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Name: Sasindi Nethara Welagedara
Student Reference Number: 10898941

Module Code: PUSL2021	Module Name: Computing Group Project
Coursework Title: Project Proposal	
Deadline Date: 25/10	Member of staff responsible for coursework: Mr. Pramudya Thilakarathne
Programme: Computer Science	

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- S N Welagedara (10898941 || 10898941@students.plymouth.ac.uk)
- O M N Thathsiluni (10898924 || 10898924@students.plymouth.ac.uk)
- P N Guruge (10898768 || 10898768@students.plymouth.ac.uk)
- C N Manage (10899418 || 10899418@students.plymouth.ac.lk)
- W G B C Bandara (10899400 || 10899400@students.plymouth.ac.lk)
- B H Hirimuthugoda (10898781 || 10898781@students.plymouth.ac.lk)

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Signed on behalf of the group: Sasindi Nethara Welagedara

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PUSL2021 Computing Group Project

Project Proposal

A Lake Cleaning Bot and a Mobile Application for the Purpose of Monitoring Data and Sustainability Aspects

Mr. Pramudya Thilakarathne

Group 06
BSc (Hons) Computer Science Batch 22.2

Project overview

The end goal of this project is to develop a single robot with a system to address algae and slime overgrowth in lakes. The system will be able to automatically monitor, collect, and treat algae, as well as clean the lake of debris and waste matter, and check the pH value of the water, its oxygen levels, and temperature levels while transferring the collected data to an interconnected application, where anyone would be able to monitor the quality of the water bodies making it easy for scientists and researchers to collect relevant data.

The addition of a mobile app and/or a website would be a valuable tool for a wide range of stakeholders, including government agencies, lake managers, environmental organizations, research institutions, local communities, businesses, and individuals so that they're able to analyze the data collected in order to find trends and patterns to develop more effective management strategies. The app would provide a convenient and real-time way to view and manage data collected by the robot, such as water quality parameters, algae growth levels, and the robot's location. This would allow users to monitor lake conditions remotely and to respond quickly to any potential problems.

The system will consist of a single robotic vehicle equipped with a variety of sensors and tools. The sensors will be used to monitor lake conditions, including water temperature, pH, dissolved oxygen levels, and the presence of algae, and waste matter along with garbage thrown out by careless individuals which then could be sent for recycling purposes if possible. The tools will then be able to collect the mentioned waste matter, apply herbicides and other treatments, and restore and rehabilitate aquatic habitats damaged by unfavorable conditions.

The robotic vehicle will be able to operate autonomously, following preprogrammed routes. The vehicle will also be equipped with a communication system to transmit data to a central control station. This will allow for remote monitoring and control of the vehicle, as well as for the collection and analysis of data on lake conditions.

Additional features

- In addition to the core functionality of addressing algae overgrowth, the system will also be able to:
    - Clean the lake of debris and garbage. This could be done using a variety of tools, such as skimmers, nets, and vacuum cleaners.
    - Check the pH value of the water, its oxygen levels, and temperature levels. This data can be used to monitor the overall health of the lake and to identify any potential problems.
    - Environmental preservation: Contribute to the preservation of aquatic ecosystems by reducing the negative impact of algae overgrowth on water quality and aquatic life.
    - Sustainable design: Implementing sustainable and eco-friendly technologies for algae collection and disposal.
    - Remote Monitoring: Incorporate remote monitoring and control capabilities, allowing operators to oversee the robot's operations and make adjustments as needed.
    - Data Analysis: Collect data on algae levels and water quality to help scientists and researchers understand and address the factors contributing to algae overgrowth.

Benefits

- Improved Water Quality: The system can effectively monitor, treat, and clean lakes, leading to improved water quality by reducing algae overgrowth, waste matter, and maintaining the right pH and oxygen levels.

- Environmental Conservation: It contributes to the conservation and restoration of aquatic ecosystems by rehabilitating damaged habitats and preventing pollution.

- Real-Time Monitoring: The app provides real-time data on lake conditions, enabling rapid response to any issues and helping with early intervention.

- Data-Driven Management: Interested parties can make informed decisions and implement better lake management strategies by analyzing the collected data.

- Efficiency: Automation reduces the need for manual lake maintenance, which can be costly and time-consuming.

- Environmental Education: It educates and engages communities and individuals in lake conservation efforts, promoting environmental responsibility.

- Sustainability Initiatives: Recycling waste matter contributes to sustainability efforts and environmental awareness.

- Scientific Research: The collected data can be valuable for scientific research, helping researchers understand and address environmental issues.

- Government and Regulatory Compliance: The system can assist government agencies and regulatory bodies in monitoring and enforcing environmental standards.

- Emergency Response: Admins can take control of the robotic vehicle in emergency situations, such as addressing sudden water quality crises.

- Cost Savings: Over time, the system can lead to cost savings compared to traditional manual lake maintenance methods.

- Global Application: The technology can be adapted and applied to lakes and water bodies worldwide, addressing a widespread environmental challenge.

Objectives of the project

- Develop a Single-Robot System: Create a robotic system designed to address issues such as algae overgrowth, waste matter, and pollution in lakes.

- Autonomous Monitoring and Treatment: Enable the system to autonomously monitor lake conditions, specifically focusing on algae levels, and apply treatments as needed.

- Debris and Waste Matter Cleanup: Develop the capability to clean the lake of waste matter, including items discarded by individuals, and dispose of it properly.

- Water Quality Monitoring: Equip the system with sensors to check and record critical water quality parameters, including pH levels, oxygen content, and temperature.

- Data Collection and Storage: Collect and store data related to water quality, algae growth patterns, and trends, facilitating analysis and decision-making for lake management.

Why this solution?

- Algae overgrowth is a serious environmental problem in Sri Lanka. It can deplete the water of oxygen, which can kill fish and other aquatic life. It can also produce toxins that can harm humans and animals. Slime overgrowth can make lakes unsightly and unpleasant to use. It can also clog water intake pipes and make it difficult to treat water for drinking.

- A robotic system can be a more efficient and effective way to address algae overgrowth than traditional methods. Traditional methods often involve the use of chemicals, which can be harmful to the environment and human health. A robotic system can use a variety of methods to collect and remove algae without any human interference with the aquatic life, without the need for harmful chemicals.

- A robotic system can operate in areas that are difficult or dangerous for humans to access. This is especially important in Sri Lanka, where many lakes are located in remote or inaccessible areas.

- A robotic system can collect data on lake conditions, such as water quality, algae and slime growth, and temperature. This data can be used to monitor the overall health of the lake and to identify any potential problems.

- The system could be used to collect and remove algae blooms from lakes. This would improve the water quality and make the lakes more enjoyable for people to use.

- The system could be used to apply eco-friendly herbicides to algae blooms. This would help to control the growth of algae and improve the overall health of the lake.

- The system could be used to monitor lake conditions and identify areas that are infested with algae. This information could be used to target algae growth and control efforts more effectively.

- Could be used to collect data on the impact of algae growth on aquatic ecosystems. This data could be used to develop better strategies for managing and perseverance of aquatic life

Target Audience

- Government agencies responsible for water quality management: These agencies can use the system to monitor and improve the water quality of lakes in their jurisdiction.

- Lake managers: These individuals are responsible for the day-to-day management of lakes. They can use the system to monitor and address algae-related issues, as well as other lake management issues.

- Environmental organizations: These organizations can use the system to support their efforts to protect lakes and other water resources.

- Research institutions: These institutions can use the system to collect data on the quality of water.

- Businesses that rely on lakes: Businesses such as tourism operators and fisheries can use the system to protect the lakes that they rely on.

- Individuals who use lakes for recreation: Individuals who use lakes for activities such as swimming, fishing, and boating can use the system to ensure that the lakes are safe and enjoyable to use.

Proposed Application/Website Features and Description

- Admin Dashboard: A dedicated dashboard for administrators to monitor the overall system, manage users, and access advanced functionalities.

- Interactive Dashboard: Users can view a customizable dashboard displaying essential parameters and trends for the monitored lake, making it easy to track changes over time.

- Real-Time Data Monitoring: The app will provide real-time access to data collected by the robotic vehicle, including water temperature, pH, dissolved oxygen levels, algae growth, waste matter levels, and water quality.

- GPS Tracking: The app will show the robot's current location and its path, allowing users to track its movement and operational history.

- Alerts and Notifications: Users will receive alerts and notifications for critical events or changes in lake conditions, such as sudden algae blooms or abnormal water quality.

- Data Analysis Tools: The app will include tools for data analysis, enabling users to identify patterns and trends that can inform better lake management strategies.

- Remote Control: A remote control feature will allow authorized users to adjust the robot's operations or change its route in response to changing conditions.

- Historical Data Access: Users can access historical data for research and analysis, facilitating long-term lake ecosystem studies.

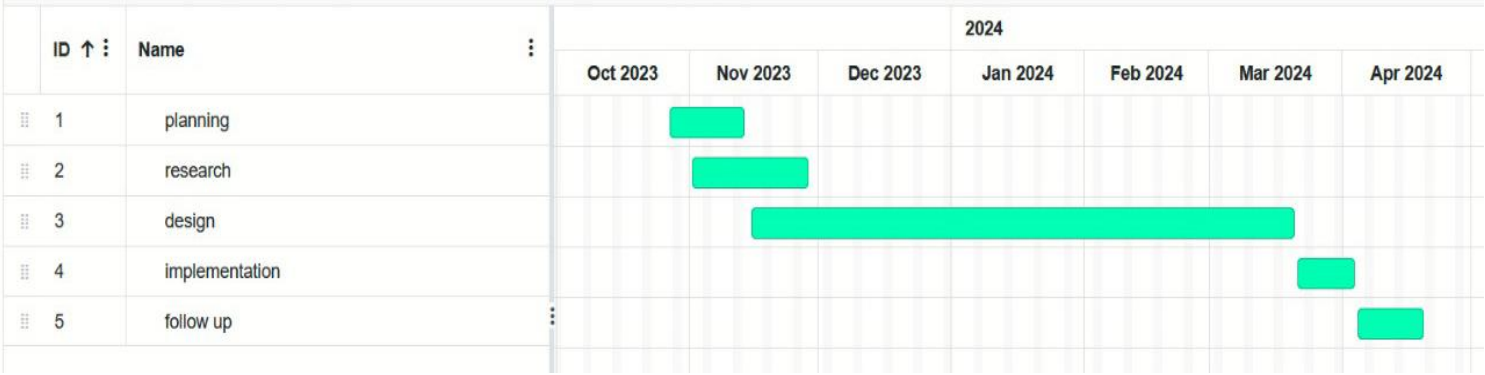
- User Permissions: Different user roles and permissions will be available to ensure controlled access to data and operational features.

- Reporting and Data Export: Users can generate reports and export data for scientific research or regulatory compliance purposes.

- Sustainability Initiatives: Users can learn about recycling and conservation programs related to the collected waste matter, promoting environmental responsibility.

- Robot Control: The ability to take manual control of the robotic vehicle or override its autonomous operations in emergency situations.
- Maintenance Scheduling: Schedule maintenance tasks for the robotic vehicle and monitor its overall health and performance.
- System Configuration: Adjust system parameters, update software, and manage hardware components as needed.
- User Support: Provide support and assistance to users, troubleshoot issues, and respond to inquiries.
- Data Access Control: Ensure that sensitive or confidential data is only accessible to authorized personnel.
- Data Backups: Set up regular data backups to prevent data loss in case of system failures.

Time Plan Chart



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