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Wireless Communication based Water Surface Cleaning Boat

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Abstract -—It is very dreadful that huge liters of excrement are being deposited into the rivers across our country. The pollutants and toxins are assisting the amassing of the toxicant in water thus affecting aquatic life. Only when the detritus floating above the water bodies become persistent, the governments' plan of action is set about and unfortunately by that time, the life cycle in that water body breaks. This research work focuses on deploying a solution for the unfavorable effects on the floating refuse, and henceforth reduces the pollution caused due to the unsettled wastes including plastics and plant weeds. The project aims to develop a waste collecting boat to scavenge the water body and abolish the floating waste. This is done by employing a conveyor belt connected to the front line of the boat. Boat movement is established using a remotecontrol application by incorporating an RF module along with an encoder-decoder pair. This method will reduce the cost of operation because of less human involvement and labor. Major challenges in implementing the boat are compact mechanical design and reliable power supply. The principle feature of this boat is the collection of refuse and floating weeds from the surface of the water into a basket which is removable [2].

Key Words: IoT (Internet of Things), Water Surface Cleaning, Gear Motors, Conveyor System, Arduino Uno, IR Sensors, Boat Controller, Arduino IoT Cloud, Garbage Collection, Autonomous Navigation, Remote Monitoring, Environmental Cleanup, Sustainability, Pollution Control, Scalable Solution, Real-time Feedback, Smart Technologies, Automation, Water Pollution, Adaptive Systems.

1.INTRODUCTION -

The Humans have been putting on an ever-increasing pressure on the earth's water resources. For the last few decades, littering of plastics into the water bodies has been a serious hazard. As a result, almost all urban water bodies in India are suffering because of pollution and are used for disposing of untreated local sewage and waste. There are several inventions relates to this issue, one among that is the skimmer boats, i.e., workboats for collecting and disposing of floating waste materials in harbor's and waterways[1] and a vehicle armed with a monitoring system to check the water quality, to clean the most polluted water with a remote-controlled mechanism[2] is also an implemented nowadays. The increasing floating waste materials in the river adversely affect the ecosystem [3]. There are situations where the aquatic organisms eat the floating debris over the water considering it as their food, causing the death of those organisms which in turn affects the ecosystem. The idea behind pond water cleaning is to reduce the waste over a stagnant water body [4]. There are several methods for the implementation of wireless communication for remote control, but the RF-communication module system is very easy to implement and also very cheap [5]. Humans have many restrictions to go underwater to do surveying seabed mosaics, shipwrecks searches, here ocean floor, and the underwater pipeline system are used to bring these fossil fuels ashore. These pipelines need periodical inspection but when human labor is used for such inspection, time

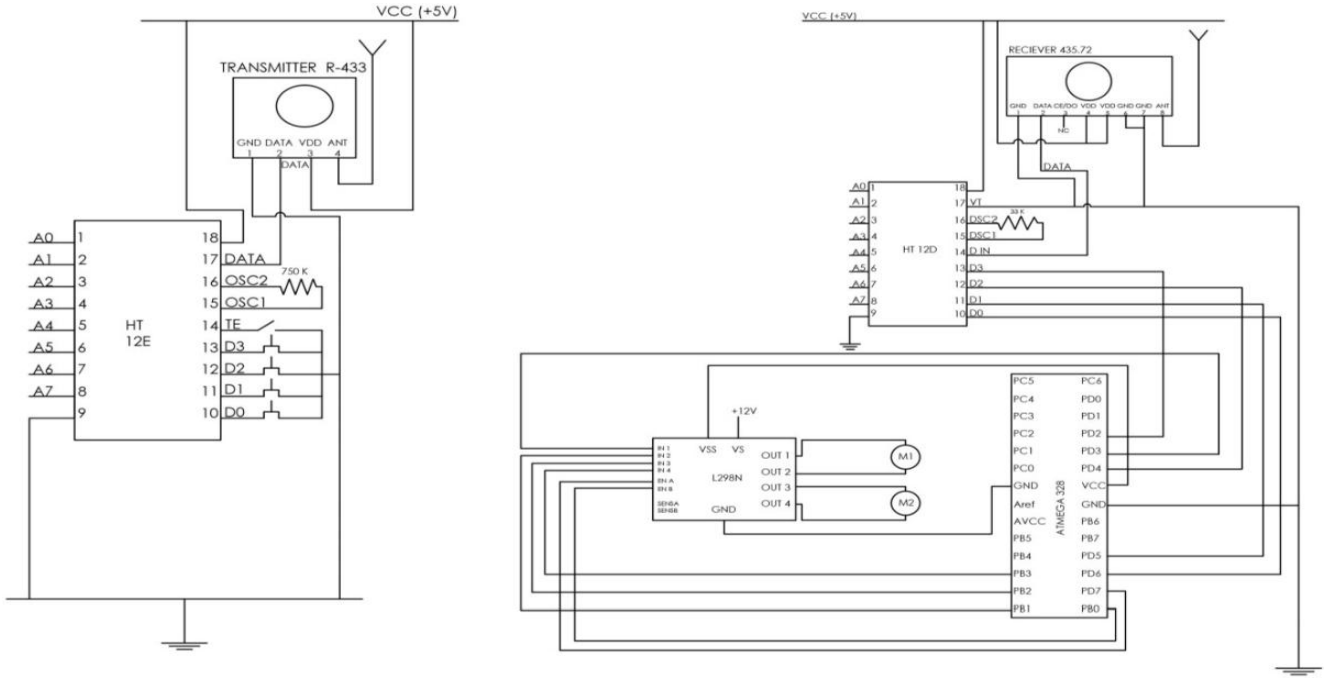
consumed and cost for human labor can't be compensated. Autonomous underwater inspection robots can be used to carry out such operations. For these operations to be carried out, it has been required to have data access that can help us determine the position and altitude of underwater inspection robots and tracking of autonomous robots [6][14]. Considering the current situation of the river water and the ecosystem, the paper comes up with a solution for collecting debris and its working, where it collects all the waste in front of the conveyor belt and the motion of the boat is controlled using serial communication with the help of a pair of RF module [19].

2. System Description

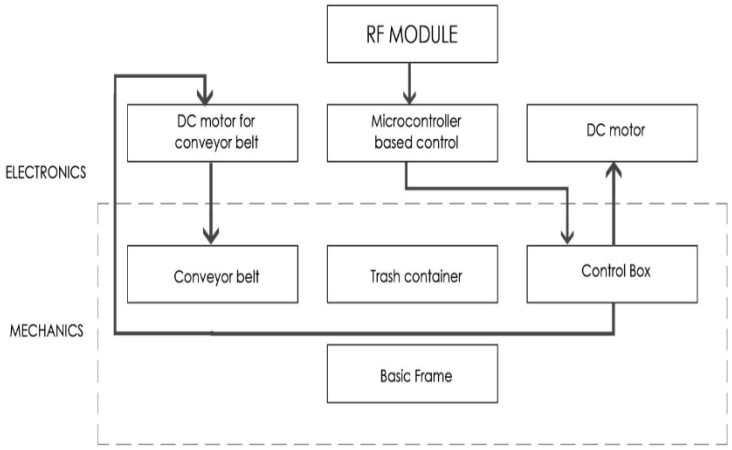
The Three DC motors have been used in this project. One is used to control the motion of the conveyor and the other two are for the motion of the boat [10]. The two DC motors used for the motion control is the Micro DC 3-6 volts Submersible Pump Mini water pump motors. These are single-phase motors with a power rating of 3 kW. The test area that had been chosen was small and hence the motors of less power rating of 0.1HP were used. The weight of the motor (0.1 Kg) was also less enough so that it does not get added up to the boat weight on the backside. The DC motor used for conveyor belt is the High Torque Mini 12V DC Gear Motor of 600 rpm. The speed of the conveyor belt was chosen to be average and hence this motor. Here L298N Based Motor Driver Module is used for driving two DC motors, which is widely used in high power motor scenarios. It consists of an H-bridge which helps in the forward and backward movement of the boat to easily and separately control two motors of up to 2A each in both directions. Concerning Fig 1, the RF-module which works on the principle of electromagnetic radiation is been used for the wireless communication of serial data through its antenna connected to pin ANT. These work on a voltage range of 3V 12V. The RF module combines a 433MHz transmitter and receiver modules. The transmitter is capable of transmitting radio waves and to regulate that wave to carry data. The data to be transmitted will be provided by the transmitter module. The main obligation of the receiver module is to receive the modulated RF signals and demodulate it. The transmission rate of RF modules varies in the range of 1Kbps to 10Kbps. These transmitted data can be received by the receiver module only if both the transmitting and receiving modules are operating at the same frequency. The enable pin of HT12E encoder has a transmission which is active low. When a trigger signal is received on TE-pin, the data is transmitted together with the header bits via an RF transmitter. Upon obtaining a transmission enable HT12E starts with a 4-word transmission cycle. This cycle is performed again until TE is low. When TE returns high, the final cycle of the encoder output concludes and then ceased. HT12D turns the serial data to 12-bit parallel data, which are then divided into 8 address bits and 4 data bits. The data received by the receiver of the RF module including the serial addresses are decoded into parallel data and are then sent to output data pins. By comparing the local address with the serial input data three times and if no error is found the input data code is decoded. When the VT pin indicates a high signal, it can be concluded that the transmission is valid. A conveyor belt is used to collect trash from the water bodies that need to be transported to the box type structure in the boat. Here the material used for the conveyor belt is a thin leather-like structure [7][8].

3. Hardware Implementation

The mechanical part of the boat includes the basic frame, the conveyor, the trash container, and the control box. The boat is built out of foam sheets for ease of maintenance. The boat is equipped with wireless control, power units, and a conveyor belt to collect the waste. The control box includes a motor driver and power supply (Batteries). A DC motor is connected to the conveyor for its continuous rotation which is powered up with a 12V battery from the control box. The conveyor collects the waste in a basket that is attached to the back of the boat [11]. The boat will hoard the trash imminent in its path [12][15]. The conveyor belt is made of PVC material which prevents roll back and offers stickiness of objects back on the water surface. Waste like polythene,



food material, etc. is intended to be the target. The conveyor belt rotates and accumulates all the floating refuse which randomly comes to the fore. When the garbage collector pit is full, then it is brought back to the initial point and all the garbage present in the collector can be removed manually by taking away the collection box. Once the waste is removed from the basket, it can be attached back to the boat for further collection. In this way, the floating garbage present on the water surface can be collected. When the boat is in the water, its movement is controlled by remote manually [16]. The remote of the boat comprises of the transmitter, encoder, pushbuttons, and a battery. On a PCB, there is a transmitter circuit that includes the four pushbuttons, encoder, and transmitter [18]. The boat uses the RF (Radio Frequency) module instead of IR because of its long-range application.[9] The RF module also controls the direction of the DC motor through a motor driver L298N IC. As the name suggests, the RF module works on the principle of radiofrequency which ranges between 30 kHz and 300GHz. The RF module is used along with an encoder/decoder pair [13]. Four push buttons are connected in parallel to the encoder which represents forward, right, left, and release motion of boat respectively. Data from each push button is given parallelly to the encoder, which in turn covers it into serial data and sends it to the receiver. Since a 9V battery is used, the voltage needed to be stepped down to 5V using a buck converter to power up the encoder and the transmitter. The parallel data transmission is done using the encoder. The pin14, i.e., TE, of the HT12E encoder, is fed with a low voltage to enable the transmission. The various pins of the HT12E are used to control the motors, i.e., pin 10 and 11 are used to control one motor, and pin 12 and 13 are used to control the other. A particular signal is sent by giving a low input to the corresponding data pin of the encoder HT12E since the encoder works on negative logic. The signals received by RF receiver which are first encoded into the serial format by HT12E and then transferred through RF transmitter, are decoded by HT12D. The decoded parallel data is sent to the Arduino. Depending on the signal received by the Arduino, code is run and respective motion is made [17]. The output from the PWM pins of the Arduino is fed into the input pins of the L298N motor driver. The output pins of the driver are connected to



the terminals of the motor which in turn operates the movement of the two DC motors simultaneously.

4.Results And Challenges

A remote-controlled surface water cleaning boat is developed. Wireless communication is achieved using RF module, but that resulted in a data change. To overcome this problem, HT12E encoder and HT12D decoder are used. Each time when a push-button is pressed, respective signals are sent through the encoder/decoder pair and the corresponding forward, right, left and release movements of the boat are achieved. Whenever trash is found floating on the surface of the water in the boat's path, the movement of the boat is controlled manually using the remote (push buttons) and they are collected through the conveyor belt and dumped in the trash collection box placed at the rear side of the boat. Testing of the hardware on a water body is demonstrated in Figures 3.a – 3.c

- Figure 3.a shows the movement of the boat towards the floating waste on the surface of the test area. The movement is controlled manually using remote**.**

Figure 3.a: Movement of the boat towards waste.

- Fig 3.b shows the continuously rotating conveyor belt picking up the waste from the surface of the water and rolling back into the collection box.

Figure 3.b: Collection of waste through the conveyor belt.

- Figure 3.c shows the waste that is finally collected inside the trash collection box.

Figure 3.c: Collected waste is dumped into the basket.

5.Conclusions And Scope

In the present scenario of climate change and Global warming, the pollution caused by floating bodies on the river and other water bodies cannot be left unseen. The mass dumping of toxic waste into these water bodies creates a question of both pollution and unhygienic surroundings. The Government is spending more money on cleaning these unwanted objects as they cut the oxygen supply for both marine flora and fauna. As the life of flora and fauna is disturbed it creates disturbances in the circle of aquatic life chain. The most prominent methods present today for the removal of these wastes are the traditional ones. Removal and collection of these wastes from a water body are labor intensive in India and thus can substitute labor work. Technology has to be incorporated in such a way that cleaning the water is done efficiently and effectively, here comes the scope of our project as our prime objective is to collect the floating waste and to reduce human labor for such works. Here a trash-collecting boat is deployed to clean the lake water. The boat comes with control and power units along with conveyors attached to it. In the future, the project can be improved to sort more categories of waste using various automated techniques and it can be made remote controlled. In this system, an advanced conveyor system and conveyor materials can be used for increasing the efficiency of collecting garbage. Also, solar power can be utilized to drive the boat instead of battery operation and can completely work on solar energy thus saving the power. To modify the size of the boat and to implement different boats that can communicate with each other's help increase the efficiency and to clean the whole are more efficiently. Only smaller water bodies are considered presently and larger water bodies can be cleaned by making some modifications to its size and capacity.

REFERENCES

1. Houssam Albitar, Anani Ananiev, Ivan Kalaykov, "In-Water Surface Cleaning Robot: Concept, Locomotion and Stability", "International Journal of Mechatronics and Automation", Volume 4, Number 2, 2014, pp 104-114.

2. Asst. Prof. R. Raghavi, Varshini, L. Kemba Devi, "Water Surface Cleaning Robot", "International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering", Volume 8, Issue 3, March-2019, pp. 831-837.

3. Prof. Kean V. Dhande,"Design and Fabrication of river cleaning system", " International Journal of Modern trends in Engineering and Research", Volume 4, Issue 2, February-2017, pp. 8-18.

4. Prof. H. M Preeti, M.Tech scholar Soumya, research guide and Prof. Baswaraj Gadgay, "Pond Cleaning Robot", "International Research Journal of Engineering and Technology", Volume 5, Issue 10, October- 2018, pp. 1136-1139.

5. Prof. Khunt Sagar P, "Wireless DC Motor Speed and Directional Control using RF", " International Journal of Novel Research and Development", Volume 2, Issue 4, April-2017, pp. 1-8.

6. Harsha Gopinath, Indu .V, Meher Madhu Dharmana, "Autonomous Underwater Inspection Robot under Disturbances", "International Conference on circuits Power and Computing Technologies", 2017.

7. Prof. Ajay Dumal, "Study of River Harvesting and trash cleaning machine", "International Journal of Innovation Research in Science and Engineering", Volume 2, Issue 3, March -2016, pp. 884-894.

8. Prof. N.G. Jogi. "Efficient Lake Garbage Collector by using Pedal Operated Boat", International Journal of Modern Trends in Engineering and Research", Volume 2, Issue 4, April-2016, pp. 327- 340.

9. M. Mohamed Idhris, M.Elamparthi, C. Manoj Kumar, Dr.N.Nithyavathy,Mr.K. Suganeswaran, Mr. S. Arunkumar, "Design and fabrication of remote-controlled sewage cleaning machine", IJETT - Volume-45 Number2 -March - 2017, pp. 63-65..

10. Mr. P. M.Sirsat, Dr. I. A. Khan, Mr. P.V. Jadhav, Mr. P.T. Date, "Design and fabrication of River Waste Cleaning Machine", IJCMES 2017, pp. 1-4.

11. Zhongli Wang, Yunhui Liu, Hoi Wu Yip, Biao Peng, Shuyuan Qiao, and Shi He, "Design and Hydrodynamics Modeling of A Lake Surface Cleaning Robot", "International Conference on Advanced Intelligent Mechatronics", July-2008.

12. Tomoyasu Ichimura and Shin-ichi Nakajima, "Performance Evaluation of a Beach Cleaning Robot "Hirottaro 3" in an Actual Working Environment", "International Conference on Control, Automation and Systems", October-2018, pp. 825-828.

13. Associate Prof. Suraya Muben, M. Kumar Yadav, B. Sirisha Reddy, T. Sowmya Reddy, B.Praneetha, "Wireless Electrical Apparatus Controlling System with Speed Control of AC motor using RF communication" , "Global Journal for Research Analysis", Volume 6, Issue 4, April 2017.

14. Harsha Gopinath, Indu. V, Meher Madhu Dharmana, "Development of Autonomous Underwater Inspection Robot under disturbances", "IEEE International Conference on Technological Advancements in Power annd Energy", 2017, pp. 724-727.

15. Jayasree P.R, Jayasree K.R, Vivek A, "Dynamic Target Tracking using a 4-Wheeled Mobile Robot with optimal path planning technique", "International Conference on Circuits Power and Computing Technologies", 2017.

16. Devika Mohan and Vivek A, "Navigation of Two-Wheeled Mobile Robots Corporatively carrying on objects", "International Conference on Circuits Power and Computing Technologies", 2017, pp 1-6.

17. Poornima Varma N, Vivek A, Ravikumar Pandi V, "Target Tracking, Path Planning and Obstacle Avoidance by Intelligent Robot", "IEEE International Conference on Technological Advancements in Power and Energy", 2017.

18. H. Albitar, A. Ananiev, I. Kalaykov, "New Concept in Water Surface Cleaning Robot", " International Conference on Mechatronics and Automation", August-2013, pp. 1582-1587.

19. Niramon Ruangpayoongsak, Jakkrit Sumroengrit, Monthian Leanglum, "A Floating Waste Scooper Robot on Water Surface", "17th International Conference on Control , Automation and Systems" , October-2017, pp. 1543-1548.