Crop Monitoring System using Arduino and NodeMCU ESP8266 (Empowering Agriculture with Smart Technology)

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Contents

Introduction

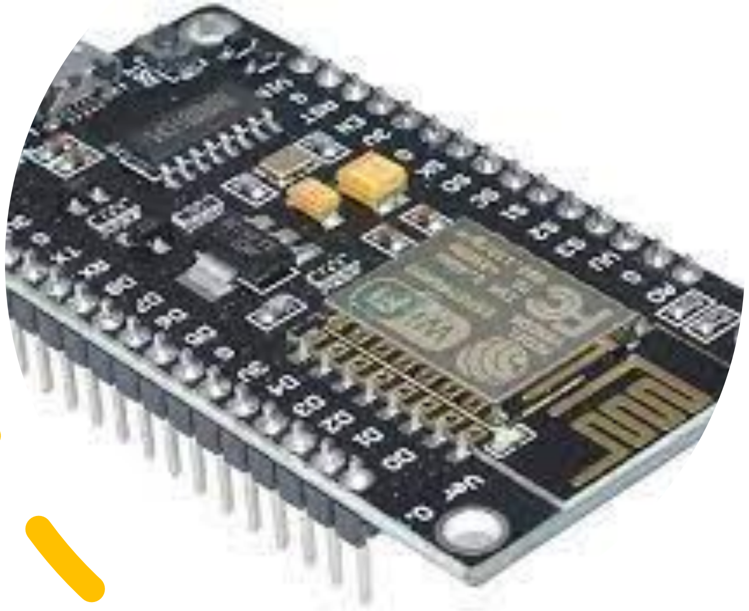
- Precision agriculture is most important in this era, as there is more population growing and agricultural land being conquire by urbanization.
- In this project we are trying to develop precision agriculture to some extent.
- We have deployed sensors like temperature, moisture, light, motion, etc. After sensing the physical variable of the crop we are trying to give some decisions to the farmer, in the 'Serial Monitor' for demonstration purpose.
- We assumed the mushroom farming scenario in this demo project.

Objectives

- The main objectives of our project are:
  - Crop monitoring with the smart technology with less human involvement.
  - Deploy different types of sensors, for data acquisition and give the farmer the concrete decisions based on the sensor data.
  - Log the acquisitioned data to the firebase for future analysis and improvement.
  - Monitor the crop so that more crops would be produced.

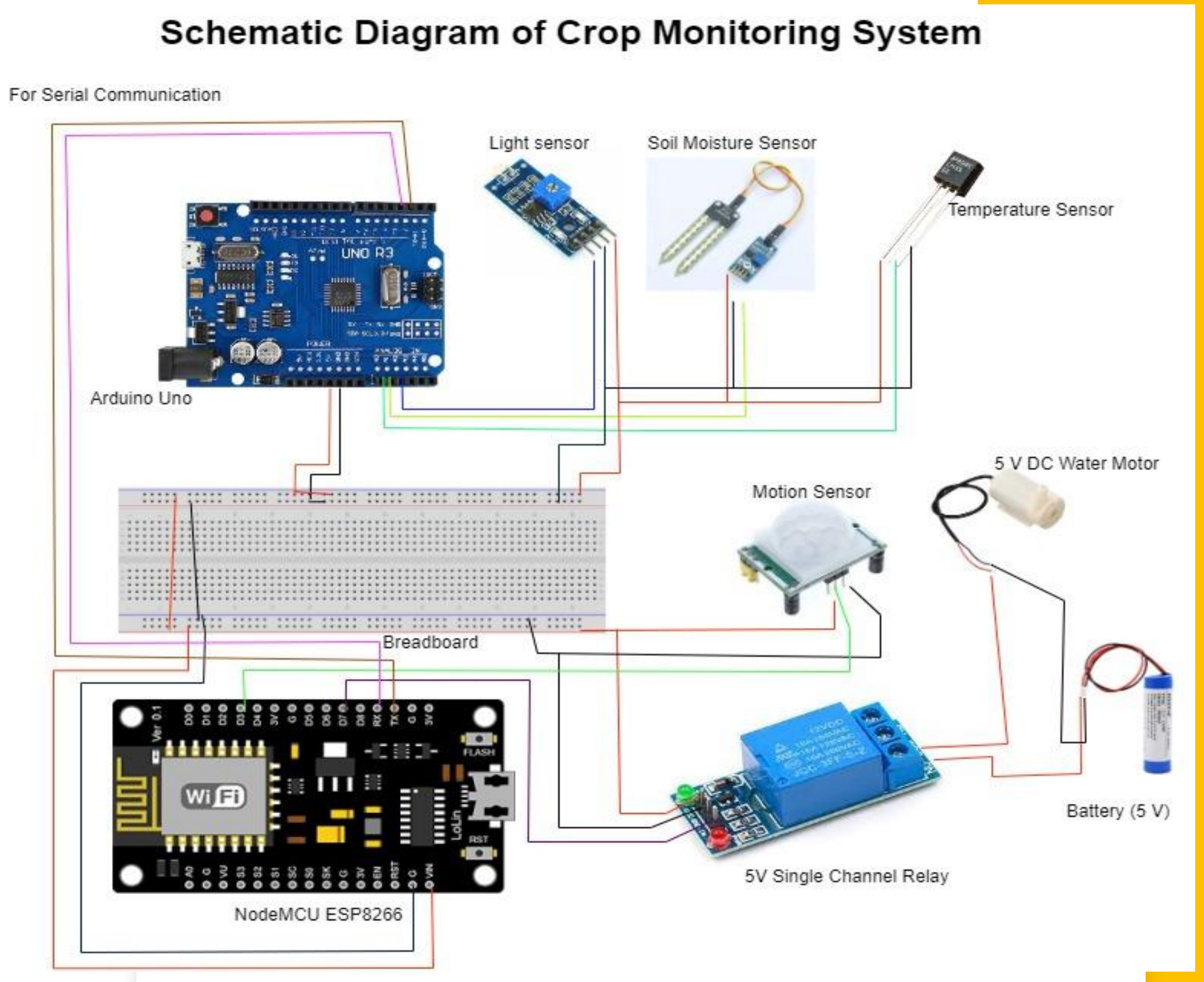
System Components

- The components of our designed system are:
  - NodeMCU ESP8266
  - Arduino
  - Temperature Sensor (LM35)
  - Light Dependent Resistor (LDR)
  - Soil Moisture Sensor
  - Motion Sensor (PIR sensor)
  - Relay 5V Single channel
  - 5V DC Water Pump
  - Breadboard
  - Some jumber wires



The connection/circuit diagram of our system is as follows:

System Architecture

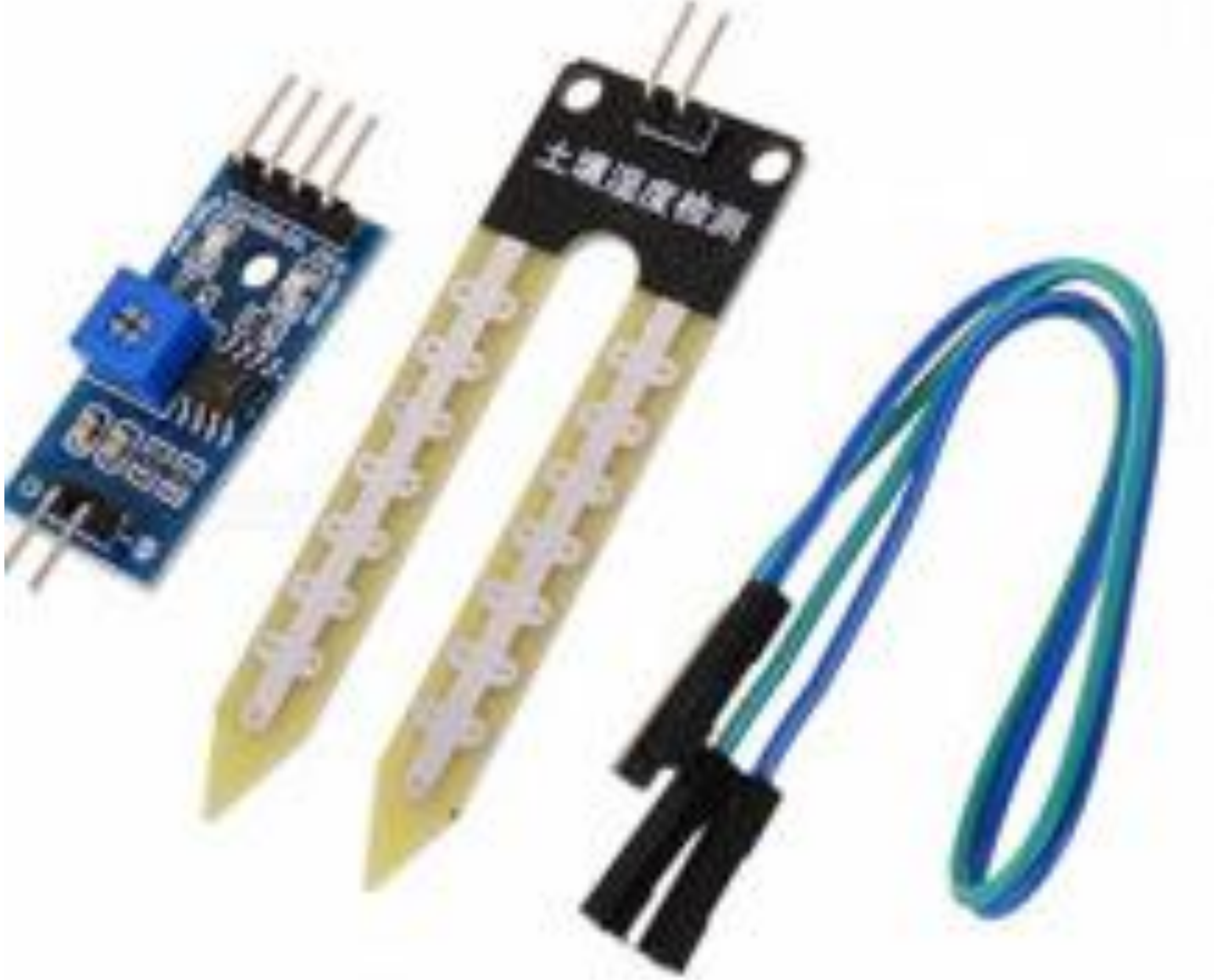


Temperature Monitoring

- LM35 is a temperature sensor that outputs an analog signal which is proportional to the instantaneous temperature.
- The output voltage can easily be interpreted to obtain a temperature reading in Celsius.

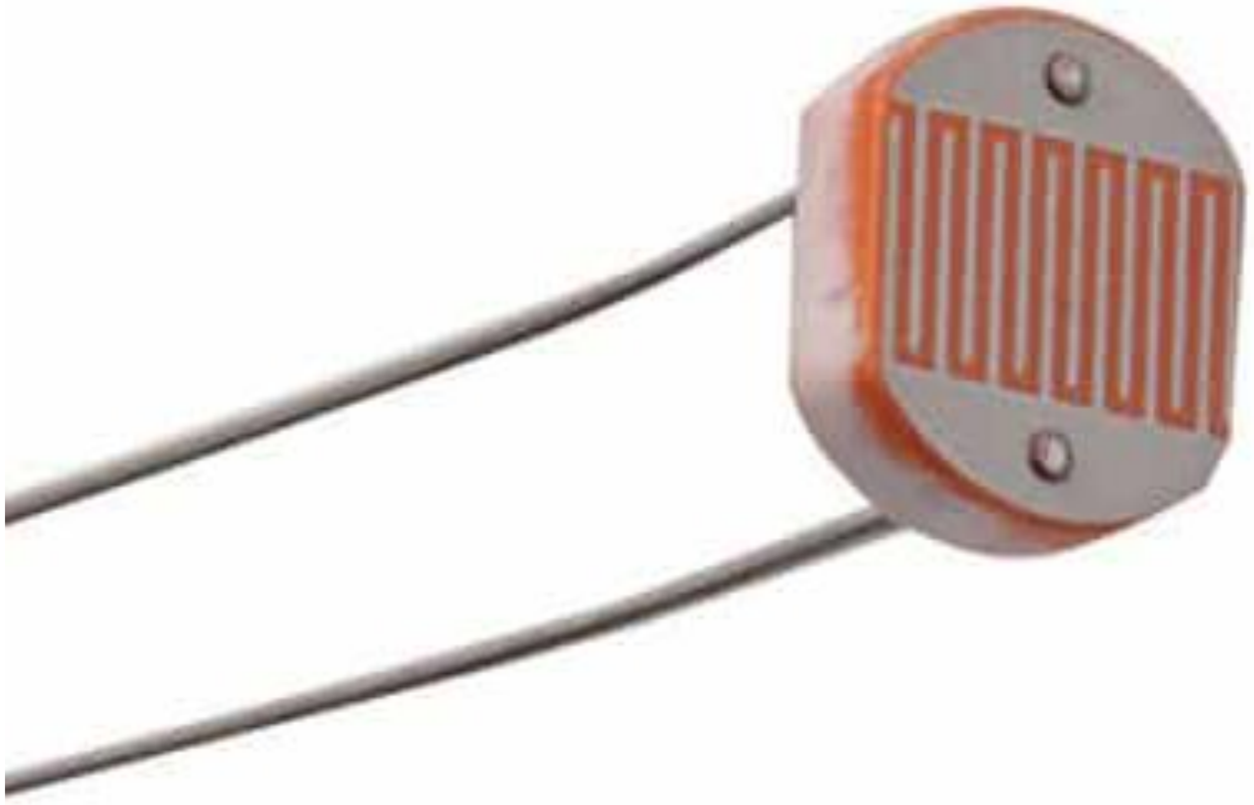
Moisture Monitoring

- Soil moisture sensor measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors.
- The Soil Moisture Sensor can be used to detect the moisture of soil.
- The sensor would outputs logic HIGH/LOW when the moisture is higher/lower than the threshold set by the potentiometer.



Light Monitoring

- LDR is an acronym for Light Dependent Resistor. LDRs are tiny light-sensing devices also known as photoresistors.
- An LDR is a resistor whose resistance changes as the amount of light falling on it changes.
- The resistance of the LDR decreases with an increase in light intensity, and vice-versa.

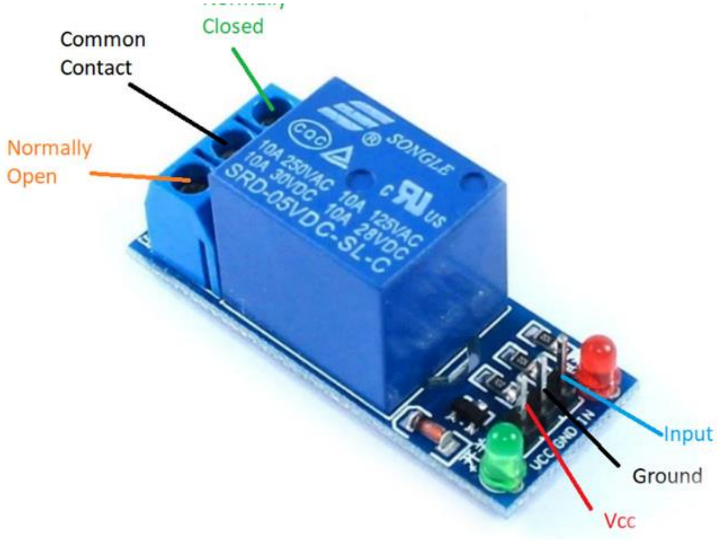


Motion Sensor

- The Passive Infrared Sensor (PIR) sensor module is used for motion detection.
- It is often referred to used "PIR", "Pyroelectric", "Passive Infrared" and "IR Motion" sensor.
- It is used to sense movement of people, animals, or other objects.
- They are commonly used in burglar alarms and automatically-activated lighting systems.

Other components

- Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch.
- 5V DC water pump.



Benefits

- Improved crop yield: Precise irrigation optimizes water usage and prevents over/under watering.
- Water conservation: Automatic irrigation only occurs when needed, saving water and energy.
- Resource efficiency: Real-time monitoring reduces the need for manual field visits.
- Data-driven decision making: Farmers can access historical data and weather forecasts to optimize crop management.
- To some extent we have developed system to give decisions to the farmers.

Challenges

- There may be many challenges to this system.
- Since our sensors are exposed to environment, it is vulnerable to damage and other intruders.
- Power supply
- Skilled manpower.

Solutions

- We have to teach new skills to the farmers to handle the sensors and other devices.
- Alternative energy sources like solar, piezo-electricity to overcome power supply problem.
- Sensors should be deployed in more secure and cattle free zones, also take care about the public movements.

Future Enhancements

- We can develop the cloud control system, so that it is easy to monitor/control the devices from the finger tip of the farmers.
- Deploy the developed system to the real field.
- Use more powerful microcontroller so that AI/ML model can be deployed for further decision making.

Conclusion

- Our developed system, is fully supporting the automation in farming with the system generated decisions for the improved farming.
- We have successfully deployed sensors like light, moisture, temperature, etc.
- Our system has become able to give appropriate decisions to the farmers.