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IoT Enabled Floatable Waste Collecting Machine With Quality Monitoring System

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ABSTRACT:

As the use of plastics grows uncontrollably in many countries, the toxins generated by these materials disturb the ecosystem and are hazardous to humans. Cleaning waste by hands would be insufficient because it frequently involves a large area of labor and endeavors, as well as the risk of contracting various diseases from the seductive microorganism found in sewage while cleaning manually. The Indian Government has taken charge of river cleaning and has invested heavily in numerous river cleaning project. Taking this into account, we intend to operate the waste collection machine by utilizing IoT to monitor the water bodies and analyze the water quality. A floatable waste-collecting machine could be a lifesaver for endangered aquatic animals and humans.

KEYWORDS: Trash Collector, Remote controlled, IoT monitoring, Water quality

INTRODUCTION:

Water is an important valuable natural resource in the world, and it should be found in many altternative forms that are divided into salt and water, as well as tiny and large. The characteristics said them apart from each other, like oceans, streams, ponds, and different natural wonders. These water bodies are vital to life on earth. But many human activities and industrial development lead to pollution of water bodies. Many countries lack the infrastructure needed to prevent plastic pollution, such as sanitary landfills, incineration facilities, recycling capacity, and circular economy infrastructure, as well as proper waste management and disposal systems as a result, 'plastic leakage' occurs into rivers and the oceans.

Every year, over 300 million tonnes of plastic are made to used in a massive selection of applications. Plastic accounts for about 80 percent of all marine garbage discovered from surface waters to sea sediments, and a minimum of 14million tonnes of it finishes up within the ocean per annum. By 2050, global primary plastic production is estimated to exceed 34 billion tonnes. Plastic waste is ingested or entangled by marine creatures, resulting in serious injury and death. Plastic pollution endangers food safety and quality, human health, coastal tourism, and climate change. More than half of our rivers and streams, as well as more than a third of our lakes, are filthy and unfit for swimming, fishing, or drinking, according to the most recent national water quality studies conducted by the Environmental Protection Agency.

A 2020 research on riverine plastic pollution from fisheries revealed greater amounts of trash fishing gear closer to the sea, with sample location along the Ganges from the Bangladesh coast to the Himalayas in India. According to the study, this is likely owing to greater levels of fishing activity and down stream buildup of fishing gear in these locations. The nets, ropes, thread, floats, and lines that makeup ghost fishing gear have been known to ensnare and kill freshwater wildlife including Gangetic dolphins, turtles, and smooth-coated otters.

DOCUMENTARY RESEARCH:

Several research in the literature have reported on and addressed river cleaning machine difficulties. M. N. Mohammed et al., (2020) have designed and developed the river cleaning robot. This study includes a recommended design for a garbage collection system that is both practical and effective for cleaning up waste from rivers, channels, and lakes. The garbage collection system is expressly

coordinated to an application for picking up a wide range of materials, such as gliding litter, trash, logs, discarded tires, and others. The integrated system makes use of Internet of Things(IoT) technologies to monitor and manage the whole operation [1].

P. N. F. M Shamsuddin et al., (2020) focused on creating a high-stability Water Trash Collector (WTC) model and fabricating it with high-quality stainless steel. The catamaran shape is the best hull type for collecting debries on the water's surface. Furthermore, the goal of the electrical section is to create a remotely controlled WTC utilizing a SkyFly controller and a battery as the primary power source [2].

Kashinath Munde and Madhavi N. Wagh (2018) proposed River Water Skimmer to minimize the amount of man power and time required to clean the river. A motor and chain drive system was used to automate the operation of river cleaning [3]. S. Malavika et al., (2020) have implemented Solar Operated Water Trash Collector using the non-conventional energy source (solar) to run garbage collection equipment in order to remove rubbish, debris, and solid waste from water and make them clean [4].

S. Arun Kumar and S. Sasikala (2020) revealed the lake cleaning robot system for eliminating surface pollutants. Raspberry Pi is used in this lake cleaning system, together with proximity sensors for detection of distance and DC motors for movement. Along with the gripper, motors, ultrasonic sensor, and IR sensor, the Raspberry Pi controls the robot's movement. The suggested system's working prototype model has excellent accuracy and takes less time to compute [5].

Pankaj Singh Sirohi et al., (2017) have proposed the River Cleaner in which the turbine revolves due to the flow of river water, and two conveyor belts are attached to it via a mechanical gear system. For solid waste management, the first conveyor belt is used to pick solid garbage from the river, and the second conveyor belt is used to pull solid waste out of the river [6].

Sandesh M Prabhu et al., (2019) constructed a river cleaning system that uses hydropower generated by a turbines that looks like a Pelton wheel. The conveyor belts move through appropriate couplings such as gears and chains when the turbine runner rotates. The turbine speed and power necessary to operate the conveyor belts that transport floating garbage away from the water body is factored into the construction of these links [7].

Ganesh S. Khekare et al., (2019) have implemented the remote- controlled river surface cleaning machine for collecting waste from the lake, this water garbage collector machine is made up of DC motors, RF transmitter and receiver, propeller, PVC pipes, and chain drive with conveyor connected [8]. Abir Akib et al., (2019) have built Unmanned Floating Waste Collecting Robot which is developed with two propellers attached to two DC motors to drive forward, backward, right, and left – a mobile application based Bluetooth control system to manage the robot from a distance and a robotic hand to make trash collection easier [9]. R.Raghavi et al., (2019) created a Surface Cleaning Robot which is RF controlled. The pH sensor in this robot determines the solubility and biological availability of the chemical elements of water [10].

METHODOLOGY:

Fabrication of Iot enabled floatable waste collecting machine with quality monitoring system is proposed. The proposal's major goal is to lift waste particles from surface of the water and deposit it in the tray, hence reducing man power and time spent to cleaning the water surface. The operation of water cleaning has been mechanished in our system using a motor and chain drive configuration. The water wheel is bolted to the shaft, which is attached to the base structure. The objective of a water wheel is to propel a machine forward, backward, left, or right over the water. With the use of a chain drive system, a motor is employed to rotate the water wheel. The waste collection conveyor is also rotated by this motor. Finally, the floating trash is gathered by a bin located within the boat. The pH sensor is also used to check the water quality via IoT framework. For remote video surveillance, a wireless camera is provided.

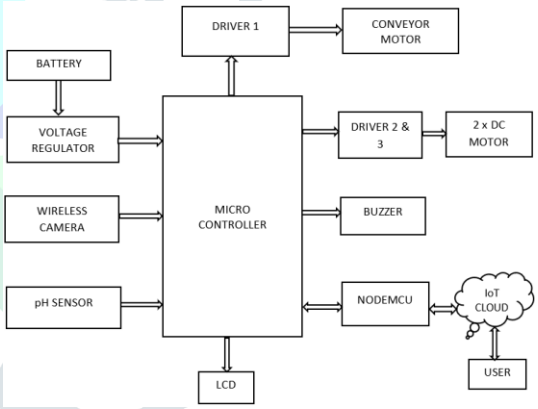

Figure 1: The proposed block diagram

The proposed IoT enabled floatable waste collecting machine's architecture is shown in Figure 1. The suggested hardware architecture includes ATmega328p that controls the robot's movement, along with the conveyor, motors, pH sensor and camera. The input and output components used in the waste cleaning machine are listed below.

BATTERY:

The major source of power for the entire electrical circuit design is the battery. Three Lead acid batteries are utilized, each with capacity of 5Ah and a voltage output of 5V.Two batteries are utilized to power three DC motors that drives the machine and conveyor belt . The control package, sensor and camera are all powered by single battery.

VOLTAGE REGULATOR:

The voltage is regulated by a voltage regulator according to the requirements. The LM7805 is a voltage regulator with three terminals. At the input, a positive unregulated voltage is supplied. Both the input and output pins have a common ground. The IC's pin is used to measure the output regulated 5V. Two LM7805 voltage regulators are employed, one for the microcontroller unit, while the other is for the relays and pH sensor.

MICROCONTROLLER:

The central processing unit is an ATmega328P microcontroller and the controller is designed around it. It consists of 28 pins and operating voltage as 1.8V to 5.5V. The controller is created in such a way that it receives directions for propeller and conveyor belt motion through Wi-Fi signals. The controller also regulates the flow of electricity to the various components of the system.

DRIVER CIRCUIT:

To turn ON the relay, a driver circuit is utilized. Optocoupler and transistor make up this circuit. The microcontroller will use DC motor drive to process the input signal. Following that, the microcontroller will provide output signals to the DC motors that are attached to it. The desired input will be given through web page which is created for controlling the machine. Figure 2 shows the user interface of the web page, which was created to allow users to manage the water waste collector remotely. Relay is a switch that is powered electrically. A magnetic field is created by current flowing through the relay coil, which attracts a lever and alter the switch contacts. Relay features two switch positions and are double throw switches since the coil current can be turned ON or OFF. For the circuit to function properly, relays and switches are used which modifies the state or motion of a DC motor.

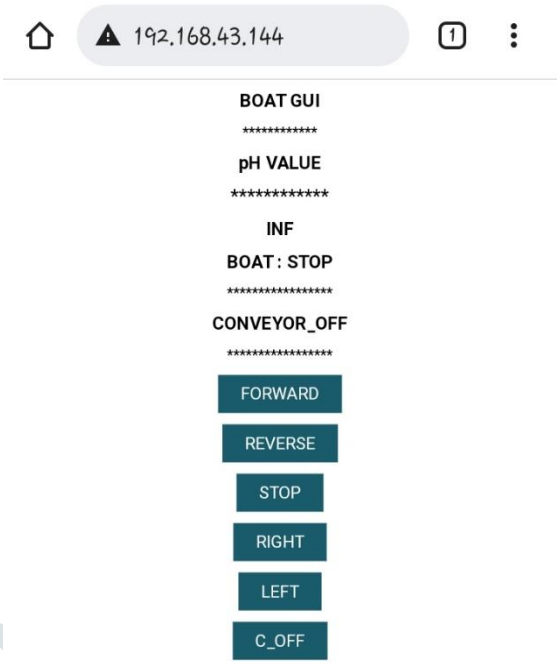

Figure 2: User Interface of the Webpage

DC MOTOR:

A DC motor is an electric machine that transforms electrical energy into mechanical energy. DC motors use direct current to convert electrical power into mechanical rotation. This machine has three 12 volt Johnson motors. The direction of the propeller is controlled by two motors, each with RPM of 30 . Another motor, with an RPM of 60, is utilized to regulate the conveyor belt.

NODEMCU:

As an IoT module, the NODEMCU ESP8266 is used. NODEMCU is an open source platform based on the ESP8266 that allows items to connect and data to be transferred using the Wi-Fi protocol. The ESP8266 has a low cost and a lot of functions, making it a suitable Internet of Things module (IoT). It can be used in any application that requires a device to connect to a internet or local nework. To store data and programmes, NODEMCU contains 128kB of RAM and 4mB of flash memory. It is perfect for IoT project due to its high processing power in-built Wi-Fi / Bluetooth and deep sleep operating capabilities. The NODEMCU is fueled through a micro USB jack and VIN pin (external supply pin). Furthermore, it may solve many of the projects demands on its own by providing some of the most important microcontroller functionalities like GPIO, PWM, ADC, and so on.

WIRELESS CAMERA:

ESP32-Cam is employed as a wireless camera. The ESP32 is a low-cost, low-power system-on-a-chip microcontroller series with integrated Wi-Fi and dual-mode Bluetooth. The ESP32-Cam is a small camera module that used the ESP32-S microcontroller and costs around $10 . Aside from the OV2640 camera and various GPIOs for

connecting peripherals, it also has a micro SD card slot for storing photograph shots with the camera or files to provide to clients.

LCD:

LCD modules are widely employed in a wide range of projects. The reason for this is because it is inexpensive, readily available, and programmer-friendly. The 16*2 LCD is named for the fact that it contains 16 column and 2 rows. LCD is placed to show messages or alerts.

pH SENSOR:

An electrochemical pH sensor is the most popular method for detecting pH. A combinational pH sensor is an electrochemical pH sensor that includes both a measuring electrode and reference electrode. The measuring electrode detects variations in pH while the reference offers a steady signal for comparison. The pH of a water body must be monitored because it impacts aquatic creatures. A change in the usual pH of a body can indicate excessive pollution. The pH of the fresh water must be 7. Values greater than7 are considered basic. Acidic values are those that are less than 7. Nowadays, as a result of industrialisation, many industrial waste, particularly liquid waste, is thrown directly into river and lakes without being recycled. As a result, it is important to keep track the pH of all fresh water resources. The pH monitoring system is used to ensure the safety of fresh water.

BUZZER:

A Buzzer is a type of auditory signalling device often known as a beeper. The most common application of buzzer and beeper is to provide users with audible feedback. A buzzer is used to ensure the Wi-Fi connectivity and notify us when the quality of the water is unbalanced.

The simulation for this system was created with Proteus software, which was created by England labcenter Electronics Ltd for schematic capture, simulation and printed circuit board layout creation. An Arduino, a motor drive, switches, and motors are included in this circuit.

Several components are used, including the body of the robot, which has a boat like shape, a propeller to move the robot forward and backward via microcontroller, and a sort of conveyor to transfer the waste on the river's surface to the designated region. This machine will gather waste that is floating on the surface of waterways, such as bottles, plastic cans, covers and so on. It is gathered by a conveyor belt and then put in the designated location. This conveyor is designated to rotate continually, especially when detecting junk and waste, therefore some form of sensor will be used in later research.

The following are listed for mechanical design:

1. The machine's primary body is shaped as tube-like watercraft. This design was chosen to allow the robot to float on water.
2. A battery is utilized as power supply to operate the machine.
3. The propeller rotates on the axle shaft, allowing the robot to move correctly.
4. The propeller will be connected to two DC motors, allowing them to be operated in a variety of ways, including forward, backward, and spinning.
5. A conveyor system is employed to transport waste from the water to designated trashcan.
6. Trashcan is placed on bottom of the machine to collect waste from the conveyor.
7. pH sensor is placed on side frame of the machine to track the pH of water to ensure the safety of fresh water.
8. A camera has been installed to allow remote monitoring of the water bodies.

RESULT AND DISCUSSION:

The performance of the real electronic device and circuit was simulated in the circuit simulation. Using Proteus software, the circuit operation was successfully demonstrated. The proteus programme was used to created the circuit design in order to simulate the mechanism construction before it was build. IoT enabled floatable waste collecting machine with quality monitoring system simulation was shown in Figure 3. Once the simulation's code has been checked, the procedure begins. This simulation depicts a pH sensor analysing water quality and transmitting data via an IoT module, with a display indicating if the water quality is excellent or terrible. The buzzer will sound if the water quality is poor. In simulation, the boat's movement is controlled by numbers 1 to 5. When you press1, the boat travels ahead, when you press2, the boat moves backward. When you press 3, the boat moves right,when you press 4, the boat moves left and when you press5, the boat stops moving. The garbage is collected and deposited in the dustbin by the conveyor belt. Press 6 to turn ON the conveyor belt and 7 to turn it OFF. The proteus software's powerful simulation capabilities and extensive resource libraries have simplified the circuit design process.

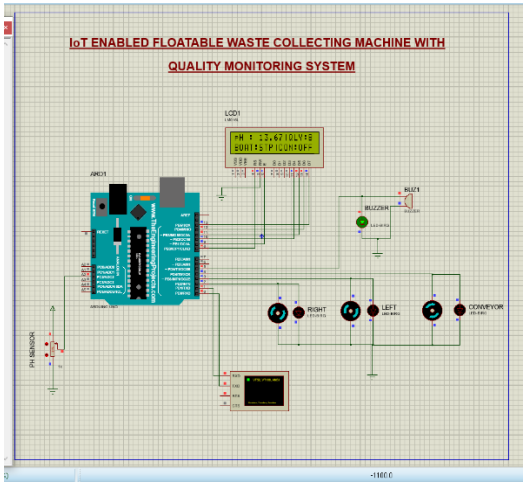

Figure 3: proteus circuit Simulation

Our proposed system is shown in Figure 4. The machine is placed where there is a higher concentration of plastic waste. Then the system is turned ON and controlled by the created webpage, which is wirelessly connected via the NODEMCU. The pH value is displayed on our mobile and LCD placed on the machine. After then a camera is activated, which is utilised to pinpoint the exact location of the trash. By looking at the live stream broadcasted by the camera and using the controls made with the webpage, the machine will navigate towards the trash . The conveyor is turned on after arriving at the destination. The conveyor gathers the flotsum and jetsam that floats in the water. Following the successful completion of the operation, the machine will be tracked back to the banks of the river or ponds, where the garbage will be separated and recycled.

Figure 4:Proposed kit

CONCLUSION:

Plastic pollution of aquatic bodies is a serious problem on a local and worldwide scale. This water cleaning machine project design and analysis is based on literature and research from many journals and papers that are relevantly available, and it is built in accordance so that it may give flexibility in operation. The presented prototype provides a low-cost, safe, and effective method of floating trash disposal with low maintenance costs, as well as an easy-to- control and monitor system, making it a viable solution to problem of plastic pollution in waterbodies. Several prototypes for cleaning floating garbage from water bodies exist. Some of them have also been used commercially. The majority of the available devies are manned, requiring more manpower and posing a risk to operator. Again, the majority of the proposed designs rely on oil-based fuels, which run the risk of leaking into water and further polluting it. So far, the battery-powered gadgets in use lack scalability. The prototype's scalability and versatility make it stand out. It can be scaled for usage in vast bodies of water with simple modifications, long-distance control can be set up via Wi-Fi connectivity, monitor the water bodies remotely, and sensors to monitor water quality can be attached onboard. The safe use of fuels in aquatic robotics is a major challenge. Oil as a fuel may results in oil spills in the event of an accident, contaminating water bodies and posing a hazards to aquatic animal's life. Our proposed design is more advantageous and safe thanks to the usage of a battery. As a result, the system offers a one-of-a-kind, scalable, and long-term solution to the problem of aquatic plastic pollution.

FUTURE SCOPE:

The primary goal of this project is to reduce time consumption and boost efficiency. Then, our ultimate goal is to monitor water quality using sensors, to measure water quality metrics that can predict adverse conditions for water living species. The water hyacinth plants can also be removed in future model. Upgrading the bin system to collect, count, and notify when the net bin is full.

REFERENCES:

1. Design and Development of River Cleaning Robot Using IoT Technology by M. N. Mohammed, S.Al-Zubaidi, Siti Humairah Kamarul Bahrain, M. Zaenudin, Muhammad Irsyad Abdullah 2020 16th IEEE International Colloquium on Signal Processing &its Applications(CSPA) .
2. Development of Water Trash Collector by P. N. F. M. Shamsuddin, M. A. Mansor, M. S. A. Hadi, N. Z. Abidin, R. Ibrahim, Journal of Advanced Industrial Electronics Research and Applications Vol. 1, Issue 1 (2020) 01-05.
3. Design and Analysis of River Water Skimmer by Kashinath Munde, Madhavi N. Wagh, International Journal of Recent Trend in Engineering and Research Volume 04, Issue 07, 2018
4. Solar Operated Water Trash Collector by S. Malavika, S. Meena, E. Indhumathi, M. Nandhini, S. Srinivasan, International Journal of Research in Engineering , Science and Management Volume-3, Issue-4, 2020.
5. Effective Aquatic waste Removal through Lake Cleaning Robot for Smart city Environment by S. Arunkumar, S. Sasikala, International Journal of Innovative and Exploring Engineering, Volume-9, Issue-4, 2020.
6. Advance River Cleaner by Pankaj Singh Sirohi, Rahul Dev, Shubham Gautam, Vinay Kumar Singh, Saroj Kumar, Imperial Journal of Interdisciplinary Research, Vol-3, Issue-4, 2017.

7. Design and Fabrication of River Cleaning Machine by Prof. Sandesh M Prabhu, Mohammad Irshad K, Mujeeb Rahman, Muhammed Shahil, Prajwal, International Research Journal of Engineering and Technology, Volume-06, Issue-07, 2019.
8. Design of Optimized and Innovative Remotely Operated Machine for Water Surface Garbage Assortment by Ganesh S. Khekare, Urvashi T. Dhanre, Gaurav T. Dhanre, Sarika S. Yede, International Journal of Computer Sciences and Engineering, Vol-7, Issue-1, 2019.
9. Unmanned Floating Waste Collecting Robot by Abir Akib, Faiza Tasnim, Disha Biswas, Maeesha Binte Hashem, Kristi Rahman, Arnab Bhattacharjee, Shaikh Anowarul Fattah, IEEE, 2019.
10. Water Surface Cleaning Robot by R. Raghavi, K. Varshini, L. Kemba Devi, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol-8, Issue-3, 2019.