CANADIAN INTERNATIONAL COLLEGE
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Communications & Electronics Engineering

Internet of Things (IoT) applied on

SMART AGRICULTURE SOLUTION

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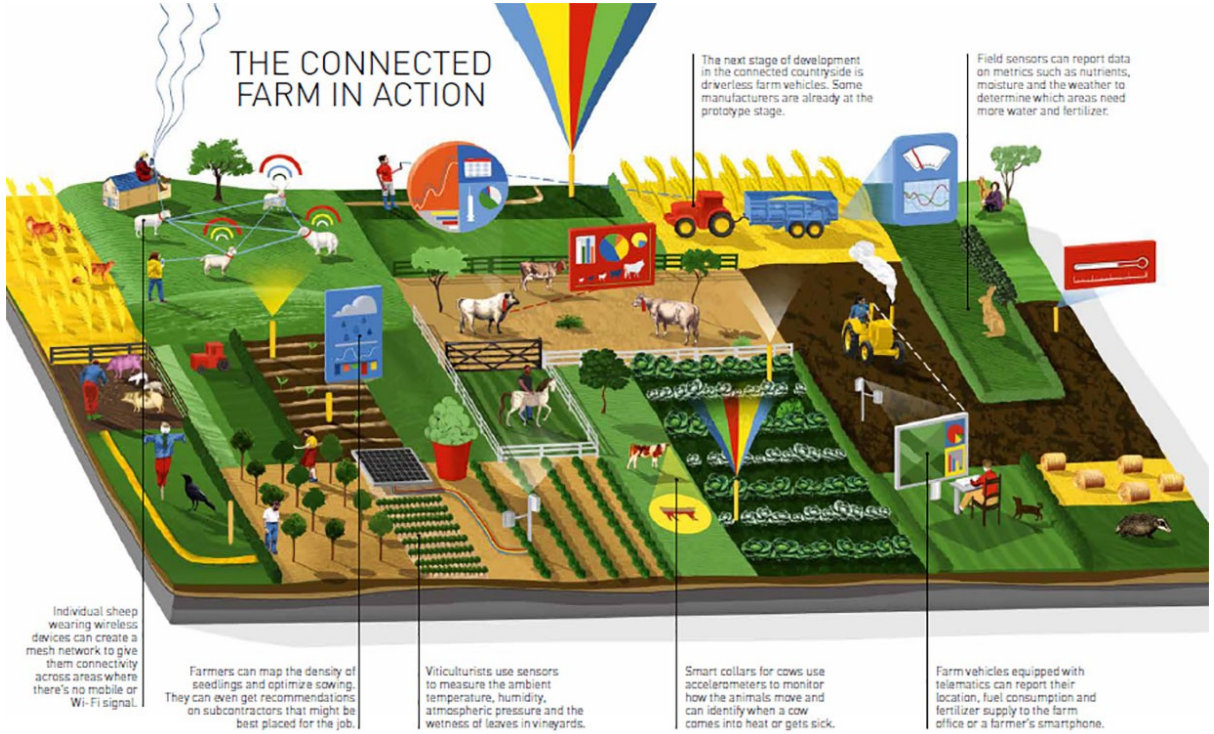
Overview

Communications & Electronics Engineering

1. Introduction
2. Problem Statement
3. Methodologies
4. Problem solving and proposed design
5. Future work
6. Conclusion

Introduction

- **Objective: Develop a smart agriculture solution leveraging IoT to automate and monitor key farming activities, enhancing farm productivity and resource management.**



History of Agriculture

10000 B.C.

Neolithic Revolution

Ancestors moved away from hunting and gathering of animals to farming. Farming was limited to that area and products were not transported.

18th – 19th Century

Machine Revolution

Second Agriculture revolution happened along with Industrial revolution. Industrial revolution has led to availability of the machinery needed for agriculture. Machinery usage in agriculture has started in this revolution which has led to more yield.

1950-1960

Green Revolution

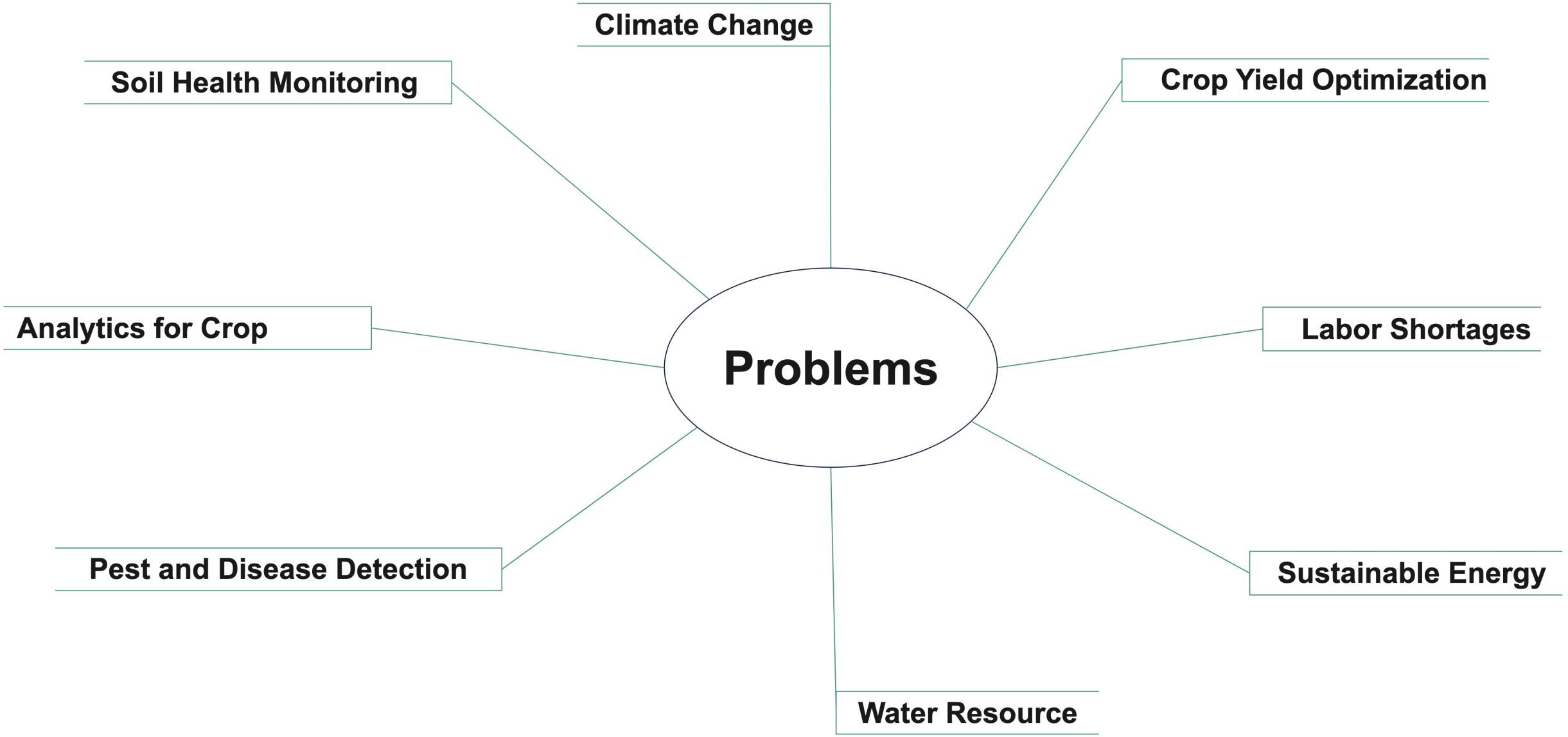
Adoptioin of technologies like Hybrid High Yield Varities, Chemical Fertilizers, Pesticides Started resulting in greater yield.

2010 - Present

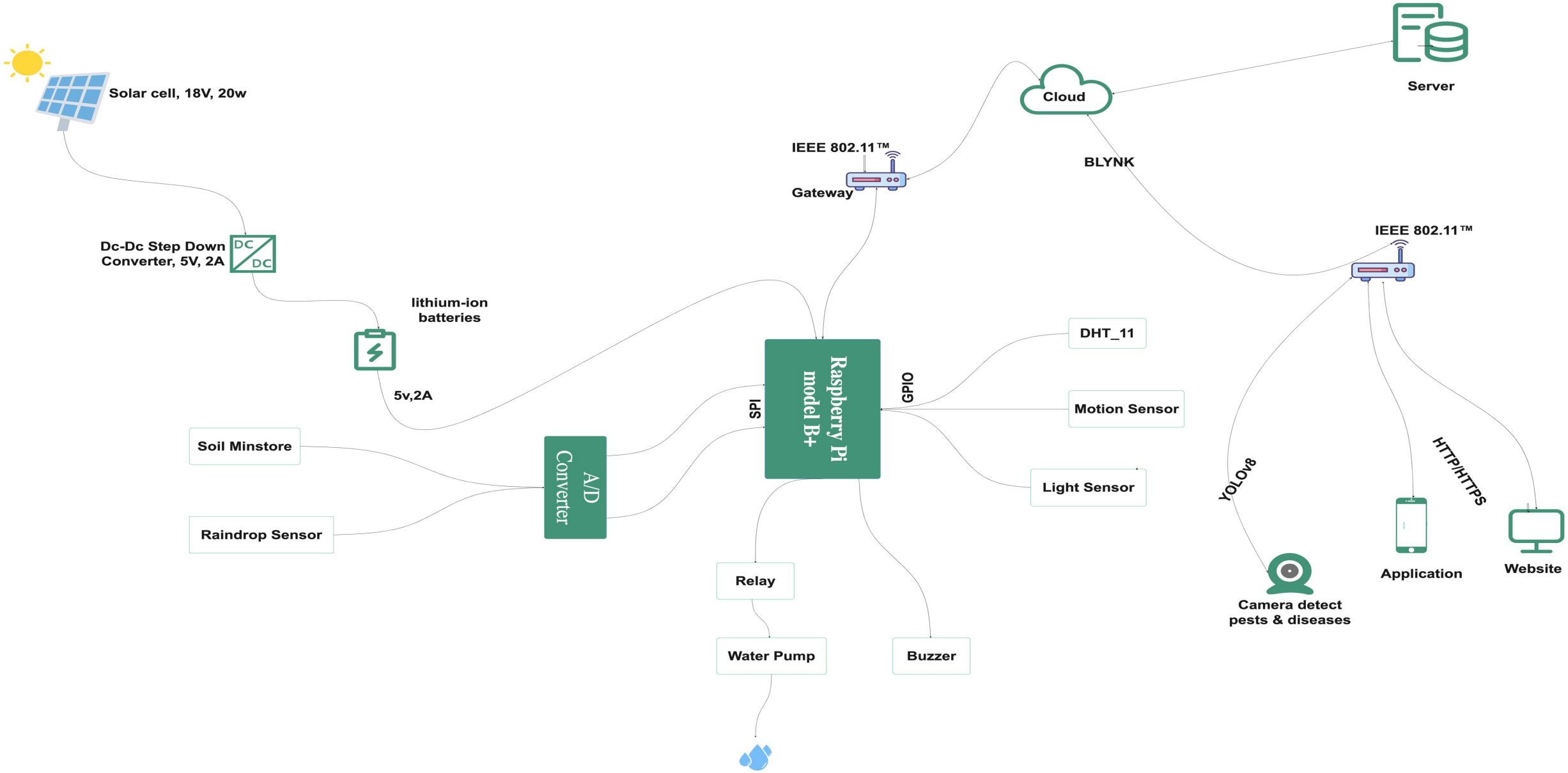
Digital Revolution

Genetically Modified Crop products, Introducing autonomous farming process, Big Data, Artificial Intelligence, Blockchains are some of the aspects of the latest revolution in Agriculture.

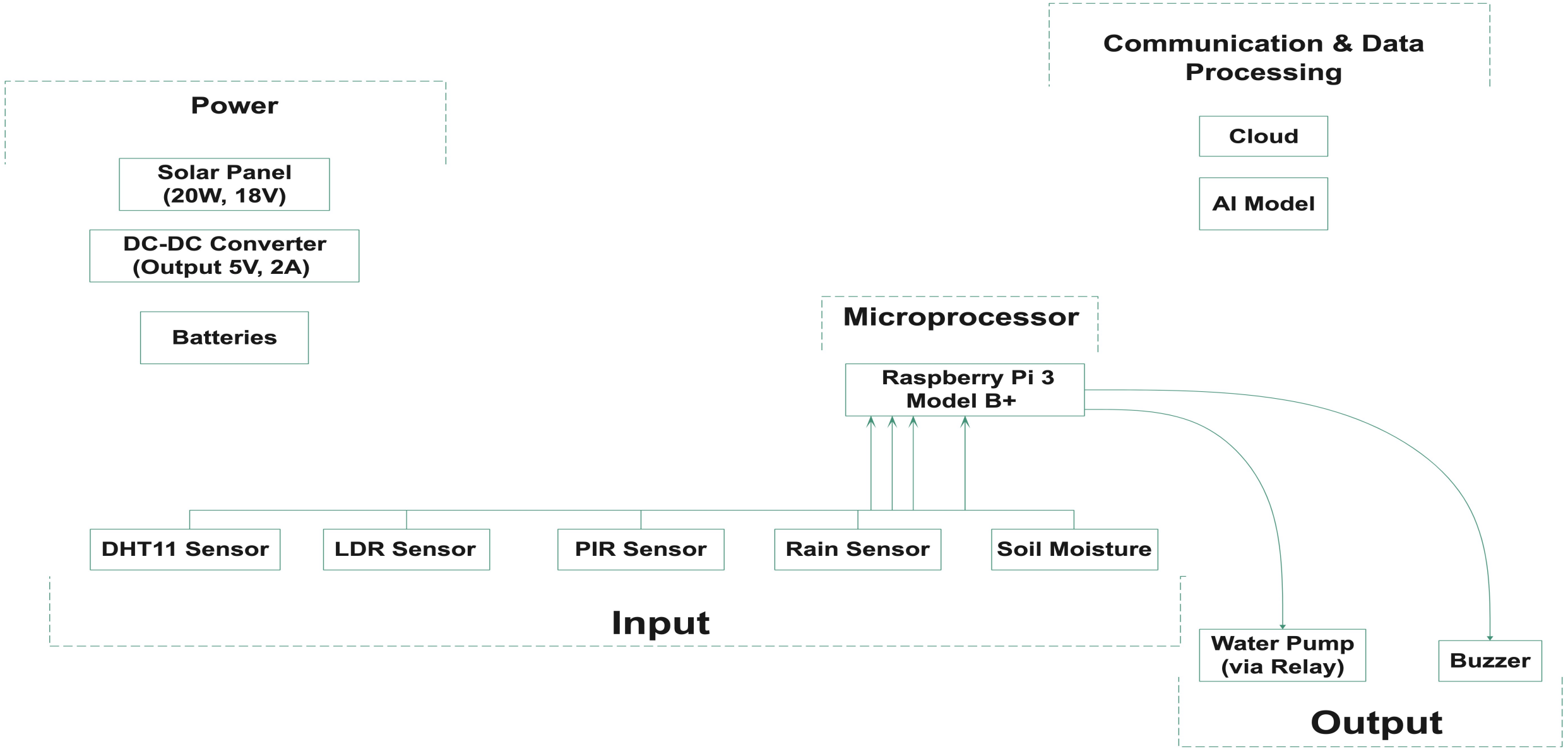
Problem Statement



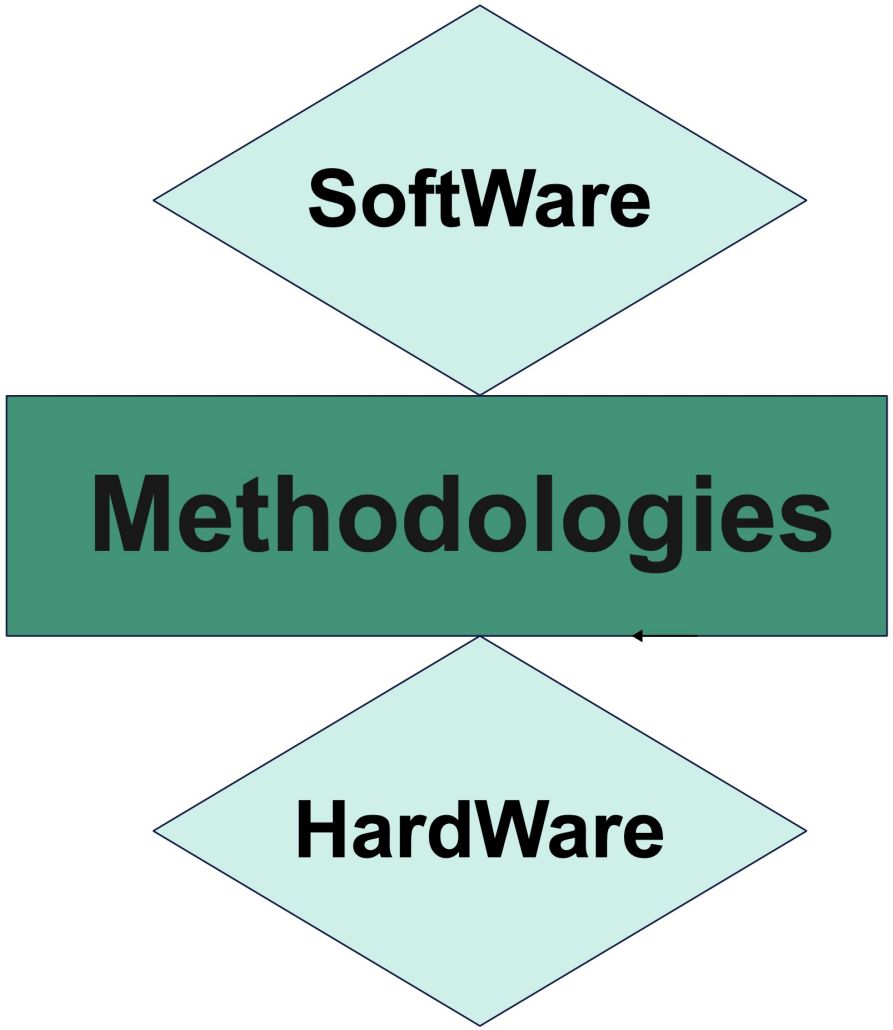
System Design



Block Diagram



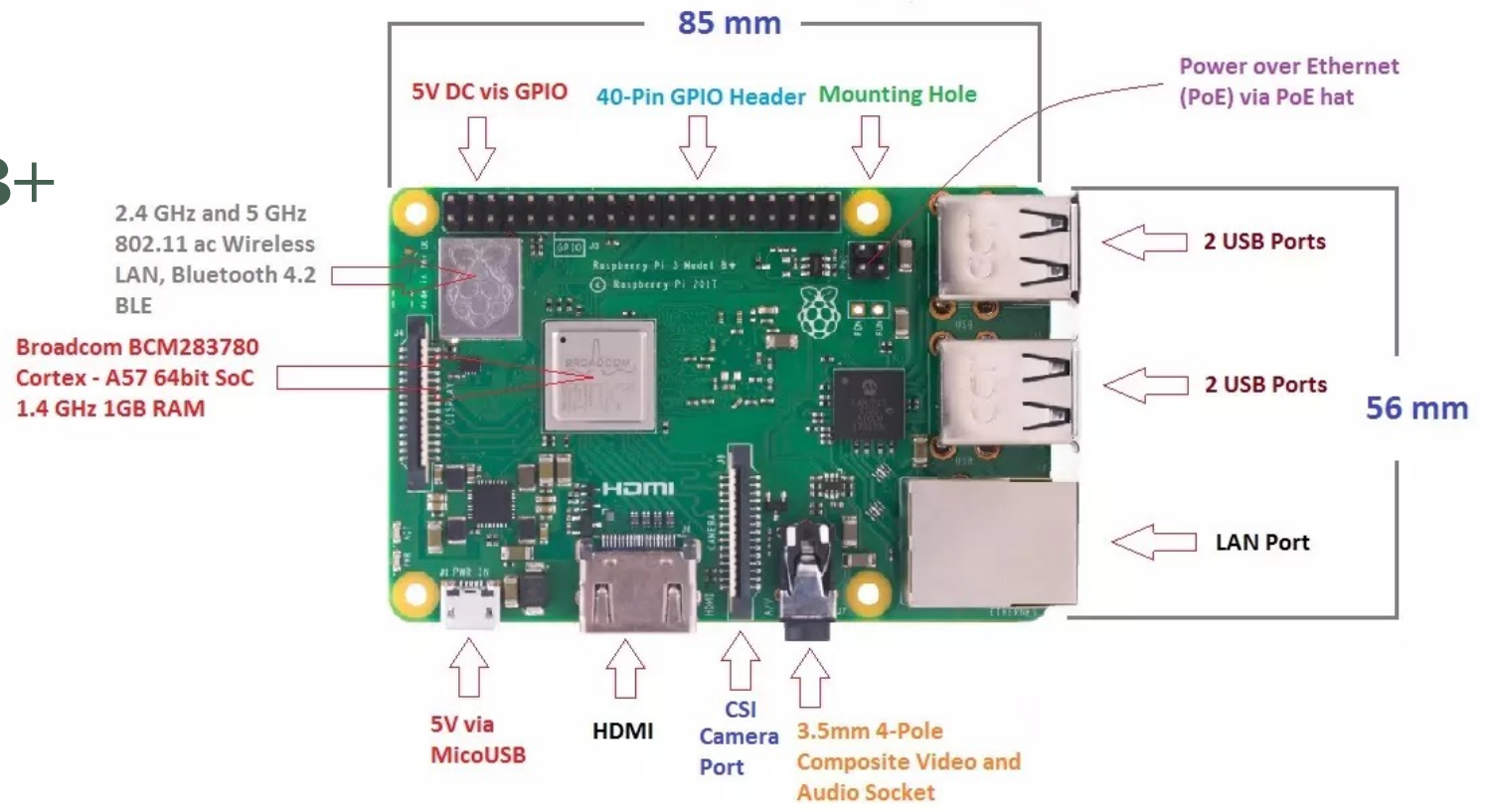
Methodologies



Hardware

Microprocessor

- Raspberry pi 3 model B+
- **ARM Architecture**
- Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.2GHz

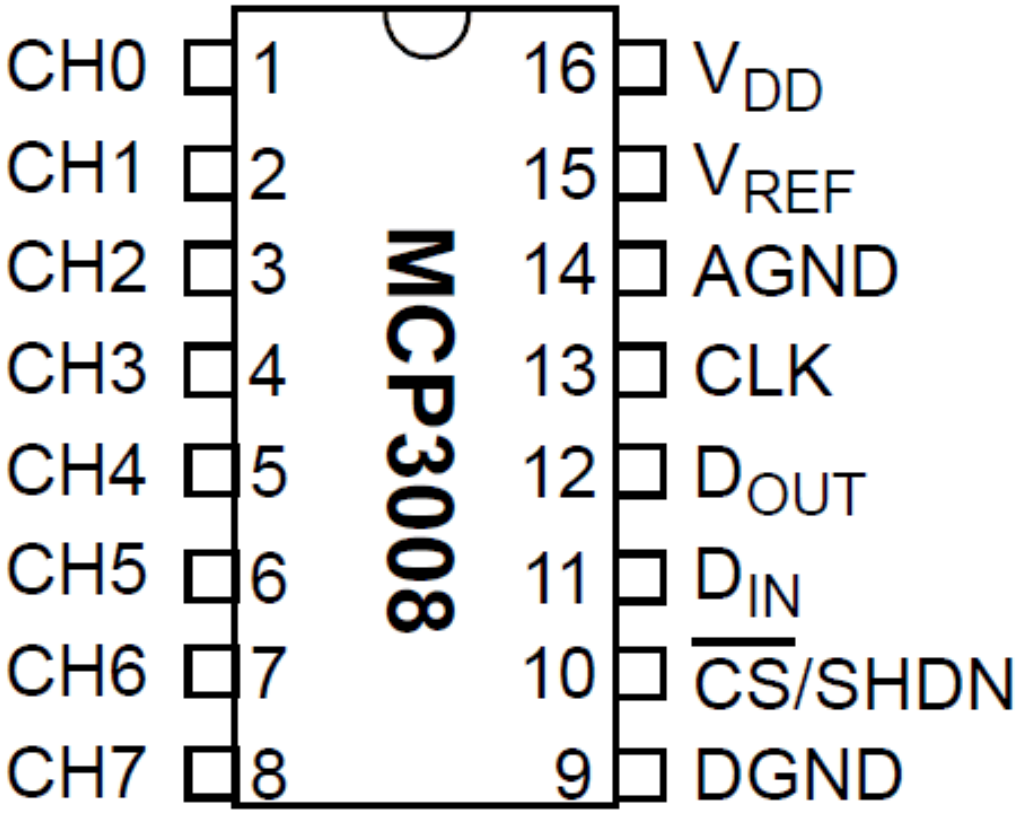


Hardware

Integrated circuit

- **Analog to Digital Converter**

- MCP3008
- Operating voltage 3.3V to 5V
- 8-Channel 10-bit ADC IC
- Communication protocol: Serial SPI interface

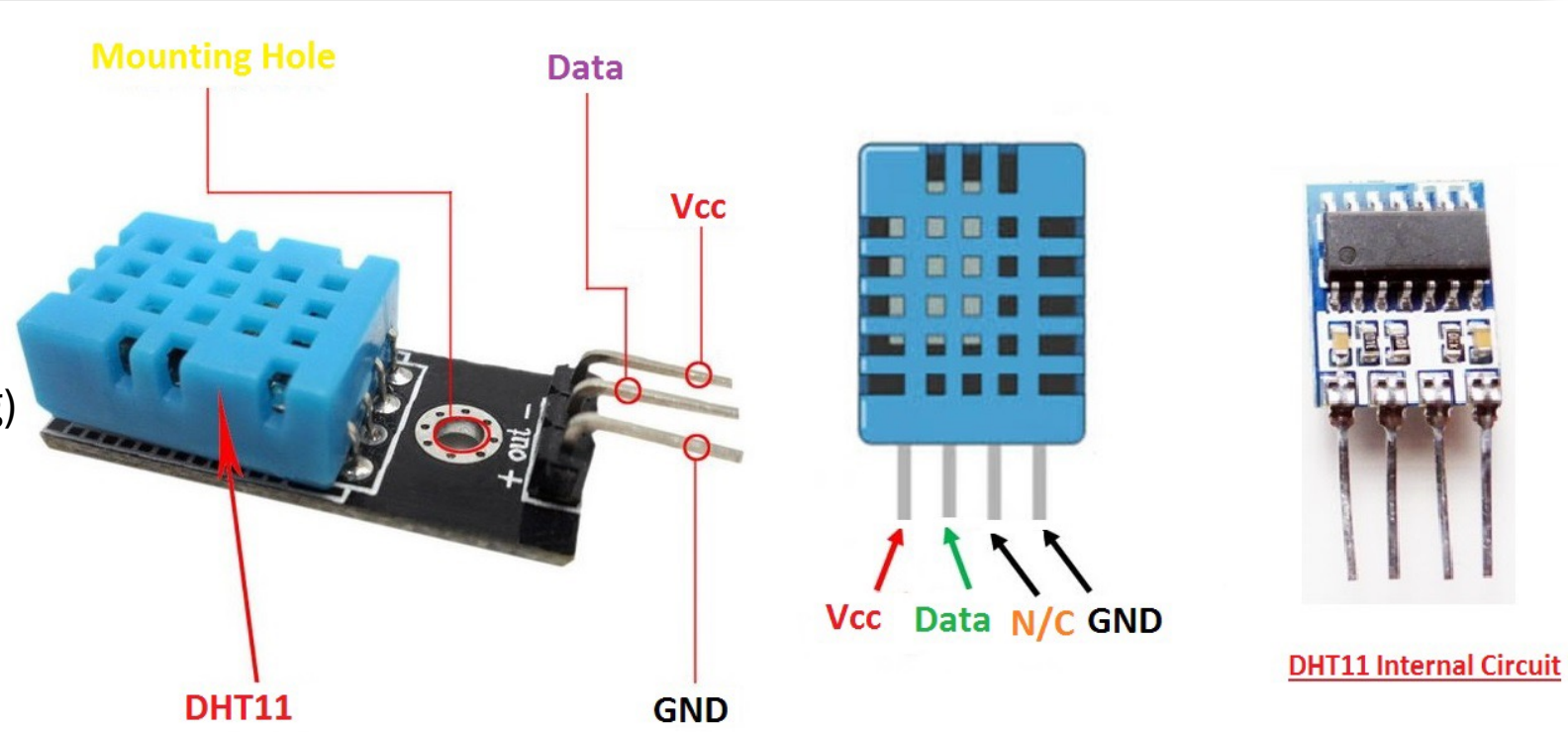


Hardware

Sensors

- **DHT11 Temperature and Humidity Sensor**

- Operating Voltage: 3.3V to 5V
- Operating current: 0.3mA (measuring)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Accuracy: ±1°C and ±1%

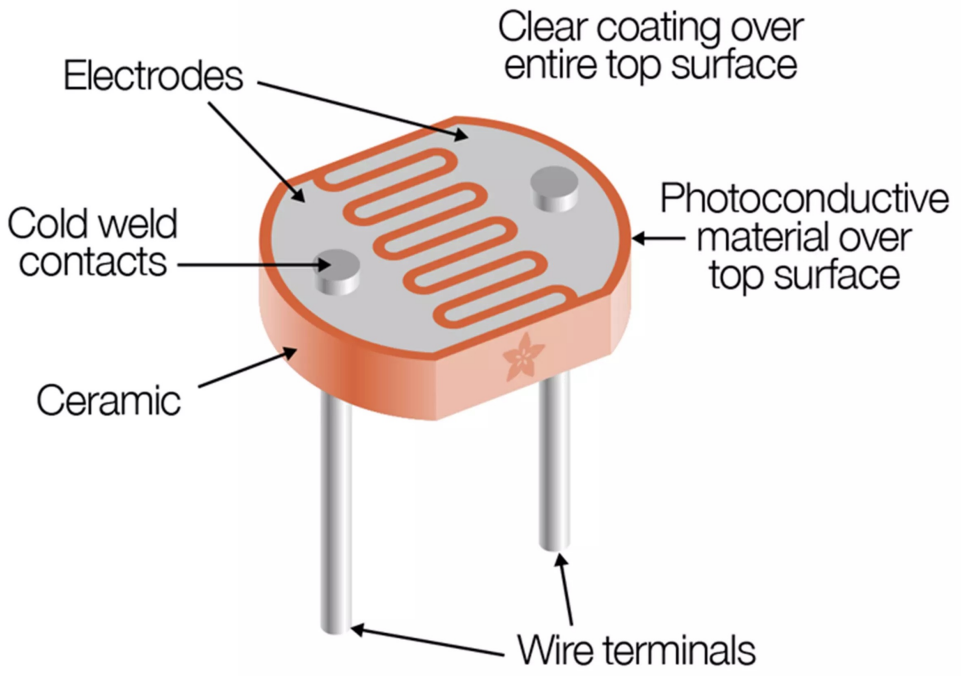


Hardware

Sensors

- **ldr (light dependent resistor)**

- Peak wavelength 600nm
- Output: Digital data

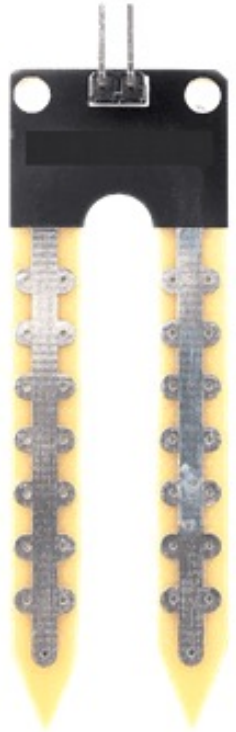


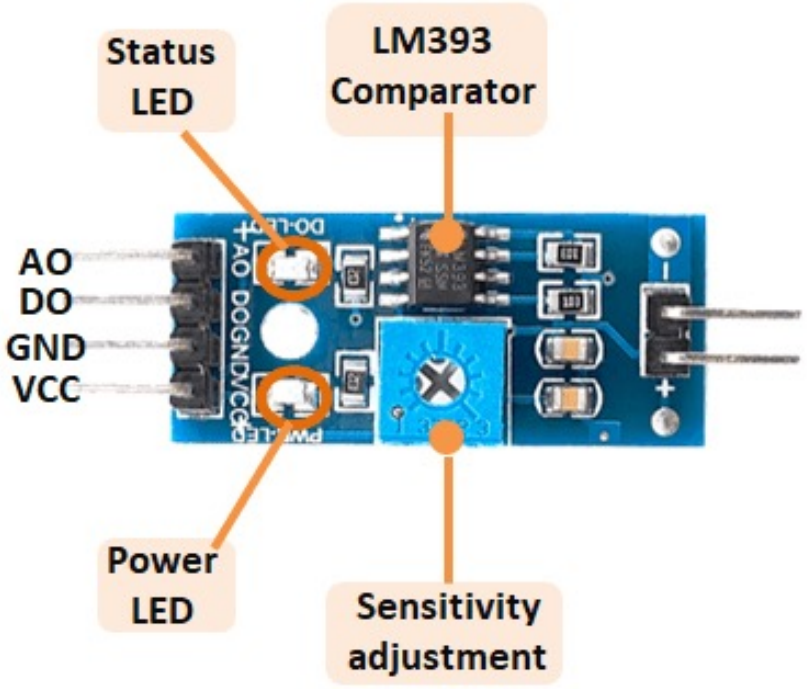
Hardware

Sensors

- **Soil Moisture Sensor**

- Operating Voltage: 3.3V to 5V DC
- Operating Current: 15mA
- Output Digital: Analog



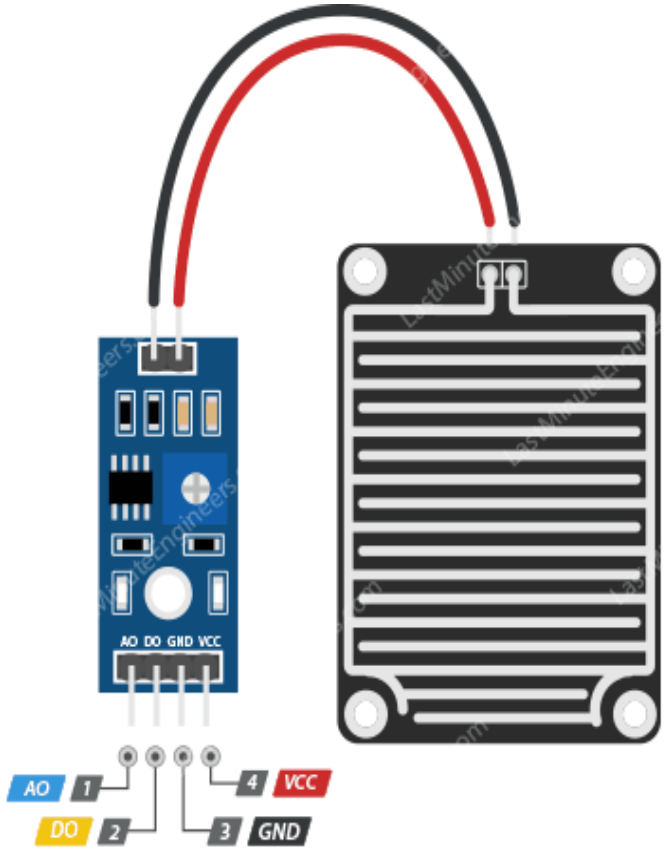


Hardware

Sensors

- **Raindrop Sensor**

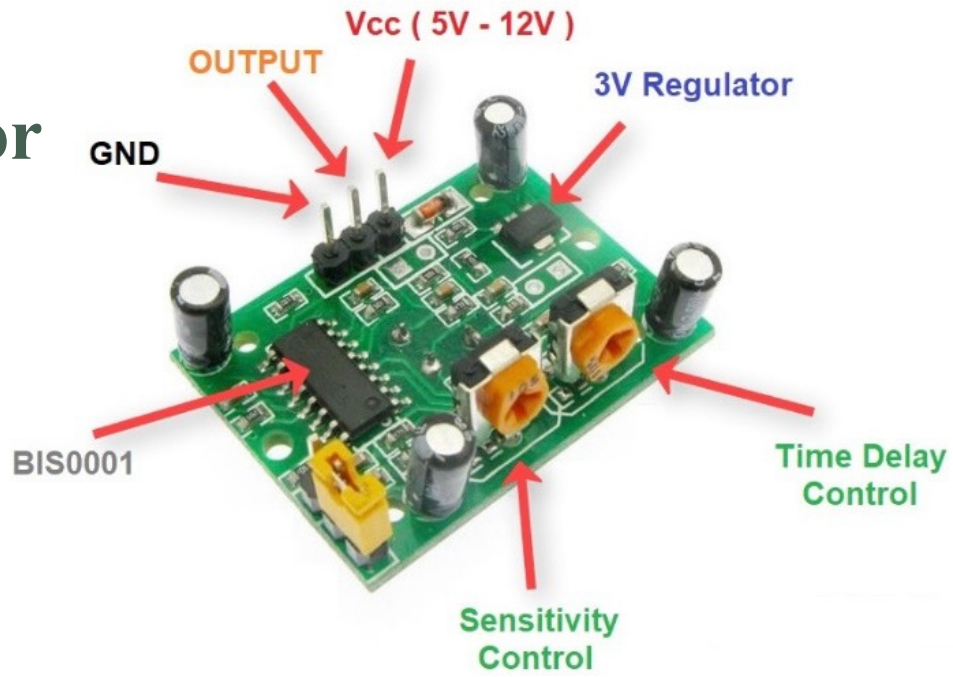
- Operating Voltage: 5V DC
- Operating Current: 15mA
- Output Digital: Analog



Hardware

Sensors

- **PIR motion detect sensor**
  - Passive infrared sensor
  - **HC-SR501**
  - Operating Current: 65mA
  - Cover distance: 120° and 7 meters



Hardware

Actuator

- **Buzzer**

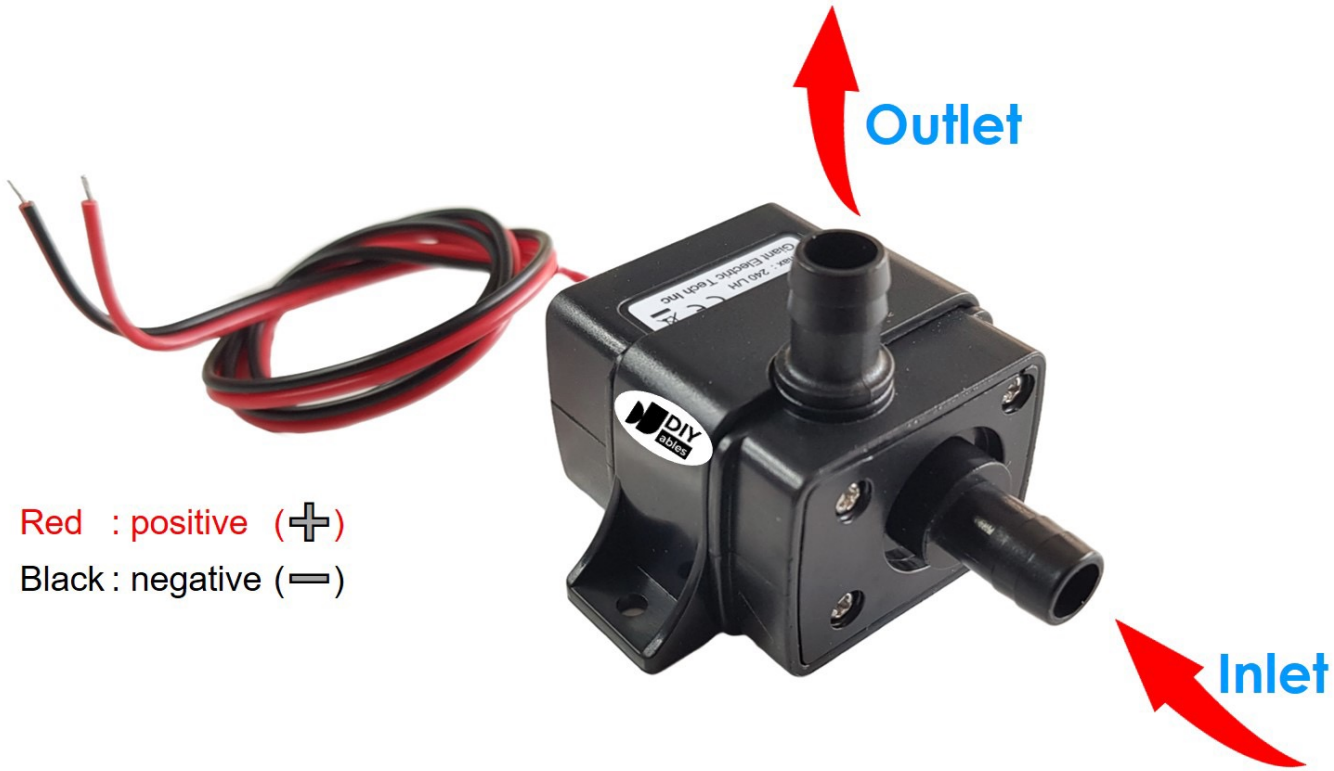
- Operating Voltage: 4-8V DC
- Operating Current: <30mA
- Sound Type: Continuous Beepz
- Resonant Frequency: ~2300 Hz

Hardware

Actuator

- **Water Pump**

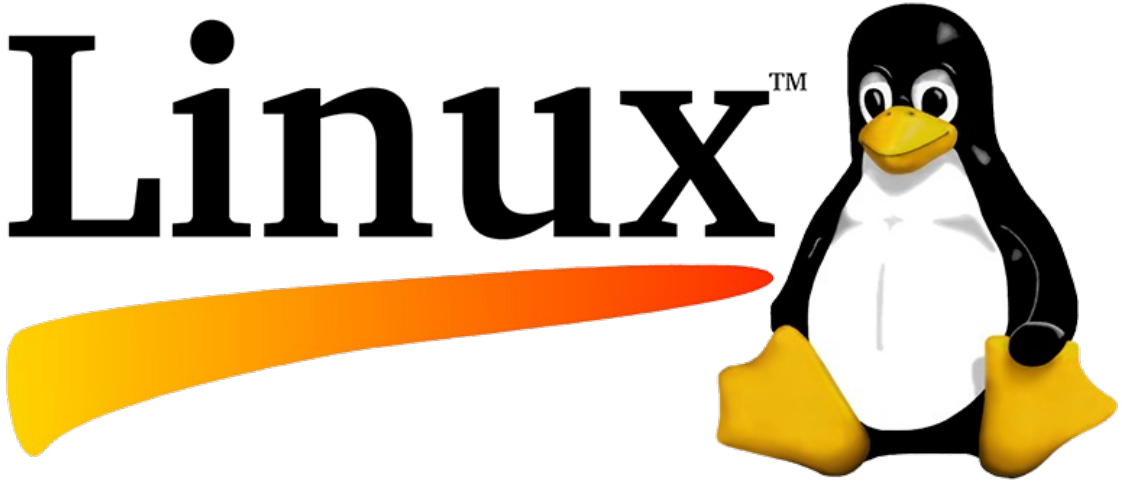
- Input Voltage: 12VDC
- Input current: 2A
- Max static flow rate: 240±20 L/H
- Hmax. (head): 3 meters (Maximum Water Pumping Height)



Software

Operating System

- Raspberry Pi OS (Raspbian): Provides a Linux-based environment for running applications and interfacing with hardware.



Software

Programming Languages and Libraries

- Python: Primary language for sensor data acquisition, actuator control, and communication with Blynk.

- Libraries: Adafruit_DHT for DHT11, RPi.GPIO for GPIO control, BlynkLib for Blynk integration, and others as needed.

Software

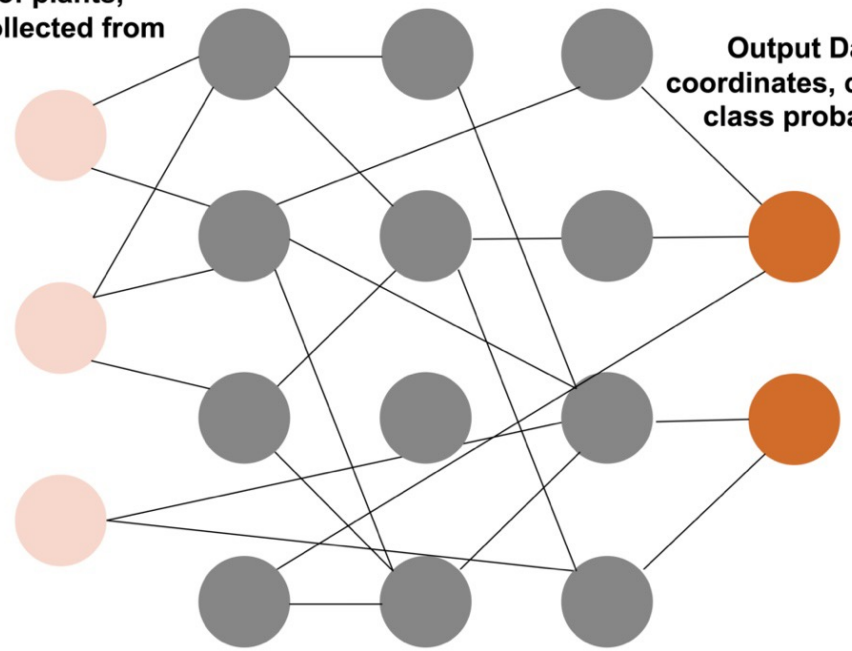
Blynk IoT Platform

- Enables real-time visualization and control of the IoT smart agriculture system via mobile or web.

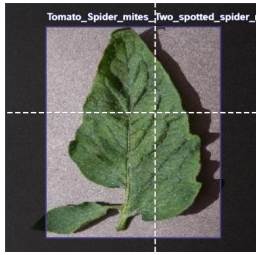
Machine Learning Model

Hidden Layers: Composed of convolutional layers. The number of layers and filters depends on the specific YOLO model (e.g., YOLOv8).

Input Data: Images of plants, pests, and diseases collected from Kaggle.



Output Data: Bounding box coordinates, confidence scores, and class probabilities for detected objects.



Input Cell

Output Cell

Hidden Cell

Machine Learning Integration

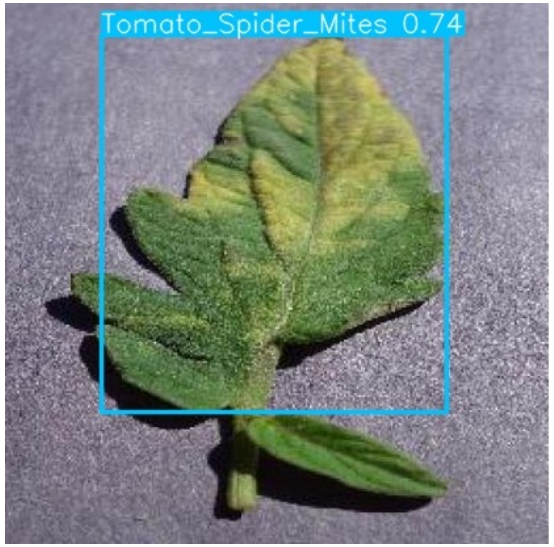
Data Collection

- Source: Kaggle
- Details: Collected 80,000 images of plants, pests, and diseases

Machine Learning Integration

Data Preprocessing

- Labeling: Used Roboflow for accurate data labeling.

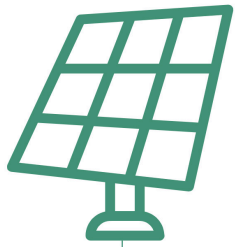


Machine Learning Integration

Model Training

- Tool: Ultralytics YOLOv8 library
- Process: Trained model on processed dataset for ten epoch.

Power

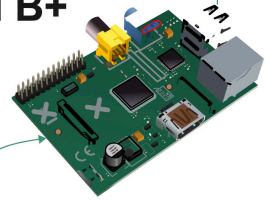


Solar Cell, 18V, 20W

Dc-Dc Step down converter, 5V,1.1A

Lithium Batteries

Raspberry pi 3 model B+



Sensors & Actuators

Power

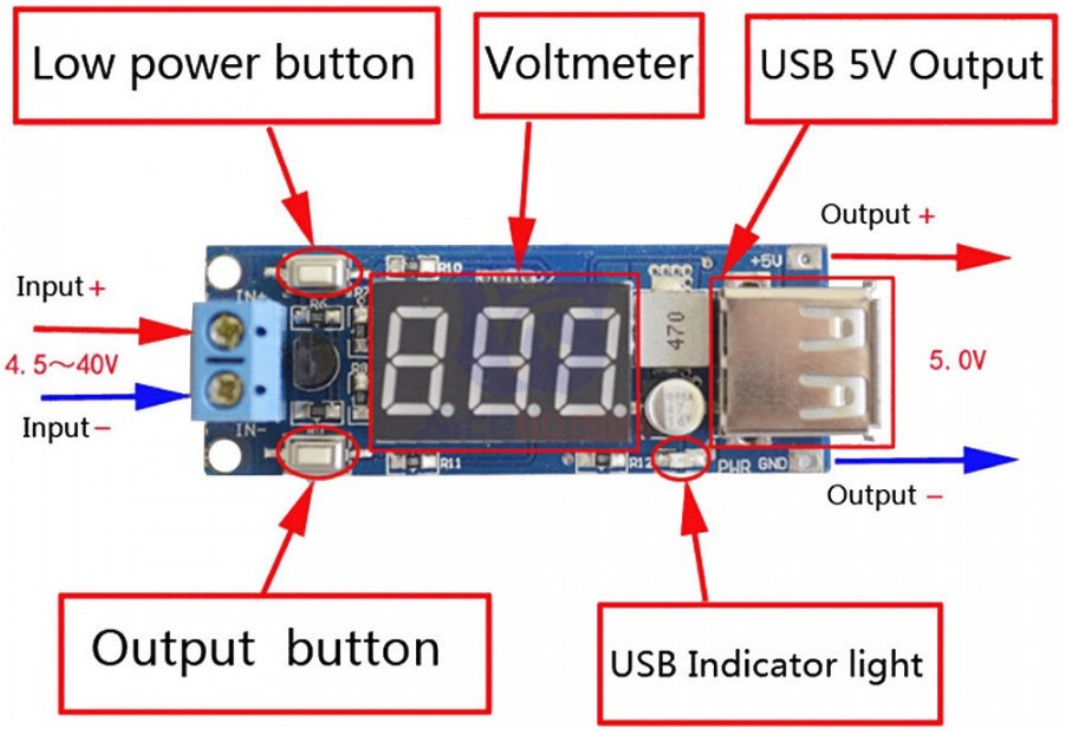
Solar Panel

- Specifications: 20W, 18V solar panel.
- Role: Harvests solar energy to charge the power bank and power the Raspberry Pi and other components.
- Positioning: Install in an optimal location with maximum sun exposure

Power

DC to DC Converter

- Model: HW-318 DC-DC Step Down Converter.
- Specifications: Input 4.5-40V, Output 5V/2A.
- Rooutputle: Converts the 18V output from the solar panel to a stable 5V/2A suitable for charging the power bank and powering the Raspberry Pi.

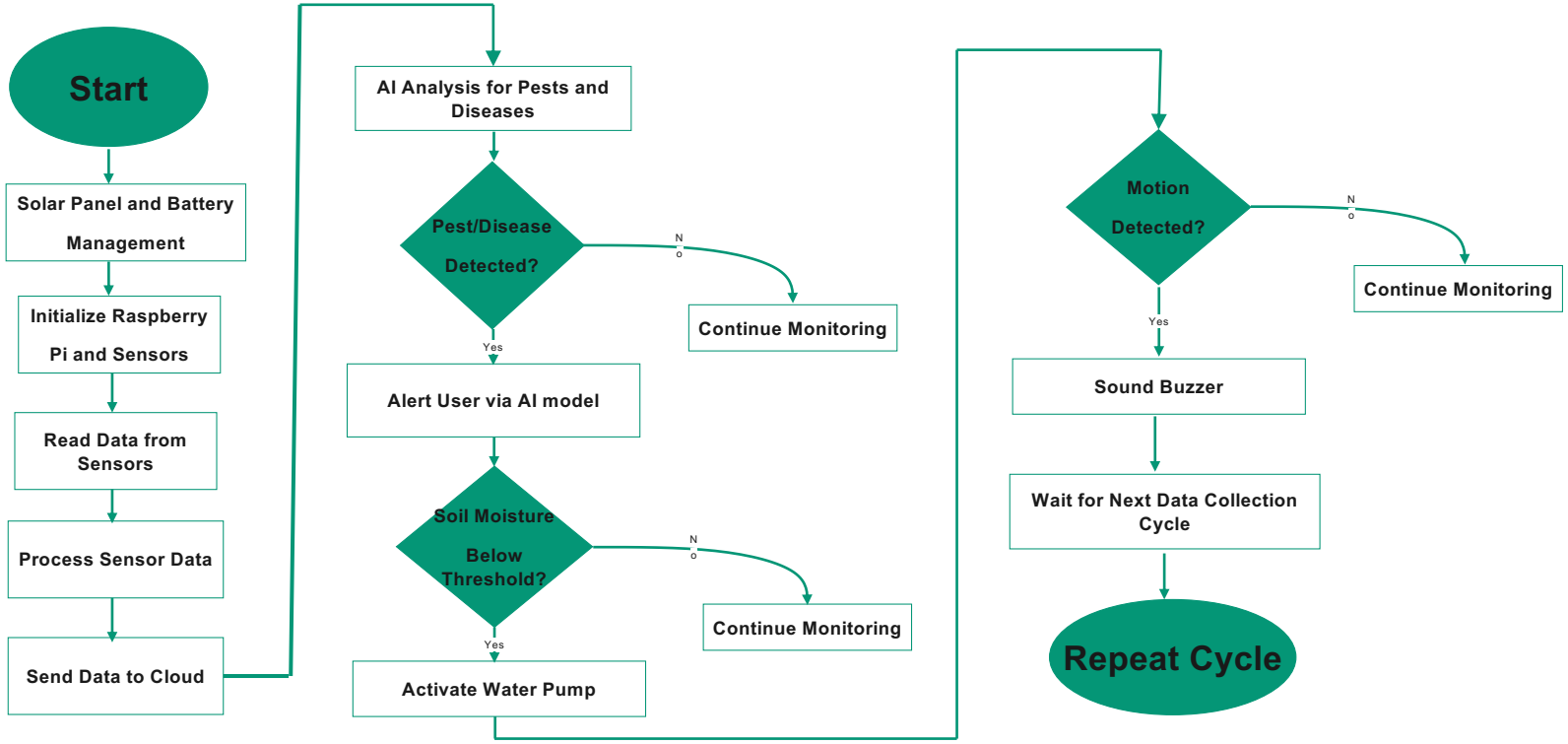


Power

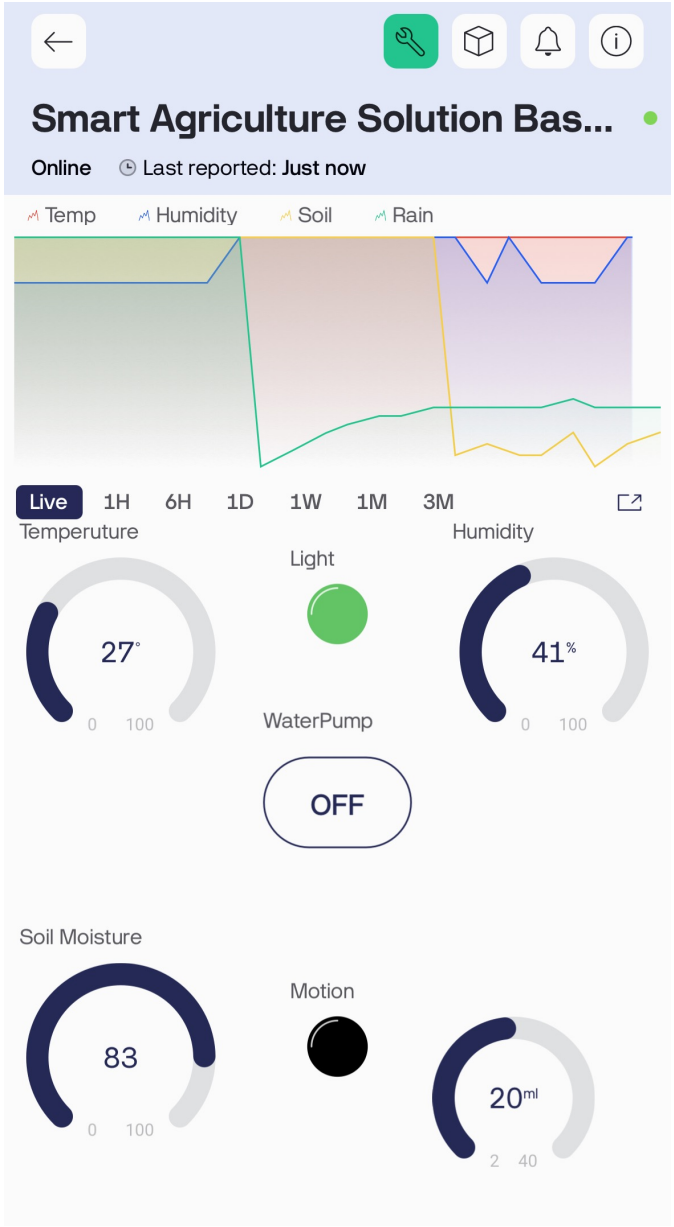
lithium batteries

- Specifications: Capacity: 10000mAh, Output: 5V/2A
- Role: Stores energy to provide a backup power source,
- ensuring continuous operation during periods of low sunlight.
- Battery Type: Lithium-ion

Flowchart


Start
Solar Panel and Battery Management
Initialize Raspberry Pi and Sensors
Read Data from Sensors
Process Sensor Data
Send Data to Cloud
AI Analysis for Pests and Diseases
Pest/Disease Detected?
No
Continue Monitoring
Yes
Alert User via AI model
Soil Moisture Below Threshold?
No
Continue Monitoring
Yes
Activate Water Pump
Motion Detected?
No
Continue Monitoring
Yes
Sound Buzzer
Wait for Next Data Collection Cycle
Repeat Cycle

Problem solving and proposed design



Future Work

- **Scalability**

Create a modular system architecture that allows for easy addition or replacement of components, facilitating system upgrades and customization.

- **Weather Synchronization**

Sync the system with weather data providers to monitor real-time weather conditions and forecasts.

- **Educational Resources**

Integrate a video library within the mobile app or web platform, providing farmers with educational content on best agricultural practices.

Conclusion

The IoT Smart Agriculture project represents a significant step forward in modernizing farming practices through the integration of advanced technologies. By harnessing the power of the Raspberry Pi 3 Model B+ and a suite of sensors, including the DHT11, soil moisture, LDR, and PIR motion sensors, we achieved real-time monitoring and precise control over environmental conditions.

Key highlights of the project

Automated Irrigation: Using data from soil moisture sensors to optimize water usage, leading to improved crop yields and water conservation.

Sustainable Energy: The integration of solar power, supported by a DC to DC converter and 10000mAh power bank, ensured reliable and environmentally friendly energy supply.

Remote Management: Leveraging the Blynk IoT platform for remote monitoring and control, enabling farmers to monitor their crops and make informed decisions from anywhere

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Thank you