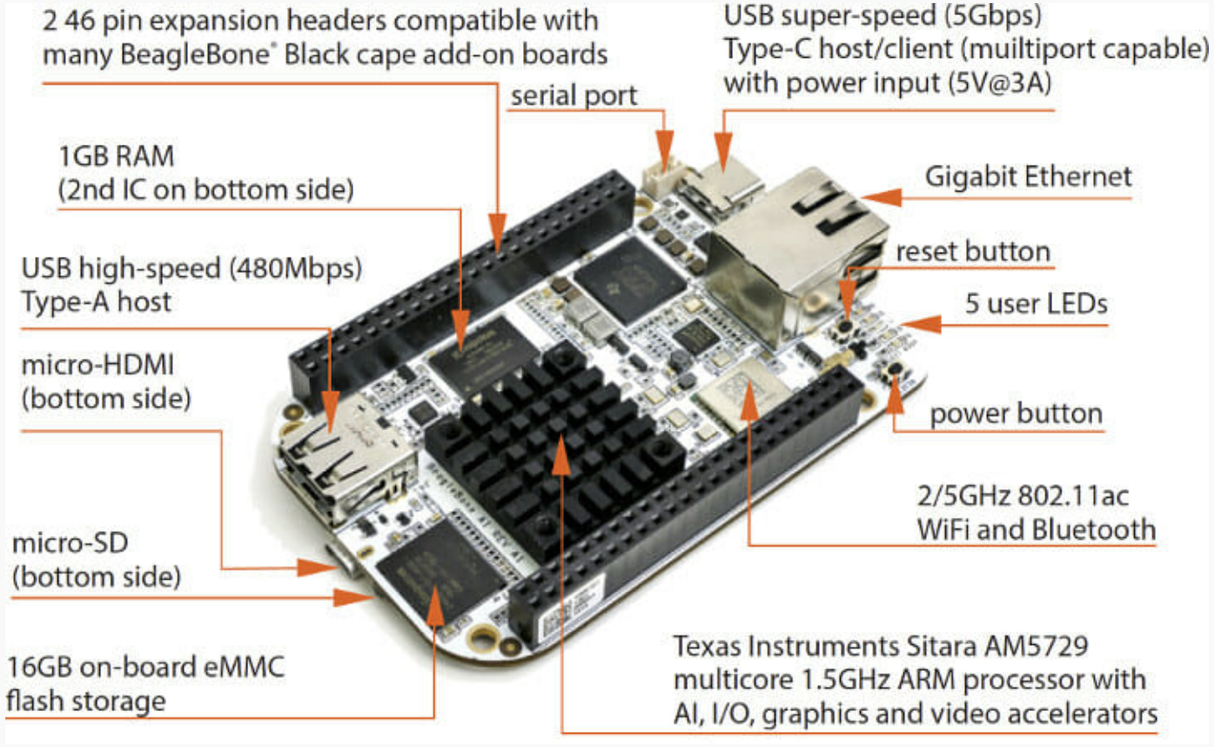
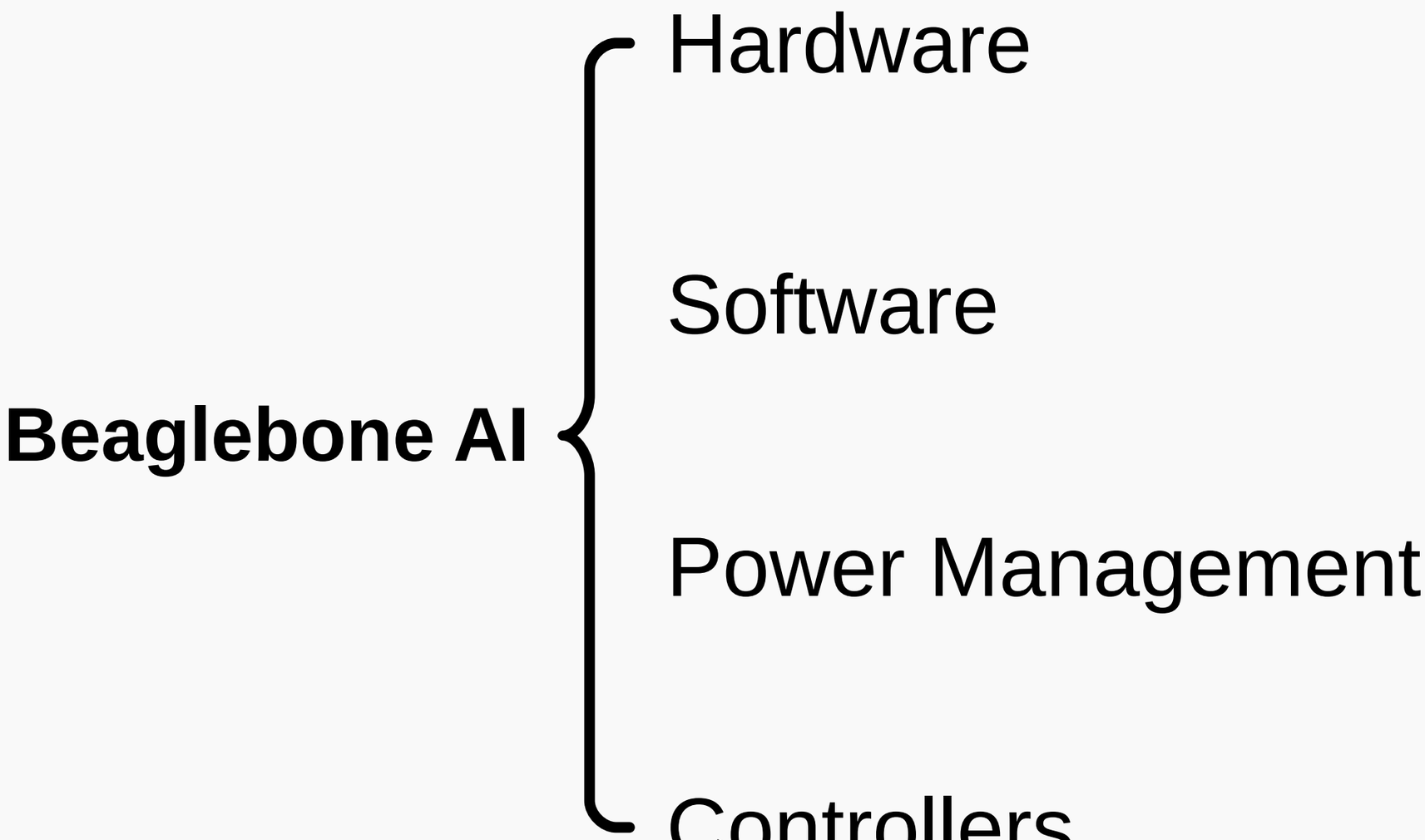
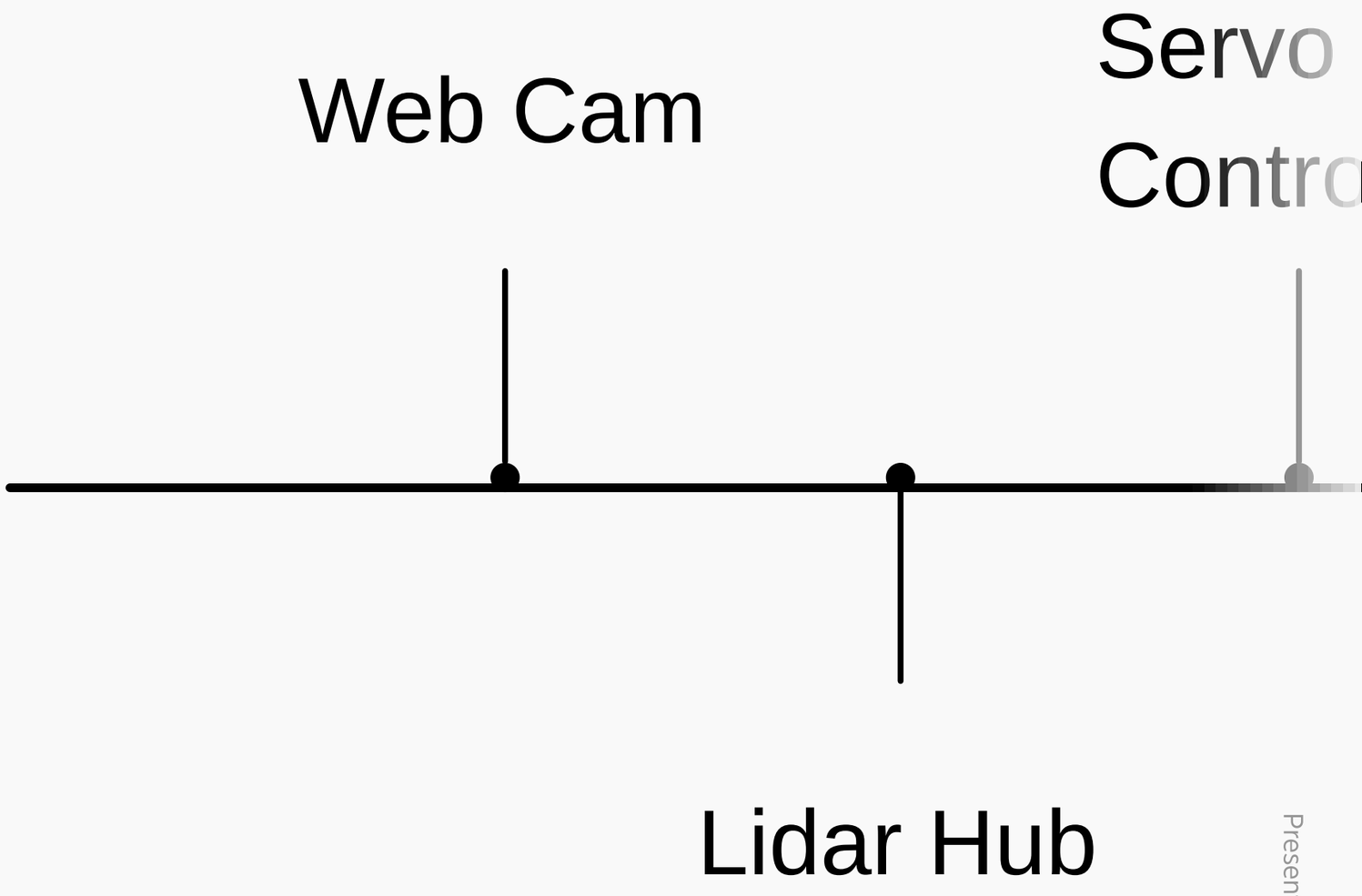


Beaglebone AI

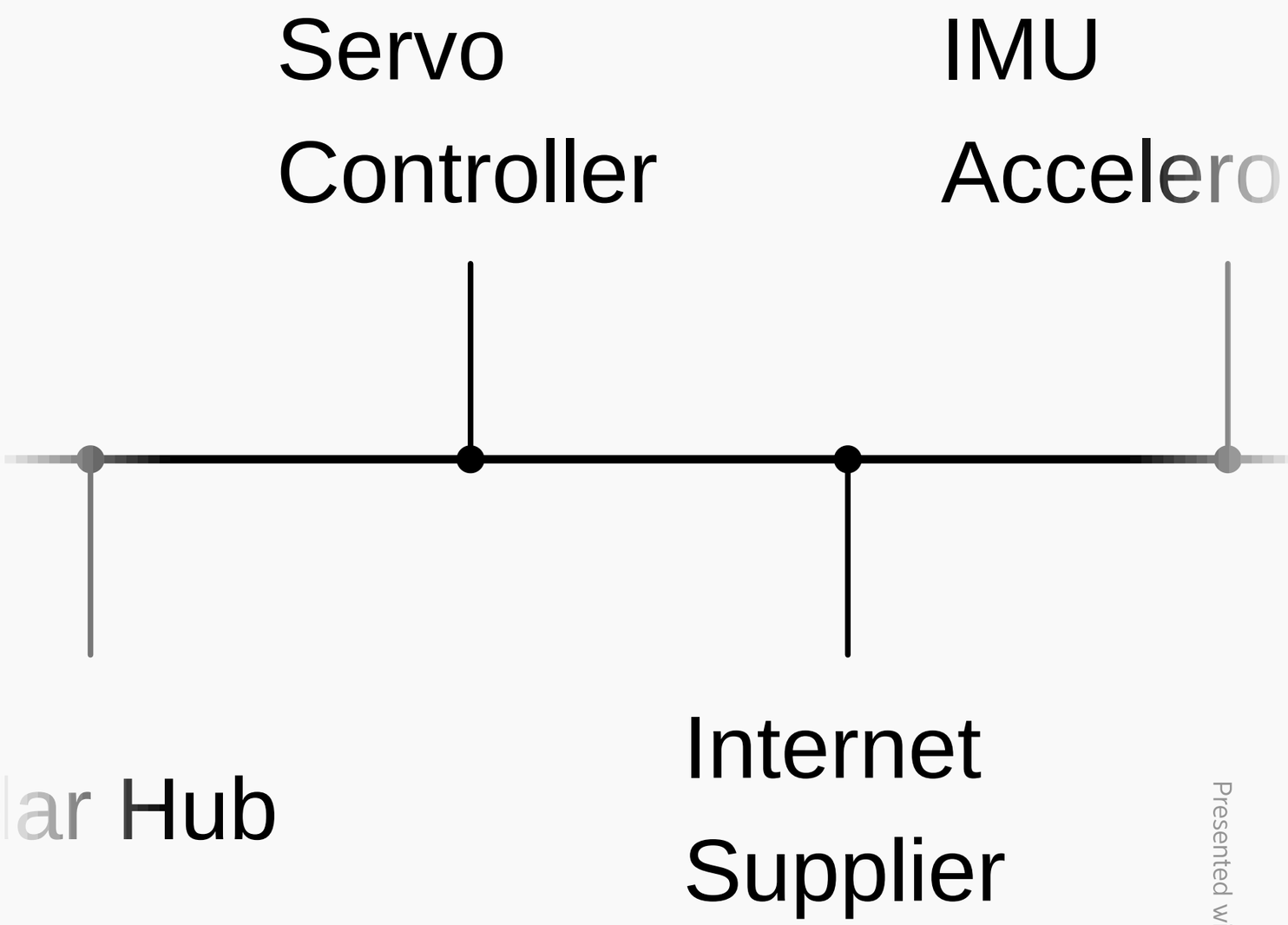


Hardware

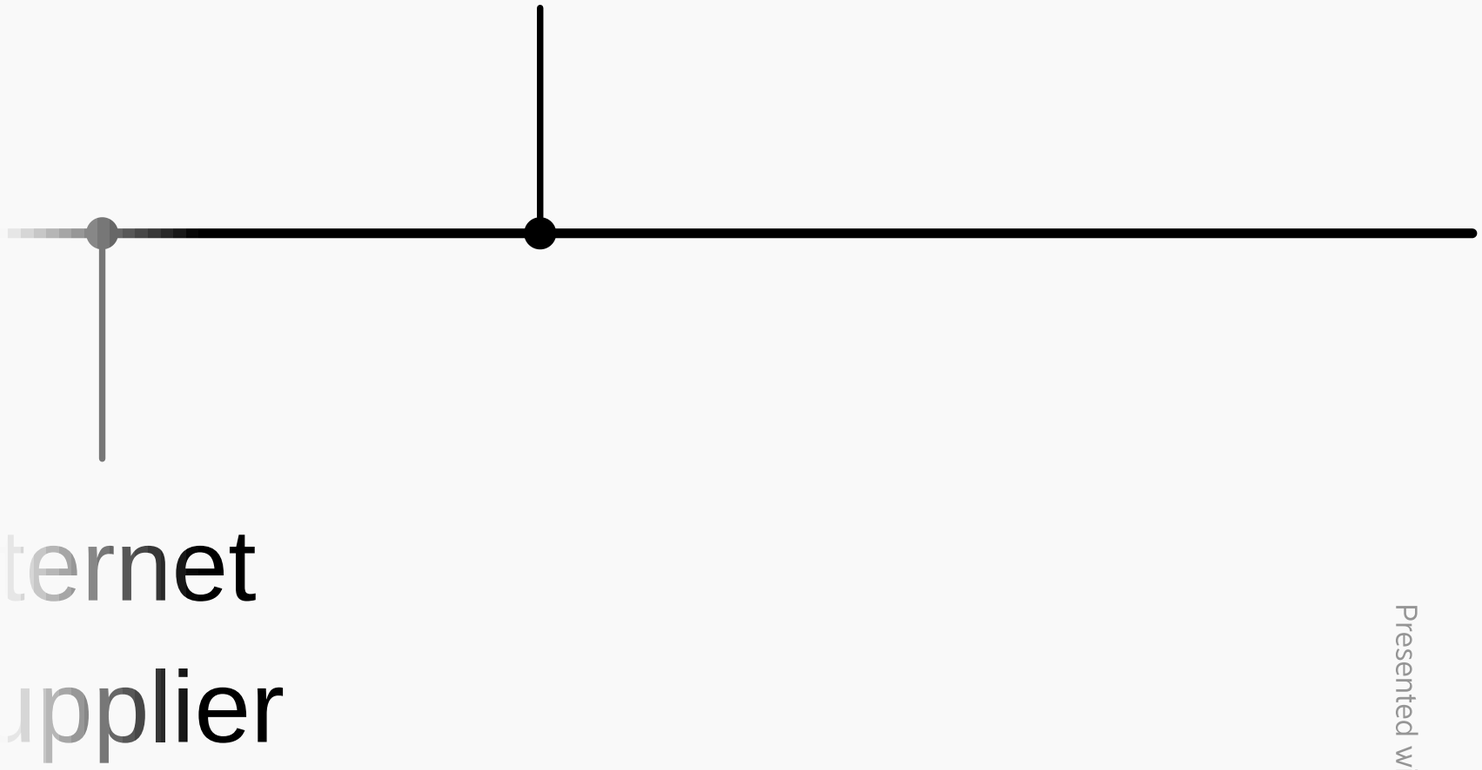
Hardware



Hardware



Hardware



Web Cam

- Overview
- Model: Logitech C920
- Algorithm
- Connection: USB
- Port: /dev/video0

Web Cam

- Model: Logitech C920
- Algorithm
- Connection: USB
- Port: /dev/video0

Overview

Overview

- Camera module type (e.g., USB, MIPI CSI, SPI, etc.)
- Resolution, FPS, and sensor details
- Purpose: Vision-based navigation, obstacle detection, AI-based movement

Algorithm

- Frame capture and processing (OpenCV, GStreamer)
- Object detection & tracking (YOLO, MobileNet, etc.)
- AI-based decision-making (Navigation, obstacle avoidance)

Hardware

- Connection
- Algorithm
- Model: SLAMTEC RPLIDAR C1
- Overview

Lidar Hub

Overview

Overview

- Mapping and localization (SLAM)
- Obstacle detection and avoidance
- Path planning

Algorithm

- SLAM (Simultaneous Localization and Mapping)
- Obstacle Detection & Avoidance
- Path Planning

Connection

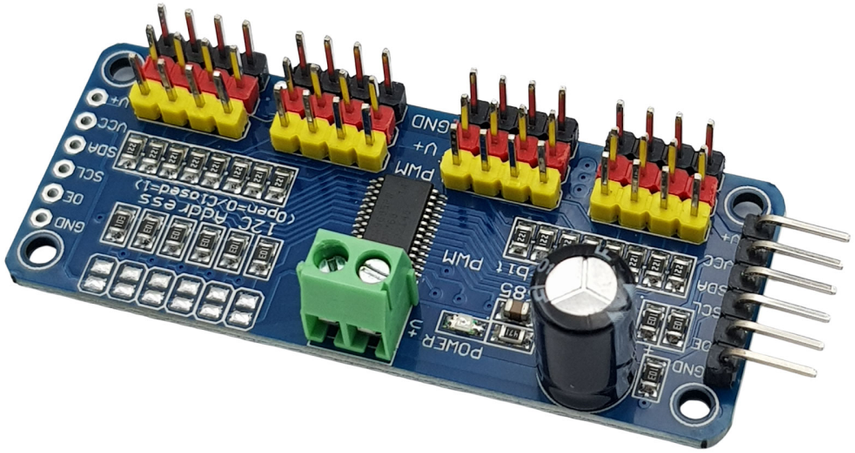
- M+
- M-
- G (GND)
- T (Tx)
- 5V

Connection

- M-
- G (GND)
- T (Tx)
- 5V

Servo Controller

- 2x PCA9685 16-channel
- Servo 24-channel Controller



2x PCA9685
16-channel

2x PCA9685 16-channel

- Overview
- Algorithm
- Connection (I2C3)

Overview

- Controlling additional servos beyond the 24-channel controller's capacity
- Generating smooth and precise PWM signals
- Offloading PWM processing from BeagleBone AI

Algorithm

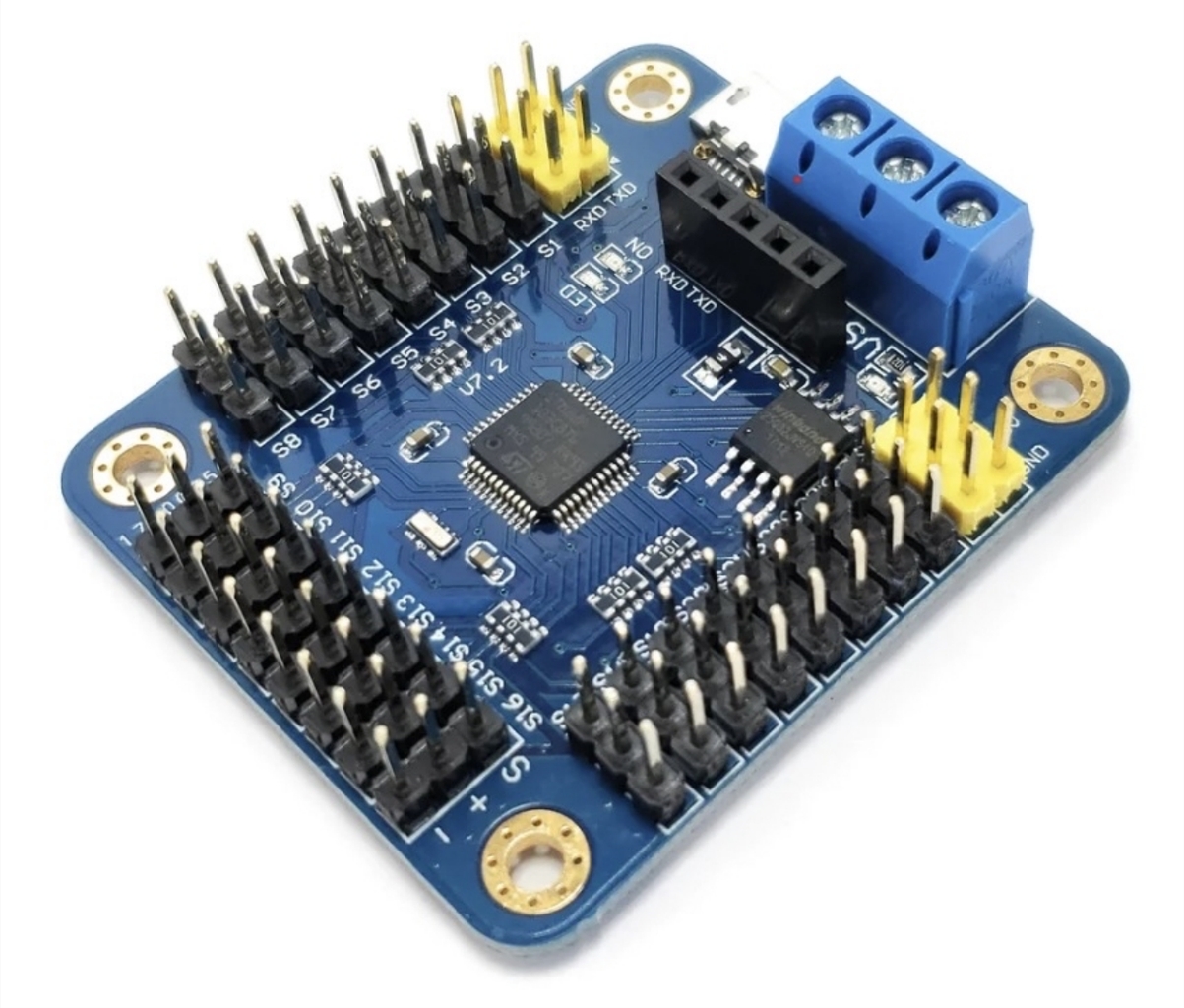
- Servo Initialization Sequence
- Inverse Kinematics for Hexapod Leg Movement
- Real-Time Adjustments

Connection (I2C3)

- GND - GND
- VCC - 5V
- V++ - 5V
- SDA - P9.20
- SCL - P9.19

Connection (I2C3)

- GND - GND
- VCC - 5V
- V++ - 5V
- SDA - P9.20
- SCL - P9.19



Servo 24-channel Controller

Servo 24-channel Controller

- Overview
- Algorithm
- Connection (UART?)
- Output

Overview

- Controlling 18 MG996R servos for hexapod leg movement
- Generating smooth and precise PWM signals
- Offloading PWM control from the main processor

Algorithm

- Servo Initialization Sequence
- Inverse Kinematics for Hexapod Leg Movement
- Manual Control (DualSense Integration)

Connection (UART?)

- GND - GND
- 5V - 5V
- Rx - P9.13 (Tx)

Output

- Frequency: 60Hz
- PWM: Input cmd

- Connection (UART5)
- Algorithm
- Model: SIM7600CE
- Overview

Internet Supplier

Overview

Overview

- Enables remote control and real-time telemetry over 4G LTE
- Provides GPS positioning for autonomous navigation
- Supports data transmission for AI-based control

Algorithm

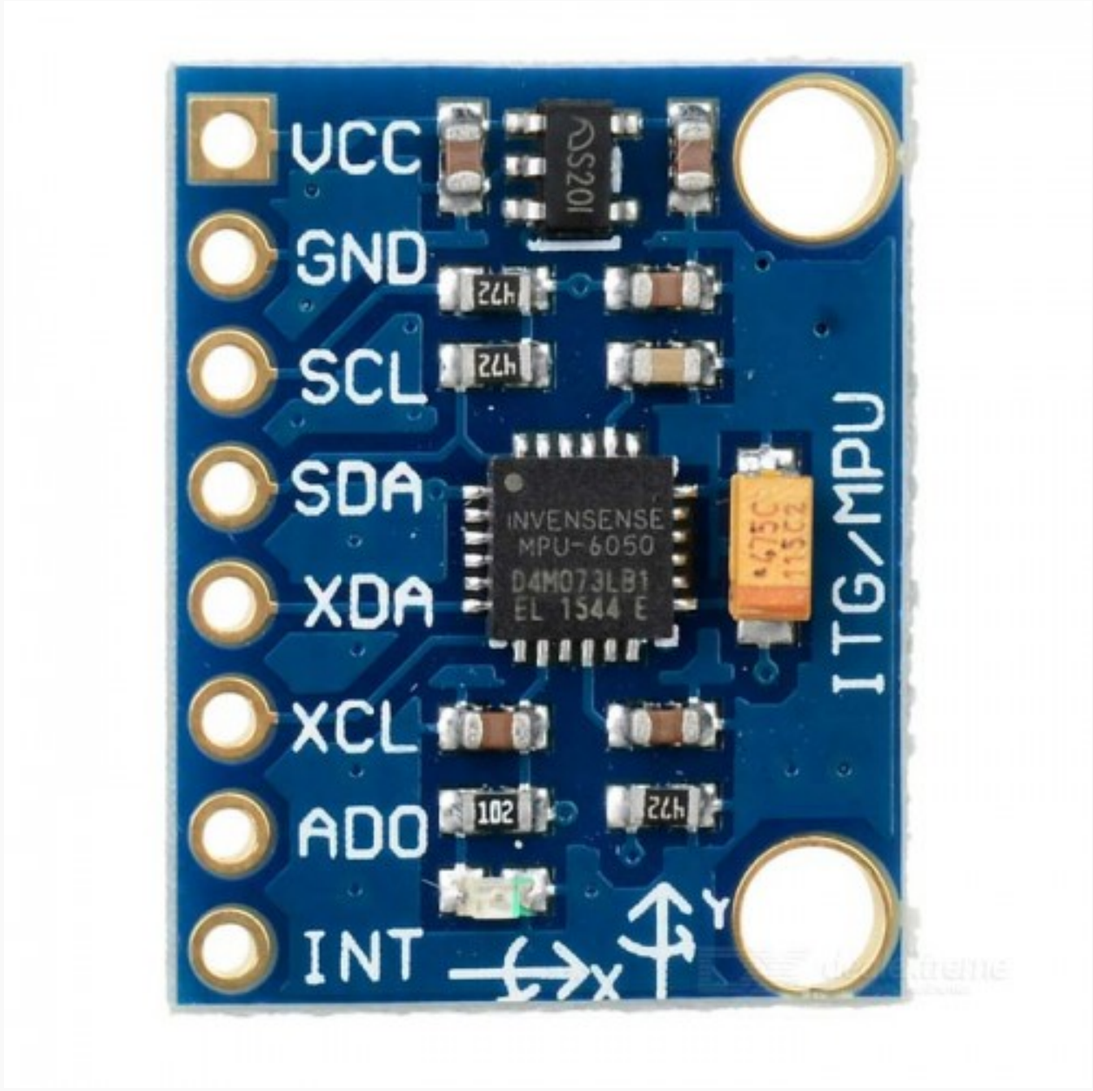
- Remote Command Handling
- GPS-Based Navigation
- 4G Data Transmission

Connection (UART5)

- GND - GND
- Tx - P8.38 (Rx5)
- Rx - P8.37 (Tx5)

IMU Accelerometer

- Overview
- Model: MPU6050
- Algorithm
- Connection (I2C3)



Overview

Overview

- Measures tilt, orientation, and movement of the hexapod
- Provides real-time feedback for balance control
- Helps in stabilization algorithms for smooth movement

Algorithm

- Balance Correction Algorithm
- PID Controller for Stability

Connection (I2C3)

- GND - GND
- VCC - 5V
- SDA - P9.20
- SCL - P9.19

Software

Software

- Hexapod Robot Control System
- Project Overview
- System Architecture
- Features
- Prerequisities

Software

- Hexapod Robot Control System

- Project Overview
- System Architecture
- Features
- Prerequisities

Hexapod Robot Control System

- A comprehensive control system for a six-legged robot (hexapod) using BeagleBone AI
- Featuring both kernel-space drivers and user-space applications.

Project Overview

- Kernel drivers for servo control (PCA9685) and IMU sensor (MPU6050).
- User-space libraries for kinematics and gait control.
- Test utilities and example applications.
- Comprehensive documentation and hardware guides.

System Architecture

- kernel_driver/: Linux kernel device drivers.
- user_space/: User applications and libraries.
- docs/: Documentation.
- scripts/: Build and utility scripts.

Features

- Multiple gait patterns (tripod, wave, ripple).
- Real-time IMU feedback.
- Inverse kinematics for precise leg control.
- Hardware abstraction layer.
- Comprehensive test suite.

Features

- Inverse kinematics for precise leg control.
- Hardware abstraction layer.
- Comprehensive test suite.
- Interactive debugging tools.

Prerequisities

- BeagleBone AI running Linux kernel 4.14+.
- I2C enabled (bus 3).
- 18x servo motors (MG996R recommended).
- MPU6050 IMU sensor.
- 2x PCA9685 PWM controllers.

Prerequisities

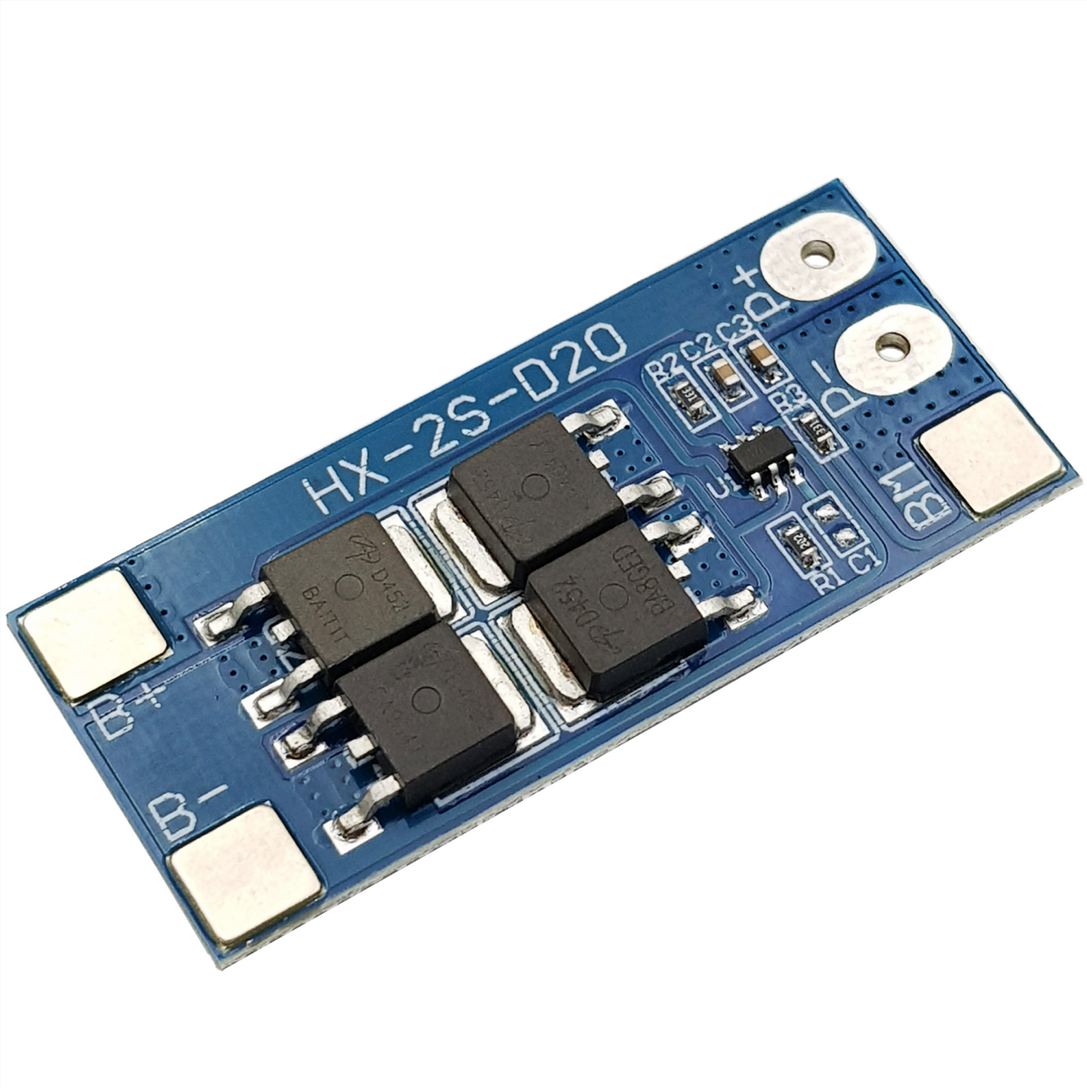
- BeagleBone AI running Linux kernel 4.14+.
- I2C enabled (bus 3).
- 18x servo motors (MG996R recommended).
- MPU6050 IMU sensor.
- 2x PCA9685 PWM controllers.

Power Management

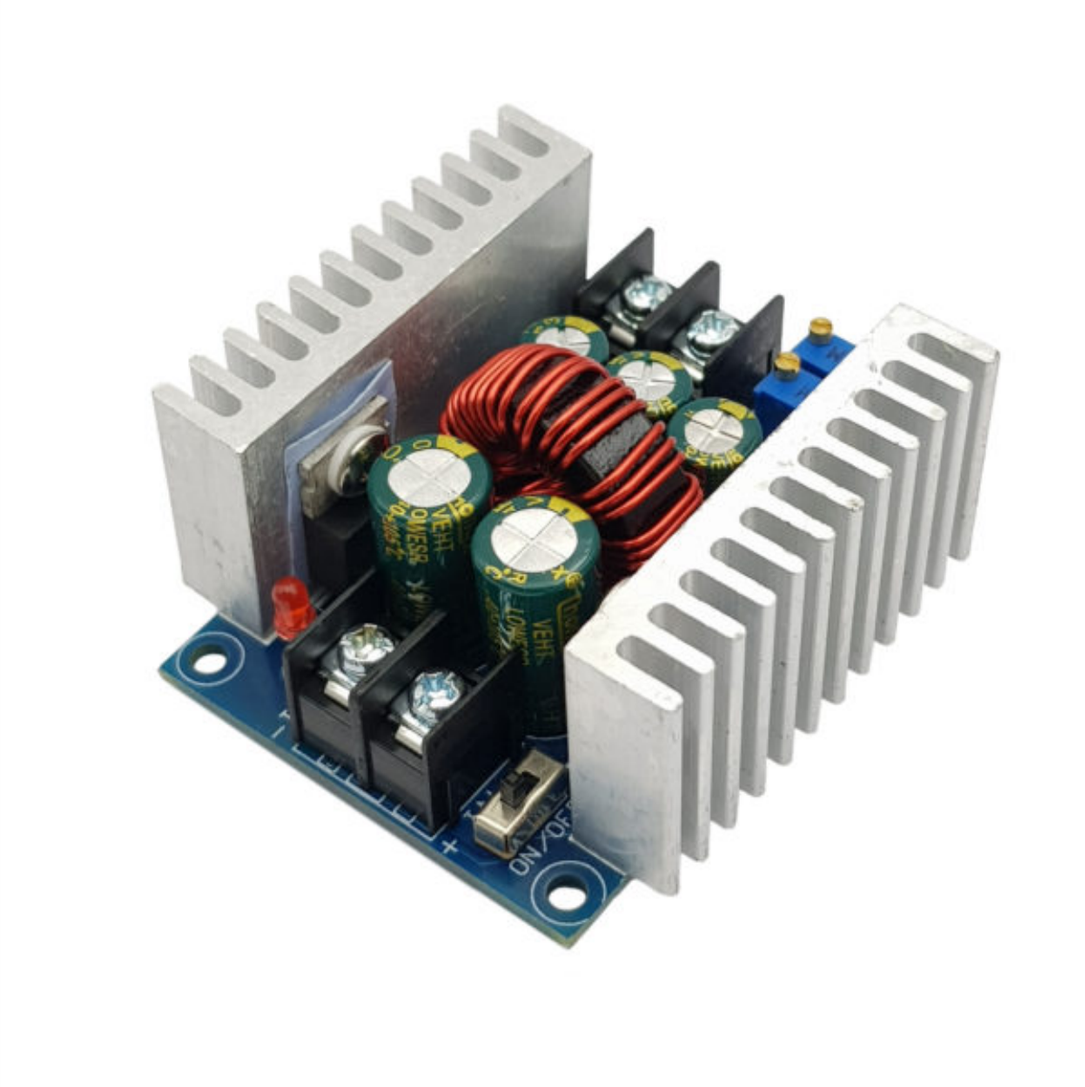
Power Management

- 4x Panasonic Li-ion Battery
- Battery Management System (2S - 2P)
- Voltage Regulator 20A 300W

4x Panasonic Li-ion Battery



Battery Management System (2S - 2P)



Voltage Regulator 20A 300W

Controllers

18x Servo

18x Servo

- Connection
- Algorithm
- Model: MG996
- Overview

Connection

- GND - GND
- VCC - 5V
- V++ - 5V

Algorithm

- Angle-to-PWM Conversion
- MG996R moves based on the pulse width

Overview

- Controls the hexapod's leg movements
- Receives positioning commands from PCA9685

Thank you