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DESIGN AND DEVELOPMENT OF ADVANCED RIVER CLEANING BOAT USING ARDUINO AND BLUETOOTH

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ABSTRACT:

The main goal is to provide an effective method for gathering and discarding waste; To analyze the issue of disposing of scrap in a public, commercial, artificial, or other appropriate setting; to create and implement a system to solve the issue; to keep the imposed system up to date and test it. We're using Arduino and Bluetooth modules to administrate an Arduino-powered scrap-collecting robot that responds to human orders. Software may be used to operate the equipment and direct the robotic jaw to gather stationary garbage. We have developed a robot that is semi-autonomous for collecting scrap. This gadget utilizes its single, five-degree-of-freedom robotic arm to pick up rubbish and distribute it wherever the operator wants.

I. INTRODUCTION

Due to its direct danger to human health and ability to degrade ecosystems, water pollution, especially in rivers, has gained international attention. Large volumes of garbage, including plastics and organic debris, build up in rivers, which has an adverse effect on the water quality and aquatic life. Conventional techniques for cleaning rivers, which often include heavy gear and physical effort, are ineffective, expensive, and time-consuming.

The design and construction of a sophisticated river cleaning boat offers a creative and environmentally friendly answer to this problem by using contemporary technologies like Bluetooth and Arduino for remote and autonomous operation. The goal of this project is to develop an automated cleaning system that can efficiently dispose of garbage while avoiding human interaction. It will also be able to navigate around water bodies and gather waste.

The Arduino microcontroller, which serves as the boat's main control unit, is at the center of this system. The boat's Bluetooth integration enables remote control operation via a smartphone, giving the operator real-time control over the waste-collection system and navigation adjustments. The cleaning system itself has a waste collecting device that collects floating trash and directs it into onboard storage. This mechanism usually takes the form of a net or a conveyor belt.

In addition, the boat runs on renewable energy, such solar panels, which makes it a greener and more sustainable option than traditional techniques. This river-cleaning boat hopes to greatly decrease water pollution, improve cleaning operations' efficiency, and aid with the preservation of aquatic ecosystems by using automation and contemporary control systems.

II. LITERATURE SURVEY

The goal of the project is to create a robotic pick-and-place using a soft gripper. The goal of the project is to create a robotic pick-and-place vehicle with a gripper that can capture objects. The project will include creating a mobile robot that can transport goods from one location to another as well as an android app. Consequently, operating the car from a distance. Any Android-powered smartphone, tablet, or other device may operate remotely using a GUI (Graphical User

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Interface)-based touch screen. This prototype will open the way for actual models that apply the same idea. [1] The Android application device at the transmitting end will operate the car by broadcasting a signal, or ASCII code, to the Bluetooth module (HC-05), which serves as an interface between the mobile device and the vehicle (robot). AVR Studio is used to program the microprocessor, which controls the motors that propel the robotic vehicle and the arm's ability to grasp items. Commands to control the robot's movement, such as forward, backward, left, or right, are communicated to the receiver at the transmitting end using an Android application device. Four motors are interfaced to the microcontroller at the receiving end; two of them are used to move the robot's arm and grippers, while the other two are used to move its body. While the Bluetooth device at the receiver end is fed to the microcontroller to operate DC motors via motor driver IC for essential tasks, the android application device transmitter serves as a remote control with an acceptable range. Any Android-powered smartphone, tablet, or other device may operate remotely using a GUI (Graphical User Interface)-based touch screen. This robot's primary benefit is its soft grabbing arm, which is intended to prevent undue pressure from being applied to the suspicious item for security purposes.

III. DESIGN OF HARDWARE

This chapter provides a quick explanation of the hardware. It goes into great depth about each module's circuit diagram.

ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno (datasheet). It has a 16 MHz ceramic resonator, 6 analog inputs, 14 digital input/output pins (six of which may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC converter or connect it to a computer via a USB connection to get going.The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a serial-to-USB converter. The 8U2 HWB line on the Uno board is pulled to ground by a resistor, which facilitates DFU mode entry. The Arduino board now includes the following updates:

• 1.0 pin out: two further new pins, the IOREF, are positioned next to the RESET pin, the SDA and SCL pins that were introduced, and they enable the shields to adjust to the voltage supplied by the board. Shields will eventually work with both the Arduino Due, which runs on 3.3V, and the boards that utilize the AVR, which runs on 5V. The second pin is unconnected and set aside for future uses.

• A more robust RESET circuit.

• The 8U2 is replaced with an ATMega 16U2.

"Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future, the Arduino reference versions will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and the platform's standard model; see the index of Arduino boards for a comparison with earlier iterations.

Fig: ARDUINO UNO

POWER SUPPLY:

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The purpose of the power supplies is to convert the high voltage AC mains energy into a low voltage supply that is appropriate for use in electronic circuits and other devices. One may disassemble a power supply into a number of blocks, each of which carries out a specific task. "Regulated D.C. Power Supply" refers to a d.c. power supply that keeps the output voltage constant regardless of differences in the a.c. main or the load.

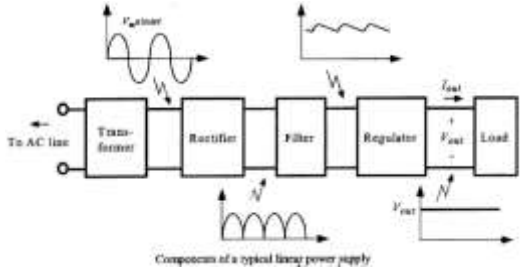


Fig: Block Diagram of Power Supply

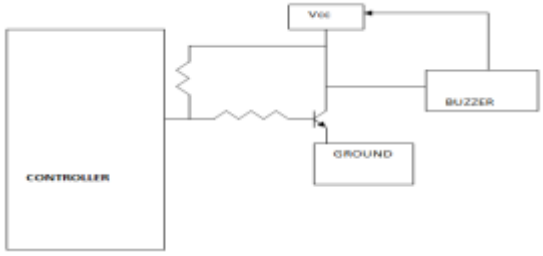
LCD DISPLAY

The model shown here is the one that is most often utilized in practice due to its cheap cost and enormous potential. Its HD44780 microcontroller (Hitachi) platform allows it to display messages in two lines of sixteen characters each. All of the alphabets, Greek letters, punctuation, mathematical symbols, etc., are shown. Furthermore, it is possible to show custom symbols created by the user. Some important features are the automatic changing of the message on the display (shift left and right), the presence of the pointer, the lighting, etc.

Fig: LCD

BUZZER

Relays, buzzer circuits, and other circuits cannot be driven by the current available on digital systems and microcontroller pins. The microcontroller pin can provide a maximum of 1-2 milliamps of current, even though these circuits need around 10 milliamps to work. Because of this, a driver—such as a power transistor—is positioned between the buzzer circuit and microcontroller.



LED:

A light source made of semiconductors with two leads is called an LED. When turned on, this p-n junction diode generates light.[5] Within the device, electrons may recombine with electron holes when a proper voltage is given to the leads, releasing energy in the form of photons.

This phenomenon is known as electroluminescence, and the energy band gap of the semiconductor controls the hue of the light, which corresponds to the photon's energy. Since LEDs are usually tiny—less than 1 mm2—the radiation pattern may be modified by integrated optical components.

Early LEDs were often utilized to replace tiny incandescent bulbs as indication lighting for electrical equipment. They were quickly bundled into seven-segment displays for use as numeric readouts, and digital clocks became popular with them. Modern

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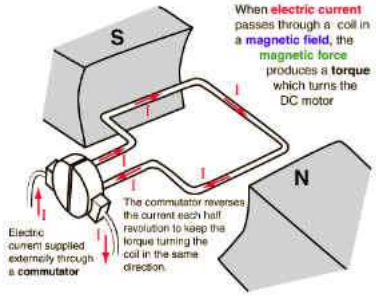
advancements have led to the creation of LEDs that are appropriate for task and ambient lighting. New displays and sensors have been made possible by LEDs, and enhanced communications technology has benefited from their rapid switching rates.Compared to incandescent light sources, LEDs are smaller, quicker switching, more physically resilient, need less energy, and have a longer lifespan. Applications for light-emitting diodes are many and include traffic signals, advertising, traffic lights, camera flashes, lit wallpaper, aircraft illumination, and car headlights. Additionally, they are much more energy-efficient, and their disposal may pose less environmental risks.

L293D:

Half-H drivers with triple high-current include the L293 and L293D. With voltages ranging from 4.5 V to 36 V, the L293 is intended to provide bidirectional driving currents of up to 1 A. Up to 600 mA of bidirectional driving current may be achieved with the L293D at voltages ranging from 4.5 V to 36 V. In positive-supply applications, these devices are intended to drive inductive loads such solenoids, relays, dc, and bipolar stepping motors, in addition to other high-current/high-voltage loads. Every input is compatible with TTL. With a pseudo-Darlington source and a Darlington transistor sink, each output is a full totem-pole driving circuit. Drivers 1 and 2 are enabled by 1,2EN, while drivers 3 and 4 are enabled by 3,4EN. Drivers are enabled in pairs. The corresponding drivers are activated and their outputs are active and in phase with their inputs when an enable input is high. These drivers are disabled and their outputs are turned off and in the high-impedance condition when the enable input is low. Each pair of drivers creates a full-H (or bridge) reversible drive appropriate for solenoid or motor applications when the right data inputs are provided.

DC MOTOR

A DC motor is intended to operate with DC electricity. Michael Faraday's homopolar motor, which is rare, and the ball bearin motor, which is a recent invention, are two instances of pure DC designs. The two most popular forms of DC motors are brushed and brushless, which are not strictly speaking DC machines since they require internal and external commutation, respectively, to produce an oscillating AC current from the DC source.



Bluetooth

Bluetooth is a wireless protocol that creates wireless personal area networks (PANs) by enabling data transfer from stationary and/or mobile devices over small distances using short-range communications technology. The idea behind Bluetooth's development was to create a single digital wireless protocol that could link many devices and solve problems caused by device synchronization. Bluetooth makes advantage of frequency hopping spread spectrum, an extremely powerful radio technology. The data is broken up and delivered in segments across a maximum of 75 frequencies. Gaussian frequency shift keying (GFSK) modulation is used in its most basic form. A gross data rate of 1 Mb/s may be attained using it. Using a safe, internationally unlicensed Industrial, Scientific, and Medical (ISM) 2.4 GHz short-range radio frequency bandwidth, Bluetooth enables communication and connection between gadgets like mobile phones, landlines, laptops, desktop computers, printers, GPS receivers, digital cameras, and video game consoles. The Bluetooth Special Interest Group (SIG) is responsible for

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developing and licensing the Bluetooth standards. Businesses in the fields of consumer electronics, networking, computers, and telephony make up the Bluetooth SIG.

Based on inexpensive transceiver microchips found in each device, Bluetooth is a standard and communications protocol with a limited range (power-class-dependent: 1 meter, 10 meters, 100 meters). Its main goal is low power consumption. When these gadgets are within range of one another, Bluetooth allows them to communicate. The Bluetooth device class indicates the type of device and the supported services of which the information is transmitted during the discovery process. In order to use the radio communications system, the devices do not need to be in line of sight of each other and can even be in different rooms, provided that the received transmission is strong enough.

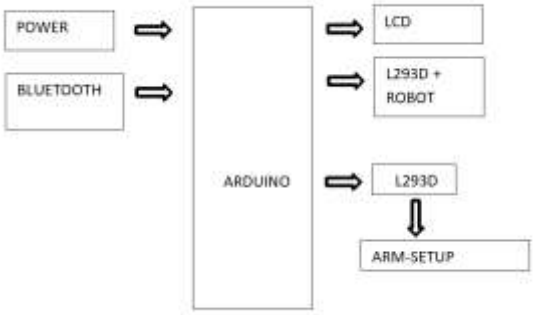
Class	Maximum Permitted Power mW(dBm)	Range (approximate)
Class 1	100 mW (20 dBm)	~100 meters
Class 2	2.5 mW (4 dBm)	~10 meters
Class 3	1 mW (0 dBm)	~1 meter

When connected to a class 1 transceiver, class 2 devices' effective range is often increased in comparison to a pure class 2 network. The increased sensitivity and transmission power of Class 1 devices enable this.

Version	Data Rate
Version 1.2	1 Mbit/s
Version 2.0 + EDR	3 Mbit/s
WiMedia Alliance (proposed)	53 - 480 Mbit/s

IV. BLOCK DIAGRAM AND HARDWARE DISCRIPTION

4.1. BLOCK DIAGRAM:



Working:

The Advanced River Cleaning Boat collects rubbish from rivers automatically by using Bluetooth and Arduino technologies. With motors, sensors, and a microprocessor powering its navigation system and garbage collecting system, the boat may be operated remotely or independently. An outline of the system's operation may be found below:

1. System Initialization

- The Arduino microcontroller initializes all connected parts, such as the DC motors, the Bluetooth module, and the trash collecting mechanism, when the system is switched on.
- The Arduino uses Bluetooth to connect with a smartphone and provide remote control of the boat for the user.

2. Boat Navigation and Control

- The boat's movement is powered by DC motors installed in it. An H-bridge motor driver is used to link these motors to the Arduino, allowing for left, right, forward, and backward movement.
- The boat's Bluetooth module interfaces with an app on a smartphone that

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supports Bluetooth, allowing the operator to transmit control signals. By adjusting the engines' speed and direction, the user of the app may maneuver the boat in real time.

- When operating autonomously, the boat can navigate pre-programmed routes and identify obstructions with the aid of ultrasonic sensors. The Arduino is able to autonomously alter the boat's trajectory to prevent accidents because to the sensors, which assess the distance to obstructions.

3. Waste Collection Mechanism

- A garbage collecting device, usually in the form of a net system or conveyor belt, is installed aboard the boat to gather floating rubbish from the water's surface.
- The garbage is collected and sent into an onboard storage chamber by the moving conveyor belt or net as the boat travels through the river.
- The Arduino is used to operate the DC motors that power the garbage collecting mechanism, making it possible to gather and convey waste into the storage room in an efficient manner.
- Depending on the amount of trash in the water, the operator may use the Bluetooth app to remotely adjust the waste collecting mechanism's speed or halt it.

4. Bluetooth-Based Remote Control

- The operator may use Bluetooth connectivity to give real-time instructions to the boat using a smartphone application. The boat may be ordered to go forward, reverse, turn, or stop. It can also be ordered to activate or deactivate the trash collecting system.
- These orders are received by the boat's Bluetooth module, which then transmits them to the Arduino for processing. The Arduino then turns on the appropriate motors and systems.
- Because of its usual Bluetooth communication range of about ten to fifteen meters, the technology is best suited for controlled situations or tiny rivers.

5. Solar-Powered Operation (Optional)

- The boat may be equipped with **solar panels** to harness solar energy, charging an onboard battery that powers the boat and its components. This makes the system more environmentally friendly and capable of operating for longer periods without external charging.
- The solar panels continuously charge the battery, which supplies power to the **DC motors**, **Bluetooth module**, and other electronic components. In cloudy conditions or at night, the battery's stored energy allows the boat to continue operating.

6. Real-Time Monitoring

- The boat's status, including motor speeds and waste collection progress, can be monitored via the smartphone application. The app may display real-time information about the boat's battery status, speed, and distance from obstacles (if ultrasonic sensors are used for autonomous navigation).
- Alerts can be generated if the boat encounters an issue, such as low battery levels, or if the waste compartment is full, notifying the operator that manual intervention is required.

7. Waste Disposal

- Once the boat's onboard storage compartment is full, it can be guided

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back to shore via remote control, where the collected waste can be manually removed and disposed of.

- The storage compartment can be designed for easy removal or access, allowing quick unloading of collected debris before the boat resumes cleaning operations.

V. CONCLUSION

We have created a multifunctional, semi-autonomous scrap collection robot. The main goals of completing this assignment are to lower manufacturing costs and implement a well-organized system for scrap collecting. When scrap garbage is managed wisely, it may contribute to a cleaner environment and reduce terrain contamination, both of which are major issues in the current COVID-19 pandemic scenario. Additionally, robotic arms are widely used. While there are still many areas in which they need to be improved, they have made work easier and decreased the degree of mistake that results from it. Through the design and integration of a suitable micro-controller and wifi module with an Android operation, this design has established the theoretical and practical knowledge required for managing a five-degree-of-freedom robot arm. This design may find use in other exciting sectors in the future.

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