Advanced Disinfecting, Analysis and Collection of Garbage from Aquatic Resources

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ABSTRACT

In the last 20 years almost all the water resources in the world are suffering from pollution. Now a days water bodies are destroyed by the disposal of untreated sewage and solid wastes. During this current scenario, these water bodies are highly polluted, then become landfills leads to the destruction of water bodies and thereby the aquatic organisms. Approximately 70% of sewage goes untreated, resulting in over 40 million litres of raw sewage being discharged directly into oceans, rivers, and lakes on a daily basis. To address these issues, various governmental initiatives and programs have been implemented with the goal of decreasing water pollution levels. Due to this issue of increasing level of pollution of water bodies, this project "Advanced Disinfection, Analysis and collection of garbage from water sources" is to analyse the water quality, collect waste from water bodies and at the same time disinfect the water. This project is remote controlled, we use DC pumps to control the direction and arrange the steering servo motor. To make the ship self-sufficient, we need to implement solar panels that would charge the battery. Wire gauges are used for waste collection. Here we use Arduino mega controller and UV light to disinfect the water and various sensors to sense the quality from the water.

Keywords: Disinfecting system, Trash collection, Analysis IoT

1 Introduction

Water is the most essential need of all living organisms, and it is the most important, and water pollution is one of the biggest threats we face today. More than 70 percent of the fresh water in our country has become unusable. Therefore, it is important to have clean water. Almost all rivers in India are now very heavy. Scientists at the NEERI in Nagpur estimated that around 70 percent of India's water is polluted.

The aim of our project is to collect waste from water bodies and to clean up and analyze the water. This work was done to understand the current state of our water sources, we have discharge of sewage, toxins, waste etc. The project results in the collection of waste from water sources. It facilitates the analysis of parameters such as pH, turbidity, and temperature. After analyzing these parameters, the proposed system sterilizes water rods for various purposes. By collecting waste and purifying the water, the life of organisms in the body of water is safe. Water analysis helps in using water for many other purposes like agriculture, cleaning rivers, lakes, and other water bodies etc.

This project is remote controlled, and which can steer it accordingly, we use DC pump to provide directional control and servo motor arrangement for steering. To make the boat self-sufficient, we installed charging batteries. Metal gauge nets are used for waste disposal, UV lamps are used for water disinfection, and various sensors are used to analyze water quality.

2 Literature Review

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In conceiving our device, we sought solution to reduce water pollution caused by floating waste. Given the significant impact of pollution on the environment, we delved into various environment-related journals to find application countermeasures.

2.1 Solar operated water trash collector

The goal of the project is to collect litter from water bodies while reducing human disturbance. The waste collected by the equipment is disposed of in a simple way. It is a sewage treatment system based on solar energy, which is environmentally friendly and safe for users. It has something to do with skimmers, i.e., work boats used to collect and dispose of floating solid waste in ports and waterways [1]. It consists of a system of conveyor belts placed on the axis due to the rotation of the car, which rotates the conveyor belts and collects the waste and deposits it in a bin where all the waste is collected. In this proposed system, it only collects waste in water, but the project that we are going to implement is an advanced system for this project because it collects waste while analyzing water and sanitizing the source of water [1].

2.2 Solar powered IoT based Garbage collection system

This project utilizes solar energy to power smart trash cans that can monitor the amount of garbage collected and connect to a network for data transmission. The collected data can assist the city in optimizing waste trucks for more efficient utilization of resources such as personal, fuel and vehicles. Additionally, the data can help identify patterns in garbage collection and inform efforts to reduce waste in specific areas.
To track pollution levels in different parts of the city, waste treatment facilities are equipped with various sensors, including those for air quality and sound. The system employs pressure sensors that link to the internet via a GSM module and are powered by solar energy [2]. These self-contained units can be located throughout the city, forming a garbage network that connects to public server. The collected data enables the city to predict the most efficient routes for waste collection, optimize the distribution of trucks and personnel, and obtain real-time updates or ferry levels. By processing server-side data, the system calculates the most efficient ferry routes, paving the way for mobile applications and integrated waste management in smart cities.

2.3 Amphibious clean-up robot

The amphibious cleaning robot is designed with solar system. Its robot can run fast on land and work flexibly in water. Remote control, free switching between water and land modes, greatly improves floor cleaning efficiency, reduces transportation costs, reduces labour, and ensures operator safety [3]. The robot is equipped with a unique mechanical structure design for a rotary collection system that efficiently clears hyacinths and debris from rivers and lakes.

3 Components

3.1 NODE MCU Esp8266

The ESP8266 is a popular low-cost, Wi-Fi-enabled microcontroller that is used in a variety of Internet of Things (IoT) applications. It is a system-on-a-chip (SoC) that integrates a microcontroller unit (MCU), Wi-Fi capabilities, and a set of peripheral interfaces, such as SPI, I2C, and UART. The ESP8266 is known for its small form factor, less power consumption, and very easy to use, making it an ideal choice for DIY projects and commercial products. It can be programmed using the Arduino IDE or other development environments, and there are many third-party libraries available to simplify the development process. The ESP8266 can be used for a wide range of applications, including home automation, remote monitoring, smart devices, and industrial control systems. Its affordability and versatility have made it a popular choice

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among hobbyists and professionals alike [1].

3.2 Turbidity Sensor

A turbidity sensor is a device that is used to measure the clarity or turbidity of a liquid. It works by shining a light through the liquid and then measure the amount of light that is scattered or suspended solids in the liquid. The sensor typically consists of a light source, a detector, and a measurement circuit that converts the detected signal into a turbidity value. Turbidity sensors are commonly used in water treatment plants, aquariums, and environmental monitoring applications to ensure that the liquid being monitored is of acceptable quality.

3.3 pH Sensor

A pH sensor is the tool that measures the acidity or alkalinity of a liquid based on its hydrogen ion concentration, represented by pH value ranging from 0 to 14. A value of 0 signifies high acidity, while a value of 14 indicates high alkalinity. The sensor typically consists of a pH electrode and a reference electrode that are immersed in the liquid being measured. The pH electrode generates a voltage proportional to the pH of the liquid, which is then converted into a pH value by the measurement circuit. pH sensors are commonly used in a variety of applications, including water treatment, food and beverage production, and scientific research.

3.4 Temperature Sensor

A water temperature sensor is an instrument designed to measure the temperature of water. It detects temperature changes and converts them into an electrical signal that can be interpreted by an electronic device, such as microcontroller. Water temperature sensors are commonly used in a variety of applications, including swimming pools, aquariums, hot tubs, and water treatment plants, where monitoring water temperature is important for the health and safety of the system or its users. Different types of water temperature sensors are available, including immersion sensors that are placed directly in the water and flow-through sensors that measure the temperature of the water as it passes through a pipe or channel. The selection of the appropriate sensor depends on the specific requirements of the application.

3.5 Motor Driver

A motor driver is an electronics device used to control the speed and direction of a motor. It works by taking a signal from a microcontroller or other electronic device and converting it into a voltage or current to run a motor. Motor drives are often used in robotics, automation and other applications that require precise control of motors [4]. There are different types of drives, including H-bridge, half-bridge, and full-bridge drives. The selection of the motor drives depends only on the specific requirements of the application, including the type and power of the motor used and speed and power required. Motor drives usually have a maximum rating and current, so it's important to choose a driver that meets the motor's requirements to prevent damage to the driver or motor.

3.6 Disinfection System

A disinfection system used in a water trash collector is a process that removes harmful microorganisms and other impurities from the water. This system typically uses a combination of physical, chemical, and biological methods to disinfect the water and make it safe for human consumption or release into the environment. Chlorination is a widely used method of disinfection, in which chlorine is added to water with the aim of eliminating viruses and bacteria. Other chemical disinfectants include ozone, hydrogen peroxide, and UV light. Physical methods such as filtration and sedimentation can also be used to remove impurities

from the water [5]. In a water trash collector, the disinfection system is typically part of a larger treatment process that includes the removal of debris and other solid waste. The treated water is then released back into the environment or used for other purposes, such as irrigation or industrial processes. Overall, the disinfection system used in a water trash collector, it is essential for ensuring the safety and quality of our water supply to protect public health and preserving the nature.

3.7 LM7805 Voltage Regulator

The LM7805 is a popular linear voltage regulator that is widely used in electronic circuits to provide a stable and regulated output voltage [6]. It is capable of converting an input voltage of up to 35 V into a regulated output voltage of 5 V, making it ideal for powering low-power electronic devices such as microcontrollers, sensors, and LEDs [7]. The LM7805 regulator utilizes a voltage reference and an error amplifier to keep a constant output voltage, even with varying input voltage and load conditions. It is offered in various package types, such as TO-220, TO-92 and SOT-223, making it simple to incorporate into a diverse range of circuit designs. The LM7805 is reliable and cost-effective solution for voltage regulation in many applications, and its ease of use has made it a popular choice among hobbyists and professionals alike.

3.8 UV Sensor

The UV sensor used in a water trash collector is typically designed to be resistant to water and other environmental conditions that are present in the collection system. It can be integrated into the water treatment system and placed in the UV reactor chamber or in the distribution system downstream of the UV reactor [8]. The sensor provides real-time feedback on the UV intensity and dose, allowing operators to adjust the system parameters as needed to maintain the desired disinfection level. By monitoring the UV intensity and dose, water trash collectors can ensure that the water they release into the environment is safe and free of harmful microorganisms. The use of UV sensors can help to improve the efficiency and effectiveness of the UV disinfection process, reducing the risk of waterborne diseases and protecting the environment.

3.9 Propeller Motor

Propeller motors are typically brushless, which means they have a longer lifespan, are more efficient, and produce less heat than brushed motors. They are also often water-cooled to prevent overheating during use. The size and power of the motor used in an RC boat depends only on the size and weight of the boat, as well as the speed of the boat and maneuverability [9]. RC boat enthusiasts can choose from a variety of propeller motors, including in runner and outrunner motors, which provide different levels of power and performance. Overall, propeller motors are an essential component of RC boats and provide the necessary power and propulsion to make these miniature watercrafts move through the water.

4 System Description

Our proposed machine is a novel waste collection, disinfection, and water analysis system. The conveyor, attached to the motor shaft, rotates as the motor rotates, collecting garbage from water bodies. Meanwhile, the system disinfects and analyzes the water quality. The machine is remote controlled, and it utilizes a four-bar mechanism is designed to rotate and gather garbage at a precise angle.

The system consists of the following components:

- Microcontroller (ESP8266)
- Solar panels
- Controller Board

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- Battery 12V
- Resistors
- Capacitors
- IN4007
- Propeller motor
- pH sensor
- Temperature sensor
- Turbidity sensor
- UV sensor
- LM7805 voltage regulator
- Camera
- Waste collection conveyor

In this project we aim to collect different types of waste from water surface and thus reduce the living interface. Here we use a rechargeable battery which is the main source to power for the entire components in the system. The power from the battery is given to both the microcontroller and UV disinfection system. The ESP8266 microcontroller which is act as the head of the entire system here we program all the function that system has to work according to the user command, this microcontroller is connected to the conveyor system and DC motor at the same time it is connected the analyzing parameters i.e. the pH, turbidity, temperature sensor and also to the camera module attached in system to know about the product we are picking from water resources. When the command received from the server to the microcontroller the system starts moving according to direction of user and at the same time it will collect various parameters of water and disinfect the water resource from harmful microorganisms present in water.

4.1 Block Diagram

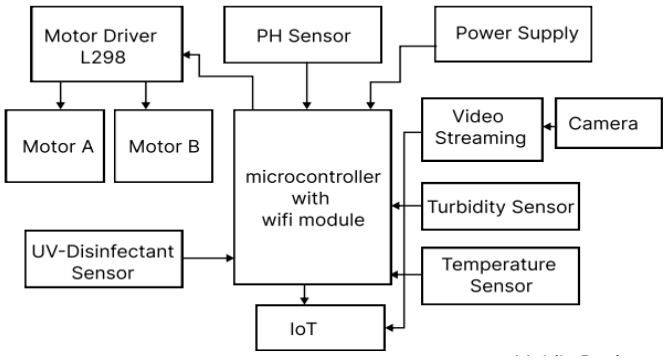

Figure 1: *Block diagram for the proposed system*

Figure 1 primary aim is to introduce a way in which garbage could be collected and disposed efficiently. Increased waste levels have made it important for proper waste management systems and procedures. The main aim of this concept is to reduce man power and time consumption for cleaning the water [2].

In this project the main aim of this machine is to lift waste debris from water surface and dispose them in the tray. It consists arrangement of conveyor which is place on shaft of motor. Due rotation of motor conveyor rotated. As the conveyor is move, it collect water debris, waste garbage and plastics from water bodies. As the machine is placed in the water the waste debris in water will get lifted and it moves in upward direction. As the waste debris reaches the upper extreme position it will get dropped in the tray. Hence this will result in cleaning of water surfaces and safe collection of waste debris from water [3].

Here we use a rechargeable battery which is the main source of power to the entire component in the system. There are two power supply. One is given to the ESP8266 microcontroller and the other is given to the UV Disinfection system. The ESP8266 Microcontroller is connected to the 12V power supply and the UV disinfection system is connected to the9V power supply. The ESP8266 Microcontroller act as the head of the entire system. The ESP8266 Microcontroller is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to Wi-Fi module. When power supply is given to the microcontroller it will gets on and we give the commands such as the movements to the microcontroller, then it gets move in the direction that we need. This microcontroller is connected to the conveyor system, motor driver, disinfection system and the analyzing parts. There is a camera module which is also connected to the microcontroller through IoT. The use of camera module is to identify the things that are floating in the water surface and to find whether there is any obstacles for the movement of the system. We are using L298N motor driver in our system that allows speed and direction control of DC motors at the same time [1].

There are four process to do in our system, first to collect the garbage in the water surfaces then to analyze the water, after that we are disinfecting the water and finally, we are doing one more analyzing process to find whether there are any changes in pH, temperature or turbidity values. First, we are doing the conveyor portion that is by IoT we on the entire system and then give commands to the microcontroller to move, after that the conveyor system gets on and it will start to collect the wastes from the water surfaces. There is a dustbin attached near to the conveyor and when the wastes come in the top of the conveyor system it will move to the dust bin. After the collection of garbage, we are analyzing the water, the analyzing portion include pH, temperature and turbidity. These sensors are attached to the microcontroller, we give commands to the microcontroller through IoT for the analyzing. After analyzing the values will be displayed in the IoT device that we are connected

4.2 Circuit Diagram

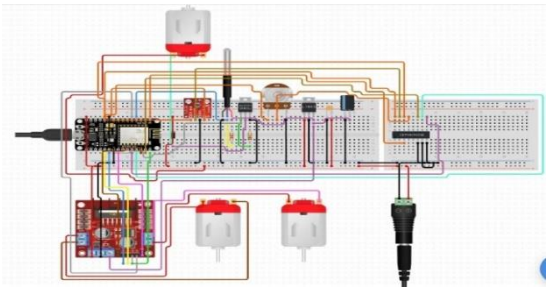

Figure 2: *The Schematic for the proposed system*

Figure 2 is the circuit diagram of the water trash collector. It consists of a microcontroller used is ESP8266 for the entire control of the system, a motor driver (L298) which controls the motor in the system and three sensors are used to analyze the water quality, i.e., pH, Turbidity and Temperature sensors. First the power supply from the battery with a voltage regulator is connected to the ESP8266 microcontroller the positive terminal of the power supply to the 3.3V pin of the ESP8266 and the negative terminal to the GND pin.

Secondly the motors of the propeller and the conveyor are connected to the motor driver it is then connected to the GPIO pins of the ESP8266 to the control inputs of the motor driver module i.e. the GPIO0 of ESP8266 to the IN1 pin of L298N and GPIO2 to IN2 pin of L298N. These pins will be used to send commands to control the motor's direction and speed. The positive terminal of the power supply is connected to the VCC of L298N, then the ground pins of the motor driver and microcontroller are connected to establish a common ground reference for both microcontroller and motor driver.

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Next, we connect the analyzing part of the system to the microcontroller connect the pH sensor's analog output to an available ADC capable GPIO pin on the ESP8266 such as A0, then connect the power supply VCC to a 3.3V pin on the ESP8266 and connect the GND of pH sensor to a GND pin on the ESP8266. The turbidity sensor's analog output is connected to the ADC capable pin on the ESP8266, the power supply of turbidity to the 3.3V pin on the microcontroller and GND pin of turbidity to GND pin of the microcontroller. DS18B20 digital temperature is connected to the GPIO pin on the microcontroller, the power supply of DS18B20 VCC is connected to the 3.3V pin on ESP8266 and GND pin of the sensor to the a GND pin on the microcontroller. The UV light is connected to a 9V power supply and is turn ON at the time of disinfection process.

5 Conclusion

Our innovative system is designed to remove surface water bodies, promoting clean water and improved water quality. The system includes a UV disinfection machine which treats collected wastewater, and the rechargeable battery which powers the system. The design is not only environmentally friendly, but also economic. This floating system is particularly useful in rural areas, where it can increase productivity and support irrigation. Unlike other systems, our design requires on external electricity, and therefore has no operating costs.

6 Results

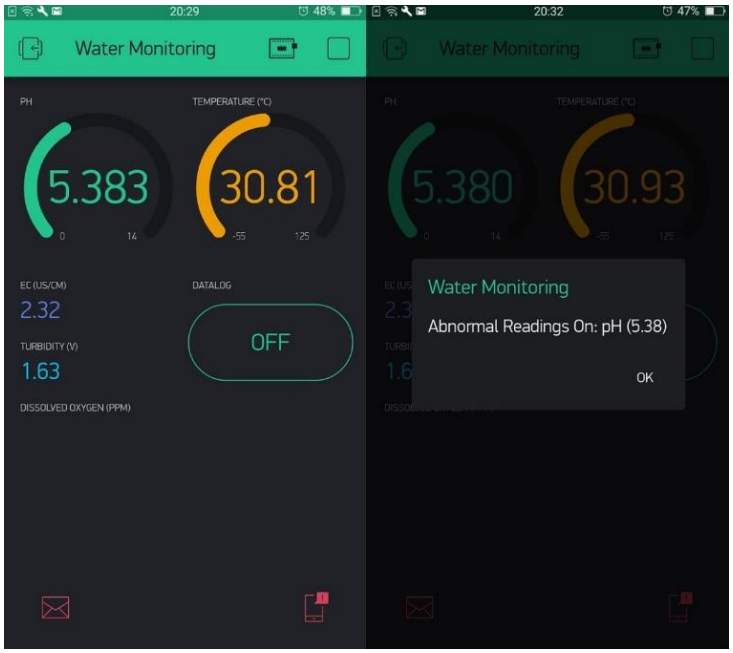

Figure 3: *Analyzing part of the system*

Figure 3 is the analyzing part of our project. Here we are analyzing the water by finding the pH, temperature and turbidity. By finding this we can find whether the water is clean or not and if it is good for the aquatic organisms to survive.

Figure 4: *Final outcome*

Figure 4 is the prototype of our project "Advanced Disinfection, Analysis and Collection of Garbage from Water Resources". This system uses a conveyor system attached to a dustbin to collect garbage from the water bodies. At both sides we using a PVC pipe which helps the system to float in the water surface. It uses three sensors to analyze the water the sensors used here are pH, Turbidity, Temperature and also a UV disinfection system to disinfect the water.

7 Future Scope

The proposed system has vast potential for dealing with floating garbage and other pollutants, making it highly scalable. Further enhancements could include incorporating wind turbines to generate additional power for the batteries. With modifications, this system could be adapted for use in automatic garbage removal in oceanic environments. Additionally, the waste collected by the trash collector could be harnessed for electricity generation.

8 Publisher's Note

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