

# 4.3.1 E-R Diagram / Block Diagram for EcoSweep Project

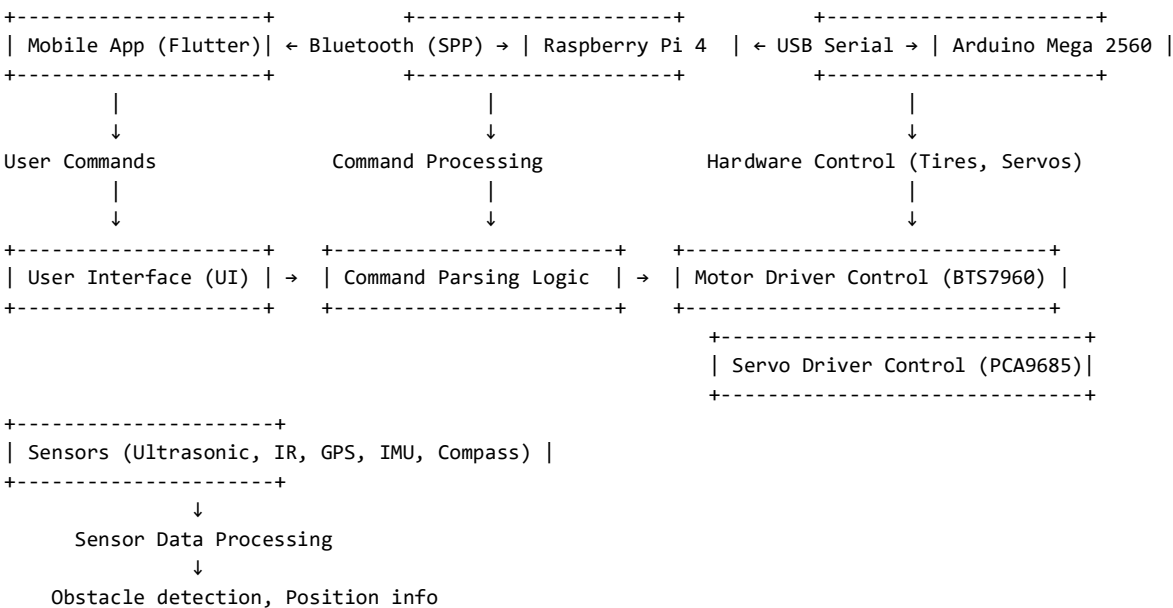
## Purpose of This Section

- Show the relationship between main entities (modules/components) in the system.
- Represent how data flows between entities in a structured manner.

## Suggested Approach:

Since this is an embedded system, a **Block Diagram** showing functional modules and their interconnections is more appropriate than a traditional database-style E-R diagram.

### Final Block Diagram Structure (Recommended Design)



## ☑ Detailed Explanation (to Add in Documentation):

### 1. Mobile App (Flutter)

- a. Acts as the user interface, providing options for manual control and semi-automatic modes.
- b. Sends control commands over **Bluetooth Classic (SPP)**.

### 2. Bluetooth SPP Communication

- a. Enables wireless data transfer from the mobile app to the Raspberry Pi.
- b. Commands are sent in structured packets (see schema design).

### 3. Raspberry Pi 4

- a. Central processing unit for communication and high-level logic.
- b. Parses incoming command data and forwards the commands to Arduino Mega via USB Serial.
- c. Also handles optional logging of commands and sensor data for future processing.

### 4. Arduino Mega 2560

- a. Low-level hardware controller.
- b. Processes command packets and controls actuators (DC tire motors & servo motors).
- c. Reads sensor data from Ultrasonic, IR, GPS, IMU, and Compass.

### 5. Motor Driver Control (BTS7960)

- a. Receives control signals from Arduino Mega to drive the tire motors.
- b. Handles power-intensive motor control for movement.

### 6. Servo Driver Control (PCA9685)



- a. Receives servo position commands from Arduino Mega.
- b. Controls the robotic arm servos for cleaning actions.


### 7. Sensors Module


- a. Multiple sensors provide environmental feedback (distance, orientation, location).
- b. Data is read by Arduino Mega and can optionally be sent back to Raspberry Pi.

## ☑ How to Design the Diagram Visually:

### *Tools you can use:*

-  Draw.io (diagrams.net) → Free & easy to use.
-  Lucidchart → Professional appearance.

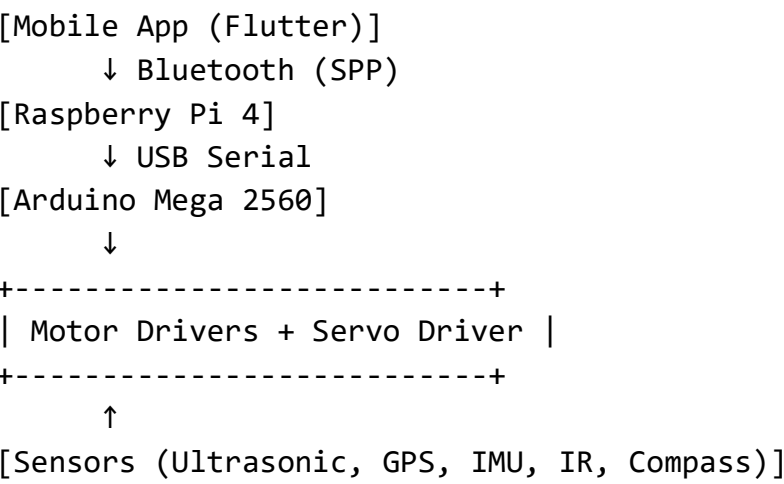
-  Microsoft Visio → For academic reports.

 Simple visual guidelines:

- Use rectangular blocks for each module.
- Show arrows for direction of data flow.
- Label the arrows clearly (e.g., “Bluetooth”, “USB Serial”, “Sensor Data”).
- Use different colors (optional) to separate command flow vs. sensor feedback.

## Summary of Data to Add in Your Report (Text + Diagram)

### ► Block Diagram Example (Textual Version to add)



### ► Key Entities and Relationship Summary Table

Entity	Description
Mobile App	User interface sending control commands
Raspberry Pi 4	High-level command processor & communication hub
Arduino Mega 2560	Hardware-level controller managing actuators and sensors
Motor Drivers (BTS7960)	Controls DC tire motors for movement

Servo Driver (PCA9685)	Controls servos for robotic arm actions
Sensors	Provides distance, orientation, and position data for decision-making