Chapter 1

INTRODUCTION

1.1 Background and context of the project

The Wireless Aquatic Debris Remover project is situated within the broader context of environmental conservation and the global effort to address water pollution. Water pollution is a pressing environmental issue that poses significant threats to ecosystems, public health, and socio-economic well-being worldwide. Among the various sources of water pollution, the accumulation of garbage and debris on the surfaces of water bodies, such as lakes, rivers, and ponds, is a particularly visible and widespread problem.

Traditional methods of cleaning water bodies, such as manual removal or mechanical are often costly, labour-intensive, and environmentally damaging. As a result, there is a pressing need for innovative and sustainable solutions to address this challenge. The Wireless Aquatic Debris Remover project aims to fill this gap by designing, developing, and testing a novel cleaning device that utilizes remote-controlled technology to efficiently remove surface debris from water bodies.

By leveraging advanced technologies such as the ESP32 microcontroller and Blynk IoT app, the project seeks to create a cost-effective, environmentally friendly, and scalable solution for water pollution remediation. The cleaner's ability to navigate water bodies autonomously, collect surface debris, and monitor pollution levels in real-time represents a significant advancement in water pollution remediation technology.

Moreover, the project aligns with broader efforts to promote environmental sustainability and foster community engagement in conservation initiatives. By raising awareness about water pollution issues and providing a tangible solution for local communities to participate in cleanup efforts, the Wireless Aquatic Debris Remover project contributes to the broader goals of environmental stewardship and ecosystem preservation [1].

1.2 Problem statement and significance

The problem statement for the Wireless Aquatic Debris Remover project revolves around the persistent issue of water pollution caused by the accumulation of garbage and debris on the surfaces of water bodies. This accumulation not only detracts from the aesthetic beauty of

water environments but also poses serious environmental and health risks. Traditional methods of cleaning water bodies, such as manual removal or mechanical dredging, are often costly, labour-intensive, and environmentally damaging. As a result, there is a pressing need for innovative and sustainable solutions to address this challenge effectively.

The significance of the Wireless Aquatic Debris Remover project lies in its potential to offer a transformative solution to this critical environmental problem. By utilizing remote-controlled technology, the cleaner can efficiently skim and remove surface debris from water bodies while minimizing environmental impact and operational costs. This approach not only improves the efficiency and effectiveness of water body cleaning but also promotes environmental sustainability by reducing reliance on fossil fuels and minimizing carbon emissions.

1.3 Objectives and scope of the project

The objectives and scope of the Wireless Aquatic Debris Remover project are outlined as follows:

1. To develop a robust and efficient design for the Wireless Aquatic Debris Remover that utilizes remote-controlled technology for surface debris removal.
2. To construct a functional prototype of the cleaner based on the finalized design, incorporating selected materials, components, and programming.
3. To conduct rigorous testing of the prototype in both controlled laboratory settings and real-world water environments to evaluate its performance, efficiency, and reliability.

Chapter 2

LITERATURE REVIEW

M. Mohamed Idhris, M. Elamparthi, C. Manoj Kumar Dr.N. Nithyavathy, Mr. K. Suganeswaran, Mr. S. Arun kumar, DESIGN AND FABRICATION OF REMOTE-CONTROLLED SEWAGE CLEANING MACHINE [2], The motive of the project is to automate the sewage cleaning process in drainage, to reduce the spreading of diseases to human. The black water cleaning process helps to prevent pest infestations by reducing the residues that can attract and support pests. It also improves the shelf life and sensory quality of food products. In the proposed system, the machine is operated with remote control to clean the sewage. Hence, this system avoids the impacts from the sewage waste and its harmful gases. This helps to prevent the mosquito generation from the wastage. The system has a wiper motor that starts running as soon as the set-up is switched on. Two power window motors are connected to the wheel and it is driven with the help of the remote-control set-up. The process starts collecting the sewage wastes by using the arm and it throws back the waste into the bin fixed in the machine at the bottom. An arm is used to lift the sewage and in turn a bucket is used to collect them. The set-up runs even in sewage area with water (limited to a particular amount) so that the wastages which floats on the water surface also gets collected. The garbage which affects the drainage is also picked up and removed. This system has limited human intervention in the process of cleaning and in turn reduces spreading of diseases to mankind. Modern services are becoming polarized.

Pankaj Singh Sirohi, Rahul Dev, Shubham Gautam, Vinay Kumar Singh, Saroj Kumar Review on Advance River Cleaner [3], River water is used for irrigation which in return gives food to the people. They also maintain the ecology of region and bring prosperity. We made this project to clean the river. After implementing this project, we can control the pollution of river it is very beneficial for our society. In this project turbine rotates by flow of river water and through the mechanical gear arrangement we arrange two conveyor belts. The first conveyor belt is used to pick solid waste from river and the second conveyor belt is used to draw solid waste out of river for solid waste management. Water is the source of life. It covers 70% of the Earth. But only a small portion of this precious natural resource is fit for human consumption. Out of the earth’s total water 97% is stored in oceans which are not fit for human consumption. The further 3% is stored in various sources like glaciers, rivers, lakes and under-ground aquifers. Rivers have a special place in the lives of the Indians. They

consider rivers to be sacred, take holy dip during Amavasya (new moon), Purnamasi (full moon) and on other religious occasions. River water is used for irrigation which in return gives food to the people. They also maintain the ecology of the region and bring prosperity. An area without a river is considered to be poor. Unfortunately, during the past two decades water quality has deteriorated at a rapid pace. One of the major reasons for this is the solid waste being thrown to the rivers, turning them to be a dirty drain. The Ganga and the Yamuna, the two most sacred rivers of our country are no exception to it. Thousands of crores of rupees is being pumped to save the rivers through various plans. Now days we can see river pollution is biggest problem for our planet so we introduce our society with an advance river cleaner. This is an advance river cleaning system. We make this project for looking to clean river

Mr.Abhijeet. M.Ballade, Mr. Vishal.S.Garde, Mr.Akash.S.Lahane and Mr.Pranav.V.Boob Design & Fabrication of river cleaning system [4], India is holy country & during lots of festival like ganesh visarjan, navratri durga puja & mainly Siahnsth kumbhmela there is lots of water pollution of Godavari River at Nashik. The water pollution is very important problem in rivers, ponds and water bodies near Godavari River at Nashik. Due to increase in water pollution in the form to waste debris; it is hampering the life of aquatic animal and make their life in danger. Similarly, sometimes the aquatic animal tends to eats surface waste debris considering it as a food; which ultimately cause the death of animals. Due to polluted water many skin diseases to human kind are observed. So that to reduce the water pollution we are trying to make river cleanup machine. “River cleanup machine" a machine which involves the removing the waste debris from water surface and safely dispose from the water body. The river cleanup machine works on hydropower to extract waste water debris, plastics & garbage from Godavari River at Nashik

Ndubuisi c. Daniels Drainage System Cleaner A Solution to Environmental Hazards [5], The Drainage system cleaner is a machine which helps to protect the environment from different kinds of environmental hazards through the promotion waste management by the removal of garbage from the drainage system. These wastes when not removed end up settling in residential places where these wastes are burnt thereby causing climate change otherwise these wastes block the drainage systems thereby causing flooding. The machine is designed in such a way that it generates motion for its functions by itself through the action of running water thereby cutting out the dangers of the powering the machine by other sources of power because of the harshness of the rain on these other sources. The drainage system cleaner has

three major parts which are the Propeller, the Cleaner and the Pan all make up for its effective functioning. The Drainage system cleaner was tested on three different days in the first day it rained in the months of September, October and November 2012 respectively. Based on the findings made after the test the Drainage system functioned well when there is maximum load. I therefore recommend the use of this system by various individuals, government companies and waste recycling companies for prevention of environmental hazards and also encouraging waste management. Drainage systems are blocked most times by garbage like nylon, plastic bottles, and empty cans which cluster together and find their way into the drainage systems. If these garbage are allowed to flow the will end up flowing down to recreational beaches used for tourism purposes making a scene not pleasurable to the eyes (Larsen et al 2009) else these garbage flow to residential sites where they are burnt in a way of getting rid of them, thereby causing climate change. Overflow of water drainage system occurs when there is a blockage of an end of the drainage system forcing the water to find its way elsewhere apart from the mapped out drainage system, therefore the running water spills over the horizontal height of the drainage systems spreading to regions alongside the drainage system, thereby causing problems such as pushing down of structures such as fences, water logging of farm lands and residential buildings etc

Osiany Nurlansa, Dewi Anisa Istiqomah, and Mahendra Astu Sanggha Pawitra AGATOR (Automatic Garbage Collector) as Automatic Garbage Collector Robot Model [6], Nowadays, the environment problems arise in many towns in Indonesia. These problems come along by developing activities such as construction of houses, offices, and other business areas. The Environment problems occur due to several reasons; they are the low budget allocation on environment management and public awareness in protecting the environment. The Environment issue which comes up from year to year and still cannot be solved is about garbage and waste from various places dispose into rivers. Those garbages can clog water flow, induce the water become dirty, smelly, and often over flow so then give effect floods. This research aims to design and make AGATOR (Automatic Garbage Collector), a rotor robot model as automatic garbage collector to counter accumulation of garbage in the river which has no flow effectively and efficiently. The method of implementation is design and construction. This method includes the identification of needs, analysis of the components required specifically, hardware and software engineering, developing, and testing. The test results obtain data by specification of AGATOR includes IC ATMega16 with 5 Volt voltage and 1,1 ampere current, IC Driver with 12 Volt voltage and 1,2 Ampere current, and Limit

switch as the controller. Support devices of the robot are mechanical robot, robot control system, sensor system, and actuator robot. The maximum load drives the garbage receptacle until 5 kg. The average speed of robot when take out the garbage is 0.26 m/s.

Basant Rai Pollution and Conservation of ganga river In modern India [7] According to a World Bank Sponsored Study (State of Environment Report- U.P.) (In: Mallikarjun, 2003), pollution levels in the Ganga are contributing 9-12% of total disease burden in Uttar Pradesh (U.P.). The coliform bacteria levels are in excess of 2 lakh MPN as against the national water quality standard of 5000 (Mallikarjun, 2003). The report estimated total health damage on account of water pollution in up to is around 6.4 million daily (Disability Adjusted Life Year).According to the CPCB survey report, the total municipal sewage generated in the identified 25 towns in 1985 was of the order of1340 million liters per day (mld). Apart from this sewage, 260 mld of industrial wastewater, runoff from 6 million tons of fertilizers and 9,000 tonnes of pesticides used in agriculture within the basin, large quantities of solid waste, including thousands of animal carcasses and human corpses were being released into the river every day. Out of this, works corresponding to 873 mld only (65%) were taken up under the first phase of GAP. The remaining sewage was to be taken up under the 2nd phase of GAP which is already in progress. The Action Plan primarily addressed itself to the interception and diversion for treatment of the targeted municipal sewage of 873 mld. According to report of Water Resources Planning Commission (May, 2009), the programme GAP and NRCP has been positive. Water quality monitoring IJSART - Volume 3 Issue 11 –NOVEMBER 2017 ISSN [ONLINE]: 2395-1052 Page | 11 www.ijsart.com done by reputed independent institutions indicates some improvement in the water quality over pre-GAP period. The water quality analysis of samples collected at 16 stations on River Ganga during 1986 and 2008 shows improvement in Dissolved Oxygen (DO) levels at 4 locations namely up and down streams of Allahabad and Varanasi. All the 16 stations except Patna downstream and Rajmahal show reduction in Biological Oxygen Demand (BOD) values.

Chapter 3

METHODOLOGY

This project focuses on creating a remotely operated waste collection device for aquatic environments, utilizing an ESP32 microcontroller for operations control, including propeller management for navigation, and an ESP32 CAM for real-time visual feedback. The device incorporates a servo motor to adjust the camera angle for optimal waste identification, and a conveyor belt system for the collection of waste. The entire operation is orchestrated through the Blynk IoT platform, which also facilitates user interaction for device control and live video stream access. The methodology encompasses several critical steps outlined below:

3.1 Initial Setup and Configuration

Component Assembly: Assemble the mechanical structure of the waste collector, including mounting the four propellers for navigation, the servo motor for camera angle adjustments, and the conveyor belt for waste collection.

ESP32 and ESP32 CAM Integration: Integrate the ESP32 microcontroller with the propulsion system (propellers) and connect the ESP32 CAM for live video streaming. Establish communication between the ESP32 and the servo motor for camera angle manipulation, and with the conveyor belt system for waste collection.

3.2 Software Development and Platform Integration

Blynk IoT Platform Setup: Configure the Blynk IoT platform to create a user interface for remote control. This includes setting up widgets for controlling the propellers' speed and direction, servo motor for camera angle, and the conveyor belt's operation.

Programming ESP32: Develop the software to program the ESP32 microcontroller, enabling it to respond to commands from the Blynk IoT platform. This involves coding for the manipulation of propellers, adjustment of the camera angle via the servo motor, and operation of the conveyor belt.

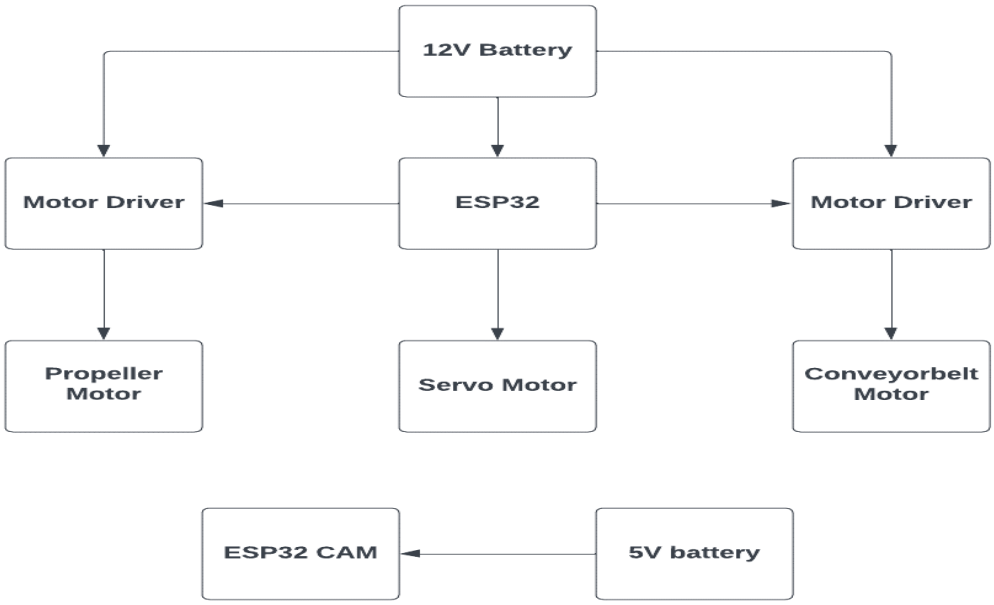

Fig 3.2.1 Block diagram of software interfacing

3.3 Calibration and Functional Testing

System Calibration: Calibrate the device for optimal performance, ensuring precise control over propeller speed for navigation, accurate servo motor adjustments for camera angle setting, and efficient operation of the conveyor belt for waste collection.

Testing: Conduct thorough testing to ensure seamless integration and communication between the ESP32, ESP32 CAM, servo motor, conveyor belt, and the Blynk IoT platform. This includes testing the device's response to remote commands for movement, camera angle adjustments, and waste collection functionality.

3.4 Deployment and Operation

Field Testing: Deploy the waste collector in a controlled water body for field testing, assessing its navigation, waste identification through live video feed, and collection capabilities.

Operational Deployment: Following successful testing and adjustments, the device is deployed in the targeted aquatic environments for operational waste collection. Continuous monitoring and control are facilitated through the Blynk IoT platform, ensuring effective waste management.

This methodology ensures a systematic approach to designing, developing, and deploying an ESP32-based waste collector for water environments, leveraging the advanced capabilities of the ESP32 microcontroller and ESP32 CAM, controlled remotely via the Blynk IoT platform.

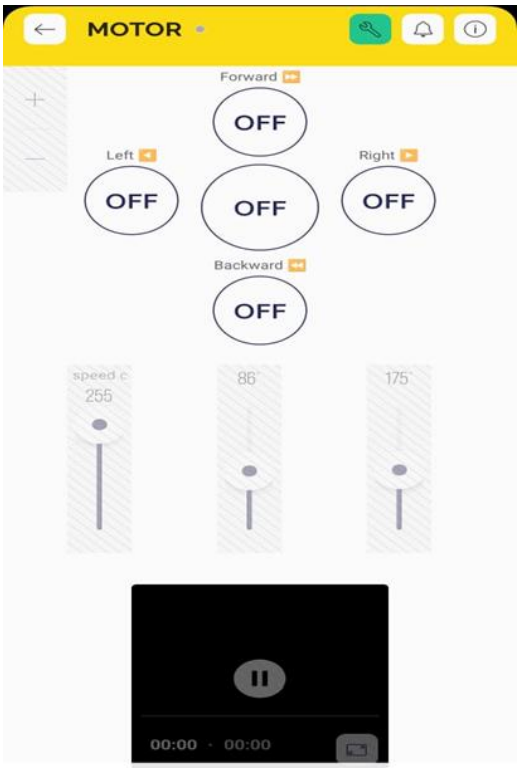

Fig 3.4.1 Controls in Blynk IoT app

Fig 3.4.2 Prototype of Wireless Aquatic Debris Remover

Chapter 4

SYSTEM DESIGN

The system architecture for the Wireless Aquatic Debris Remover revolves around the integration of the ESP32 microcontroller and ESP32 CAM programmed using the Arduino IDE and controlled via the Blynk IoT app. This architecture encompasses both hardware and software components, enabling remote control and monitoring of the cleaner's operations. At the core of the system is the ESP32 microcontroller, which serves as the central processing unit responsible for coordinating various functions of the cleaner. The microcontroller is programmed using the Arduino IDE, allowing for the development of custom firmware tailored to the specific requirements of the project. The Blynk IoT app acts as the user interface, providing a convenient means for users to send commands and receive feedback from the cleaner. Through the app, users can remotely control the movement and operation of the cleaner, as well as monitor its performance in real-time. The communication between the ESP32 microcontroller and the Blynk IoT app is facilitated through Wi-Fi connectivity. The microcontroller connects to the local Wi-Fi network, allowing seamless communication with the Blynk server and the associated mobile app. In terms of project planning, the development process is divided into several phases, including requirements gathering, design, prototyping, testing, and deployment. Each phase is meticulously planned and executed to ensure the timely and successful completion of the project. Key milestones include the development of the ESP32 firmware, integration with the Blynk IoT app, prototyping and testing of the cleaner's hardware components, and final deployment in real-world water bodies. Throughout the project, emphasis is placed on collaboration, iteration, and continuous improvement. Feedback from testing and user interactions is incorporated into the design and development process, allowing for refinement and optimization of the system architecture [8].

Chapter 5

IMPLEMENTATION

The project begins with the hardware setup where the ESP32 microcontroller is connected to the propellers, conveyor belt, and servo motor. The ESP32 camera module is also integrated into the system. Once the hardware is set up, the Blynk IoT platform is installed on the device for remote control and monitoring of the waste collector.

The next step involves programming the ESP32 using a suitable development environment. The program should include the necessary libraries for the ESP32 camera module and the Blynk IoT platform, and it should be designed to control the propellers, conveyor belt, and servo motor.

Following the programming of the ESP32, the system is integrated with the Blynk IoT platform. This involves writing code to connect the ESP32 to the Blynk IoT platform, which allows for remote control of the waste collector. The Blynk interface is then set up to control the propellers, conveyor belt, and servo motor, and to display the live video feed from the ESP32 camera module.

Once the system is set up and integrated with the Blynk IoT platform, it is tested to ensure that all components are working as expected and that the system can effectively collect waste from water. The live video feed on the Blynk IoT platform is checked to ensure it's functioning correctly.

After successful testing, the waste collector is deployed in the water. Its performance is monitored through the Blynk IoT platform, and necessary adjustments are made to ensure optimal operation. The implementation process concludes with regular maintenance and updates to improve the system's performance and efficiency.

Chapter 6

CONCLUSION

The Wireless Aquatic Debris Remover, developed to address water pollution, has proven effective in collecting surface debris. It uses advanced technologies like the ESP32 microcontroller, Blynk IoT app and remote control, monitoring, and energy efficiency. Despite challenges in hardware compatibility, software stability, and power management, solutions were found through innovation and refinement. The cleaner provides a cost-effective, eco-friendly alternative to traditional methods and paves the way for future water pollution remediation technology.

Chapter 7

FUTURE WORK

- Expansion with Advanced Features: This includes the implementation of machine learning algorithms for waste identification, upgrading the system's capacity to handle larger waste volumes or operate in diverse water environments, and enhancing the live video feed with additional sensors for more comprehensive data gathering [9].
- Improvement of User Interface on Blynk IoT Platform: This involves refining the user interface on the Blynk IoT platform to offer a more intuitive and user-friendly experience, incorporating features like real-time data visualizations, customizable controls, and detailed system status updates for enhanced user interaction and monitoring.

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