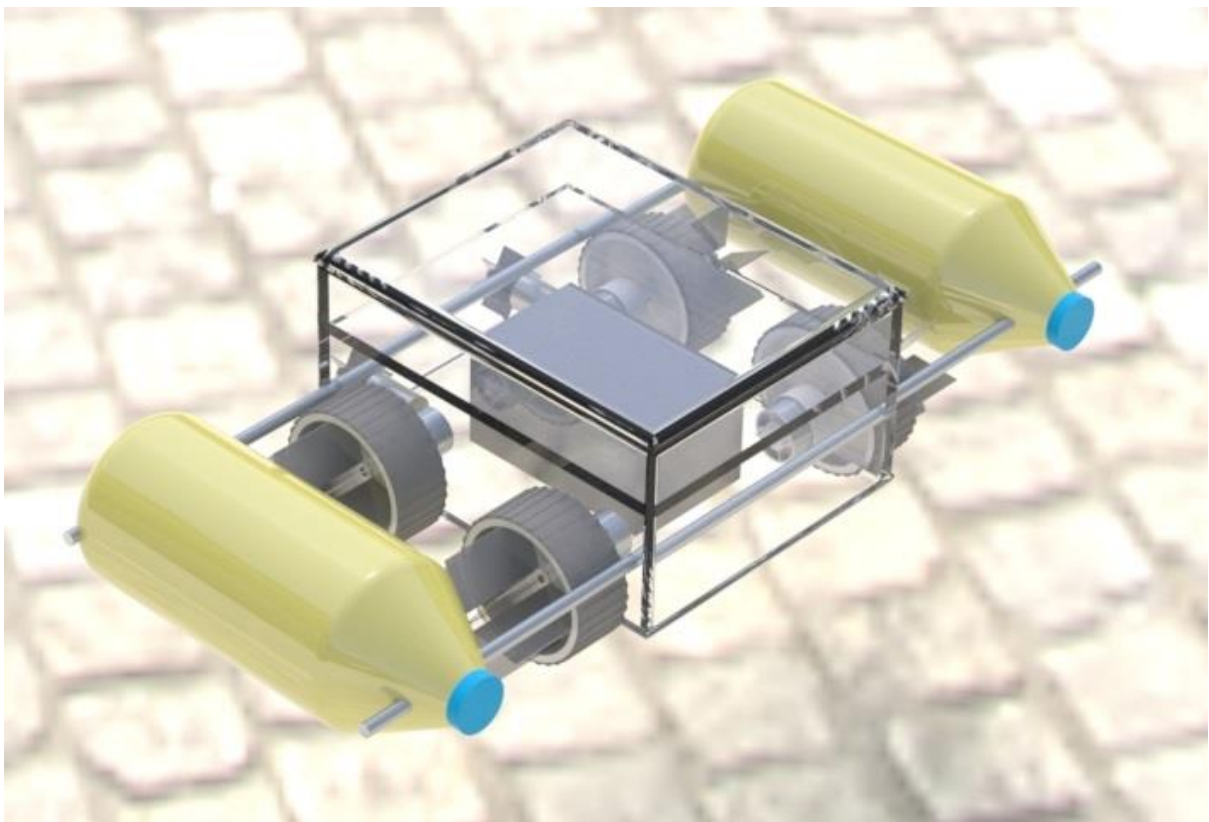


# Amphibious Surveillance Robot (ASR)



## **Introduction:**

This project is a remotely-operated amphibious robot which utilises GPS coordinates to navigate autonomously. It is provided with an on-board camera which transmits snapshots as commanded to the controller where these are processed to generate further commands. It also has an ability to capture real-time video feed which can be transmitted to the controller end.

## **Working principle:**

The ASR uses the inbuilt Wi-Fi of the Raspberry Pi to communicate with the controller. It receives its location via the GPS module, which is relayed to the controller. The user specifies the target location on a map, according to which an optimal path is calculated and relayed to the bot. The bot upon receiving the data, navigates to the indicated target while following the calculated path. An override is also available to manually guide the bot.

The wheels of the ASR are designed to function as a standard differential drive while on land and as propellers while on water. Two additional propellers, powered by high RPM motors, are present to aid in steering the bot while on water. The hollow body and the attached ballasts aid in the floatation of the bot.

The bot is powered by an on-board rechargeable battery which powers all the on-board systems including the drive and the Raspberry Pi.

The on-board camera may transmit snapshots as well as a live video feed to the controller.

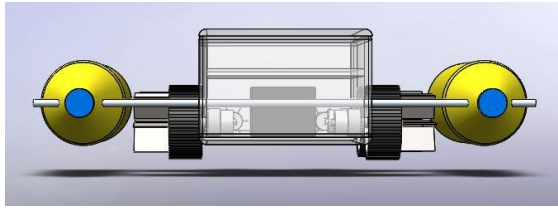


Fig: Front View

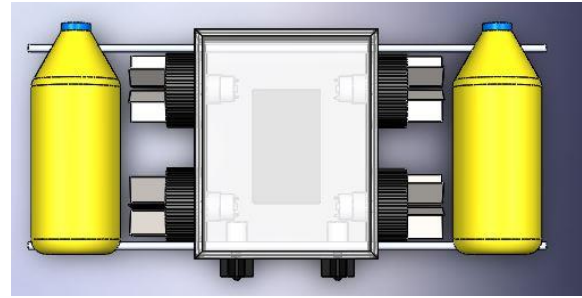


Fig: Top View

## Components:

### Hardware components:

- a. **Raspberry Pi 3:** The primary and the most significant part of the bot, which receives signals over the in-built Wi-Fi and processes the signals to accomplish required operations of the bot. It is also connected with a camera module and sends the output of the camera over the Wi-Fi to the controller. In short, it handles the motors (centre-shaft DC motors as well as high-rpm motors), GPS module and camera module.
- b. **Motors**
  - i. Centre-shaft motors: These are the primary driving actuators of the bot. They are 12V-1000RPM DC geared motors.
  - ii. High-RPM motors: These, with the propellers, are responsible for the navigation of the bot over the surface of water.
- c. **Wheels:** The centre-shaft motors use hard plastic wheels which are 10cm in diameter.
- d. **Propellers:** The high-RPM motors use propellers which are 5cm in diameter with four wings.
- e. **Power Source:** 12V DC 7.2Ah rechargeable battery
- f. **Ballast:** Used for floatation.
- g. **Pi camera:** 5 MP
- h. **GPS module:** The bot uses the GPS module to send its location to the controller end, where the location is used for generate instructions for navigation.
- i. **PIR Sensor:** The bot uses this sensor to observe the infrared radiation of surrounding to detect live human.
- j. **Acrylic body:** Acrylic sheet is light-weight and easy to use or mould into different shapes.

### Software components:

- a. **Raspbian:** This is the default operating system on the Raspberry Pi that acts as a platform for all other applications.
- b. **VNC Viewer:** This acts as a communication medium between our bot and controller system.
- c. **Python3:** All the programming is expected to be done in Python3.

## Features:

1. Amphibious: Designed to operate on both land and water
2. Remotely operated
3. GPS based navigation system
4. Camera for real time video surveillance
5. Live human detection in disastrous situations

## Applications:

1. **Surveillance:** This robot can be used for surveillance monitoring purpose on different applications (such as on border by military) and controlled from anywhere through GUI interface. The control mechanism is provided along with video transmission facility. The video transmission is practically achieved through high-speed image transmission. Initially, the robot will be equipped with a camera which will capture the scenario in front of it will transfer the images to the server on which the user will be controlling and watching the live feed.
2. **Search and Rescue operations:** This ASR can be used in cases of extreme cases like a natural calamity where there is a huge loss of life and property. Those areas where immediate rescue operations and supplies are needed such flood or other similar disasters, the bot can be used to search for people and property where direct access of human beings is unfeasible or impractical.

## Future Improvements:

Although this robot can execute the basic objectives of a surveillance bot, there is a wide scope of improvement. More sensors resulting in better accuracy can improve the bot's performance and efficiency. Thermal imaging techniques can further improve the reliability of the bot for tougher and complicated operations.

**Estimated cost:** ₹ 12,000

## Credits

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