iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** I **Month of publication:** January 2021

DOI: https://doi.org/10.22214/ijraset.2021.32901

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue I Jan 2021- Available at www.ijraset.com

Remote Controlled Automatic Water Surface Cleaner

Prof. A. J. Bamnote[1], Shivani Dudhe[2], Arya Kubde[3], Sakshi Lolekar[4]
[1]*Assistant Professor, Department of Mechanical Engineering, YCCE, Nagpur*
[2, 3, 4]*Students of Mechanical Engineering, YCCE, Nagpur*

Abstract: ***In Developing countries like India, Water pollution is increasing day by day. A lot of garbage is just thrown or dumped inside the water bodies which gravely affects aquatic life as well as human health. Focusing on the cleanliness of water bodies, this paper focuses on the design of Bluetooth based water surface cleaner for stagnant water bodies. This model can work automatically and reduces manpower. It has a mechanical arm attached at the stern to lift the garbage and has an in-built garbage collector to accumulate it. The collecting tank can accumulate upto 5kg of garbage in a single cycle. Atmega 328p is used as the main microcontroller for controlling the motion of the boat and for collecting the garbage from water bodies. Our project's main aim is to reduce power and time consumption and thereby increasing the efficiency of the machine.***
Keywords: Bluetooth based, Atmega 328p, in-built garbage collector, water surface cleaner, mechanical arm

I. INTRODUCTION

Nature has always brought peace from the busy and stressful life to mankind. People often visit to behold the divinity of nature, sadly humans, litter everywhere and leave the place with the garbage that may be decomposable or maybe not. Somehow collecting trash from over the land is easier for humans than collecting trash from water bodies. Planning and collecting waste from over the surface of water bodies itself is a challenging task for humans. A lot of trash is found over the surface of water bodies (like lakes, ponds, rivers). Trash containing plastic bottles, wrappers, polythene bags, and other harmful waste. It leaches into the water that degrades the water quality containing toxic compounds, resulting in poor health of the ecosystem. Currently, plenty of innovative projects focuses on the removal of garbage from the water surface, but cleaning technology like the skimmer boat needs fuel to run and large manpower is required to operate, also to manage the entire functioning of the system. we need a solution that is not harmful to nature, eco-friendly, easy to operate, and is technically intelligent. Our project is compact, easy to handle and operate, and is eco-friendly as it works on solar energy.

II. LITERATURE SURVEY

The basic method to collect trash is to use a conveyor belt to lift the garbage from the water. The garbage is collected in a trash container attached to the back of the boat. Three DC motors have been used. One motor is used for continuous rotation of the conveyor is the High Torque Mini 12V DC Gear Motor of 600 rpm and the rest two motors are used for motion of the boat are the Micro DC 3–6-volt submersible pump mini water pump motors with 3kW power rating. The boat is controlled by a wireless remote manually. L298N Based Motor Driver Module has been used for driving two motors. It also consists of an H-bridge for easy forward and backward movement of the boat. RF-module that works on the principle of electromagnetic radiation has been used for the wireless communication of serial data through its antenna connected to pin ANT. The transmission rate of the RF-module varies in the range of 1-10 Kbps. When the boat is in the water it is operated using a remote from the shore. Foam sheets have been used to build the boat for easy maintenance. The conveyor belt is kept thin and is made up of PVC material so that rollback can be prevented. The conveyor belt can collect waste like polythene, food material, etc. whichever comes to the fore. When the trash container is full, the boat is bought back to the shore. The trash container is taken out to remove the trash. After clearing the trash, it is attached back to the boat and the boat is sent back in the water to clean it [1].

It is a water surface garbage cleaning robot based on the principle of suction. The robot consists of two parts. The first part is the upper computer that is the APP control terminal of the mobile phone which is used to control the moving track of the robot. And the second part is the lower computer, consisting of the STC12C5A60S2 control circuit, Wi-Fi module, power module, cleaning module, and transmission module, which together realize the cleaning and transmission function of the garbage on the water surface. The robot is powered by two groups of 12V aircraft model batteries. The suction fan shell is designed so that it is waterproof and its absorption force can only be along the collection pipeline.

©IJRASET: All Rights are Reserved

The fan is set on the upper layer, the collection device is set on the lower layer and the garbage inlet pipe is set on the middle layer. The fan is rotated at high speed to produce strong airflow. The upper sends control instructions to the Wi-Fi module. The Wi-Fi module receives the data and sends it to the mobile phone APP by the serial port.

The received instructions are also sent to the serial port end of the STC12C5A60S2 controller by the serial port. The controller performs corresponding operations according to the instructions, such as the movement of the cleaning robot, garbage cleaning, steering gear rotation. After switching on the robot, the garbage enters from the suction mouth. Passing by the airflow pipeline, the garbage reaches the connection between the airflow pipeline and the fan shell. The U-shaped baffle rotates the garbage at high speed and the filter screen separates the water and garbage. The garbage is removed manually after reaching the shore. The robot has a speedboat like structure which reduces the resistance in the water and makes the operation more flexible. The robot is mainly made with polypropylene with a thickness of 2mm to reduce the self-weight. The net weight of the robot is 10 kg. It can collect a maximum of 17kg of garbage and can run continuously for 2-3 hours. At the speed of 0.35 m/s, the performance of the robot is stable and is easy to operate. The robot is efficient in collecting trash like leaves, cigarette butts, plastic debris, and other small items [2].

The waste scooper is designed to minimize human effort and collect bottles and waste that floats by 1.71 kg/minute. The entire assembly is kept above two pontoons. Two waste-collecting mechanisms are used which makes the system more efficient first is the scooping arm on both sides of the robot which is made of plastic net .and second is the conveyor belt system in front side the belt also has fins scoops that make the trash collecting task more efficient. the electronics component is controlled by Arduino UNO and Arduino 2560 through wireless LAN. Motor drivers of scoopers at the front and sideways, paddle wheels, and rudder receives the signal from Arduino Uno 2560. Various sensors are used to detect waste, speed control, lifting arm speed control, and a camera is mounted to visualize the work field [3].

The paper presents the robot which is developed to collect the rubbish floating over the water surface and uses a conveyor belt mechanism for the same. Propeller generates, driving force to run the complete system, and direction is controlled by steering mechanism where brushless DC motor manages angle of the propeller. Various sensors are employed to detect obstacles in its path and hence avoid clashing. Also, sensors for location localization and visual information feedback so that operator could view the surrounding. The pontoons carry the entire robot weighing 480kg to 500 kg. Entire electronics are controlled by the pc104 control system. The system is designed to work at an autonomous system and also teleoperation mode. Proper care is taken for material selection like stainless steel is used to reduce water leakage and corrosion [4].

The autonomous river cleaning robot is a unique robot that can work 24x7 autonomously. The robot is designed to clean major rivers like the Ganga and Yamuna. For detecting the pollutants gimballed camera with two-axis rotation is used, which tracks the pollutant with the help of JSV color space or SURF. When the camera detects the pollutant in the river, the propulsion system in the robot gets activated which navigate the robot to the pollutant. Two methods of propulsion are used, first is air propulsion which is made up of an 8-inch diameter, which is powered by a BLDC motor of 1200KV. While the other propulsion system used is underwater propulsion which is achieved with the help of a one-inch propeller powered by geared DC motors. These methods are used for achieving transverse long-distance and precise turning while the robot is in stagnant water. Once, the robot reaches the pollutant a gear operated mechanical gripper is used for picking up the solid waste. The robot promises to clean over 100 tonnes of sludge and pollutants in a year [5].

III. COMPONENTS

1) *Mechanical Arm:* A worm drive gear arrangement is used in the mechanical arm as it supports self-locking, for lifting the garbage from the water body and collect it into a collecting tank. The arm can collect upto 1.5kg garbage and is powered by a DC motor of 10rpm.
2) *Collecting Bin:* Collecting Bin can accumulate upto 5 kg of waste so that there is no need to unload the garbage from the boat frequently.
3) *Polycrystalline Solar Panels:* Polycrystalline Solar Panels are used for charging the battery as they are easily available in the market. The Panel converts the sunrays incident on it into electricity. Polycrystalline Solar Panel usually has 15%-17% efficiency. We have used a solar panel of 12v voltage rating.
4) *DC Motors:* Two geared Motors of 60rpm are used for operating the left and right Paddlewheels, while a 10rpm geared DC Motor is used for lifting the mechanical arm. Geared DC Motors are the ideal motors to use in water as they deliver high torque at low speed.

©IJRASET: All Rights are Reserved

5) *Battery:* We have selected a 12V-12A lithium-ion battery for powering all the components in our boat. We are also using a battery management unit to prevent the battery from overcharging.
6) *Voltage Regulator:* We are using the Voltage Regulator to provide a fixed 5V output voltage to Atmega 328p as it has an operating voltage of 1.5V-5.5V while we are using a battery of 12V.
7) *L293D Motor Driver Module:* We are using L293D Motor Driver Module to control the DC motor connected to Paddle Wheels and mechanical Arm.
8) *Atmega 328p:* We are using Atmega 328p as main microcontroller, as it is can execute powerful instructions in a single clock cycle. It has 32k bytes memory size and can be programmed as per need.

IV. DESIGN AND WORKING

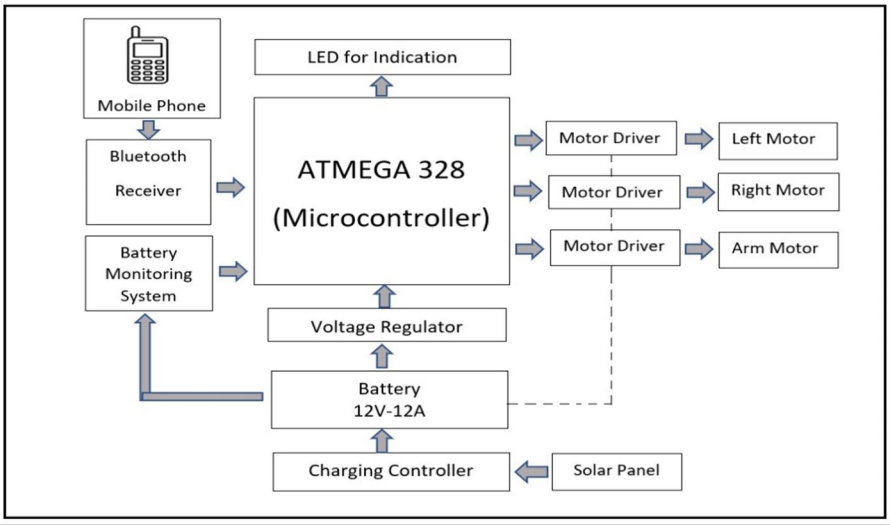


Fig 1: Block Diagram

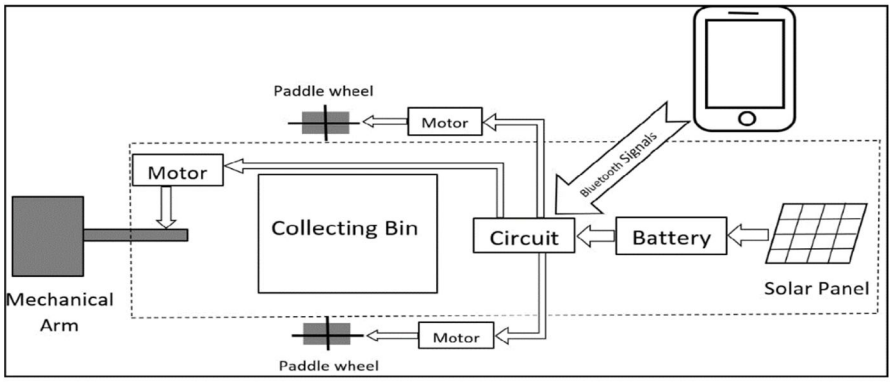


Fig 2: Schematic Diagram

The design and operation of the boat (fig 1) is as follows:
The boat is made with two pontoons fixing together leaving free space in the middle for the placement of garbage collecting bin and solar panels. We have used pontoons made up of acrylic sheet to reduce the weight of the boat. Pontoons are the best option as they help in reducing the surface waves generated while collecting the garbage from the water surface. Four paddle wheels are attached to these pontoons for providing motion to the boat. These wheels are driven by 60 rpm geared DC motors. On top of this assembly, a foraminous collecting bin is present which has a mechanical arm attached to its bottom which helps in picking up the garbage from the water surface and collecting it into the collecting bin. A worm drive gear arrangement is used in the mechanical arm as it prevents back drive and can be operated only in one direction. The arm is powered by a 10-rpm geared DC motor.

©IJRASET: All Rights are Reserved

The collecting bin can accumulate a maximum of upto 5kg garbage. We have used a renewable energy source i.e., solar power for generating the electricity required to power up the whole assembly. We have used polycrystalline solar panels of 12V rating when sun rays get incident on this panel, they convert this light energy into electrical energy. This electricity generated is then stored in a 12V-12A lithium-ion battery. We have used Atmega 328p as the main microcontroller for controlling the motion of the boat and for operating the mechanical arm. The HC-05 Bluetooth Module is connected to this main microcontroller, which helps in receiving the commands from the mobile app. The Atmega 328p will then decode this command signal and further send it to the L293D motor driver which will then execute the command of either operating the wheels or the mechanical arm.

V. CONCLUSION

This model provides an effective and robust solution for cleaning water bodies, as it is light weight and small in size. It is capable of lifting 5kg of garbage in single operation and the mechanical arm can lift 1.5kg of garbage at once. Solar energy, a renewable source of energy has been used to supply power to the model. To increase the effectivity and efficiency, we have focused on reducing time and power consumption. It is efficient in lifting floating garbage like leaves, sticks, wrappers, polythene bags, etc.

VI. ACKNOWLEDGMENT

We take this opportunity to express our gratitude towards Prof. A. J. Bamnote for motivating us to take this project, helping us in solving our difficulties, and guiding us throughout our project. We also express our sincere thanks to all those who helped us in numerous small and big work related to our project.

REFERENCES

[1] Jishnu Satheesh, Anagha P Nair, Devipriya M, Chithra A, Govind Mahesh, Jayasree P R, “Wireless Communication based Water Surface Cleaning Boat”, Proceedings of the Fourth International Conference on Trends in Electronics and Informatics (ICOEI 2020) IEEE Xplore Part Number: CFP20J32-ART; ISBN: 978-1-7281-5518-0.

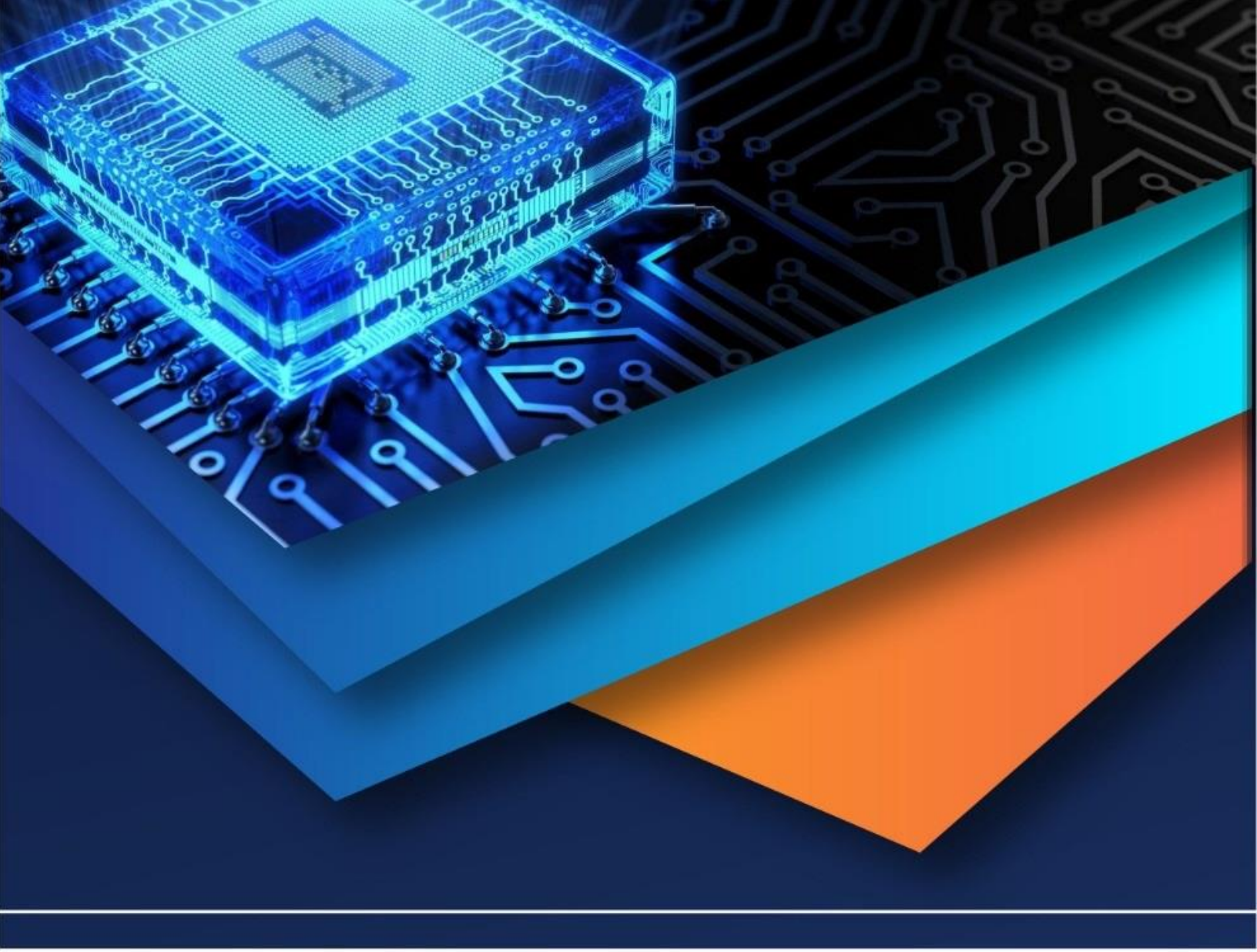
[2] Xiaohong Gao, Xijin Fu, “Miniature Water Surface Garbage Cleaning Robot”, 2020 International Conference on Computer Engineering and Applications (ICCEA).

[3] Niramon Ruangpayoongsak, Jakkrit Sumroengrit, Monthian Leanglum,“A Floating Waste Scooper Robot On Water Surface”, 2017 17th International Conference on Control, Automation and Systems (ICCAS 2017) Oct. 18-21, 2017.

[4] Zhongli Wang, Yunhui Liu, Hoi Wut Yip, Biao Peng, Shuyuan Qiao, and Shi He, “Design and Hydrodynamic Modeling of A Lake Surface Cleaning Robot”, 2008 IEEE/ASME International Conference on Advanced Intelligent Mechatronics July 2 - 5, 2008, Xi'an, China.

[5] Aakash Sinha, Prashant Bhardwaj, Bipul Vaibhav, and Noor Mohammad, “Research and Development of Ro-Boat – An Autonomous River Cleaning Robot” in Proc. of SPIE-IS&T Electronic Imaging, SPIE Vol. 9025.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)