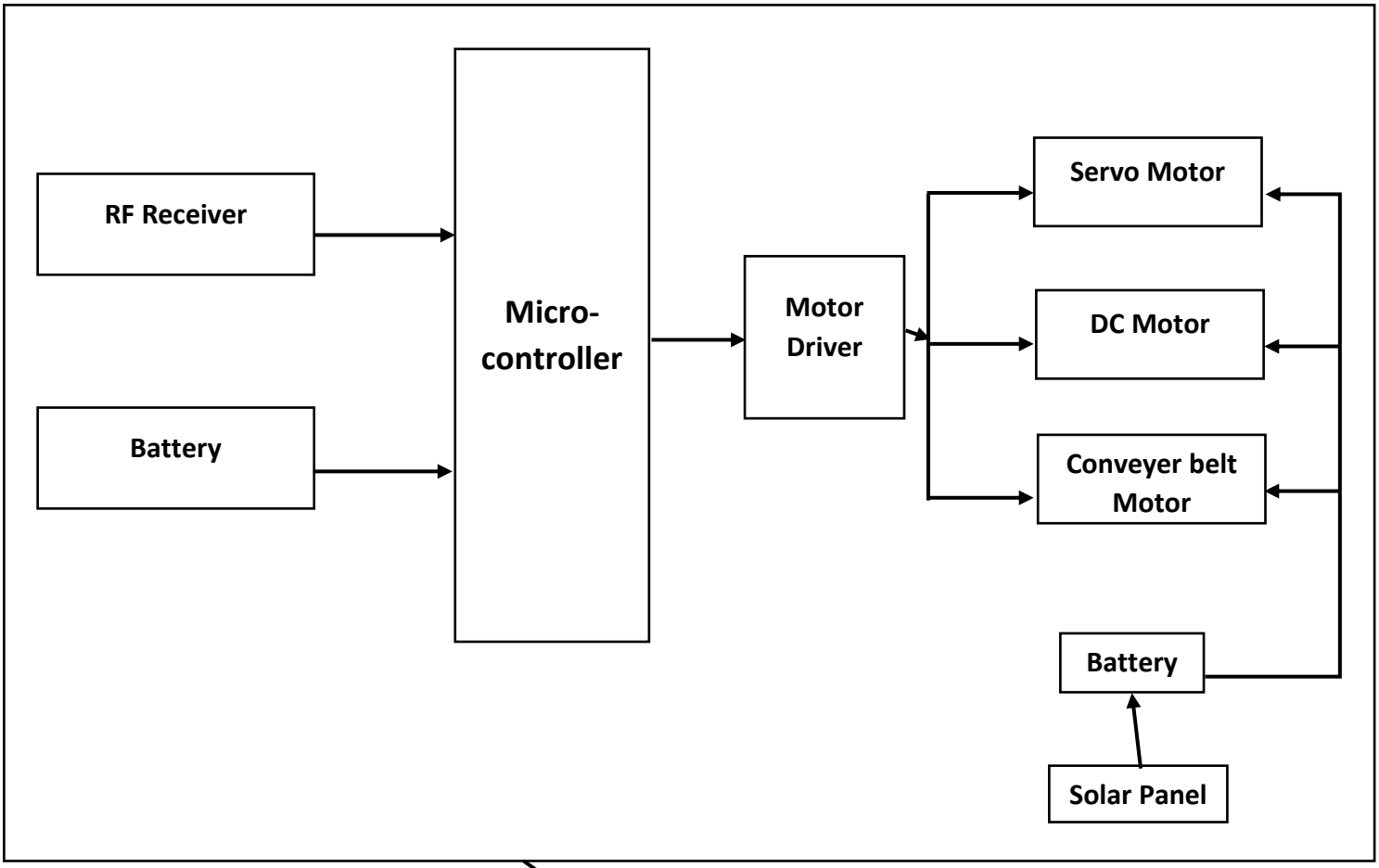
Working:

- The main function of this machine in this project is to remove waste material from the surface of the water and deposit the plate.
- It consists of a conveyor mounted on a motor drive. The conveyor is rotated by a motor.
- Wastewater, dust, and plastic are collected from the water body as the conveyor moves. Debris in water will rise and float when the car is submerged in it. Once the litter reaches the top point, the plate will drop.
- Therefore, this will lead to the cleaning of water surfaces and the safe collection of waste from water.

Components:

- Arduino board
- RF wireless remote
- Motor driver module
- DC motors
- Battery
- Charge Controller
- Resistors
- Capacitors
- DC pump
- Trash Bin
- Cables and connectors
- Relay Module





Garbage Collection System/ Receiver

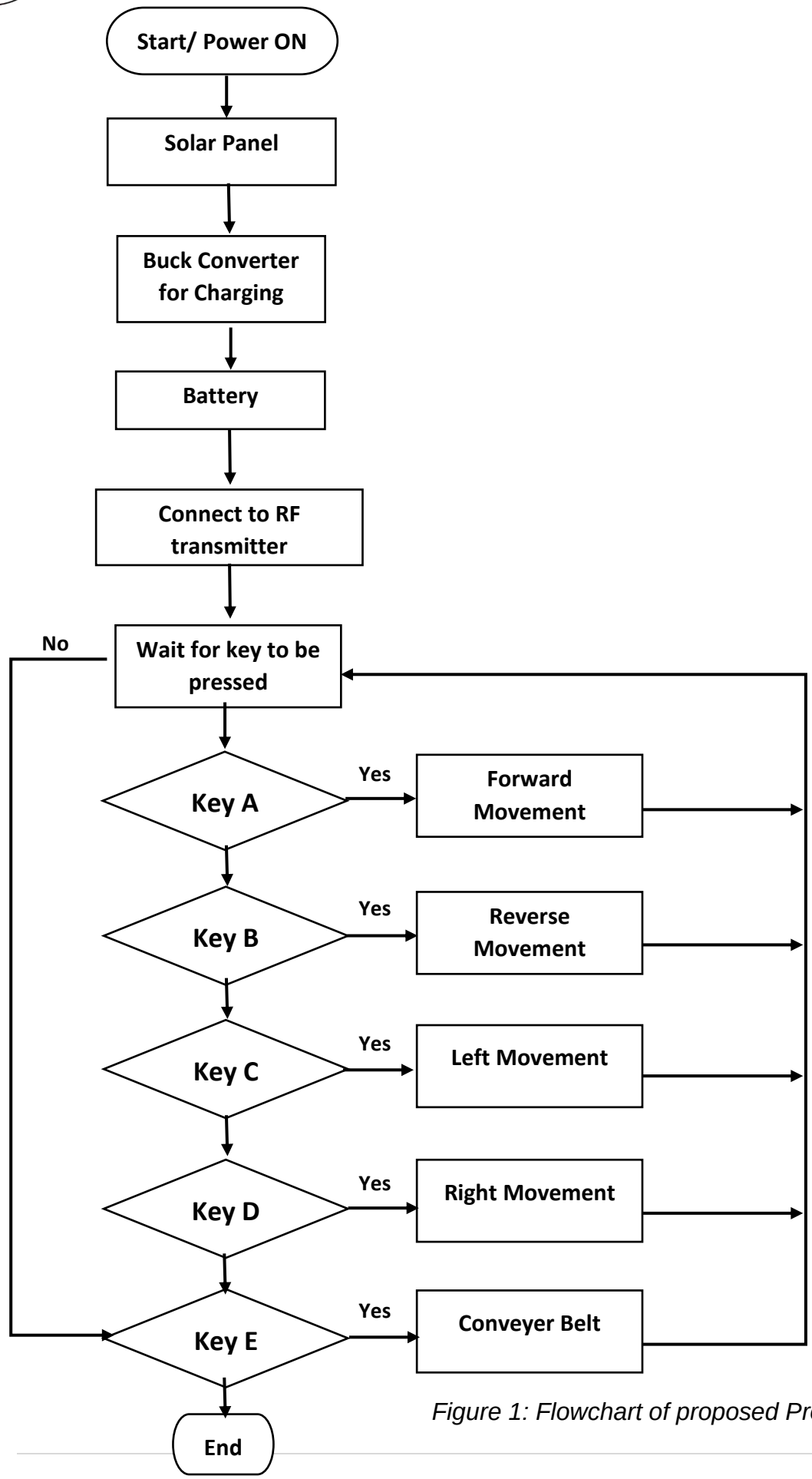


Figure 1: Flowchart of proposed Project

Budget Details:

Serial No	Components	Quantity	Cost
1	Arduino board	1	10000
2	Solar panel	1	13000
3	RF wireless remote	1	8500
4	Motor driver module (L293D)	1	5000
5	DC Motors	3	7500
6	Battery	1	22000
7	Charge controller	1	5000
8	Resistors	50	1000
9	Capacitors	20	3000
10	DC pump	1	4000
11	Trash bin	1	2000
12	Cables and connectors	20	2000
13	Relay module	1	2500
	Miscellaneous	**15000**	
	Estimated cost	**PKR 100,500/-**	

Project Implementation Schedule:

Activity	November	December/ January	February	March/ April/ May	June
Collection of Literature					
Study of Literature					
Simulation					
Purchasing					
Implementation of Schemes/Model					
Analysis & Simulation, Hardware Testing					
Final Write-up & FYP Report Submission					

Utilization of Project Results:

This project will be helpful in the following ways:

- This project uses solar energy to collect waste.
- This project will help users to maintain a clean water environment.
- It will work remotely without any human effort.
- It will help to keep the reservoir free from debris.
- This project is to reduce water pollution by collecting floating waste from the water.
- A waste collector consists of an automatic mechanism that travels in water and collects waste as it flows.
- By removing waste and debris from water bodies, the project directly contributes to reducing the negative impact of pollution on aquatic life and ecosystems. This can lead to improved water quality and healthier habitats for various species.
- Waste collectors can demonstrate to local authorities, environmental organizations, and the public that they support greater implementation to combat water pollution.

References:

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[3] Mahadi, Muhammad Nazirul Aiman, Dalila Misman, and Muhammad Rusydi Muhammad Razif. "An Efficient and Eco-Friendly Lake Bin Machine." Progress in Engineering Application and Technology 3, no. 1 (2022): 512-520.

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[5] S. Somal, G. Phadke, P. Gaikwad, S. Gavade, and M. Mane, "Ocean Surface Trash Collector," ADBU Journal of Electrical and Electronics Engineering (AJEEE), vol. 4, no. 1, pp. 23-27, 2020.

[6] Satheesh, Jishnu, Anagha P. Nair, M. Devipriya, A. Chithra, Govind Mahesh, and P. R. Jayasree. "Wireless Communication based Water Surface Cleaning Boat." In 2020 4th International Conference on Trends in Electronics and Informatics (ICOEI)(48184), pp. 716-720. IEEE, 2020.

[7] Ingle, Kshitija A., Akash G. Bhatkar, Rahul S. Tarmale, Tejashri D. Ingle, Mohan S. Bawaskar, and Mangesh J. Nemade. "A Review of River Cleaning Robot Using Solar Power." International Journal of Research in Engineering, Science and Management 3, no. 7 (2020): 103-107.

FYDP to CEP Mapping

S#	Attribute	Complex Problem	Targeted (Yes/No)	Justification
1.	Preamble	*Engineering problems which cannot be resolved without in-depth engineering knowledge. And have some or all of the characteristics listed below:		
2.	Range of conflicting requirements	Involve wide-ranging or conflicting technical, engineering and other issues.		
3.	Depth of Analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.		
4.	Depth of Knowledge required	Requires research-based knowledge much of which is at, or informed by, the forefront of the professional discipline and which allows a fundamentals-based, first principles analytical approach.		
5.	Familiarity of issues	Involve infrequently encountered issues		
6.	Extent of application codes	Are outside problems encompassed by standards and codes of practice for professional engineering.		
7.	Extent of stake-holder involved	Involve diverse groups of stakeholders with widely varying needs.		
8.	Consequences	Have significant consequences in a range of contexts.		
9.	interdependence	Are high level problems including many component parts or sub problems.		

* Prime Attribute

FYDP to SDGs Mapping

Sustainable Development Goals (SDGs)		
Goal#	**Description**	**Justification**
Goal 1	**NO POVERTY** End poverty in all its forms everywhere	
Goal 2	**ZERO HUNGER** End hunger, achieve food security and improved nutrition and promote sustainable agriculture	
Goal 3	**GOOD HEALTH & WELL-BEING** Ensure healthy lives and promote well-being for all at all ages	***Yes, clean water is important for society.***
Goal 4	**QUALITY EDUCATION** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	
Goal 5	**GENDER EQUALITY** Achieve gender equality and empower all women and girls	
Goal 6	**CLEAN WATER AND SANITATION** Ensure availability and sustainable management of water and sanitation for all	***Yes, the water management and its cleaning is necessary.***
Goal 7	**AFFORDABLE AND CLEAN ENERGY** Ensure access to affordable, reliable, sustainable, and modern energy for all	
Goal 8	**DECENT WORK AND ECONOMIC GROWTH** Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all	
Goal 9	**INDUSTRY, INNOVATION, AND INFRASTRUCTURE** Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.	
Goal 10	**REDUCED INEQUALITIES** Reduce inequality within and among countries	
Goal 11	**SUSTAINABLE CITIES AND COMMUNITIES** Make cities and human settlements inclusive, safe, resilient and sustainable	
Goal 12	**RESPONSIBLE CONSUMPTION AND PRODUCTION** Ensure sustainable consumption and production patterns	
Goal 13	**CLIMATE ACTION** Take urgent action to combat climate change and its impacts	***Yes, clean water is important for climate.***
Goal 14	**LIFE BELOW WATER** Conserve and sustainably use the oceans, sea and marine resources for sustainable development	***Yes, it is important for ecological, economic, social reasons as well as for the overall health and well-being of the plants.***
Goal 15	**LIFE ON LAND** Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
Goal 16	**PEACE, JUSTICE AND STRONG INSTITUTIONS** Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
Goal 17	**PARTNERSHIPS** Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	

Undertaking

This is to certify that to the best of my knowledge; the content of this project proposal is my own work. This proposal has not been submitted for any degree or other purposes. I certify that the intellectual content of this project is the product of my own work and that all the assistance received in preparing this proposal and sources have been acknowledged.

Signature_____
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Proposed Supervisor's Comments

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_____

Signature_____
Dr. Gull Rukh
Lecturer

Comments of FYDP Coordinator

Comments of FYDP Coordinator in accordance with recommendations of FYDP Committee.

Signature of FYDP Coordinator: _____ Dated: _____

Approval by the Chairman of Department

Signature: _____ Dated: _____