



Farm Droid

An Autonomous Agricultural Robot

Proposal



Project Title : Farm Droid

Group-1



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Project Objectives



Autonomous Navigation

Implement GPS-based pathfinding to travel to specific field coordinates independently.



Adaptive Mobility

Develop a robust rover system capable of traversing uneven agricultural terrain.



Computer Vision

Utilize OpenCV to recognize crops, weeds, and obstacles in real-time.



Monitoring

Integrate sensors for measuring soil moisture, pH levels, and weather conditions.

System Architecture

The system adopts a "Distributed Computing" architecture to handle computational loads efficiently.

The Brain: Raspberry Pi 4

- Handles high-level logic and path planning.
- Processes visual data using OpenCV.
- Communicates via Serial/I2C.
- Language: Python.

The Controller: Arduino/ESP32

- Dedicated to real-time operations.
- Generates PWM for motor drivers.
- Reads analog sensor data.
- Language: C++.

Mandatory Components & Modules:

Controllers

- Raspberry Pi 4 Model B (4GB): 14,100 BDT
- Arduino Uno R3: 988 BDT
- ESP-32 Development Board (×2): 1,100 BDT

Motors & Drivers

- MG995 Servo (×8): 6,160 BDT
- DS3218 20KG Servo (×2): 4,700 BDT
- MG996R Servo (×2): 780 BDT
- SG90 Micro Servo (×4): 600 BDT
- PCA9685 Servo Driver (×2): 894 BDT

Sensors

- GPS, LiDAR, IMU, Encoders, Pressure, PIR, Ultrasonic, IR, Camera
- Total Sensors Cost: 4,978 BDT

Power & Audio , Mechanical & Misc






- Power & Audio Modules: 356 BDT
- Mechanical Parts & Wiring: 4208 BDT

Tools

- Digital Scale & Hex Saw: 274 BDT



Data Flow Methodology

-  **Environment Input:** The robot interacts with the physical world, collecting raw data from the field.
-  **Data Acquisition:** Arduino/ESP32 collects data from Soil, Rain, and Temperature sensors. The Camera captures visual streams.
-  **Processing:** The Raspberry Pi processes visual data (OpenCV) for object detection and receives sensor readings via I2C/UART.
-  **Decision Making:** Path planning algorithms determine the next move based on obstacle detection and GPS coordinates.
-  **Physical Action:** Motor commands are sent back to the Controller to drive the actuators and servo arm.

Technology Stack:

- **Language:** Python (Vision/Logic), C++ (Arduino Firmware)
- **Vision:** OpenCV, TensorFlow Lite (Optional for object detection)
- **Hardware Interface:** I2C (Inter-Integrated Circuit), UART (GPS)
- **Power Management:** LiPo Batteries with Buck Converters (UBEC) for system stability.

Hardware Components:

- **Actuators:** DC Gear Motors or MG996R Servos (Mobility), SG90 (Gripper/Arm).
- **Sensors:** NEO-6M GPS, Ultrasonic (HC-SR04), Soil Moisture, Rain Sensor, DHT11.
- **Controllers:** Raspberry Pi 4 Model B (4GB), Arduino Uno / ESP32.
- **Drivers:** PCA9685 PWM Driver (for Servos) or L298N/Motor Driver (for Wheels).
- **Vision:** Official Raspberry Pi Camera Module / USB Webcam.

Optional Components & Modules:

Category	Component Name	Unit Price	Qty	Total
Sensors	Liquid pH Sensor (0-14 Value)	2,150	1	2,150
	Soil Moisture Sensor Dual Output	70	1	70
	Rain Drop Sensor	80	1	80
	DHT11 Temp & Humidity Sensor	120	2	240
Safety & Security	MQ-2 / MQ-135 Gas Sensor	139	2	278
	RC522 RFID Reader Kit	175	1	175
Rover Mode	Gear Motor with Wheel (Yellow)	155	4	620
Optional Items Total				3,613 BDT

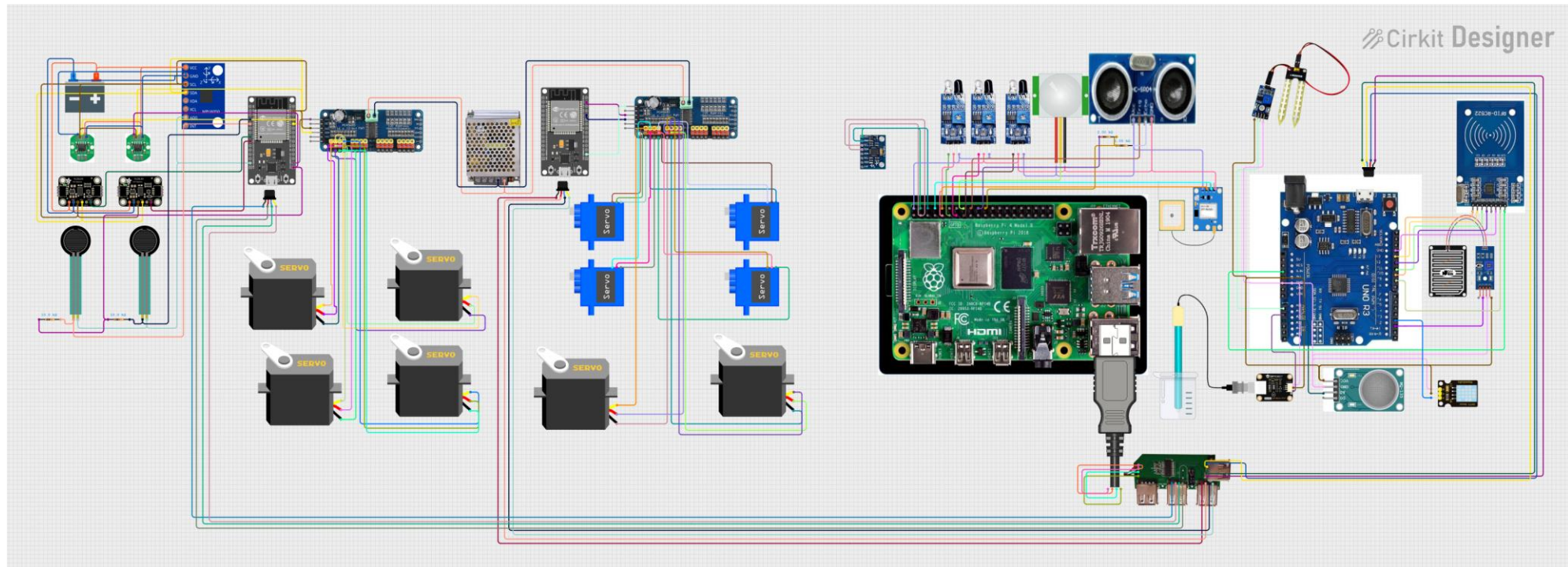
Project Financial Summary:

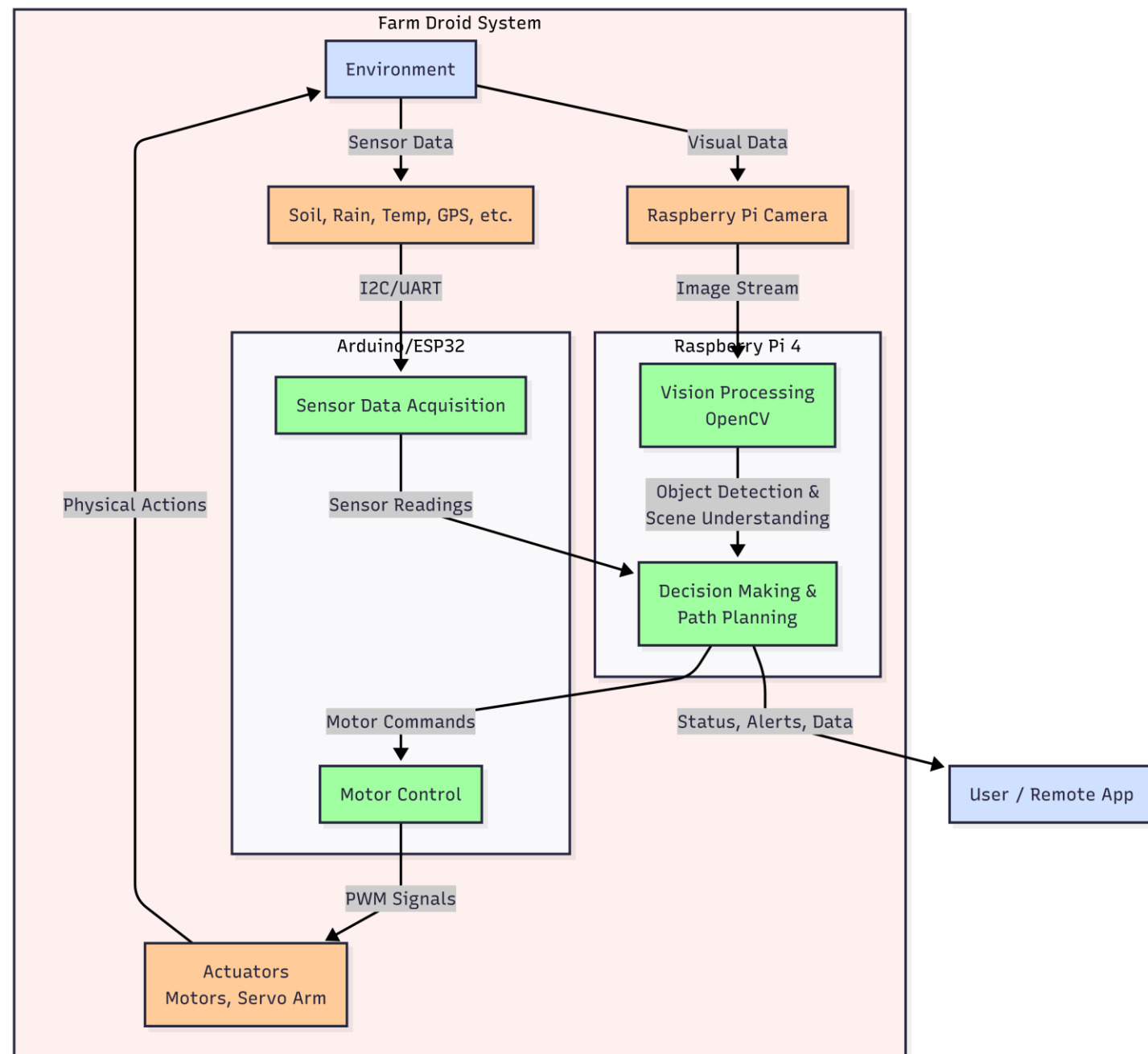
Mandatory Components Cost	39,138 BDT
Optional Components Cost	3,613 BDT
Grand Total Project Cost	42,751 BDT

Work Plan (Timeline):

Task	Month 1	Month 2	Month 3	Month 4
Mechanical Assembly (Chassis & Drive)	✓			
Circuit Integration & Power Dist.	✓	✓		
Locomotion & Motor Control		✓	✓	
Vision & GPS Integration			✓	✓
Arm Control & Final Testing				✓

Circuit Diagram:





Thank You!

Any Questions?



Image Sources



<https://mintekresources.com/wp-content/uploads/2023/04/Padfood-Roller-Compacting-Lime-Treated-Soil-e1681320292833.webp>

Source: mintekresources.com



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