

Hardware Implementation of Smart Seabin

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Abstract- Protecting environment from various sources of pollution is imperative to ensure the sustainability of the earth. Water pollution has also become one of the significant issues due to increasing water-related activities such as transportation, fisheries, entertainment and many others. It threatens the well-being and prosperity of human and nature as well as the quality of water in the surrounding. This project of Smart seabin is to develop a system that can remove floating trash, oil, fuel, and detergents from the water to resolve water pollution problem so that would not threaten. The threats faced by marine life and surrounding particularly in the sea may appear to be overpowering. At the end of this research, a fully functional trash collector is expected to be operating along the shoreline of sea to clean up debris. This developed Smart seabin will further benefit especially for water body in resolving the water pollution issues.

Keywords- Microcontroller, Energy Storage, power stabilizing problems, energy savings, Plastic Pollution, marine pollution.

I. INTRODUCTION

One of the largest problems in our world today is the extreme pollution of our oceans and waterways. Each day, thousands of tons of trash and plastic debris are dumped into our oceans. Since plastic does not break down, like most natural substances, it is left floating in our waters. Approximately 10–20 million tons of plastic end up in the oceans each year. A recent study conservatively estimated that 5.25 trillion plastic particles weighing a total of 268,940 tons are currently floating in the world's oceans. This plastic debris results in an estimated \$13 billion a year in losses from damage to marine ecosystems, including financial losses to fisheries and tourism as well as time spent cleaning beaches. Animals such as seabirds, whales, and dolphins can become entangled in plastic matter, and floating plastic items such as discarded nets, docks, and boats—can transport microbes, algae, invertebrates, and fish into non-native regions, affecting the local ecosystems. Without healthy oceans, there is no life. Oceans are the life blood of our planet and humankind and it is in our best interest to keep them clean.[1]

II. DESCRIPTION OF SYSTEM

The Smart seabin is a floating waste bin that is located in the water at boat marinas, docks, harbors, and other coastal areas where it can be regularly emptied and maintained. The Smart seabin is collecting all floating rubbish; water is sucked in from the surface and it passes through a catch bag filter inside the Smart seabin. The water is then pumped back to the sea, leaving the litter and debris trapped in the catch bag for proper disposal. Hence, The Smart seabin requires frequent cleaning that is done by various environmentally conscious organizations in different locations. The Smart seabin also has the potential to collect certain amounts of the oils and liquid pollutants floating on the water surface.

III. OBJECTIVE OF PROJECT

Our mission statement is simple: To live in a world without the need for Smart seabin. It may seem like a contradiction but at the end of the day, marine litter should not be in the water in the first place. The idea was if there was rubbish bins on land, why not in the water? Over time, the scope of the project evolved into a comprehensive research, technology, and educational initiative with global interest and reach. The world's marinas, ports and yacht clubs are the perfect place to start helping clean our oceans. With no huge open ocean swells or storms inside the marinas, these relatively controlled environments provide the perfect locations for Smart seabin installations. One of the goals for the Smart seabin Project is to provide practical and tangible solutions to reduce the plastics in our oceans which is one of the world's greatest problems. Find out more about how our journey started with a simple idea: If we can have rubbish bins on land then why not have them in the ocean?

The main objective of this project:

- To implement hardware model for smart seabin.
- To control speed of motor of smart seabin with the help of Arduino.
- To power the smart seabin from solar.
- To alarm when bin is full of waste.

IV. PROPOSED DESIGN

The Smart seabin is a floating waste bin that is located in the water at boat marinas, docks, harbors, and other coastal areas where it can be regularly emptied and maintained. The Smart seabin is collecting all floating rubbish; water is sucked in from the surface and it passes through a catch bag filter inside the Smart seabin. The water is then pumped back to the sea, leaving the litter and debris trapped in the catch bag for proper disposal. Hence, The Smart seabin requires frequent cleaning that is done by various environmentally conscious organizations in different locations. The Smart seabin also has the potential to collect certain amounts of the oils and liquid pollutants floating on the water surface. The Smart seabin are currently using 12 volt submersible water pumps.

These water pumps are connected with 12V battery and solar panel. We have connected various components which are controlled by Arduino We can use either one of them. Water is sucked into the sea bin. Water is sucked by CAM mechanism. A cam is a rotating or sliding piece in a mechanical linkage used especially in transforming rotary motion into linear motion.^{[1][2]} It is often a part of a rotating wheel (e.g. an eccentric wheel) or shaft (e.g. a cylinder with an irregular shape) that strikes a lever at one or more points on its circular path. The cam can be a simple tooth, as is used to deliver pulses of power to a steam hammer, for example, or an eccentric disc or other shape that produces a smooth reciprocating (back and forth) motion in the follower, which is a lever making contact with the cam. A cam timer is similar, and were widely used for electric machine control (an electromechanical timer in a washing machine being a common example) before the advent of inexpensive electronics, microcontrollers, integrated circuits, programmable logic controllers and digital control.

V. BLOCK DIAGRAM

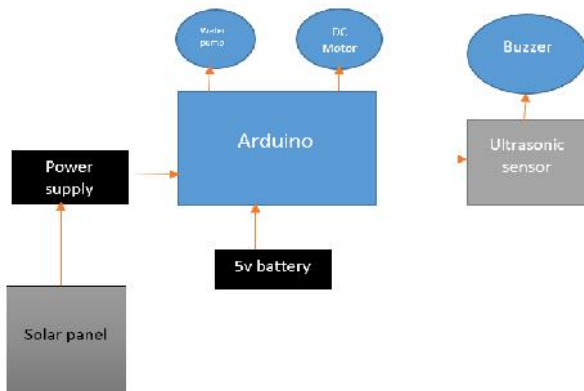


Figure 1.1 Block Diagram of scheme of the System

VI. HARDWARE FRAMEWORK

- 1) ARDUINO
- 2) SOLAR PANEL
- 3) DC MOTOR
- 4) WATER PUMP
- 5) BUZZER
- 6) SWITCH
- 7) Voltage Regulator
- 8) BATTERY
- 9) ULTRASONIC SENSOR

6.1 Arduino

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.[2]

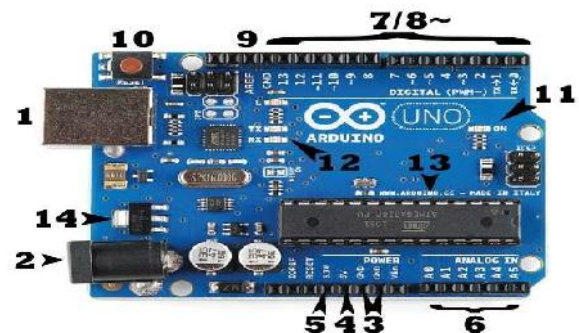


Figure 1.2: Arduino

6.2 SOLAR PANEL

Among all renewable energy sources solar energy is the most acceptable solution as it is available in abundant and free of cost worldwide. Solar Photovoltaic (PV) is used to convert solar energy into electrical energy. The complete solar energy conversion system consists of Solar PV, Power electronics converters and control unit to regulate the power extracted from solar PV. Solar PV cells have nonlinear characteristics. Its efficiency is very low and the DC power output varies with solar irradiation and ambient temperature.[3]



Figure 1.3: SOLAR PANEL

6.3 DC MOTOR

An electric motor operated by DC (direct current) is known as a DC motor (unlike an induction motor that operates via an alternating current). A DC motor converts DC electrical energy into mechanical energy.

DC motors are the oldest types of electro-mechanical machines. They were invented after the creation of the first sources of DC current. They are more advantageous over other AC machines regarding controlling the speed regulation, they could be found in many applications which require high-speed control accuracy and reliable effective dynamic responses such as industrial, medical and military purposes where the speed must be variable in wide range. DC motor speed is directly proportional to armature voltage, by adjusting the armature voltage.[4]



Figure 1.4: DC GEAR MOTOR

6.4 Water pump

The working principle of a water pump mainly depends upon the positive displacement principle as well as kinetic energy to push the water. These pumps use AC power otherwise DC power for energizing the motor of the water pump whereas others can be energized other kinds of drivers like gasoline engines otherwise diesel.[5]



Figure 1.5: Water pump

6.5 Buzzer

The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound devices. It is mainly divided into piezoelectric buzzer and electromagnetic buzzer, represented by 'HA' or 'H' in the circuit. According to different design and uses, the buzzer can emit various sound such as music, siren, buzzer alarm and electric bell.[6]



Figure 1.6: Buzzer

6.6 Voltage Regulator

A **voltage regulator** is an electronic or electrical device that can sustain the voltage of power supply within suitable limits. The electrical equipment connected to the voltage source should bear the value of the voltage. The source voltage should be in a certain range which is acceptable for the connected pieces of equipment. This purpose is fulfilled by implementing a voltage regulator.

A voltage regulator – as the name suggests – regulates the voltage, regardless of the adjustments in the input voltage or connected load. It works as a shield for protective devices from damage. It can regulate both AC or DC voltages, depending on its design. The most common series of voltage regulators is the **78XX series**. The two digits after the 78 represent the output voltage of the regulator, for example the 7805 is a 5V regulator and the 7812 is a 12V regulator. The output voltages available with fixed regulators covers a large range from 3.3V to 24V with nice values like 5V, 6V, 9V, 15V and 18V available.[7]

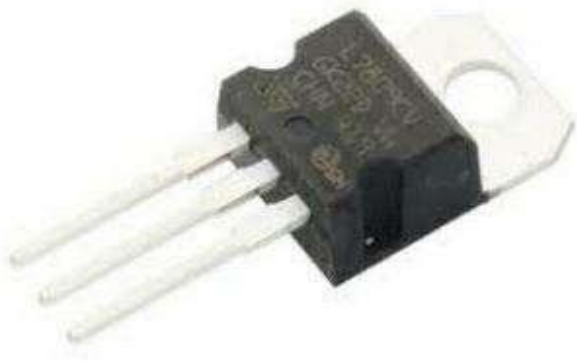


Figure 1.7: Voltage Regulator

6.7 Battery

A battery is a power source consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved to include devices composed of a single cell.



Figure 1.8: Battery

6.8 ULTRASONIC SENSOR

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).[8]



Figure 1.9: Ultrasonic sensor

VII. MODEL OF THE SYSTEM



Figure 1.10: Top view of complete System

VIII. RESULT

The Project is tested successfully in virtual pond and results obtained are satisfactorily. The bin is designed to collect floating waste around. Seabin successfully collected waste with the help of Arduino. The buzzer sounds when the bin is full of waste. All the waste is removed manually from the bin, when the buzzer sounds. The seabin is powered with solar panel making it independent of the conventional sources of energy. It is also connected with conventional battery source as a backup. This way the model is very cost effective.

IX. ADVANTAGES

- To the Water Cleaners: Water cleaners that going on the water risking their safety and health, they can use the prototype to collect wastes without going on the water. This can prevent accidents and diseases.
- To the Residents: Residents near in water areas can be affected during bad weather because of the canals blocked with wastes that causes floods. Collecting wastes on the canals using the prototype can prevent flood and diseases.
- To the Wildlife: Wildlife living in water areas are the most affected by the wastes thrown by people. Getting rid of wastes would give the water areas an ability to sustain life for the different living organisms.
- To the Environment: Preserving environment is one of the most important things to do. Getting rid of all water wastes can help the people secure the sources of water.
- To the Government: The government can use this prototype to have a technological advancement in collecting wastes in different water areas. They can distribute the prototype to every place that requires the need of waste reduction.
- To the Country: The country cannot survive without a clean water environment. Eliminating the wastes on the water areas can help the country maintain its healthy environment for the people.

X. CONCLUSION

The project design of river water cleaning machine 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 project “Design of Water Waste Collector by Smart seabin” is designed with the hope that it is very much economical and helpful to river and Pond cleaning.

The manoeuvrability of the prototype on the water body allows the user to filter water at the prone area. At the

moment the prototype is tested floating freely on stagnant water. This feature is suitable for aquaculture industry where this prototype can be installed at the designated reservoir. Using on shelf materials where they can be purchase locally made this prototype is cheap to build comparing to its capability to do filter plus using a renewable energy. In other hands this prototype offering a green approach solution for a better quality environment.

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