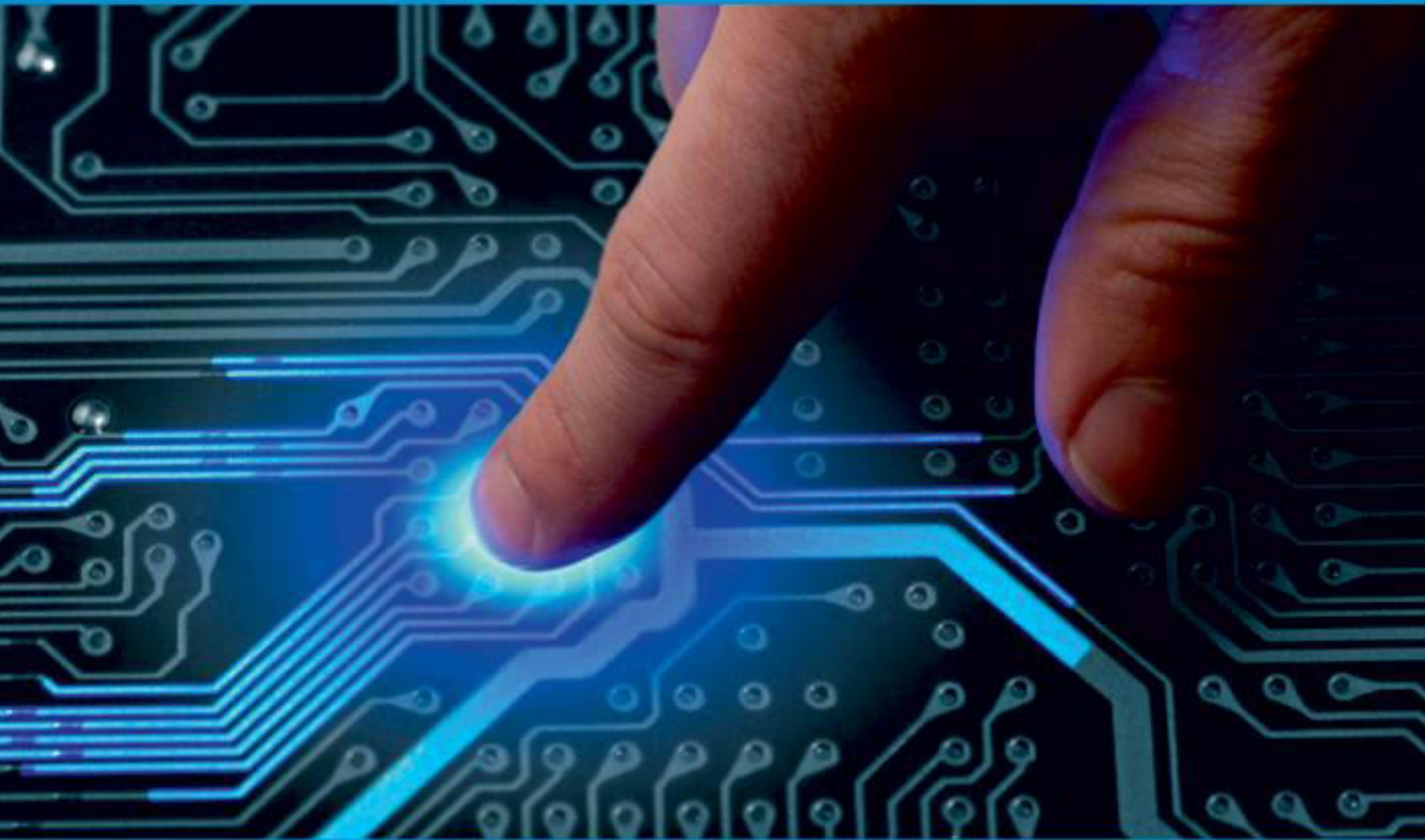
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 11, Issue 5, May 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105119 |

Floating Robot for Water Quality Monitoring and Waste Detection

Amisha Kumari, Farheen Khatoon, Kajol Ambwani, Manasa M, Kavya K R

Student, Dept. of ISE, The Oxford College of Engineering, Bangalore, India

Assistant Professor, Dept. of ISE, The Oxford College of Engineering, Bangalore, India

ABSTRACT: Water pollution is a major problem worldwide. Collecting large amount of floating dry waste such as plastic bottles on the surface of the water bodies is necessary to keep the various water bodies clean. While it is well known that the world is 70% water, just 3% of it, in the form of rivers and lakes, is drinkable. However, by releasing industrial wastes and sewages water has become polluted and is undrinkable. The WWAP estimates that 70 percentage of industrial wastes are dumped untreated into waters where they pollute the usable water supply and in a country like India where rivers are considered as sacred waters like Ganga, Yamuna and Godavari are polluted by littering, throwing flowers, bathing and plastic waste in the name of worship. Every year an estimated 8 million tons of garbage is dumped from somewhere in the region of 600,00 places of worship into rivers. In order to minimize the pollution and keep the water surface clean, this paper proposes an affordable and advanced floating garbage removing robot. The floating video footage which is taken by camera for the identification of water waste. In order to improve efficiency for research and surveillance, sensors like pH sensors and temperature sensors are used. A computer-controlled robot called the Floating Robot has an object detecting system and a water sampling system installed.

KEYWORDS: Surveillance, Object recognition, Waste detection and collection, Analysis of water quality.

I. INRODUCTION

In recent years, many researchers have designed, constructed, and developed various types of water robots alongside other types of robots. The field of aquatic engineering has witnessed several emerging technologies. Within this domain, we have explored several proposed methodologies in water research and surveillance. Floating water robots offer convenient solutions for tackling various challenging tasks in oceans or any water source. Waterproofing every component of these robots presents a major challenge in such projects. The CSIRO ICT Centre of Australia has successfully created an affordable robot for environmental monitoring on the Great Barrier Reef. This cylindrical autonomous water vehicle focuses on real-time visual simultaneous localization and mapping (SLAM), cooperative multi-vehicle navigation, and perception-driven control. Likewise, the University of Michigan has designed and constructed a cylindrical and elongated autonomous water vehicle, while researchers from the Technical University of Malaysia and the University of Malaysia have developed a smooth propulsion system for a similar robot. This system employs a horizontal propeller for forward and backward movement, a servo for left and right turning, and a water pump system for vertical motion. Injecting water into the vehicle's water tank causes it to descend, while releasing water from the tank allows it to float. Different shapes of water vehicles have been designed in various robotics domains. For instance, an electrical system has been designed for a spherical water robot utilizing three vectored water jet thrusters powered by a high-power DC motor, with a servo motor controlling the direction of thrust. Researchers have also experimented with water robots equipped with acoustic localization systems for localization and tracking purposes. Semi-autonomous submarines are commonly used for marine environmental research. Researchers have constructed remotely operated vehicles (ROVs) with camera systems and gripper systems, utilizing PVC material. Navigation technology for autonomous water vehicles has been developed with advanced battery capacity and the integration of hydrogen fuel cells, providing accurate navigation capabilities for longer missions. Other remotely operated vehicles include manipulator arms, water samplers, light penetration sensors, and temperature and depth sensors. The Kyushu Institute of Technology has developed the AquaBox series for shallow water observation. More recently, the researchers at the University of Science and Technology of China have designed a mini water robot equipped with a high-definition camera for detecting water conditions. Several control systems, such as ZigBee communication and light-based approaches, are utilized for water vehicles.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105119 |

II. PROBLEM STATEMENT

Different types of floating robots have been developed for surveillance and navigational purposes. These robots are all employed for particular jobs, such as pipe monitoring and leak detection in various pipe networks. The mechanical modeling used in these robots is very complex to design and control. Although quite expensive, these robots are highly efficient and useful. Because of this, using these robots in surveillance and research results in higher overall costs. We propose a system that is both economical and effective.

III. PROPOSED SYSTEM

The proposed system describes a mechanical system which will float on the surface of the water. The Robot may be controlled more precisely and effectively with an efficient electronic control system. The floating Robot will be installed by many useful features such as sensing position of robot, magnetic field measurement, temperature measurement, water sampling, water surface object picking and camera therefore, is very useful in surveillance and research. The floating Robot is made of polyvinyl chloride pipes so the structure has light weight. The whole system works on 12V DC supply therefore energy is saved. It is a cost-effective system, so it is very useful in military, natural disasters management and many other various fields.

IV. METHODOLOGY

The Raspberry Pi is an extremely affordable computer that runs Linux, but it also provides a set of GPIO (general purpose input/output) pins, allowing you to control electronic components for physical computing and explore the Internet of Things (IoT). pH sensor reads the pH value of the water. A Waterproof temperature sensor measures the temperature of water and a turbidity sensor identifies the clarity and particle content in water. Surveillance is done using a camera which is monitored wirelessly on display and detects any waste floating on the water surface. The sensory data is uploaded to cloud through internet. The uploaded data can be downloaded and will be used for prediction algorithm. Motors are connected to driver motor circuits. Robot uses Propellers for movement. The floating robot is used to check both the water quality and the detection of waste on the surface of water.

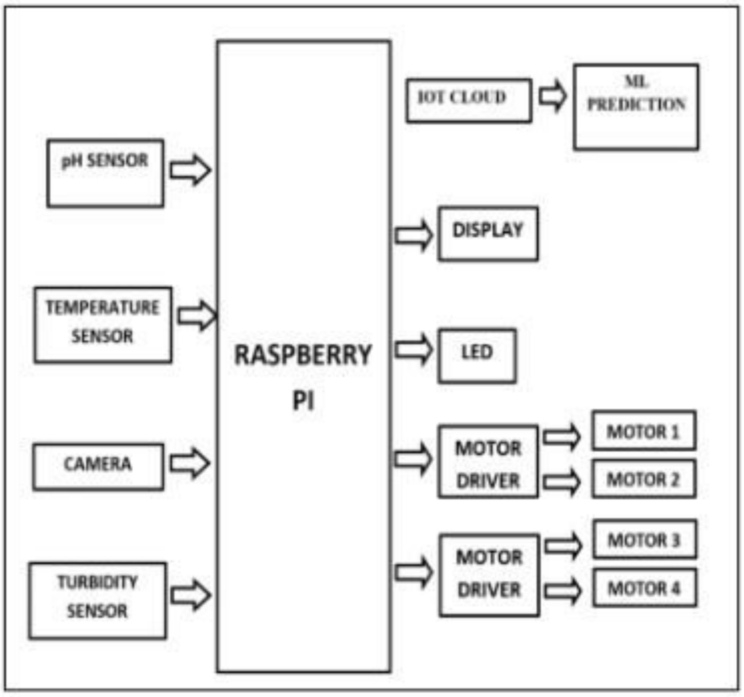


Fig: Block Diagram

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105119 |

V. HARDWARE AND IMPLEMENTATION

VOLTAGE REGULATOR:

A voltage regulator regulates the voltage in accordance with the specifications. Switching voltage regulators like the LM2675 are made to step-down an input voltage to a lower output value. Depending on the precise model of the regulator, the LM2675 can accept input voltages between 8V and 40V and regulate them to a fixed output value that can be set between 1.23V and 35V. With the use of external resistors, the output voltage can be adjusted.

DC MOTORS:

A DC motor, also known as a direct current motor, is an electric motor that uses the electromagnetic induction principle to transform electrical energy into mechanical energy. By switching the polarity of the voltage delivered to the motor, a DC motor's rotational direction can be altered. A stator, which is the stationary portion of the motor that houses the magnets, and a rotor, which is the spinning portion of the motor that houses the coils of wire, are the basic parts of a DC motor. The rotor rotates when a current is delivered to the coils, and the stator and rotor are separated from one another by an air gap.

MICROPROCESSOR:

A microprocessor is an integrated circuit that contains the processing unit or CPU (Central Processing Unit) of a computer or other electronic device. It is a small and efficient device that performs arithmetic, logic, and control operations on digital data. Raspberry Pi 3b+ is a part of the Raspberry Pi series of microprocessors, which are designed to be affordable, small, and flexible, making them ideal for a wide range of applications. The Raspberry Pi 3B+ is powered by a 1.4 GHz quad-core ARM Cortex-A53 CPU and has 1GB of RAM. It also includes built-in Bluetooth and Wi-Fi connectivity, as well various input/output interfaces, including HDMI, Ethernet, USB, and GPIO pins.

TURBIDITY SENSOR:

A turbidity sensor is an electronic device used to measure the turbidity or cloudiness of a liquid. The sensor is made up of two components that are placed on either side of the liquid under test: a light source and a detector. The detector monitors the amount of light that is scattered or absorbed by the liquid's suspended particles after the light from the source is routed through the liquid. The turbidity sensor may be used to detect the concentration of suspended solids in the liquid since the amount of light scattered or absorbed by the particles in the liquid is proportional to their concentration.

TEMPERATURE SENSOR:

A wired temperature sensor can be used to detect the temperature of water, It may be a crucial element in determining the quality of water. It's critical to select a temperature sensor that is water-resistant because it will be immersed in liquid. Three wires make up the waterproof temperature sensor: ground, power, and data. The data line is linked to a GPIO pin, while the ground and power cables are attached to the Raspberry Pi's ground and 3.3V pins, respectively. To make sure the connections are water-tight, waterproof wire connectors or sealants are employed. Put the sensor in the water for testing after it has been connected and the software installed. The sensor must be completely submerged and must not touch the container's edges or bottom, as this could skew the temperature reading.

ANALOG TO DIGITAL CONVERTER:

An analog-to-digital converter (ADC) termed the ADS1015 can transform analogue signals into digital signals at a 12-bit resolution. With a programmable gain amplifier (PGA) and a sampling rate of up to 3300 samples per second, the ADS1015 can convert four analogue inputs. The I2C protocol, which enables a number of devices to be linked to the same I2C bus, is used by the ADS1015 to communicate with a CPU. Its low power consumption and ability to run with a power supply voltage range of 2.0V to 5.5V make it perfect for battery-powered applications.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105119 |

WIRELESS CAMERA:

Wireless cameras are surveillance cameras that send video and audio data wirelessly to a receiver or a network device. They are often referred to as Wi-Fi cameras or wireless security cameras. These cameras broadcast data over a local wireless network or the internet using wireless technology, generally Wi-Fi. They can be mounted or placed in desired locations quickly. These cameras offer various features such as motion detection, night vision, two-way audio, and remote access via mobile apps or web browsers. They can be integrated with other devices and systems, including home security systems and smart home platforms. Wireless cameras provide different storage options, including local storage and cloud storage. While they offer convenience and flexibility, it is important to ensure network security and consider factors such as range and signal strength when deploying wireless camera systems.

VI. FUTURE SCOPE

Enhanced Data Collection: Floating robots equipped with advanced sensors can gather real-time data on various water quality parameters such as temperature, pH, dissolved oxygen, turbidity, and nutrient levels. Continued advancements in sensor technology will enable more accurate and comprehensive data collection, providing valuable insights for water management and pollution control.

Autonomous Operation: Future floating robots are likely to incorporate artificial intelligence and machine learning algorithms, enabling autonomous navigation, data analysis, and decision-making. They can autonomously patrol water bodies, identify potential pollution sources, and optimize their sampling strategies to focus on areas of concern.

Waste Detection and Management: Floating robots can play a crucial role in waste detection and management in water bodies. They can be equipped with cameras, image recognition algorithms, and machine learning models to identify and track floating debris, oil spills, or other pollutants. These robots can alert authorities in real-time, enabling prompt response and mitigation actions.

Integration with IoT and Networks: Floating robots can be integrated into the Internet of Things (IoT) and networked systems, creating a comprehensive monitoring network. They can communicate with other monitoring devices, weather stations, and databases to exchange data and enhance the overall situational awareness of water quality conditions.

Environmental Impact Assessment: Floating robots can assist in conducting regular environmental impact assessments by monitoring the long-term effects of human activities on water bodies. By continuously collecting data, these robots can detect trends, patterns, and anomalies, helping to identify potential sources of pollution and evaluate the effectiveness of mitigation measures.

Collaborative Applications: Multiple floating robots can work collaboratively in a swarm or fleet to cover larger areas efficiently. By leveraging swarm intelligence, they can coordinate their activities, share data, and optimize their operations to maximize the coverage and accuracy of water quality monitoring and waste detection.

Public Engagement and Education: Floating robots can contribute to public engagement and education by raising awareness about water pollution issues. They can provide real-time data and visualizations that are easily understandable to the general public, fostering a sense of environmental responsibility and encouraging collective action for water conservation.

VII. CONCLUSION

In conclusion, the development of a floating robot capable of detecting water quality and object detection presents an innovative solution for environmental monitoring and surveillance in aquatic environments. This project addresses the challenges of monitoring water conditions and identifying objects in various bodies of water, such as oceans, lakes, or rivers. By utilizing advanced sensing technologies, such as water quality sensors and object detection algorithms, the floating robot can provide real-time data on water parameters, such as pH levels, temperature, and pollutant concentrations. Additionally, its object detection capabilities enable the identification and tracking of objects of interest, such as plastics, leaves and water waste. The integration of wireless communication allows for remote control

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105119 |

and data transmission, enhancing the efficiency and accessibility of the monitoring system. Overall, the floating robot's ability to monitor water quality and detect objects contributes to the preservation and conservation of aquatic ecosystems while enabling effective decision-making for various applications, including environmental research, pollution management, and water resource planning.

REFERENCES

[1] Sanij Kumar Deb, Jahed Hossen Rokkey, Tuton Chandra Mallick, Ms. Juliana Shetara "Design and Construction of a Water Robot" 2019

[2] Md. Shahnauze Ahsan, Hossen Mobarak, Kainatun Nahar chy "Design and Construction of a Radio-Controlled Floating Waste Collector Robot" 2019

[3] Abir Akib, Faiza Tasnim, Disha Biswas, Maeesha Binte Hasheem, Kristi Rahman "Unmanned Floating Waste Collecting Robot" 2020

[4] Md. Nafis Raihan, Mahbubur Rahman, Fahad Bin Alam, Ekra Bin Syed Mojib "A Novel Approach for Waste Collection: Automated Waste collecting Robot with advanced image recognition technology and Onboard Robotic arm" 2020

[5] Ajanya J S, Gauri Nair, Krishna E, Nisha Badusha, N Radhika Krishnan "Aqua Robot: Floating Waste Removal Robot" 2020

[6] Okyza Maherdy Prabowo, Yuyun Tresnawati, Dyah Kusumastuti "Design of Water Quality Monitoring System using Remove Operated Vehicle" 2021

[7] S Gupta, M Kohli, R Kumar, S Bandra "Iot based Robot for Water Quality Monitoring" 2021

[9] Gary Haggard Wade Hutchison Christy Shibata, "Introduction: Visual BASIC 6.0", 1st ed., 2015

[10] Francesco Fornai, Gabriele Ferri, Alessandro Manzi, Francesco Ciuchi, Francesco Bartaloni,and Cecilia Laschi," An Autonomous Water Monitoring and SamplingSystem for Small-Sized ASVs," IEEE JOURNAL OF OCEANIC ENGINEERING.

[11] ZhenliLu, YafeiXie, HuiganagXu, JunLu, LiminMao, Changkao Shan and Bin Li ," Design of a MNSM-based Controller for the Swimming Motion of a Snake-like Robot," 5th Annual IEEE International Conference on Cyber Technology in Automation, Control and Intelligent Systems, Shenyang, China, June 8-12, 2015.

[12] Philippe Giguere, Yogesh Girdhar and Gregory Dudek," Wide-Speed Autopilot System for a Swimming Hexapod Robot," 2013 International Conference on Computer and Robot Vision. [5] Seaperch.org.(n.d). Online Training Videos .[online]. Available: http://www.seaperch.org/online training videos. Accessed: Jan. 15, 2017

[13] Utah Underwater Robotics.(n.d). How to build a ROV.[online].Available https://utahrov.org/how-to-build-a-rov/ . Accessed: Jan. 15, 2017

[14] Michail Makrodimitris and Evangelos Papadopoulos," Design and Implementation of a Low Cost, Pump-Based Depth Control of a Small Robotic Fish," 2014 IEEE/RSJ International Conference on Intelligent Robots and Systems, Chicago, IL, USA, September 14-18, 2014.

[15] Carrick Detweiler, Stefan Sosnowski, IuliuVasilescu, and Daniela , "Saving Energy with Buoyancy and Balance Control for Underwater Robots with Dynamic Payloads," Experimental RoboticsSpringer Tracts in Advanced Robotics, Volume 54, 2009, pp. 429-438

[16] M. Dunbabin, J. Roberts, K. Usher and P. Corke, "A New Robot for Environmental Monitoring on the Great Barrier Reef," CSIRO ICT Centre, P.O. Box 883, Kenmore QLD4069, Australia, 2004.

[17] H. C. Brown, A. Kim and R. M. Eustice, "An Overview of Autonomous Underwater Vehicle Research and Testbed at PeRL," Marine Technology Society Journal, Volume 43, Number 2, 2009.

[18] M. S. M. Aras, H. A. Kardirin, M. H. Jamaluddin, M. F. Basar and F. K. Elektrik, "Design and Development of an Autonomous Underwater Vehicle (AUV-FKEUTeM)," Malaysian Technical Universities Conference on Engineering and Technology, June 20-22, 2009.

[19] C. Yue, S. Guo, M. Li and L. Shi, "Electrical System Design of a Spherical Underwater Robot (SUR-II)," Proceeding of the IEEE International Conference on Information and Automation, Yichuan, China, August 2013.

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details