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Design and Development of Lake Cleaning Machine using Artificial Intelligence

Lateefulla Khan, Leander Joseph, Manisha M Shaju, Mohammed Abdul Basith, Yadhukrishna M R

Department of Information Science and Engineering, The Oxford College of Engineering

Bangalore, India

ABSTRACT: The conventional method used to clean water bodies is manual process where it requires a boat, Skimmer, nets etc. to clean the water body. But this conventional method is time-consuming, expensive and requires a skilled operator. By considering all this we decided to introduce an automated river cleaning machine that is powered by AI and is more efficient than conventional method and also cost-efficient. The AI controlled vehicle has been designed to clean the surface of the river. The vehicle will be equipped 6 DC motors, Adruino micro-controller, ESP32 camera, collector bin, propeller belt and a battery. Vehicle is also equipped with sensors like Ultrasonic sensor, Turbidity sensor, PH sensor. The camera continuously captures images of the surface of the water and sends it to the server where they are processed by a deep learning algorithm to identify various types of garbage and accordingly send instructions to the Vehicle. On detecting garbage the vehicle moves towards the garbage and with the help of a propeller belt the garbage is lifted from the water surface and is collected in a bin. The turbidity and PH sensor's will collect data and send it to the server for real time analysis of the quality of the water. Vehicle can also detect if any human is drowning into water and raise an emergency alarm. This whole process is automated and requires no human interference. However the user can also manually control the vehicle using an android mobile phone application.

I.INTRODUCTION

Clean water is a basic need for all living beings. Without water survival in the Earth is not possible. Water covers about 70% of the Earth's surface among that only 3% of that is pure water. Water gets polluted due to any reasons like industry waste, sewage waste, garbage waste. Hence it is important to preserve the water resources. We considered this water pollution as a serious issue and start to work on the project. Traditional method for collecting water surface floating waste is manual basis, by means of boat trash skimmer. The above methods are costly risky and large time consuming. To eliminate the drawbacks of the above-mentioned methods the remote-controlled and autonomous water cleaning machine is designed which will help in cleaning the water surface efficiently and in an eco/friendly. The water waste cleaning vehicle consists of Arduino micro-controller, Node MCU, ESP32 camera module, DC motor, battery, pH sensor, Turbidity sensor, Ultrasonic sensor are attached to it for collecting the waste and monitoring the quality of the water.The AI based lake cleaning vehicle operates autonomously without requiring any human intervention. The machine consists of cleaner mechanism which collects & remove the waste from the water. It consists of Belt drive mechanism which lifts the debris from the water. This project will be useful for cleaning rivers, ponds, lakes and other water bodies. It is important to monitor the pH of a water body. An alteration in normal pH in a water body can be an indication of increased pollution or other environmental factors.Hence the solubility and biological availability of the chemical constituents of water are determined by pH sensor. We also monitor the turbidity of water using the Turbidity sensor to check the cloudiness of water.Although the whole process is automated and requires no human intervention it can also be controlled via android mobile phone application.

II. SIGNIFICANCE OF STUDY

The main aim of this project is to develop a water surface vehicle equipped with water quality monitoring sensors, cameras and AI based debris detection module with less human interference. This AI based lake cleaning machine monitors the water quality and also collects the garbage waste that is floating on the water surface.The camera captures the images of the lake and forwards it to the server which runs the image through an algorithm that is trained to detect garbage on detecting garbage the server sends instructions to the boat to go and collect the garbage. It also detects if any person is drowning and alerts the user. We use camera for monitoring the surface of the water bodies. In our project we use pH sensor to monitor the solubility and biological availability of the chemical constituents of water and turbidity sensor for monitoring the cloudiness of water.

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III. REVIEW OF RELATED STUDIES

Guillen-PeñarretaJhonny, Vizhñay-Aguilar Carlos, Serpa-Andrade Luis1, Pinos-Velez duardo (2017) conducted a study on special glasses for obstacle detection with location system in case of emergency and aid for recognition of dollar bills for visually impaired persons. In their study they found out that there is GPS/GSM application which is of great utility and complied with the intended purpose, as the visually impaired people often get lost and will implement the emergency button. In addition, the implementation not only possesses for people with this type of disability but also for disabilities as a deaf person or with physical disabilities.

Ramisha Rani K (2017) conducted a study on an audio aided smart vision system for visually impaired. In their study they found the utility thatcan robotically become aware of, analyze and recognize textual content in a photograph around the visually impaired and provides corresponding voice hints by means of bluetooth headphones.

Arjun Pardasani, Prithviraj N Indi, Sashwata Banerjee, Aditya Kamal, VaibhavGarg (2019) conducted a study on smart assistive navigation devices for visually impaired people. In their study they found out atechnology that directly converts text to braille and gives the visually impaired user an option to read in braille along with the audio message.

Feng Lan, GuangtaoZhai and Wei Lin (2015) conducted a study on a smart glass system that will help visually impaired people gain increased independence and freedom in city life. They have implemented an application of public signs recognition on the smart glass system. This application can detect and recognize the public signs in cities and give corresponding voice hints to the blindness.

IV. OBJECTIVES OF THE STUDY

- Collect many types of wastes: -Our product should not be restricted to collect only one type waste. It must diversify its function to accomplish the given task. The mechanism made for to collecting wastes should be tough enough to collect plastic wastes, plastic bottles, organic wastes which include crop debris, food wastes &any type of wastes which is floating on water
- Less human interference: - The very basic idea should be satisfied that is to avoid the interference of the operator. This will happen only by the adoption and sustained usage of technology in the workspace.
- Collect more amount of waste: Very firstly it must collect around 5kg of waste at a time when it is being left to the water.
- Easy disposal of waste: Another important thing is easy removal of wastes which are collected in the collecting box.
- It must be stable: To make the product stable it must get through with proper design calculations. It should withstand extreme conditions such as additional load exerted by the water waves and as well as by the wastes which are being collected.
- Monitor pH level of water using pH sensor which is attached to the machine.
- Monitor the cloudiness of water using Turbidity sensor.
- Detect garbage in the water body using image processing.
- Detect drowning person in the water body using image processing.
- To detect any obstacle effaced by the vehicle, ultrasonic sensor is used, which will alert the user if any obstacle is on its path.

V. METHODOLOGY

The vehicle will be equipped with six dc motor. Two dc motors for movement of the vehicle, two dc motors to move the vehicle left and right and two dc motors will be used for cleaning the lake. Vehicle will have Arduino Uno microcontroller which will act as brain of the vehicle. Node MCU will be attached with the vehicle to communicate wirelessly and ESP32 Camera module is used to capture images from the lake to detect waste debris floating in the water

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body. pH and Turbidity sensor are attached to the vehicle to detect water quality. Ultrasonic sensor is used to detect obstacle in front of the vehicle. Code is written in C language and dumped to Arduino to initialize all the components.

- In the execution phase when the vehicle is switched on it will start capturing the images using the camera.
- The images captured will be sent to the server using ESP 8266 Wi-Fi module and then it will be processed by the server and id it detects any waste it will send instructions to the ardiuno microcontroller to move the boat towards the waste and then collect it.
- It also has a manual mode in which it communicates with user's android device. It will respond to the user's instruction.
- The vehicle returns all the sensor readings to the server i.e. the Turbidity sensor and the pH sensor values so that the user and see the values.
- There is another feature i.e. the vehicle parallel runs another algorithm to detect if someone is drowning and if it detects that someone is drowning it raises an alarm via a buzzer that is mounted on the boat. By adding this additional functionality there is a vast area in which this vehicle can be used.
- The whole process is automated However if the user wants to control the boat manually it can be controlled using a mobile phone application i.e. an android mobile application.

VI. SAMPLE DATASET

The sample data set used in our project is a self-made dataset that comprised of about 500 images of clean and dirty water respectively. This dataset used was successful in giving us an accuracy score of 99%.

Techniques Used in the Present Study

Obstacle identification

The distance between the obstacle and the user will be measured using ultrasonic sensors.

Object Identification

Convolutional Neural Networks is used to identify the clean and dirty images that are being sent to the server via the camera. This is one of the most efficient algorithm available for image classification.

Sensor Values

The vehicle is equipped with sensors such as pH and Turbidity, as soon as the vehicle is turned on the sensors start collecting the data and sending it to the server.

VII. CONCLUSION

This project is emphasis to provide flexibility in operation. This is easy in operation and cost of maintenance is low. Hence this project "Design and Development of Lake cleaning machine using Artificial Intelligence" is mostly designed to make system very much economical and helpful to remove water impurities like plastics, trashes, water debris which is floating on river and pond surface. This is mainly very useful maintaining human health and for increasing the life of aquatic animals. This project is fabricated on the basis of literature and research on different journal and paper relevantly available and fabricated in accordance so it can provide flexibility in operation. This innovation is easy and less costly and has lot of room to grow more economical. This project is designed with the hope that it is very much economical and helpful to river and Pond cleaning. On the basis of it design and estimating cost and availability it is very cheap and very useful for the society.In future this project can be improved to sort more categories of waste. In this system we can use advance conveyor system and conveyor material for increasing the efficiency of collection of garbage. We can use the solar panel for providing power to the boat instead of battery operation. To modify the size of boat according to its waste collecting capacity is increases. This project makes only for small lake by doing some modification in its size and capacity it can use in big lake and river

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BIOGRAPHY

Lateefulla Khan is a student of Information Science and Engineering at The Oxford College of Engineering Bangalore, India (2021). He has worked on many projects such as database projects, Web projects etc. His interests include Machine Learning, Data Science and IOT.

Leander Joseph is a student of Information Science and Engineering at The Oxford College of Engineering Bangalore, India (2021). He has worked on many projects such as Web projects, Mobile applications etc. His interests include Internet of Things, Cryptography, and Cyber Security etc.

Manisha M Shaju is a student of Information Science and Engineering at The Oxford College of Engineering Bangalore, India (2021). She has worked on many projects such as database projects, Networking projects. Her interests include Front End Development, Graphic designs, networking.

Mohammed Abdul Basith is a student of Information Science and Engineering at The Oxford College of Engineering Bangalore, India (2021). He has worked on many projects such as database projects, Smart Objects etc. His interests include Mobile application Development, Wireless Communications.

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