**FUTURE ENGINEER- CODE ROGER**

**Team no: 1113**

**1. Power System**

* The robot is powered by **two 3.7V Li-ion batteries (total ~7.4V)** connected through a **battery connector and switch**.
* Power is distributed to the **Arduino Uno, L298N motor driver, ESP32-CAM, and sensors**.

**2. Control Unit**

* The **Arduino Uno Rev 3** acts as the brain of the robot.
* It processes data from the **ultrasonic sensors** and sends commands to:
  + **DC motors** via the L298N motor driver (for forward/backward movement).
  + **Servo motor (SG90)** for steering control.
* The **ESP32-CAM** provides camera vision for live streaming and object/line/ball detection (depending on programming).

**3. Sensing System**

* **3 Ultrasonic Sensors (HC-SR04)** are mounted at the **front, left, and right** of the robot.
* Their function is to **measure distance** and detect obstacles or opponents.
* The sensors continuously send distance data to the Arduino, allowing the robot to avoid collisions and decide movement direction.

**4. Motion System**

* **2 DC Motors (N20, 250 RPM)** drive the robot’s wheels, connected through the **L298N motor driver**.
* The motor driver receives PWM signals from Arduino to control **speed and direction**.
* A **servo motor (SG90)** is used for **precise angular movement** (for steering or an attachment mechanism).

**5. Camera & Vision (ESP32-CAM)**

* The ESP32-CAM module captures **real-time video feed**.
* This can be used for:
  + Remote monitoring (streaming to phone/laptop).
  + AI-based object detection (e.g., ball/goal recognition).
  + Line or color tracking (if programmed).

**6. Working Cycle (Step-by-Step)**

1. **Power ON** → Batteries supply voltage to Arduino, ESP32-CAM, and motors.
2. **Initialization** → Arduino checks ultrasonic sensors; ESP32-CAM starts video stream.
3. **Navigation** → Robot moves forward using DC motors.
4. **Obstacle Detection** → If ultrasonic sensor detects an object within a set distance, Arduino adjusts movement (stop, turn, or reverse).
5. **Camera Input** → ESP32-CAM identifies target (ball/goal/line).
6. **Action** → Servo motor moves to adjust direction or activate mechanism.
7. **Continuous Loop** → Robot repeats sensing, decision-making, and movement until task is completed.

**7. Conclusion**

The robot works by combining **sensors (for environment awareness), motors (for movement), Arduino Uno (for control), and ESP32-CAM (for vision)**. Through programmed logic, it can autonomously avoid obstacles, detect objects, and complete tasks required in the **WRO RoboSports challenge**.