JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

AUTOMATED RIVER CLEANING WITH ROBOTICS

Bhavana Majji[1], Golconda Lokesh[2], Thumma Bala Rohit Reddy[3], J. Pandu Ranga Rao[4]

[1]Assistant. Professor, Department of Electronics and Communication Engineering
[2] Student , Department of Electronics and Communication Engineering
[3]Student , Department of Electronics and Communication Engineering
[4]Professor, Department of Electronics and Communication Engineering
Sreyas Institute of Engineering and Technology, Nagole , Telangana, India

***Abstract* -** The layout and execution of a cutting-edge river cleaning system that combines GPS, GSM, Raspberry Pi, and Arduino technologies is presented in this study. This device makes it possible for autonomous navigation, remote monitoring, and data logging of collected garbage, which improves the effectiveness and coverage of river cleaning operations. By combining these technologies, the cleaning boat can be tracked in real time, data can be sent to a central computer, and the robot can avoid obstacles and find the best cleaning paths thanks to an ultrasonic sensor.

IndexTerms: GPS, GSM, Raspberry Pi, and Arduino, obstacles.

1. INTRODUCTION

The ecology and public health are seriously threatened by the growing contamination of waterways. The effectiveness and thoroughness of current cleaning techniques are frequently lacking. This project suggests a system that combines the computing power of the Raspberry Pi with the autonomous capabilities of Arduino, as well as GPS for navigation and GSM for distant communication, in order to overcome these constraints. The goal of this novel strategy is to streamline and automate the river cleaning procedure [1].

2. LITERATURE SURVEY

Muhammad Irsyad Abdullah, Siti Humairah Kamarul Bahrain, M. Zaenudin, S. Al-Zubaidi, and M. N. Mohammed. [2] Waterlogging brought on by plastic, thermocol, and metal is causing problems and favoring diseases like typhoid and intestinal illness. It would be insufficient to clean the wastes using manual processes because doing so often involves a vast amount of time and effort and is likely to be impacted by various illnesses caused by the irresistible bacteria in the sewage. This research offers a workable and effective mechanism for collecting waste design for cleaning up waste from lakes, rivers, and channels. The garbage collection system is specifically designed to be used for removing a variety of materials, including tires, logs, trash, and gliding litter. Utilizing IoT technology, which can monitor and oversee the complete procedure and is a component of the integrated system. The vessel was designed to fulfill the prerequisite of operating in places outside of the seaward zone, offering other choices for disposing of waste and garbage from the water environment. This was motivated by the interest and necessity to clear contaminants in the conduits' region.Qidwai, Malek Ayesh Uvais [3], This problem's mitigation has gained international attention. as the quantity of rubbish being dumped into seas continues to increase. The impacts of global warming, which is partly brought on by inappropriate garbage dumping into seas, have been attempted to be mitigated in recent decades by governments, scientists, organizations, and people. A solar-powered aquatic robot that is half submerged and made of sustainable, recyclable, and recycled materials is shown in this study. By removing restrictions on the type of robot floaters, motors, microcontrollers, and operating systems that may be employed, the robot seeks to offer freedom in the selection of building materials. Cardboard (95.3%), cellophane (94.1%), plastic bottles (93.8%), medical facial masks (93.2%), polystyrene (92.6%), bags made of polythene and covers (96.2%), and metallic cans (93.8%) are the seven types of garbage that are frequently left behind by this robot. The ability to identify waste and the effectiveness of introducing minimal, medium, and high robot movement were the main criteria used to evaluate the unique detection system. Additionally, the efficacy of the powertrain and the detecting system in low light conditions were evaluated. The detecting system's low-light capabilities will be improved, a larger dataset will be formed, and a larger battery will be attached.Kunwar P. Singh, Gunja Jain, Amrita Malik, and Ankita Basant [4], The instruction, verification, and making use of The article discusses many artificial neural network (ANN) models for assessing the dissolved oxygen (DO) and biochemical oxygen demand (BOD) levels of the Gomti River in India. The coefficient of determination (R^2) (square of the correlation coefficient), bias, and root mean square error (RMSE) were calculated using the dependent variables' observed and model-derived values and were used to assess the efficacy of the ANN models. The connection from the model to the residuals-calculated values of DO and BOD was another way to assess how well the model fit the data. Both of the ANN models' calculated DO and BOD levels closely matched the corresponding observed values in the river water. The partitioning strategy was used to assess the relative significance and how the input variables affect the model's output. The ANN models that have been found can be employed as instruments to calculate water quality parameters.Matevž Dular, Ester Heath, Ion Gutierrez-Aguirre, and Tjaša Griessler-Bulc [5], Acoustic cavitation is a well-known method for treating (cleaning) wastewater and water. But hydrodynamic cavitation has just lately been proposed and used, either alone or in conjunction with other methods like ultrasound. This paper's first section provides a wide summary of various techniques that purify water via hydrodynamic cavitation and wastewater. The subsequent section of the paper covers our most recent efforts to use hydrodynamic cavitation to eliminate dangerous cyanobacteria (Microcystis aeruginosa), bacteria (Legionella pneumophila), viruses (Rotavirus), green microalgae (Chlorella vulgaris), and drugs (clofibric acid, ibuprofen, ketoprofen, naproxen, diclofenac, and carbamazepine) from water and wastewater. As will be demonstrated, hydrodynamic cavitation corresponds to acoustic cavitation and may occur in a variety of ways, each with its own distinct traits and origins. This has up to now been disregarded, which ultimately resulted in subpar technique performance. We shall demonstrate that various contaminants require distinct hydrodynamic cavitation types (different removal mechanisms) to be successfully removed. Even while hydrodynamic cavitation is still a ways off from being a common water cleaning method, new research has already indicated significant optimization potential, which may produce a low-energy device for cleaning wastewater and water.3. MethodologyAccording to the block diagram, the suggested system makes use of the following parts: Raspberry Pi serves as the central processing unit, handling GPS and GSM communication and controlling the robot's navigation. Arduino manages sensor data acquisition (temperature, humidity, ultrasonic) and controls the motors. The GPS module enables autonomous navigation by providing real-time location data. The GSM module facilitates wireless communication for transmitting data to a remote location. The motor driver (L298N) controls the DC motors that propel the robot. Sensors include a Dallas temperature sensor, a DHT11 temperature and humidity sensor, and an ultrasonic sensor for obstacle avoidance. The Bluetooth module provides a means for short-range communication, likely for initial setup or local control. The conveyor belt mechanism uses a conveyor belt mechanism to effectively gather and remove garbage from river surfaces. To operate the system, the robot uses GPS data to navigate the river on its own, a conveyor belt to collect trash, sensors to measure the water quality indicators, and GSM to send the data it has collected.

3. METHODOLOGY

The proposed system utilizes the following components: Raspberry Pi acts as a main computing unit, managing GPS and GSM communication and directing the navigation of the robot. Arduino controls all sensor data acquisition (temperature, humidity, ultrasonic) and motor control functions. Also included in the electronics package is a GPS module which allows for autonomous navigation through real-time location tracking. The addition of a GSM module makes for wireless communication making it easy to transmit data to a remote location. The motor driver (L298N), which is connected to the Arduino, controls these DC motors which ultimately moves the robot. Sensors on the robot, from left to right – Dallas temp sensor, DHT11 temp & humidity sensor, ultrasonic sensor for obstacle avoidance. The Bluetooth module gives you an easy way to add short-range communication, perfect for onboarding or local device control. The removable conveyor belt mechanism turns the entire conveyor belt mechanism into a rolling trash collecting machine. To run the system, the robot relies on GPS data to autonomously navigate along the river, along with a conveyor belt to collect trash, sensors to indicate the collected water quality indicators and GSM to send the information it gathered.

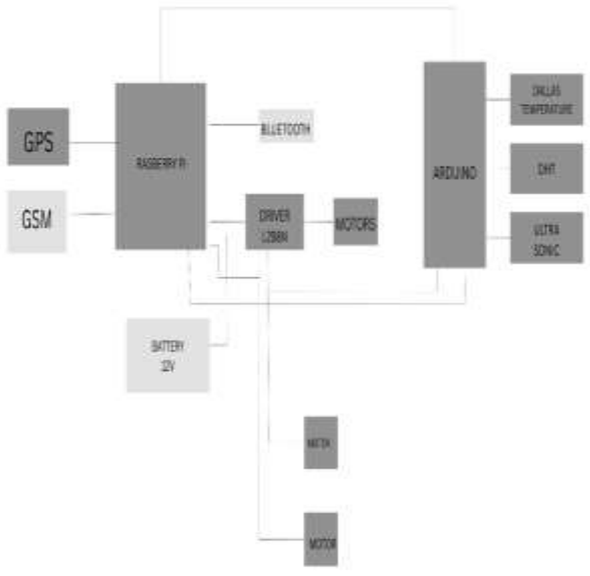

Fig.1 Block Diagram

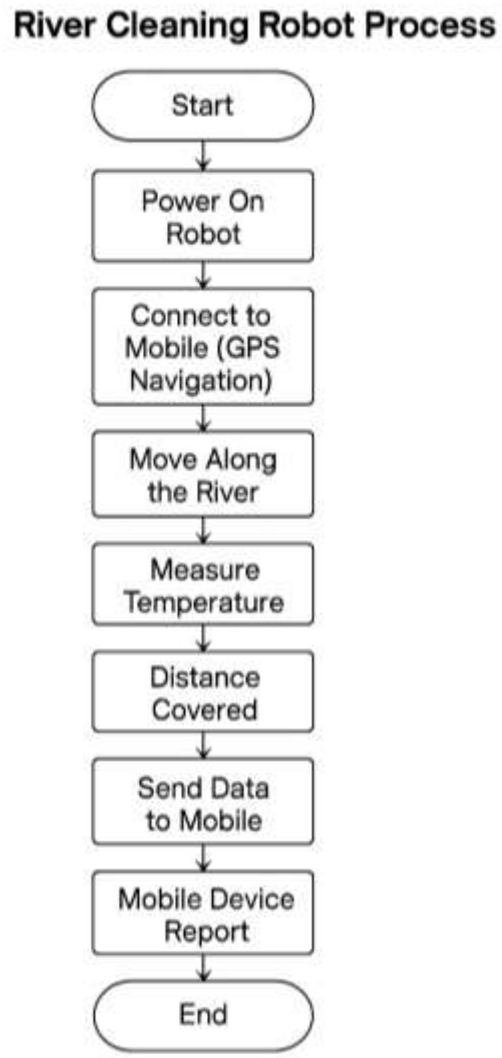

Fig 2. Flow chart

4. WORKING OF THE MODEL

The Raspberry Pi computes the boat's position and chooses the best cleaning route using location data from the GPS module. Using instructions from the Raspberry Pi, the Arduino manages the boat's motion and garbage collecting system. The boat may avoid obstacles with the use of ultrasonic sensors. For monitoring and analysis, the GSM module sends the boat's location, garbage data gathered, and system status to a distant server. The system may be remotely monitored and controlled via a user interface (web or mobile application). Create a GPS-enabled autonomous river cleaning robot. Put in place a system that collects garbage from river surfaces efficiently. Incorporate sensors to monitor water quality indicators like temperature and pH in real time. Create a data transfer communication system based on GSM. Create a mobile interface that can be used for GPS navigation and to connect to the robot
(probably via Bluetooth).

5. RESULTS AND IMPLEMENTATION ANALYSIS

Our challenge has a particularly ingenious and automated solution to chill the river, utilizing the vital, irreplaceable, useful resource of tapping cutting-edge know-how to dump the confines of conventional guides and strategies. Using the ever-inventive Raspberry Pi and Arduino duo, the team’s invention is autonomous enough to collect liquid waste using a conveyor belt-style collection system powered by a river-tracing GPS sensor. Arduino manages communication under the hood, performing all of the heavy lifting real-time record-changing communication via GSM, as well as easy remote monitoring. Arduino handles all the digital and analog sensor data — including temp/hum sensors and motorized open/close devices—and all the motor operations. We supplement this with complementary physics-based analysis of any detected obstacle, combining laser rangefinding with a fixed ultrasound sensor to ensure that any obstacle can be avoided, allowing the robot to drive faster and more efficiently most of the time safely. Bluetooth radios are portrayed as a relatively new short-range communication technology that could be used during the installation or maintenance of a product. This method enhances water dispersion and amplifies the efficiency of refuse gathering. Beyond learning while washing, as the robot moves through the water and collects waste, it’s constantly running a diagnostic check on itself. It allows for real-time push notifications to a paired mobile device via Bluetooth, not just including the dustbin state (fullness percentage) but also including temperature and humidity levels and its current GPS coordinates.

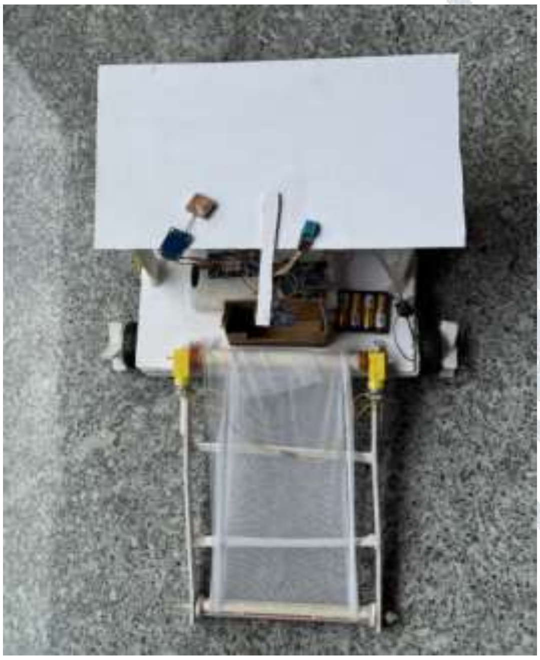

Fig3. Working model of the system

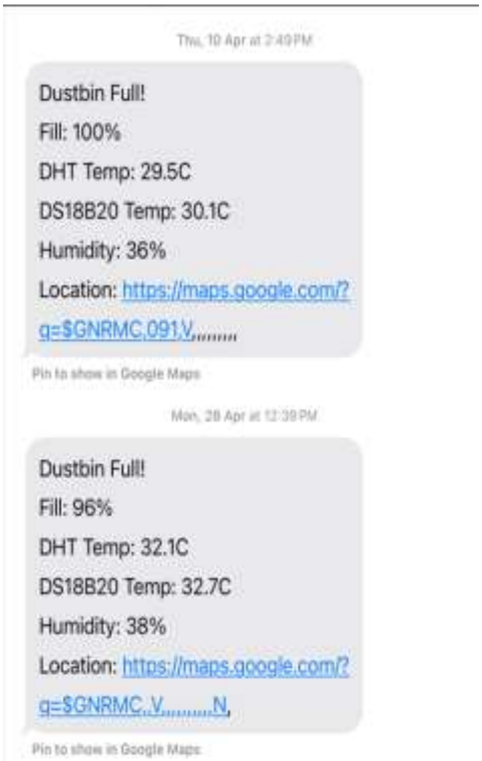

Fig 4. Values show on mobile display.

6. ADVANTAGES & LIMITATIONS

6.1 Advantages

By automating the debris-collecting process, the technology lowers the amount of physical work required. The system helps with environmental preservation efforts by cleaning and monitoring water quality through integrated sensors such as temperature and humidity. Future improvements, like the addition of remote monitoring capabilities, are possible with the Raspberry Pi, which makes the system flexible enough to meet changing requirements.

6.2 limitations

Because the system is battery-powered, its operating hours may be limited, and it has to be recharged frequently. Frequent unloading in contaminated regions may be necessary due to the conveyor belt's limited capability for collecting debris. Without strong safeguards, the system's stability and effectiveness may be threatened by strong water currents or severe weather.

7. CONCLUSION

By efficiently automating the garbage collection process, the river cleaning robot lowers the need for human involvement and boosts productivity. Beyond trash removal, basic water quality monitoring is made possible by the integration of sensors such as humidity and temperature. The robot, which was controlled by Bluetooth/GSM and powered by a Raspberry Pi, turned out to be an affordable and expandable option.

8. FUTURE SCOPE

For sustainable energy and uninterrupted operation without the need for battery charge, include solar panels. Add sophisticated sensors to improve water analysis (e.g., turbidity, dissolved oxygen). Use camera modules to implement AI-based item identification for targeted cleaning and intelligent trash classification.

9. REFERENCES

[1] Headley, T., Tanner, C. C., & Council, A. R. (2008). Application of floating wetlands for enhanced for stormwater treatment: a review. Auckland, New Zealand: Auckland Regional Council.

[2] Gómez-Pastora, J., Dominguez, S., Bringas, E., Rivero, M. J., Ortiz, I., & Dionysiou, D. D. (2017). Review and perspectives on the use of magnetic nanophotocatalysts (MNPCs) in water treatment. Chemical Engineering Journal, 310, 407-427.

[3] Walczak, N., Walczak, Z., & Nieć, J. (2021). Influence of debris on water intake gratings in small hydroelectric plants: An experimental study on hydraulic parameters. Energies, 14(11), 3248.

[4] Chandurkar, K., ParinayLavatre, D., & Bawane, N. (2020). An Improved River Cleaning System. Annals of the Romanian Society for Cell Biology, 333-339.

[5] Marques, A. P., Rangel, A. O., & Castro, P. M. (2009). Remediation of heavy metal contaminated soils: phytoremediation as a potentially promising clean-up technology. Critical Reviews in Environmental Science and Technology, 39(8), 622-654.

[6] Mohammed, M. N., Al-Zubaidi, S., Bahrain, S. H. K., Zaenudin, M., & Abdullah, M. I. (2020, February). Design and development of river cleaning robot using IoT technology. In 2020 16th IEEE International Colloquium on Signal Processing & Its Applications (CSPA) (pp. 84- 87). IEEE.

[7] Ayesh, M., & Qidwai, U. (2022, September). Detection and Collection of Waste Using a Partially Submerged Aquatic Robot. In Intelligent Systems and Applications: Proceedings of the 2022 Intelligent Systems Conference (IntelliSys) Volume 3 (pp. 133-149). Cham: Springer International Publishing.

[8] Dular, M., Griessler-Bulc, T., Gutierrez-Aguirre, I., Heath, E., Kosjek, T., Klemenčič, A. K., . .. & Kompare, B. (2016). Use of hydrodynamic cavitation in (waste) water treatment. Ultrasonics sonochemistry, 29, 577-588.

[9] Su, W., Sun, Q., Xia, M., Wen, Z., & Yao, Z. (2018). The resource utilization of water hyacinth (Eichhornia crassipes and its challenges. Resources,7(3), 46.

[10] Singh, K. P., Basant, A., Malik, A., & Jain, G. (2009). Artificial neural network modeling of the river water quality—a case study. Ecological modelling, 220(6), 888-895.