Project Title: **IoT Based Multifaceted Rover**

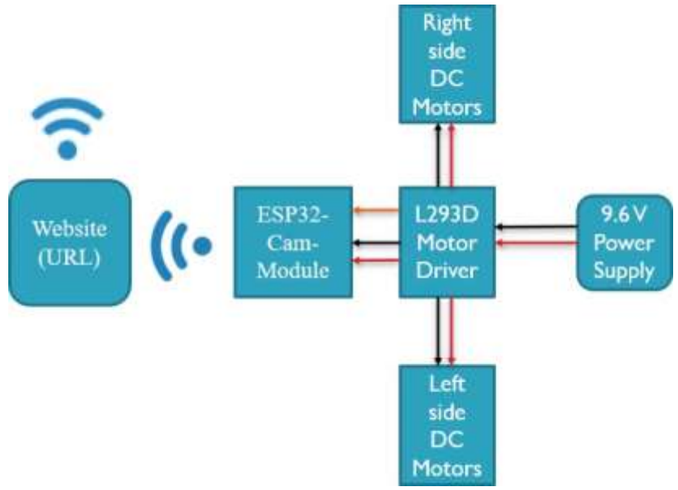
Dr. K. R. Joshi, Dr. R.S. Kamathe, Dr. V. V. Hanchate, Poorva Dinesh Patil, Priya Umesh Kokil, Tejas Sunil Patil

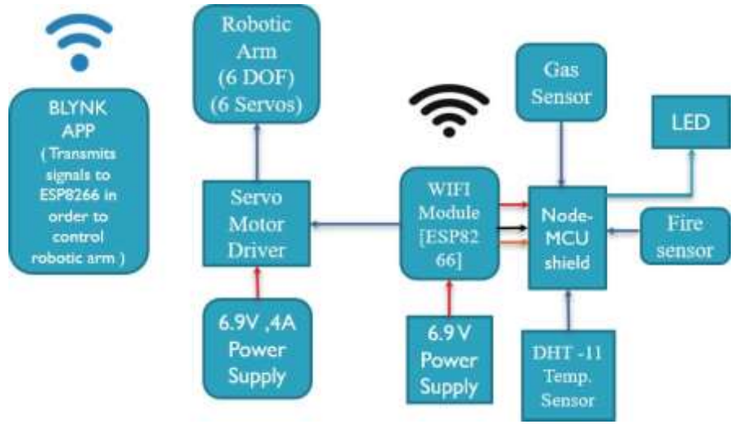
Objective: The project aims to build a multipurpose rover consisting of different sensors that can be operated by using Blynk App. It will consist of multiple systems, capable of performing multiple functionalities.

Methodology:

1. Rover will be controlled via a webpage, through which we can accelerate it forward or backward and can turn it left or right.
2. The Robotic Arm will operate in 6 degree's of freedom (i.e. 6 DOF) and these 6 rotations will be controlled by servo motors.
3. The servo motors will have a rotation limit up to180 degree's, & angle of rotation of these servo motors will be controlled via BLYNK APP.
4. Sensor unit consisting of various sensors will read the physical data from surrounding and send the digital data via WIFI module to the BLYNK APP, where we can monitor the sensor's data.
5. Rover maneuvering system & live video streaming will be controlled by ESP - 32 Camera Module .
6. Sensor unit & Robotic arm will be controlled by a WIFI + controller (Node-MCU) module and data from various sensors will be processed by this Module.

Block Diagram:





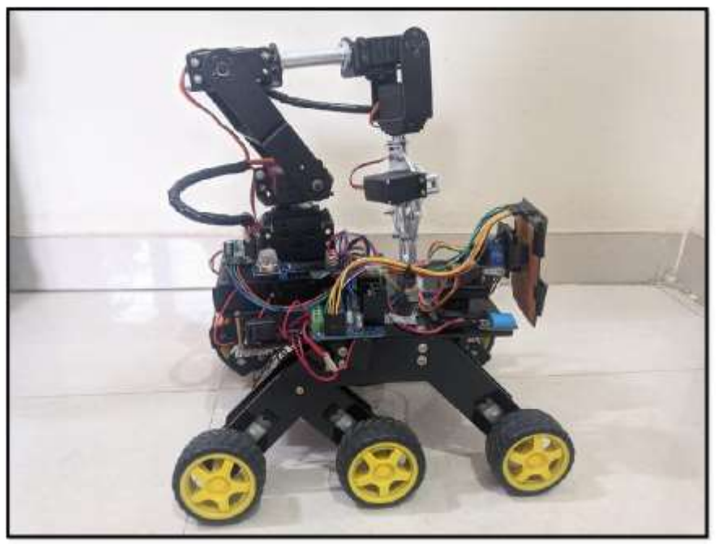
Testing & Debugging:

1. If we give voltage >= 10 volts, to ESP-32 camera module, then it will not operate (i.e., live feed will not be visible on webpage and rover will not move), So, we need to give, approx. 9.6 volts or < = 10 volts to ESP-32 camera module, so that it can operate properly. While testing the ESP-32 camera live feed, the video streaming quality was poor, blurry, and laggy.
2. Hence, we need to open AsyncWebSocket header file, and change one parameters value i.e. (WS_MAX_QUEUED_MESSAGES), from 369 to 1, and then upload the code, and then all blurry-ness of the camera goes away.
3. While testing the servo motors, the threshold power supply to the 6 servo motors should be approx. 6.9 Volt approx. in order to avoid wear and tear of servo motors.
4. While testing robotic arm, we came to the conclusion that, shoulder and elbow servo motors should have a stall torque of 20kg/cm @ 7.4V and above, while base, wrists, and gripper servo motors should have stall torque of 15kg/cm @ 7.2V.
5. While installing servo motors to the robotic arm there resting angle should be 90 degrees.
6. While writing the code for robotic arm, we found out the Min. Pulse width and Max. Pulse width to be 600 and 2400 respectively, by testing each servo motor.
7. While operating the robotic arm, if any servo motor shows slow movement for that particular joint, then our batteries are discharged, so we then to charge our batteries.
8. Black colour gripper was replaced by silver colour gripper, because black one had loose h made it difficult to grab any object firmly.

Specifications / Features:

- The project aims to build a multipurpose autonomous rover that could move by using ESP-32 camera module and is controlled by a WebSocket webpage.
- It can be sent to hostile and hazardous places, where it is unsafe for humans, like mines, radioactive prone areas, etc. thereby reducing human risk.
- Though technology is developing at an extremely fast rate, there are still many jobs that are threatening to human life. Many people still work in hazardous and risky jobs for very low daily wages.
- Also, in any case of disaster, the current technologies involve lot of human effort and error. Sometimes victims get struck in debris and die unnoticed, as it is very difficult for humans to locate them.
- The rover is provided with various sensors that monitors parameter like temperature, smoke, fire etc. The sensors continuously monitor the environment and update the value to the Blynk App, enabling the user to view the values in a mobile APP, in real time.
- The rover could be controlled from smartphone through a web-socket web-page. Also, a camera mounted on the rover live streams the video to the same webpage.
- The rover can also be used for surveillance, with the help of camera.

Results:



C roject, we have assembled the robotic arm & sensor unit which is controlled by one controller (Node-MCU). The Movement of rover & the video live streaming is controlled by another controller i.e., ESP32 CAM **M** rned about Web-socket, in order to improve half duplex communication of HTTP server. We also learned about, the PWM pulse-width calculations required for the servo shield (PCA 9685).