Swirl Sink: A Novel Lake Cleaning Solution

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Abstract - *Water is a crucial resource required for the survival of living beings, it is important to keep it clean and maintain its hygiene. There are various reasons for water pollution such as chemicals from industries and factories, garbage waste, sewage waste etc., hence to remove or clean them traditional methods are employed. There's a need to incorporate technology such that cleaning work is done efficiently and effectively. Swirl Sink is a novel solution to this problem which is plaguing the modern world lakes. It is an innovative take on the existing solutions; after extensive research and analysis into the existing lake cleaning devices/machines, we came up with a unique design. The device is designed is such a way that it collects the waste which floats on water bodies and stores it in a built in container, the collected waste can be easily disposed from the device, the device cleans wastes such as plastics, garlands, bottles and other wastes found floating on water. The most important concept on which this project is based on is a whirlpool. It generates an artificial whirlpool by creating suction using a motor pump which pulls in the surrounding water with the trash; hence the trash gets trapped inside the contraption.*

***Key Words*: Whirlpool, Swirl Sink, Lake, Cleaning, Water**

1. INTRODUCTION

Lakes are an important aspect of the Earth's terrain. They are extremely precious ecosystems and provide a range of resources like food and minerals to humankind. They are not only one of the most significant sources for fresh water, but also extend valuable habitats for plants and animals alike to thrive in, they also moderate the hydrological extreme events like drought and floods, influence microclimate, enhance the aesthetic beauty of landscapes and offer lots of recreational opportunities. Lakes have a very special significance in India.

Pollution: The last two decades have seen an explosive increase in the urban population without a corresponding expansion of civic facilities such as adequate infrastructure for the disposal of waste. Hence, as more and more people flock to the cities the urban civic services are becoming less adequate. As a result, almost all urban water bodies in India are facing repercussions because of the pollution and are also being used for disposal of untreated local sewage and solid waste, and in many places, the water bodies have been turned into landfills.

Even though, there are a plethora of policies and acts for the protection and restoration of urban lakes and wetlands, urban water bodies are in extremely poor condition. Their numbers are declining rapidly. Looking back, in the beginning of the 1960s Bangalore had 937 lakes, now the figures have declined to about 189 and they too are slowly dying. Having unhealthy lakes also result to the fall of ground water levels. Assessments from various research institutes have shown that the number of water bodies in the city has reduced by 79% in the last forty years due to unplanned urbanization and encroachment of lakes simultaneously the built-up area has increased from 8% in 1973 to 77% in 2018.

2. LITERATURE SURVEY

Ketan V Dhande et al. (2017) According to Prof. Ketan V. Dhande invented a River Cleanup Machine which is used in those places where there is waste debris in the water body[1]. In this device a waterwheel driven conveyer mechanism and belt drive mechanism lifts the debris from the water. According to the article from "The Times of India" newspaper entitled with "Nagpur Municipal Corporation begins Nag- Pilli rivers campaign", The Nagpur Municipal Corporation has set the project for cleansing the Nag and Pilli River in West Nagpur. The goal of the project is to rejuvenate and beautify the river. As the world is moving towards creation of smart cities due to enormous growth in the population and advancement, the technology becomes important to control water cleaning through efficient methods[2]. Although the world keeps advancing with new technologies and advanced infrastructure the way some things are done remain the same. Automation is required is order to match the advancements and keep up with the current trends while also having a high efficiency and use[3].

Ajay Dhumal et al. (2016) Prof. Ajay Dhumal's proposal is about an aquatic harvester which can be used to perform a variety of tasks, including aquatic plant handling and garbage removal from rivers, lakes, bays, and harbors [4]. Speaking in layman's terms it is a type of a barge. It harvests the debris using a conveyor system designed to collect and unload vegetation, cutting height is also adjustable according to the requirement, it can be used up to 6 feet below the water surface. The Cutter bars collect material and drag it on board the vessel using the conveyor belt; when the barge reaches its maximum capacity the cut material is transported to a disposal site and unloaded using the conveyor belt. According to Prof. N. G. Jogi cleaning the lake water is the main aim as the villages of India consist of various small and

big lakes and most of the villages do not use the water of lake for farming, drinking or for daily use due to the amount of garbage present in the lake water[5].

Basant Rai et al. (2013) This article by Basant Rai ref [6] talks about a World Bank Sponsored study, according to which pollution levels in the Ganga are contributing to 9-12% of total disease in Uttar Pradesh (U.P.). The coliform bacteria levels are in over 2 lakh Most Probable Number (MPN) as opposed to the national water quality standard of 5000. The heath damage reported due to water pollution was estimated up to a staggering 6.4 million dailies (Disability Adjusted Life Year). According to the Central Pollution Control Board (CPCB) survey report, the municipal sewage from the identified 25 towns in the year 1985 was 1340 million liters per day (MLD). Apart from this sewage, 260 MLD of industrial wastewater, residues from about 6 million tons of fertilizers and 9,000 tons of pesticides used for agricultural purposes within the basin, large quantities of solid waste, animal carcasses and human corpses were being released into the river every day. Works corresponding to cleaning 873 MLD that is approximately 65% were taken up under the first phase of Ganga Action Plan (GAP) which was formulated to clean up river Ganga by the government of India.
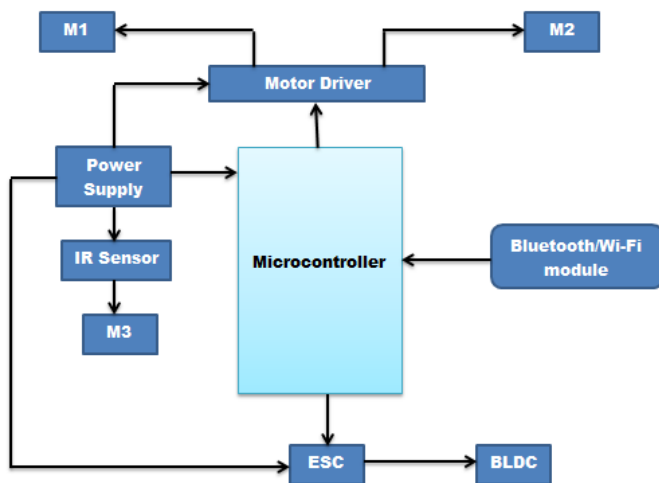
3. METHODOLOGY

Figure – 1: Block Diagram of Swirl Sink

Swirl Sink is an Aquatic machine that is applied to lake cleansing in order to help decrease water pollution by collecting the floating debris and trash on the water surface. Our purpose is to bring a cost-effective, efficient, and user friendly solution to lake cleaning. Swirl Sink uses the principle of turbulence by causing a whirlpool through artificial suction created by the motor pump mounted at the bottom of the chassis which causes the waters surrounding the machine to move inside it with the floating trash.

4. COMPONENTS DESCRIPTION

Hardware requirements-

Arduino Mega: The ATmega2560 is what the Arduino Mega microcontroller is based on. It possesses 16 analog inputs in addition to the 54 digital input/output pins out of which 15 can be used as PWM outputs, 4 UARTs (hardware serial ports), a USB port, a power jack, an ICSP header, a 16 MHz crystal oscillator, and a reset button. It is a significant upgrade to the previous Arduino boards containing everything needed to support the microcontroller; To get started it simply needs to be connected to a computer with an USB cable for interfacing using the IDE or it can be powered with an AC-to-DC adapter or battery.

LM7805 Voltage Regulator: The LM7805 voltage regulator is an iconic regulator IC that finds its application in most of the projects. The number 7805 when split has two denotations, "78" means that it is a positive voltage regulator and "05" means that it provides 5V as output. So the 7805 will provide a +5V output voltage.

The maximum output current of this IC is 1.5A. But, it suffers from heavy heat loss hence a Heat sink is recommended for operations that consume more current.

L298N Motor Driver: The L298N is a high power Motor Driver Module for driving DC and Stepper Motors. It consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control a maximum of 4 DC motors, or 2 DC motors with directional and speed control.

DC Motors: The DC Motors used are of 1000 RPM and 12Volts.Geared motors are usually a simple DC motor with a gearbox attached to it. This can be used in an all-terrain robot and a variety of other robotic applications. To be able to connect to wheels or any other mechanical assembly these motors have a 3 mm threaded drill hole in the middle of the shaft. Nut and threads on the shaft are used for making connections easily and the internally threaded shaft makes it easy for connecting it to the wheel. For Heavy Duty applications, DC Geared motors with robust metal gearbox aroused which are available in a wide RPM range and are ideally suited for robotics and industrial applications.

HC-05 Bluetooth Module: The Bluetooth module used for the full-duplex wireless functionality to the device is the HC-05 Bluetooth module. It is connected to the serial port of a microcontroller, which allows the microcontroller to communicate with other devices over a Bluetooth connection. This module can run in both master and slave mode and can be used in various applications, for example, smart home applications, remote controls, data logging applications, robotics, monitoring systems, and more.

Arduino IDE: Coding is usually done in their specific Development environments likewise The Arduino Software IDE or the Arduino Integrated Development Environment is

an application which contains a text editor for writing programs, a message area, a text console, a toolbar with options for common functions and a series of menus. It is connected to the Arduino or Genuino board to upload programs and communicate with them. The Arduino IDE is open-source making it easy to write code and upload it to the board. The code is then run on the chip. Most 3D printed electronics are Arduino compatible; they use the ATmega chip and enable the user to upload their code into the Arduino microcontroller.

5. APPLICATIONS AND OBJECTIVES

- **Clean Water-bodies such as lakes:** The Project's main objective is to clean lakes and make them pollution free by collecting trash and other floating garbage debris on the surface of the water-bodies with minimal interference to the local ecosystem.

- **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.

- **Easy disposal of waste:** Another important thing is easy removal of wastes which are collected in the collecting area inside the Swirl sink.

- **Eco-Friendly:** It should not harm the aquatic animals. It must not have any adverse effect on the water source.

- **User-Friendly:** Users should be able to operate the device with minimal training and prior knowledge about it.

6. CONCLUSION

Water makes up about 71% of the earth's surface is and only 0.5% of the earth's water is available freshwater which in turn is found in lakes, rivers, and swamps. Swirl Sink was designed with an intention of the water debris floating on the lake, by using our device we can collect many floating wastes like plastic bottles, bags, garlands without any human interference and then dispose of the waste easily. Cleaning lakes is possible by remotely operating the device which is very user friendly. Also, our project helps in reducing the water pollutants to a certain extent. The project is socially helpful for the Laborers who clean the lake and makes them economically available. Usage and spread of this device would be the perfect example for "Technological application in environmental protection". This shows tech can also be used constructively unlike how some environmentalists claim that tech is responsible for the downfall of the natural environment and rapidly declining resources. Currently the project is remote controlled but through automation techniques, it can be made completely automated. This device can be used for many other purposes in the future as its versatility lies in its modularity. It can be modified to clean water bodies by adding the appropriate chemicals using AI to determine the pollutant. Solar panels can be added on it to make it self-sufficient; it can also double down as an eco-system monitor with many more additional features.

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