Smart Crop Health Monitoring and Automated Irrigation System

HARDWARE INTEGARTION USING ARDUINO :

1. Code :

#include <SoftwareSerial.h>

#define MOTOR\_EN 8

#define MOTOR\_IN1 9

#define MOTOR\_IN2 10

#define IR\_SENSOR\_LIGHT A0

#define IR\_SENSOR\_OBSTACLE A1

SoftwareSerial BT(2, 3);

bool motorRunning = false;

unsigned long motorStopTime = 0;

void setup() {

pinMode(MOTOR\_EN, OUTPUT);

pinMode(MOTOR\_IN1, OUTPUT);

pinMode(MOTOR\_IN2, OUTPUT);

pinMode(IR\_SENSOR\_LIGHT, INPUT);

pinMode(IR\_SENSOR\_OBSTACLE, INPUT);

Serial.begin(9600);

BT.begin(9600);

BT.println("Connected. Please enter your city name:");

}

void loop() {

if (BT.available()) {

String input = BT.readStringUntil('\n');

input.trim();

if (input.startsWith("DATA:")) {

displayWeatherData(input);

} else if (input.startsWith("ON")) {

runMotor(input);

}

}

if (motorRunning && millis() > motorStopTime) {

stopMotor();

BT.println("Motor stopped after set duration.");

}

int obstacleVal = analogRead(IR\_SENSOR\_OBSTACLE);

if (motorRunning && obstacleVal < 400) {

stopMotor();

BT.println("Obstacle detected! Motor stopped.");

}

}

void displayWeatherData(String input) {

BT.println("---- Weather and Sensor Data ----");

DATA:City=Delhi,Temp=32,Moisture=25,IR=1,Pressure=1012,...,Status=Irrigation Needed,Comment=Dry soil

input.remove(0, 5); // Remove "DATA:"

input.replace(",", "\n");

BT.println(input);

int lightValue = analogRead(IR\_SENSOR\_LIGHT);

String healthStatus = "";

if (lightValue > 800) {

healthStatus = "Crop Health: Healthy (High light intensity)";

} else if (lightValue > 500) {

healthStatus = "Crop Health: Moderate (Medium light intensity)";

} else {

healthStatus = "Crop Health: Unhealthy (Low light intensity)";

}

BT.println(healthStatus);

if (input.indexOf("Status=Irrigation Needed") != -1) {

BT.println("Irrigation is needed. Type 'ON <seconds>' to start motor.");

} else {

BT.println("No irrigation needed.");

}

}

void runMotor(String cmd) {

int duration = cmd.substring(3).toInt();

if (duration > 0) {

BT.println("Motor running for " + String(duration) + " seconds.");

digitalWrite(MOTOR\_EN, HIGH);

digitalWrite(MOTOR\_IN1, HIGH);

digitalWrite(MOTOR\_IN2, LOW);

motorRunning = true;

motorStopTime = millis() + (duration \* 1000);

} else {

BT.println("Invalid duration.");

}

}

void stopMotor() {

digitalWrite(MOTOR\_EN, LOW);

digitalWrite(MOTOR\_IN1, LOW);

digitalWrite(MOTOR\_IN2, LOW);

motorRunning = false; }

3. Hardware Components:

Arduino Uno

L293D Motor Driver

DC Motor

IR Sensor 1 (Crop health - Light intensity)

IR Sensor 2 (Obstacle detection)

HC-05 Bluetooth Module

9V Battery (for motor power)

Jumper wires and Breadboard

4. Hardware Connections:

🔹 1. Motor & L293D:

L293D Pin Connects To

IN1 (pin 2) Arduino pin 9

IN2 (pin 7) Arduino pin 10

EN1 (pin 1) Arduino pin 8 (MOTOR\_EN)

VCC1 (pin 16) Arduino 5V

VCC2 (pin 8) 9V battery +ve

GND (pin 4,5,12,13) Arduino GND + battery GND

OUT1 & OUT2 DC Motor terminals

🔹 2. IR Sensor for Crop Health (Light Intensity):

IR Sensor Pin Connects To

VCC Arduino 5V

GND Arduino GND

OUT Arduino A0

🔹 3. IR Sensor for Obstacle Detection:

IR Sensor Pin Connects To

VCC Arduino 5V

GND Arduino GND

OUT Arduino A1

🔹 4. HC-05 Bluetooth Module:

HC-05 Pin Connects To

VCC Arduino 5V

GND Arduino GND

TX Arduino pin 2 (RX) (via voltage divider)

RX Arduino pin 3 (TX)

🔹 5. Powering the Motor:Use a 9V battery or separate 6V-12V source connected to VCC2 on L293D.

Connect the battery GND to Arduino GND to complete the circuit.

5. Block diagram :

6. Results :

* **Arduino Uno** – Main controller for sensors and motor.
* **HC-05 Bluetooth** – Connects Arduino to mobile app.
* **IR Sensor A0** – Detects **light intensity** to assess **crop health**.
* **IR Sensor A1** – Detects **obstacles** during irrigation.
* **L293D Motor Driver** – Drives the **DC motor** (water pump).
* **DC Motor** – Runs for user-defined time to water crops.
* **Mobile App (Serial Bluetooth Terminal)** –  
  Sends commands, shows weather/sensor data, and alerts.
* **OR Logic** – Irrigation is needed if **soil is dry OR crop health is bad**.