JSRT JOURNAL

PAGES: 239-251
06/07/25

JOURNAL OF SCIENTIFIC RESEARCH AND TECHNOLOGY VOLUME-3 ISSUE-7 JULY

Eco Friendly Solar Powered Garbage Disposal Boat

Savitri[1], Shivaganga[2], Sanjana[3], Jyothi[4], Ritika[5]

[1]*Professor, EEE Department, Sharnbasva University, Kalaburagi, India.*

[2,3,4]*Students, EEE Department, Sharnbasva University, Kalaburagi, India.*

ABSTRACT

This article presents the garbage collection robot on the beach using wireless communications. The robot is built on the caterpillar wheels, sizes 52x74x17 cm and the power is supplied from 12V 1.2Ah battery which is connected to 3W solar cells. The user can control a robot via a program developed from MIT app inventor application based on Android. The commands from user are sent via Bluetooth to Arduino for processing. In addition, it is also equipped with an IP camera with added pan/tilt capabilities which relays feedback information to the human operator via Ad-hoc system. The results of robot performances were found that the robot can move with an average speed of 0.5 meters per second on the sand via wireless communication and collect the big garbage with side 12.5 x 49 cm, for example, glass bottles, and plastic, etc. From the experimental results, it can clearly indicate that the proposed robot is superior to handle tasking conveniently, control capability, and operate environmentally friendly.

Keywords: Robots, Wireless, Garbage, Collection.

I. INTRODUCTION

Garbage is a major problem worldwide attention. It can be seen from organizations that support and fix this problem, such as Ocean Conservancy [1] that is a non-profit environmental advocacy group based in Washington, D.C., United States. The organization reports on 23 August 2013 that over the past 27 years, over 9.5 million volunteers have removed 163 million pounds of trash from more than 330,000 miles of coastline and waterways in 153 countries and locations. At the present, more than 10 million pounds of trash along nearly 20,000 miles of coastlines were picked up by more than 550,000 people. In Thailand, this problem affects to the destruction of the beautiful scenery and attractions. Moreover, it causes the problem about the sea animal death. For example, the death of the whale on the beach, Patong, Phuket [2] because it eats the plastic waste. Although, some organizations [3] try to clean the beach but the amount of the trash on the beach is still increasing at all time. Therefore, the development of the technology such as robot for collecting the garbage is the one aspect that is interested.

Until now, the service robots about cleaning robot for the swimming pools [4], the house [5], the wall [6] and the domestic stairs [7]) are interested and developed continually but the cleaning robot for the beach does not be much interested. Therefore, this paper presents the development of a prototype garbage collection robot on the beach. This robot uses the Bluetooth for communication between the user and the robot. Moreover, IP camera with added pan/tilt capabilities can send the image data to the user via the Adhoc system. The details of this paper are organized as follows. In section 2, we will introduce the material and methods of the robot including the hardware and software implements. The result of the experiment and the conclusion will be described in section 3andsection 4 respectively.

II. LITERATURE SURVEY

1. Eco Beach Cleaner

Amit Kumar Yadav1, Animesh Singh2, M. A. Murtaza3 and Ajendra Kumar Singh4
1,2UG Student, Department of Mechanical and Automation, Amity University (Lucknow Campus), INDIA

ABSTRACT: Trash and litter left on beaches can endanger the life of coastal animals, like turtles and birds, and also damage tourism industries by diminishing the natural beauty of beaches. To solve this problem, most coastal areas employ manual labour, volunteer work, or large zambonini-like machines to pick of trash. However, these operations are very expensive and time-consuming.

2. **Arduino Based Cleaner Robot**

Shubham Tiwari1 , Prof. Sangeeta Kotecha2 , Gaurav Rasal3 , Pramod Shukla4 , Ajinkya Mandavkar5 Department of Electrical Engineering1,2,3,4,5 Atharva college of Engineering, Malad (w), Mumbai

ABSTRACT: The main objective of this project is to design and implement a vacuum robot prototype by using Arduino Uno, Motor, Ultrasonic Sensor, and IR Sensor and to achieve the goal of this project. The whole circuitry is connected with 12V battery. Vacuum Robot will have several criteria that are user-friendly.

3. **Design of River Waste Collector Machine Using Arduino**

1K.P.M.Y.V.DATHU, 2 M.MONISH KUMAR, 3V.KARTHEEK, 4M.M.KARUNAKAR 1 B.Tech Student, 2 B.Tech Student, 3 B.Tech Student, 4 Assistant Professor 1,2,3,4, Department of Electrical and Electronics Engineering

ABSTRACT: Prime objective of our project is to collect all the wastes which are found floating on water bodies and to minimize labor work. These are done by using a hardware prototype and by using an Microcontroller for controlling all parts of a machine by using an smart phone by using Wi-Fi or Bluetooth. We have attempted to meet every one of the destinations to this item fruitful with the end goal that our item gets propelled in the market.

Material and Methods:

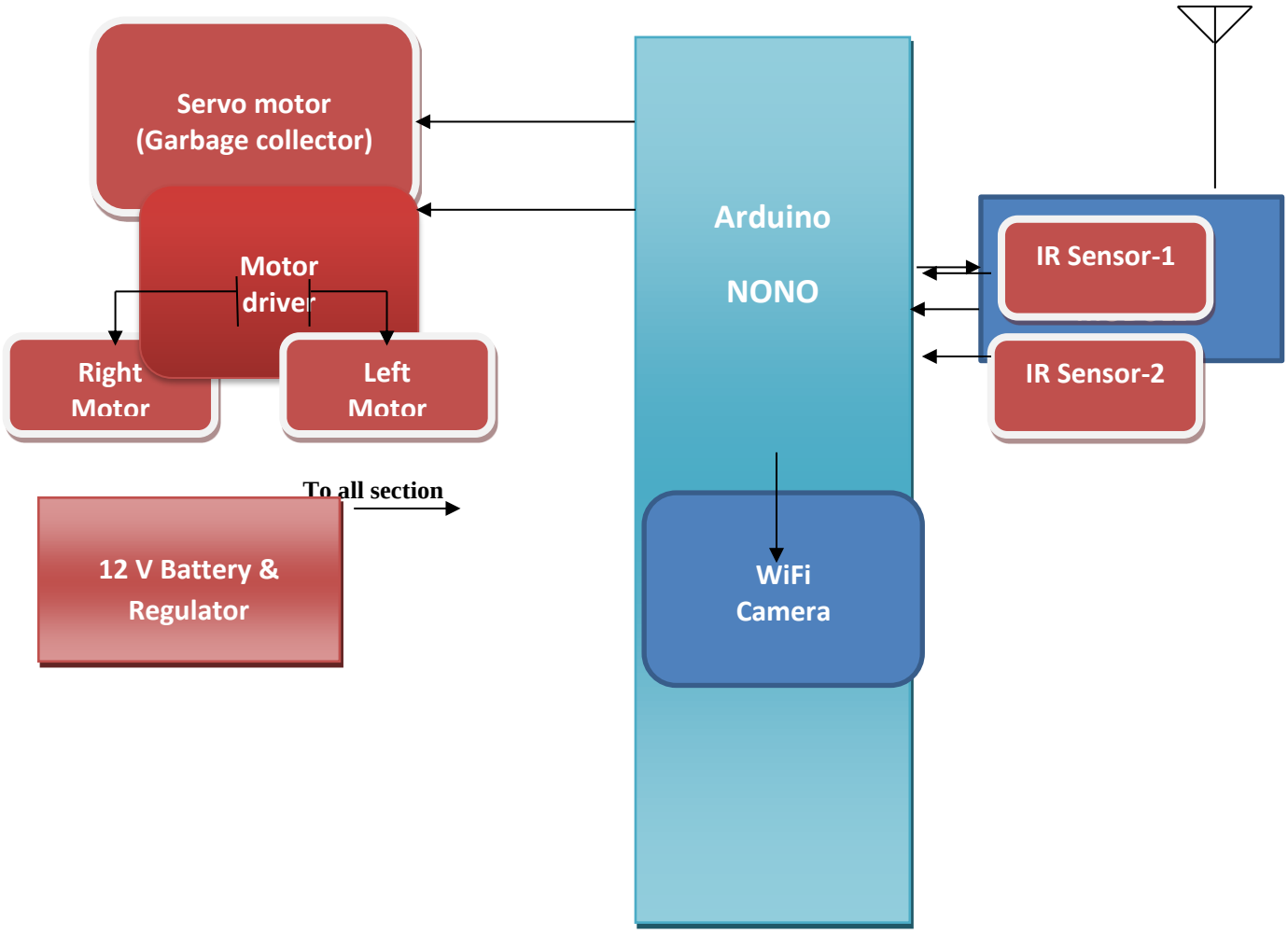
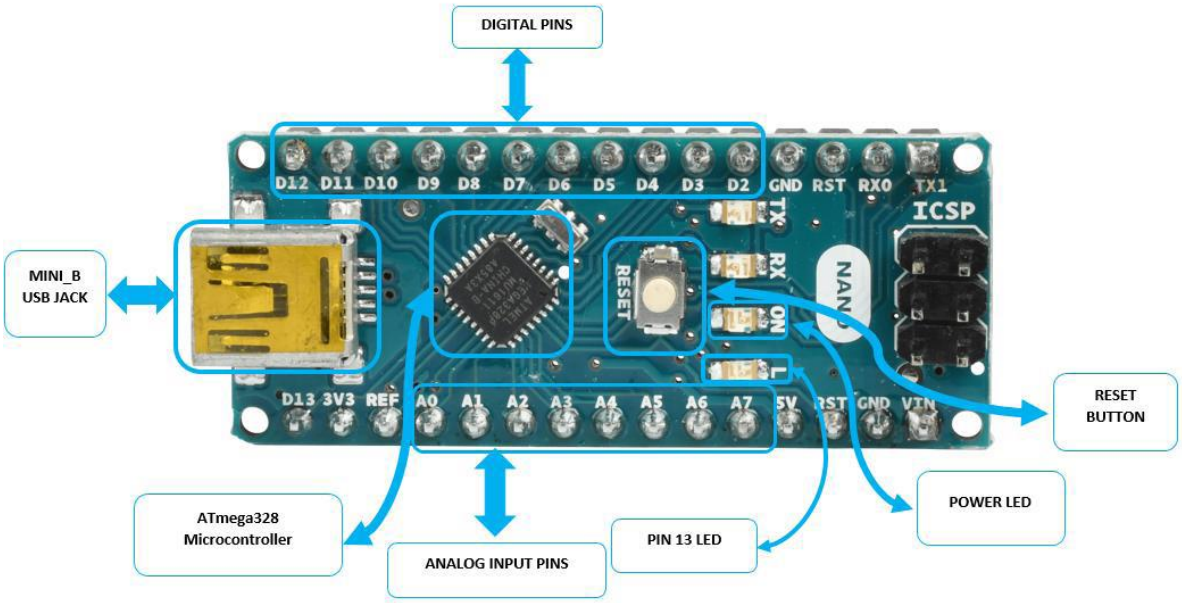


Fig. 1 Proposed block diagram

SYSTEM WORKING:

Set up Bluetooth availability between Android Application and the Bluetooth module. Check whether the gadget is associated. Connect the Bluetooth module(HC-05) to our mobile and then move to app. Whenever associated, give the pre-characterized directions to the smaller scale telephone of the portable handset. At that point the put away the directions on a specified android application which is installed on a mobile. Open the android application and give the instructions which we are given in the arduino program. Then the machine will works as follows.
we have used Arduino NANO board for processing the whole system. These type of robots which should be handle in a secret manner it have camera which will also controlled by remote, batteries, an antenna. In our robot we have also used CCD camera (charged couple device), it is used to latch all information or data to the robot. On our remote controlled we are using Bluetooth app for controlling the robot. If the robot have to travel in dark areas or in night we have set up a LED light on the CCD camera with all the lightning circuitry. Bluetooth module (Radio frequency modules) are also used in this robot for receiving and transmitting the signals from remote to agent robot, so the user can control the robots speed, turning of robot basically whole control over the robot. To have good control over speed and turning we have used brushed DC motors (three) with its motor driver l2989 (two) in our Beach cleaning robot

HARDWARE DESCRIPTION:
ARDUINO NANO



BLUETOOTH PROFILE

Bluetooth is low cost, low power short-range radio technology originally developed as a cable replacement to connect devices such as mobile phone handsets, headsets and portable computers. No longer do people need to connect, plug into, install, enable or configure anything to anything else.

The Bluetooth specification is an open, global specification defining the complete system from the radio right up to the application level. Version 1.0 of the Bluetooth came into existence in 1994 when Ericsson Mobile Communication began its study for alternatives to replace the cable and this technology hit the market in 1999. This study concluded with radio link as a better option than the optical communication like infrared because of its line of sight limitation.

It is not possible to get universal acceptance for a new technology developed by a single company particularly for blue tooth. Because numerous corporations are designing and producing vast range of telecom gadgets.

Then they formed Bluetooth Special Interest Group(SIG) to define and promote Bluetooth specification with five key promoters:

- Ericsson Mobile Communications
- Intel Corp.
- IBM Corp.
- Toshiba Corp.
- Nokia Mobile Phones

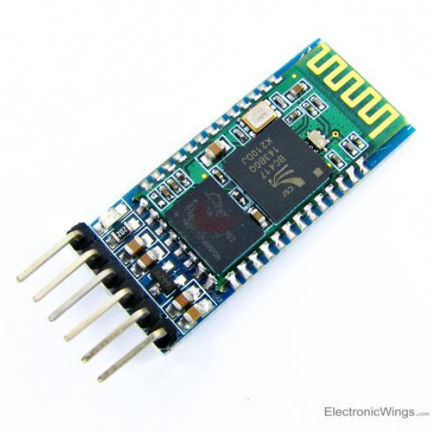
Bluetooth devices operate at 2.4 GHz globally available license free band. This band is reserved for general purpose usage of Industrial, Scientific and Medical applications. Thus Bluetooth has to be very robust because many users, polluters of this shared spectrum.

The operating band is divided into 1MHz spaced channels signaling data at 1 mega signals per second for the sake of obtaining maximum available bandwidth. Its modulation scheme is Frequency Shift Keying (FSK). Technical robustness is not possible if the Bluetooth devices operate on the constant frequency. Bluetooth devices has to jump to another frequency continuously within the available bandwidth. After sending a packet both devices has to jump another radio channel effectively which is called Frequency Hopping Spread Spectrum (FHSS). Each Bluetooth timeslot lasts for 625 micro seconds. Generally Bluetooth devices hop for every packet or every 2 packet or every 5 packets.

Bluetooth is mainly designed for low power radio frequency link available in the range of 10m, 20m and 100m. Bluetooth specification allows three different powers they are referred as three classes of Bluetooth devices.

Bluetooth devices can operate in two modes for data transfer using Bluetooth devices one has to act as Master and other as Slave. It is the Master which initiates the transaction, establishes the link with slave. Most importantly Master decides the Frequency Hoping Spectrum, which Slave has to follow. One Master can have maximum seven slaves thus it has to decide seven different Frequency Hoping Spectrums.

HC 05 Bluetooth Module:



HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.

Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

Specifications

- Hardware Features
- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna
- With edge connector

Software Features

- Default Baud rate: 38400, Data bits:8, Stop bit:1,Parity:No parity, Data control: has.

Supported baud rate: 9600,19200,38400,57600,115200,230400,460800.

- Given a rising pulse in PIO0, device will be disconnected.

- Status instruction port PIO1: low-disconnected, high-connected;
- PIO10 and PIO11 can be connected to red and blue led separately. When master and slave

are paired, red and blue led blinks 1time/2s in interval, while disconnected only blue led blinks 2times/s.

- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE:"0000" as default
- Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection.

Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

It has 6 pins,

1. Key/EN: It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

1. Data mode: Exchange of data between devices.

2. Command mode: It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.

2. VCC: Connect 5 V or 3.3 V to this Pin.

3. GND: Ground Pin of module.

4. TXD: Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)

5. RXD: Receive data serially (received data will be transmitted wirelessly by Bluetooth module).

HC-05 module Information

- HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.
- This module works on 3.3 V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator.
- As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.

L293D IC (DC MOTOR DRIVER)

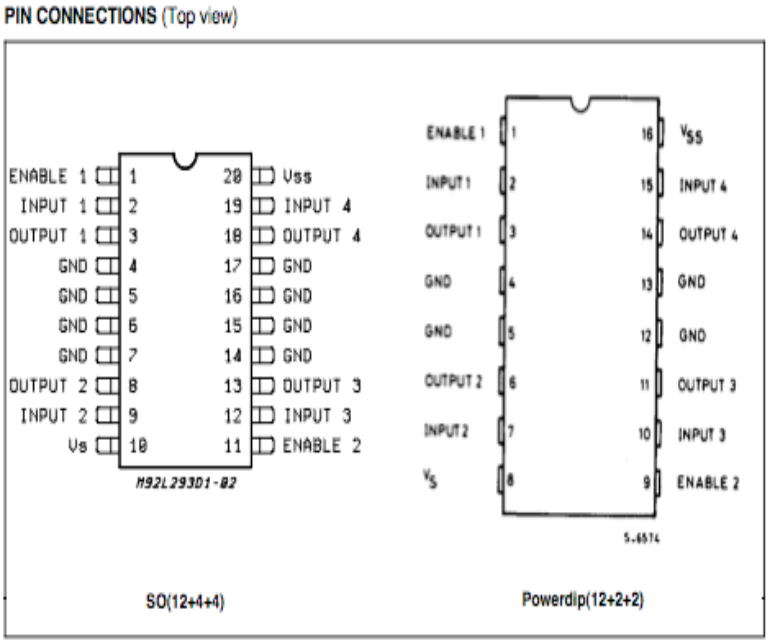


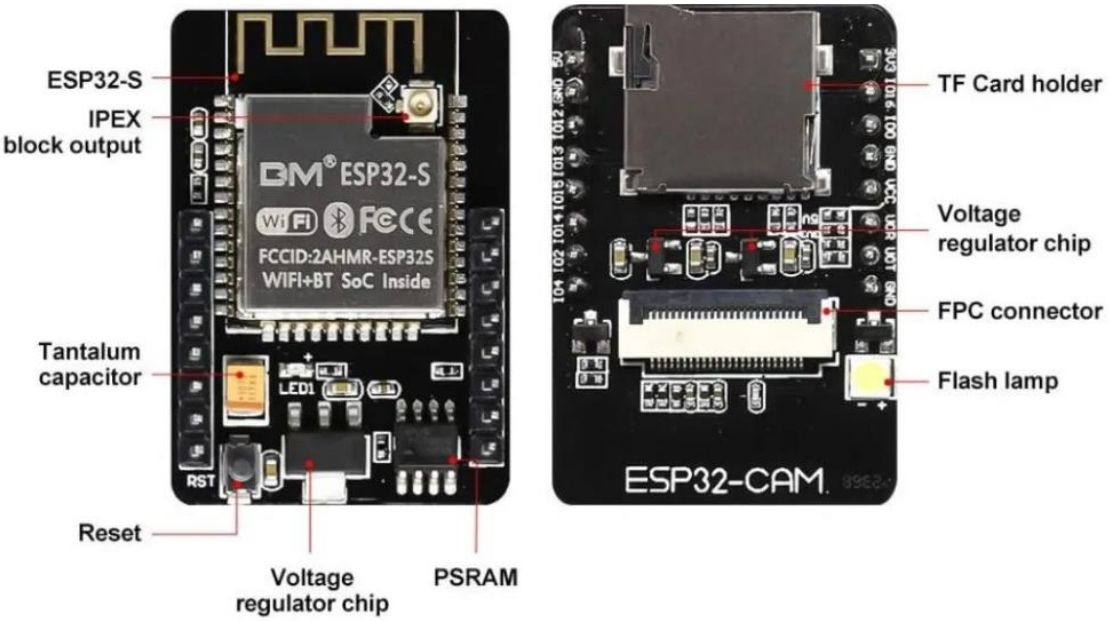
FIGURE: L293 & L293D Driver ICs

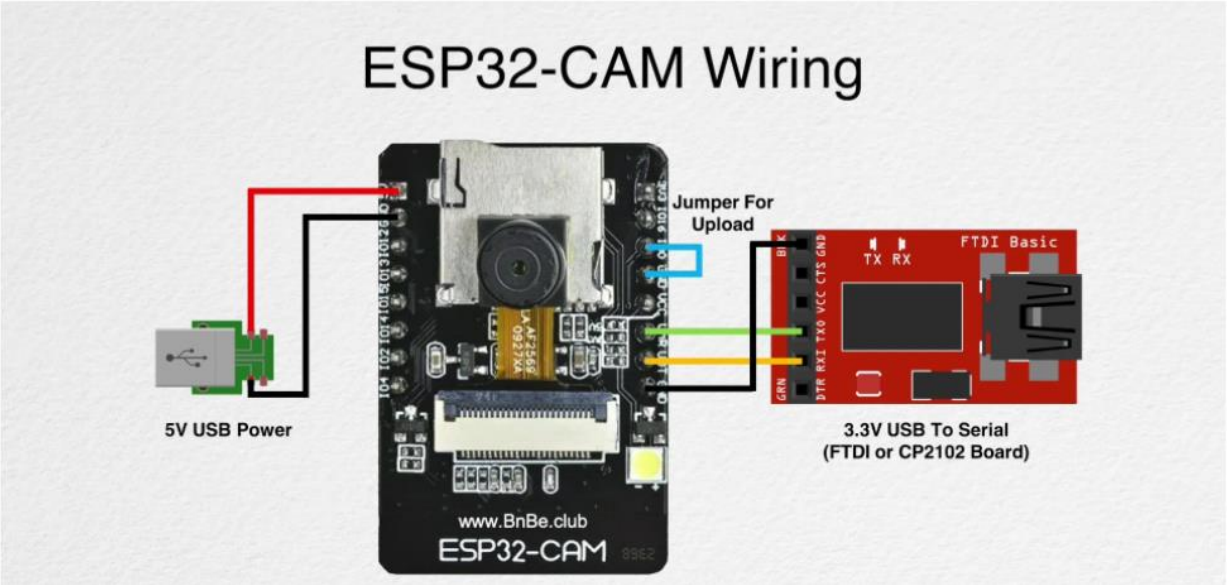
MOTORS:

A DC motor is a rotational electrical machines that changes over direct flow electrical energy into mechanical energy. The most well-known sorts depend on the powers delivered by magnetic fields. About a wide range of DC engines have some inward component to intermittently alter the course of current stream in part of the engine.
DC engines were the principal type broadly utilized, since they could be fueled from existing direct-current lighting power distribution system. A DC motor's speed can be controlled over a wide range, utilizing either a variable supply voltage or by changing the quality of current in its field windings. Little DC engines are utilized in instruments, toys, and apparatuses. The all inclusive engine can work on direct current however is a lightweight brushed engine utilized for convenient power instruments and machines. Bigger DC engines are utilized in impetus of electric vehicles, lift and raises, or in drives for steel moving plants.

ESP32-CAM AI-Thinker Components

This development board is a 27*40.5*4.5 DIP style PCB Board. The following figure shows the components of the ESP32-CAM board from both top and bottom side.





ESP32-CAM	FTDI Cable
GND	GND
5V	VCC (5V)
U0RX/GPIO3	TX
U0TX/GPIO1	RX
GPIO0	GND

BATTERY:

An electric battery is a gadget comprising of at least one electrochemical cells with outside associations gave to control electrical gadgets, for example, spotlights, advanced mobile phones, and electric cars. At the point when a battery is providing electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal stamped negative is the wellspring of electrons that will move through an outside electric circuit to the positive terminal. At the point when a battery is associated with an outside electric burden, a redox response changes over high vitality reactants to bring down vitality items.

WHEELS:

A water wheel is a machine for changing over the vitality of streaming or falling water into valuable types of intensity, frequently in a watermill. A water wheel comprises of a wheel, with various edges or basins organized outwardly edge framing the driving surface. The blades which are present around the wheels will push the water and then the machine will move the direction that we required.
This wheel is connecter to a motor and motor is fixed to a device. Whenever we want to move a vehicle on a river or water, then we are rotating specified motors due to that rotating wheels the vehicle will move forward, backward, left or right.

Servo Moto (Positional Rotation):

Servo motors (or servos) are self-contained electric devices that rotate or push parts of a machine with great precision. By rotating a shaft connected to the engine throttle, a servo regulates the speed of a fuel-powered car or aircraft. Servos also appear behind the scenes in devices we use every day.The servo motor is actually an assembly of four things: a normal DC motor, a gear reduction unit, a position-sensing device (usually a potentiometer—a volume control knob), and a control circuit.

The function of the servo is to receive a control signal that represents a desired output position of the servo shaft, and apply power to its DC motor until its shaft turns to that position. It uses the position-sensing device to determine the rotational position of the shaft, so it knows which way the motor must turn to move the shaft to the commanded position. The shaft typically does not rotate freely round and round like a DC motor, but rather can only turn 200 degrees or so back and forth.The servo has a 3 wire connection: power, ground, and control. The power source must be constantly applied; the servo has its own drive electronics that draw current from the power lead to drive the motor. servo motors which are in account to perform the surveillance operation

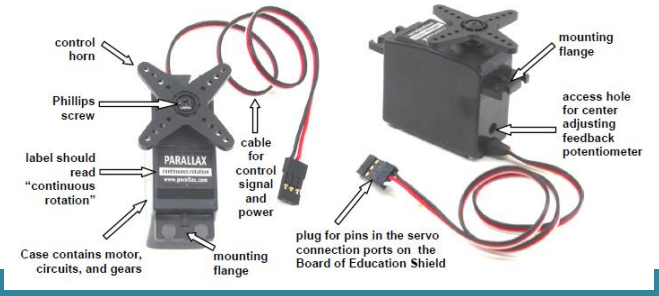


Fig. 9 DC servo motor

Software Requirement

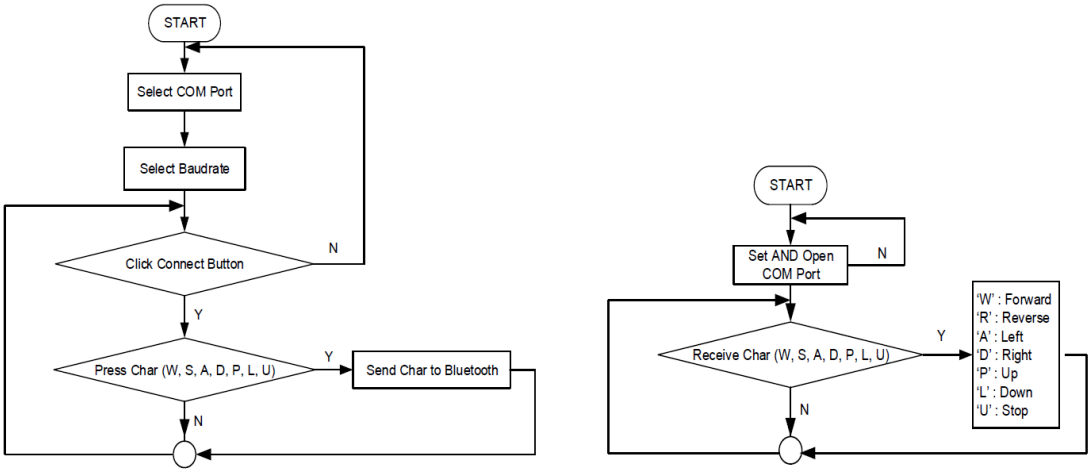
1. **Arduino**

Arduino is a type of computer software and hardware company that offers open-source environment for user project and user community that intends and fabricates microcontroller based inventions for construction digital devices and interactive objects that can sense and manage the physical world. For programming the microcontrollers, the Arduino proposal provides an software application or IDE based on the Processing project, which includes C, C++ and Java programming software. It also support for embedded C, C++ and Java programming software.

2. **Android Ultimate Bluetooth joystick App**

Software Implement

The robot controller software is developed in MIT App. It is used to control the robot by navigation command as shown in Fig. 11, such as forward command (W). Flowcharts of the robot controller software are shown in Fig. 5. The W, S, A, D and U buttons on the keyboard are used to be the forward, reverse, left, right, and stop command respectively while the P (up) and L (down) are used to control the shovel.



(a) Mobile side (b) microcontroller side

Fig.11 : Flowchart of the robot controller software

Advantages:

1. Small size so it will enter a small area.
2. Low cost, cost of body, three sensors, microcontroller and one motors driver.
3. A void any obstacle at the center of a given area, which may be discrete or continuous.
4. Ease to operate.

Disadvantages:

1. Bluetooth coverage is short distance.
2. Battery may drain fast, due to heavy motor load

Applications:

1. Domestic house cleaning
2. School, college and office etc.
3. Industry
4. Beach's
5. Function hall
6. Airport
7. Railways platform and Bus stand

Conclusion:

This project developed the robot for collecting the garbage at the beach. Wireless communication (Bluetooth and Ad-hoc) was applied to the robot for remote controlling. The developed robot can move at 0.5 m/s on the sand. Arduino is used as the brain for processing all commands. The robot can move with an average speed of 0.5 m/s on the sand via wireless communication and collect the large garbage with side 12.5 x 49 cm. This robot is expected to overcome the garbage problem especially on the beach. However, this robot still be improved to operate automatically and control from the more distance.

Future Scope

The robot can be made more large in size. One of the limitations of this robot is the range of the robot. The Bluetooth module used here has a limited range and thus this robot cannot be operated over far distances. To increase the range many other modules such as Wi-Fi and Zigbee can be used. In future, the robot may also consist of gas sensors to detect the poisonous gases in the environment. The robot may also include a bomb disposal kit in order to diffuse bombs in the beach. We can also include face recognition technology in future.

REFERENCES

1. Dr. Rekha Patil, Vidya Kumar Katrabad, Mahantappa, & Sunil Kumar. (2023). Image Classification Using CNN Model Based on Deep Learning. Journal of Scientific Research and Technology, 1(2), 60–71.
2. Ambresh Bhadrashetty, & Surekha Patil. (2024). Movie Success and Rating Prediction Using Data Mining. Journal of Scientific Research and Technology, 2(1), 1–4. https://doi.org/10.61808/jsrt78
3. Dr. Megha Rani Raigonda, & Shweta. (2024). Signature Verification System Using SSIM In Image Processing. Journal of Scientific Research and Technology, 2(1), 5–11. https://doi.org/10.61808/jsrt79
4. Dr. Megha Rani Raigonda, & Shweta. (2024). Signature Verification System Using SSIM In Image Processing. *Journal of Scientific Research and Technology*, *2*(1), 5–11. https://doi.org/10.61808/jsrt79
5. Jyoti, & Swaroopa Shastri. (2024). Gesture Identification Model In Traditional Indian Performing Arts By Employing Image Processing Techniques. *Journal of Scientific Research and Technology*, *2*(3), 29–33. https://doi.org/10.61808/jsrt89
6. M Manoj Das, & Dr. Swaroopa Shastri. (2025). Machine Learning Approaches for Early Brain Stroke Detection Using CNN . Journal of Scientific Research and Technology, 3(6), 243–250. https://doi.org/10.61808/jsrt248
7. Abhishek Ashtikar, & Dr. Swaroopa Shastri. (2025). A CNN Model For Skin Cancer Detection And Classification By Using Image Processing Techniques. *Journal of Scientific Research and Technology*, *3*(6), 251–263. https://doi.org/10.61808/jsrt250
8. Dr. Megha Rani Raigonda, & Anjali. (2025). Identification And Classification of Rice Leaf Disease Using Hybrid Deep Learning. *Journal of Scientific Research and Technology*, *3*(6), 93–101. https://doi.org/10.61808/jsrt231
9. Bhagyashree, & Dr. Swaroopa Shastri. (2025). A Machine Learning Approach To Classify Medicinal Plant Leaf By Using Random Forest And KNN. Journal of Scientific Research and Technology, 3(7), 100–115. https://doi.org/10.61808/jsrt261
10. Priyanka Kulkarni, & Dr. Swaroopa Shastri. (2024). Rice Leaf Diseases Detection Using Machine Learning. Journal of Scientific Research and Technology, 2(1), 17–22. https://doi.org/10.61808/jsrt81
11. Shilpa Patil. (2023). Security for Electronic Health Record Based on Attribute using Block-Chain Technology. Journal of Scientific Research and Technology, 1(6), 145–155. https://doi.org/10.5281/zenodo.8330325
12. Mohammed Maaz, Md Akif Ahmed, Md Maqsood, & Dr Shridevi Soma. (2023). Development Of Service Deployment Models In Private Cloud. Journal of Scientific Research and Technology, 1(9), 1–12. https://doi.org/10.61808/jsrt74
13. Antariksh Sharma, Prof. Vibhakar Mansotra, & Kuljeet Singh. (2023). Detection of Mirai Botnet Attacks on IoT devices Using Deep Learning. Journal of Scientific Research and Technology, 1(6), 174–187.
14. Dr. Megha Rani Raigonda, & Shweta. (2024). Signature Verification System Using SSIM In Image Processing. Journal of Scientific Research and Technology, 2(1), 5–11. https://doi.org/10.61808/jsrt79
15. Shri Udayshankar B, Veeraj R Singh, Sampras P, & Aryan Dhage. (2023). Fake Job Post Prediction Using Data Mining. Journal of Scientific Research and Technology, 1(2), 39–47.
16. Gaurav Prajapati, Avinash, Lav Kumar, & Smt. Rekha S Patil. (2023). Road Accident Prediction Using Machine Learning. Journal of Scientific Research and Technology, 1(2), 48–59.