COMMUNITY GARDEN MONITORING ROBOT

Empowering Sustainable Urban Agriculture

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Power

Why LiFePO4 Battery?

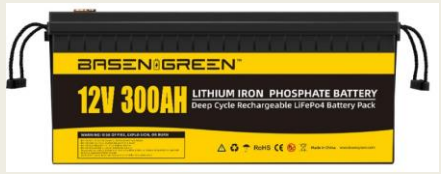
- Longer lifespan
- Higher Safety
- Wider temperature range
- Lower cost

Calculations for Battery:

- Battery Capacity = 450 W * 8 hours
- Battery Capacity = 3600 Wh (for 8 hours)
- Ah = 3600 Wh / 12 V = 300 Ah

Battery (LiFePO4)	Requirements
Energy Storage Capacity	300 Ah
Voltage	12 V

BLDC Motor



LiFePO4 Battery

Power Estimations	
BLDC Motors (5)	375 W
Computer	10 W
GPS sensor	0.64 W
LiDAR sensor	10 W
Camera (2)	6 W
Soil moisture sensor	0.12 W
Temperature sensor	0.012 W
Screen	7 W
Grippers (3)	7.5 W
Pumps	5 W
Servos (5)	6 W
Linear actuators	10 W
Total	**437.272 W**

Why BLDC Motor?

- More Efficient
- Produce Less Heat
- More Responsive

Why Actuators?

- **Grippers:** To grasp and move objects, such as soil samples
- **Pumps:** To water plants or to spray pesticides
- **Servos:** To precisely control the movement of objects, such as camera, gripper
- **Motors:** To drive the wheels
- **Linear Actuators:** To move objects in a straight line, such as opening and closing a valve

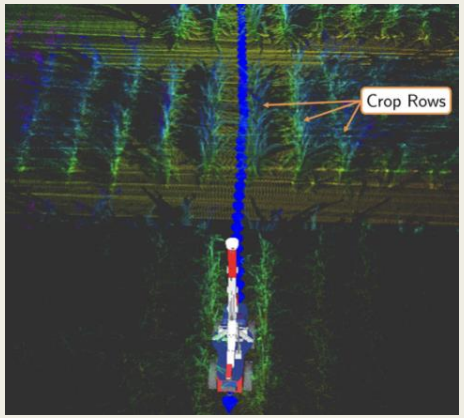
Soil moisture sensor

Temperature sensor

Navigation

Overview:

- The monitoring robot will use a combination of SLAM (Simultaneous Localization and Mapping) and LiDAR to navigate
- SLAM is used to create a map of the environment, while LiDAR is used to localize the robot within the map
- The monitoring robot will use the information to plan a path to its destination and to avoid obstacles



Example for monitoring robot navigation

Navigation Algorithm:

- **Read sensor data:** The robot will read data from the sensors to create a map of the environment
- **Update map:** The robot will use SLAM to update its map of the environment
- **Localize:** The robot will use sensor to localize itself within the map
- **Plan Path:** The robot will plan a path to its destination using the map and its current location
- **Execute Path:** The robot will execute the path plan by controlling its motors

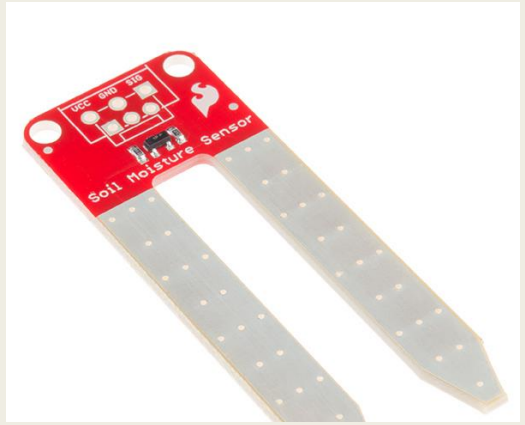
Navigation Considerations:	Navigation Sensors:	Navigation Software:
➢ Obstructions	➢ LiDAR	➢ ROS (Robot Operating System)
➢ Terrain	➢ GPS	➢ Moveit!
➢ Lighting	➢ Cameras	

Sensors

- **GPS sensor:** A GPS sensor will allow the robot to track its location. This is important for navigation and for mapping the agricultural field
- **LiDAR sensor:** A LiDAR sensor will allow the robot to create a 3D map of its surroundings. This information can be used for navigation, obstacle detection, and crop monitoring
- **Soil moisture sensor:** A soil moisture sensor can be used to measure the moisture level in the soil. This information can be used to determine when the crops need to be watered.
- **Temperature sensor:** A temperature sensor can be used to measure the temperature of the air and the soil. This information can be used to monitor the growth of the crops and to protect them from extreme temperature
- **Camera:** A camera can be used to take images of the crops. This information can be used to identify the types of crops, to assess their health, and to detect pests and diseases

GPS sensor

LiDAR sensor



Soil moisture sensor

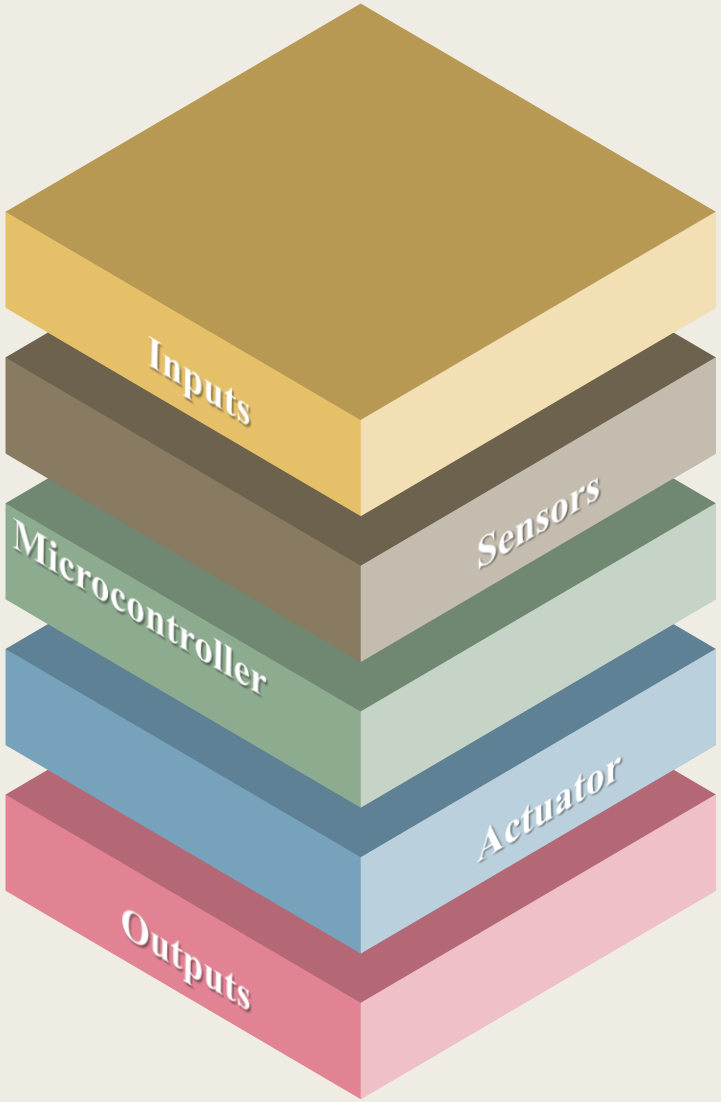
Temperature sensor

Softwares/Hardwares:

These are the signals that come from the environment. They could be from sensors, such as a temperature sensor.

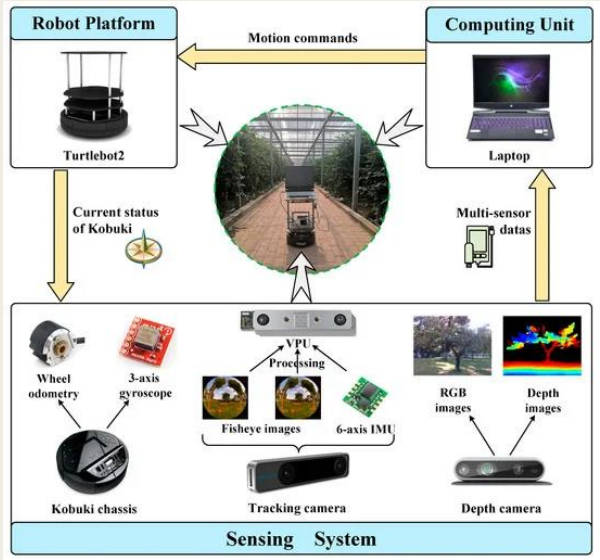
This is the brain of the robot. It controls the operation and processes the data from the sensors.

These are the signals that are sent out from the robot to the environment. They could be actuators, or they could be displayed on a display device.



This is the component that converts the input signal into a digital signal that the microcontroller can understand.

This is the component that converts the digital signal from the microcontroller into a physical action.



Basic block diagram

- **ROS (Robot Operating System):** ROS is a popular open-source robot operating system. It provides a number of tools and libraries for robot navigation, including SLAM, localization, and path planning