4.3.6 Component Diagram – EcoSweep Cleaning Robot

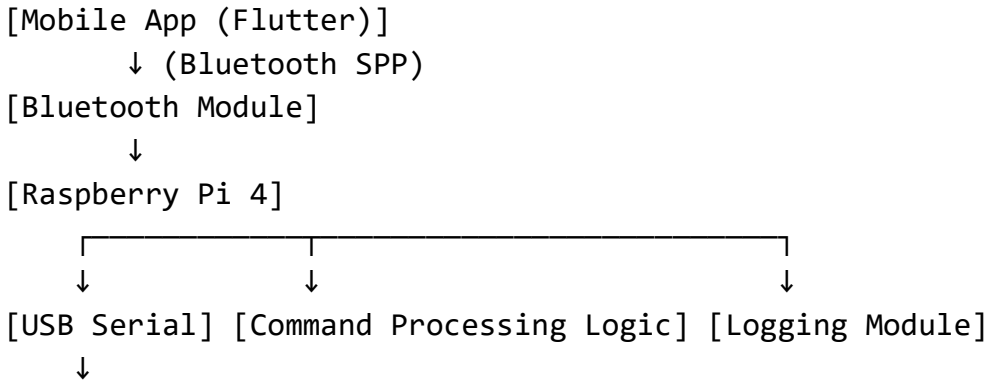
🎯 Purpose of Component Diagram

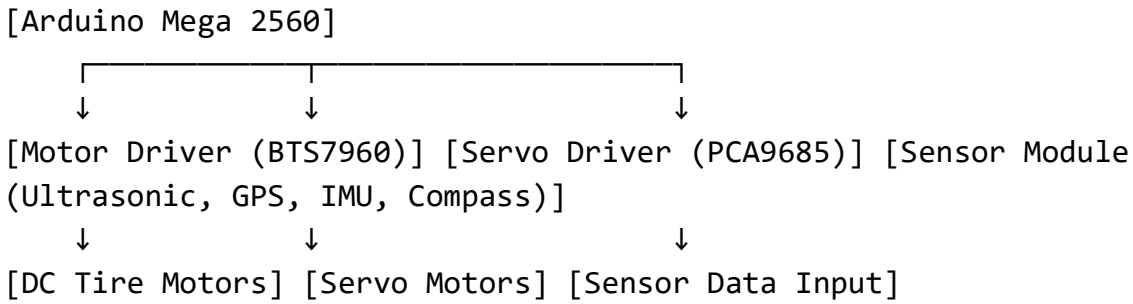
To represent the physical and logical components of the system and how they are connected or interact with each other.

☑ ▶ Main Components to Include

Component	Description
Mobile App (Flutter)	User interface application running on Android device.
Bluetooth Module	Communication channel (Classic Bluetooth SPP) between Mobile App and Raspberry Pi.
Raspberry Pi 4	Central controller managing high-level command processing, communication, and logging.
USB Serial Interface	Physical connection between Raspberry Pi and Arduino Mega.
Arduino Mega 2560	Low-level hardware controller, responsible for controlling actuators and reading sensors.
Motor Driver (BTS7960)	Controls DC motors for tire movement.
Servo Driver (PCA9685)	Controls servo motors for robotic arm.
Sensors (Ultrasonic, IR, GPS, IMU, Compass)	Environmental feedback components providing distance, position, orientation, and motion data.
Actuators (DC Motors, Servo Motors)	Components performing movement and cleaning actions.

☑ ▶ Component Diagram Structure (Textual)





☑ ▶ Example Component Diagram Table (to Add in Documentation)

Component Name	Type	Description
Mobile App	Software	UI for controlling EcoSweep
Bluetooth Module	Hardware	Classic Bluetooth SPP communication
Raspberry Pi 4	Hardware + Software	Central processing and communication hub
USB Serial Interface	Hardware	Data connection from Raspberry Pi → Arduino Mega
Arduino Mega 2560	Hardware + Firmware	Hardware controller managing actuators & sensors
Motor Driver (BTS7960)	Hardware	Controls power to DC motors
Servo Driver (PCA9685)	Hardware	Controls PWM for servo motors
Sensors (Ultrasonic, IMU, GPS, Compass, IR)	Hardware	Provides environmental data
Actuators (DC Motors, Servo Motors)	Hardware	Drives movement and arm actions

☑ Explanation to Add in Documentation

- The **Component Diagram** shows a structural view of EcoSweep in terms of its major hardware and software components.
- The **Mobile App** interacts wirelessly with the system via the Bluetooth Module.
- The **Raspberry Pi 4** acts as a controller and data logger, parsing commands and sending them to the Arduino Mega.
- The **Arduino Mega** handles low-level control, managing motor drivers, servo drivers, and reading sensor data.
- **Sensors and Actuators** form the environmental interaction layer, enabling movement and cleaning.
- The entire system works together to provide a functional cleaning robot.

☑ Summary of Data to Add in Documentation

▶ Components Table (as shown above).

▶ Component Diagram Flow (text version above).

☑ Visual Guidelines for Designing Diagram

- Rectangular blocks for components.
- Solid arrows for communication flow (e.g., Bluetooth → Raspberry Pi → Arduino Mega → Motor Driver).
- Optional: Group hardware vs. software components in layers.
- Label the connections clearly (e.g., “Bluetooth SPP”, “USB Serial”, “PWM Control”, “Sensor Data Input”).