Fayoum University

Faculty of Engineering

Project Title:

Smart Farm System

Under Supervision of:

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Project Overview:

Our project is a smart farm system that reads several agricultural sensors including a camera and feeds the data to a backend server. The server then saves the received data in a database and renders it to a website on which the farm owner can monitor his farm health and make sure that everything is going well.

Problem Definition:

The agriculture in Egypt has lots of problems that need to be solved. The agriculture sector in Egypt represents about 14.7% of the national product. There are about 8.5 million people that work in that sector which represents 32% of the Egyptian work force. Some of the problems we aim to solve are:

- No convenient way to easily monitor the current state of the farm to check on its health.
- Huge amount of effort done and time taken to keep track of time and regularly water the crops.
- Lack of sunlight.
- Waste of water in irrigation process.
- Detecting pests and notifying the owner.[1]

Project Description:

The main goal of the project is for the farm owner to be able to monitor his farm health and vital parameters. As well as to automate the irrigation process for him. All he has to do is log what seed he planted and where on the website portal then the system will adjust accordingly.

The system takes a photo of the current state of the farm every 5 minutes and the owner will be able to see the current photo through the website portal. Also, the owner will be notified if any abnormalities is detected in the sensors' readings.

Growing LEDs will provide enough light for the photosynthesis process if it gets cloudy or if it's an indoor smart farm that can't get much of sunlight.

The farm has a filtration system that will enable the reuse of the remaining water of the irrigation process. After watering the plants, the remaining water will be exposed to UV light for a duration of time to filter it. Then, it will be pumped once more to the main tank.

[1] Optional: We will incorporate a computer vision model that detects pests and notifies the owner. This feature will only be implemented later if we have enough time and resources.

The project is broken down into two main modules:

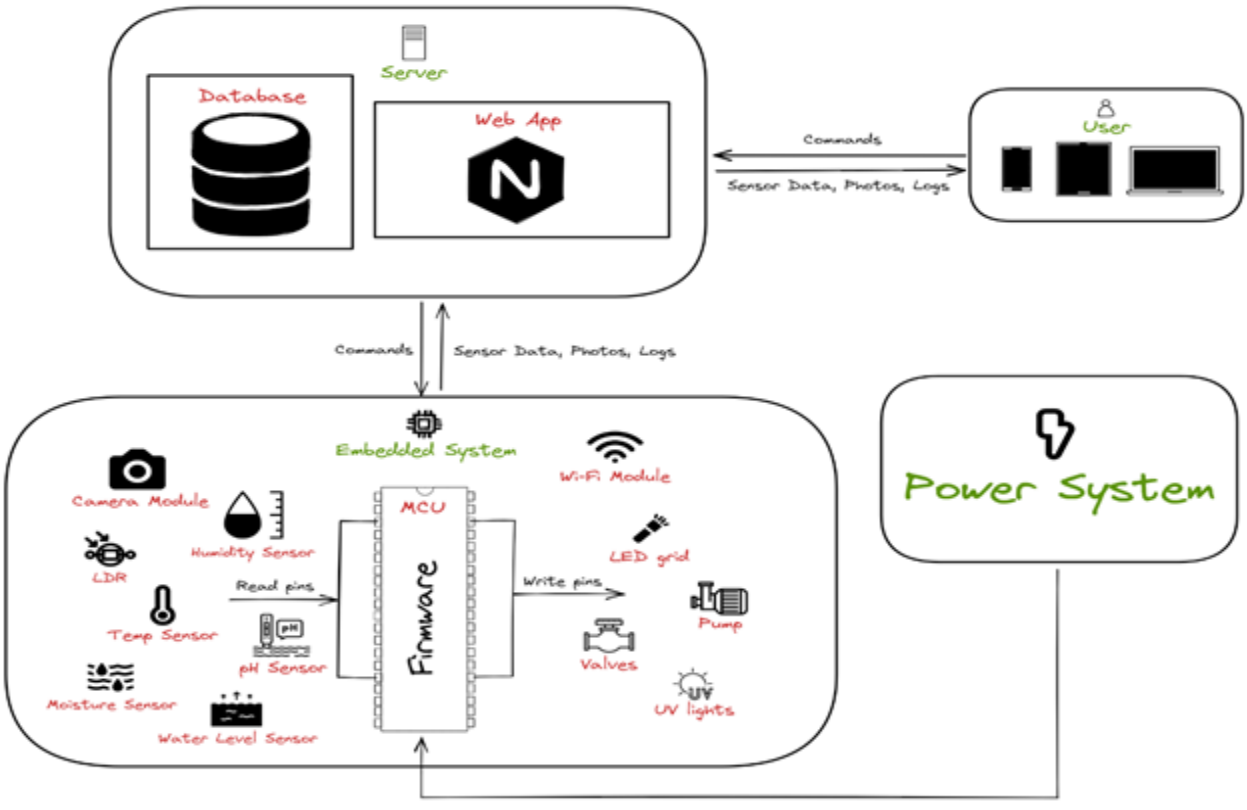
1- Software Module.
   a. ARM MCAL drivers.
   b. Server set-up.

2- Hardware Module:
   c. The farm itself.
   d. Sensors.
   e. Camera module.
   f. Wi-Fi module.
   g. Watering system.
   h. LED grow lights.
   i. Power supply system.

Additional Features:

- Plants disease/pest detection model.
- Filtration system.
- Rain drops collector.
- Power saving mode.

Project Technical Details:



The overall system is made out of four main components as shown in the previous figure.

The user logs into a website to monitor his farm. Firstly, the user will send to the server information about what seeds he has planted and where, so that the server saves it into the database and sends this information to the MCU. Then, the MCU will adjust its timer and behavior to be able to water the plants at the right time.

The user will be mostly monitoring and not really sending any data or commands to the server.

The server is responsible for receiving sensor data from the MCU and saving it into the database for future reference. It also renders the HTML files to the user.

The main component that controls the overall system and has the core logic on which the system runs is the microcontroller. It communicates with the server through the Wi-Fi module sending sensors' data and logs.

The MCU reads sensors every 30 seconds then it goes into sleep mode to save power. It also takes a photo every 5 minutes to update the camera feed on the website.

The microcontroller reads data from multiple sensors including the following:

1. Camera module.
2. Temperature sensor.
3. pH sensor.
4. Moisture sensor.
5. Humidity sensor.
6. Water level sensor.
7. LDR.

It sends control signal for the following modules:

1. LED grid.
2. Valves
3. Pump
4. UV lights

The moisture, pH, temp and humidity sensors are used to give an overall view of the current state of the farm and how healthy it is.

LDR is used to detect if there is enough light coming through to the plants. If there is not the MCU will send a control signal to light up the LED grid giving the plant the light they need for photosynthesis.

There are two tanks in the system. The first one is the main tank that supplies water for the plants. The second tank has the remaining water used in the irrigation process. And the remaining water in the second tank is exposed to UV lights for filtration.

Water level sensor is used to detect if the main water tank is running low. If it is, the MCU will send a control signal to the pump to refill the empty tank with filtered water found in the second tank.

The MCU sends a control signal to open or close a particular valve according to the data the user has sent previously.

The power supply is going to be either a rechargeable battery or from the wall using a step-down transformer with a voltage regulator. Or we can incorporate both so that as long as there is power, the MCU get the power from the wall. If there's a blackout, the MCU switches its power input to the battery.

Project Timeline: