Smart Farm

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Acknowledgment

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Contents

Abstract

Technology has been used in almost every field in our life, Which makes our life much easier. The project aims to eliminate the repetitive process of farming and make the farmer's life easier and save time which can be spent on more important things.

Smart Farm will measure the humidity of the soil and will water the plants based on the soils need using a grid system which means that the pump will move to the cell that has a low humidity in the soil and water the plant till the moister in the soil to have the right amount, as well as there is a light that well turn on based on how much light detected so that the plants will get light even in the nights, and we have a fan that is controlled by the temperature sensor so if the temperature is larger than the cutoff value the fan will work, there is also android application that is used to configure cutoff value and more as well as the fan can be replaced with a heater for a colder weathers, so also in the application the operation can be replaced so that a heater can be used instead of the larger than it can be configured to be smaller than.

the project have used arduino uno as well as an esp8266 NodeMCU, and it have a humidity sensor, temperature sensor as well as a moister sensor for the soil, and the esp8266 have a web server with RESTful endpoints for creating a clients for it.

1 Introduction

1.1 Background

Replacing human with machines saved time and efforts in many fields. In modern decades all facilities replace much ass possible of human with machines, this also help to decrease of expenses.

1.2 Problem Statement

Irrigating crops and providing the right environment for it, is an important thing, helping to increase crop production.

1.3 Objectives and Scope

Our aim is to build a smart farm, that would be not expansive, easy to use and easy to upgrade it.

1.4 Report Organization

In Chapter 2: Constraints and Earlier Coursework, we will talk about the limitation faced when working on this project, as well as talking about how previous courses helped in working in this project.
In Chapter 3: Literature Review, we will discuss similar researches and other works related to the project.
In Chapter 4: Methodology, we will discuss how the project has been built and the tools used to build the project.
In Chapter 5: Results and Discussion, we will talk about the results of this project.
In Chapter 6, Conclusion, we will give a summary of the project and what we have learned from the process of creating it and highlight some improvement that is a future work.

2 Constraints and Earlier Coursework

2.1 Constraints

2.1.1 Wrong type of rail

We used a rail that will help our system to move in specific direction, when we bought one first our thought that it would be soft, then we use belt that wrapped with the stepper motors and move the system, but we notice that the rail is rough, it didn't move the system for large distance, after deep thinking and asking people for way to solve that kind of problem, and since we can't buy a new rail its really coast, we conclude that we can use a threaded screw.

2.1.2 Stepper motor torque

Stepper motor has many torque, since our system is a big system its hard to know which torque will help and move the system.

2.1.3 Cost

System contains of many parts, each part has many type and depend on it the cost will be changes.

2.2 Earlier Coursework

Micro-controller and microprocessor course and lab these two really help us, for understanding the way of stepper motor work, the right way to deal with Arduino and use it in a real system.

3 Literature Review

smart farming is needed as smarter ways to do farming means that more quality crops produced, because of this some people have researched and created some products that can help the farmer to keep the farm under-control as well as providing some information for feedback.

3.1 Related Work

1. IoT and agriculture data analysis for smart farm [1]:

   the authors have proposed a system that can optimally water the crops based on wireless sensor network, also they have created both mobile application and a web application that is used to control the devices in the system, and they have used a soil moisture sensor as we did to monitor the soil.

2. Smart farm monitoring using Raspberry Pi and Arduino [2]:

   the authors have created a smart farm that drives fans, heaters and more using a Low Power Wide Area Networks (LPWAN) instead of the traditional wired communication, as they say that the wired communication make it difficult to extend and add more devices to the smart farm.

3.2 Quick Review

In all the smart farms that we have researched so far have the same goal, which to automate manual tasks the farmer do and lower the labor.

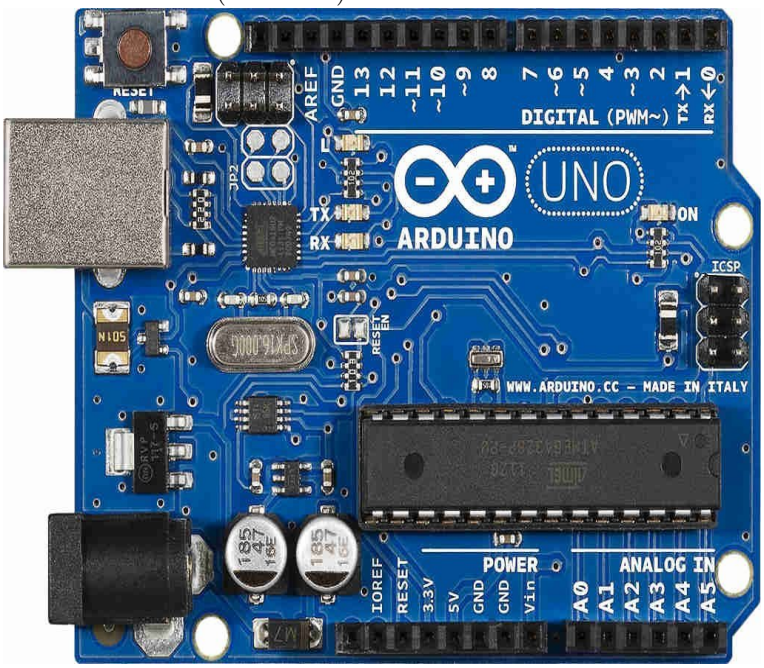
our project consist of two parts which are: the first is the xy grid system that is used for watering the plants, the second part is light and fan/heater controller which has a mobile application that can be used to modify it's parameters and view a live data coming from the system.

4 Methodology

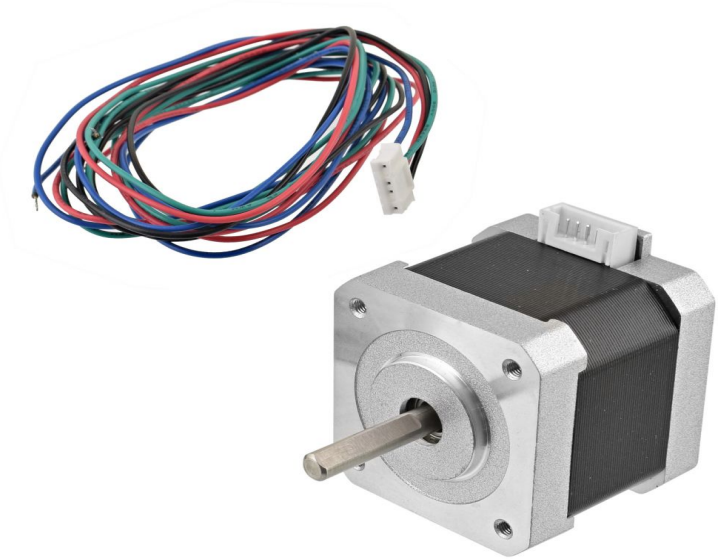
4.1 Materials

Components:

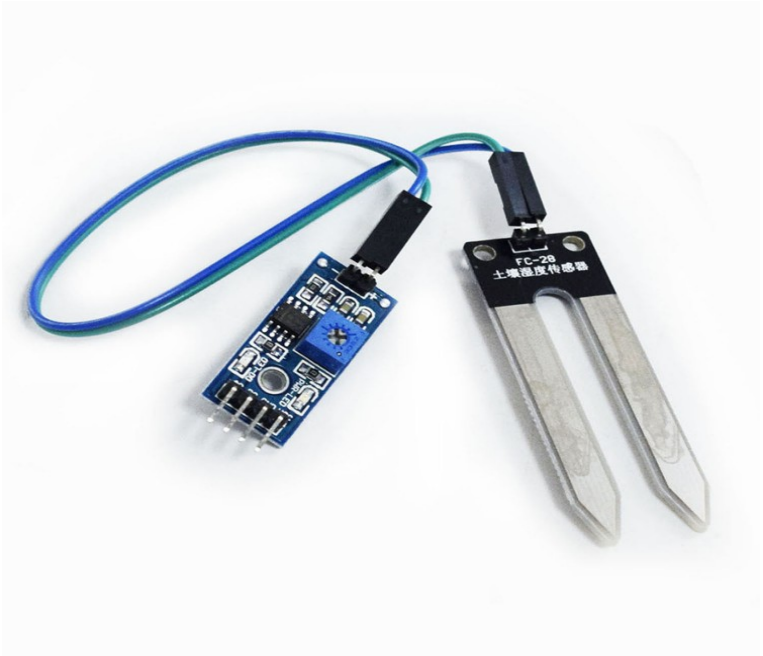
1 X Arduino Uno (controller)



2 X stepper motors

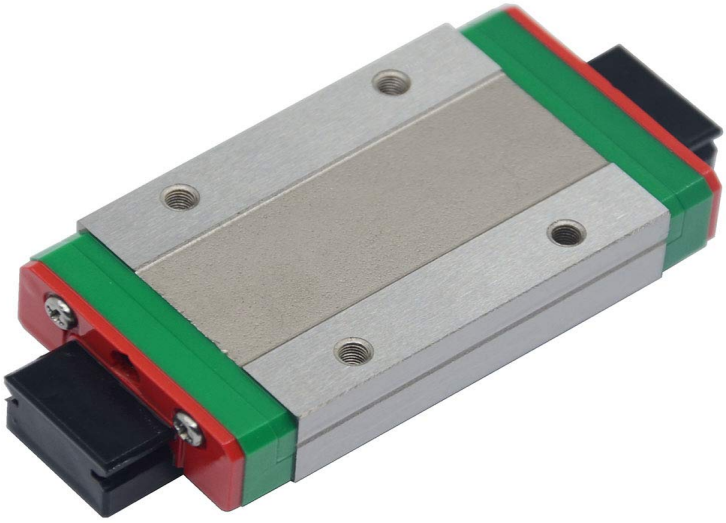


2 X Soil Moisture sensor

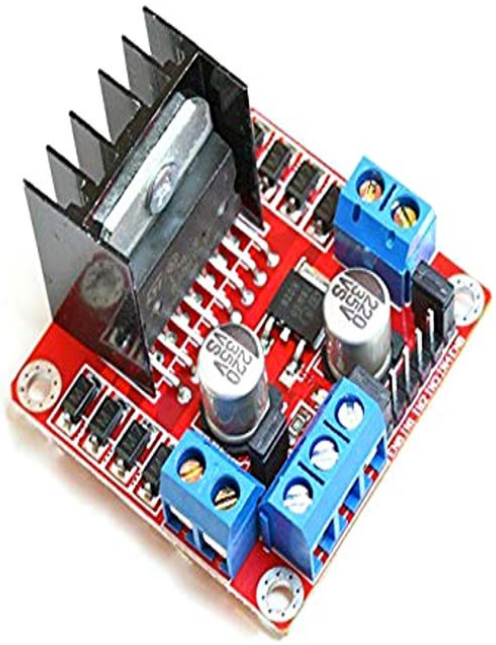


2 X Inter-tooth connection between stepper and threaded screw

2 X MGN15H Carriage Block



3 X LN98 driver



1 X battery
1 X Electrical transformer
Piece of wood

1 meter (50x50) Threaded screw
0.5 meter Threaded screw

wood screws

2 X Micro Switches

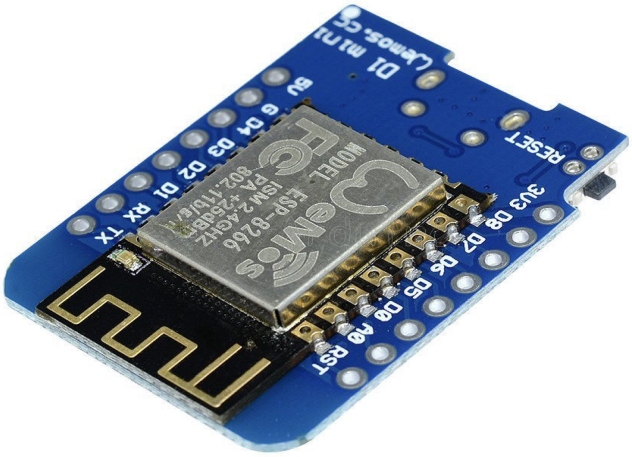
Wires of different types

1 X Water pump

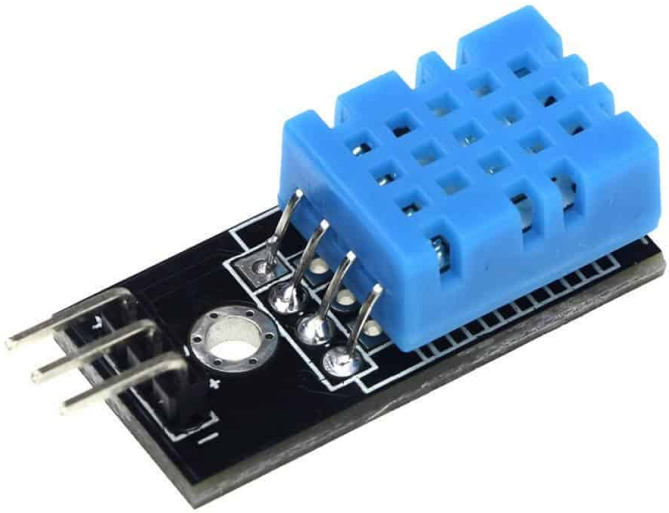
1 X Water hose

1 LCD display

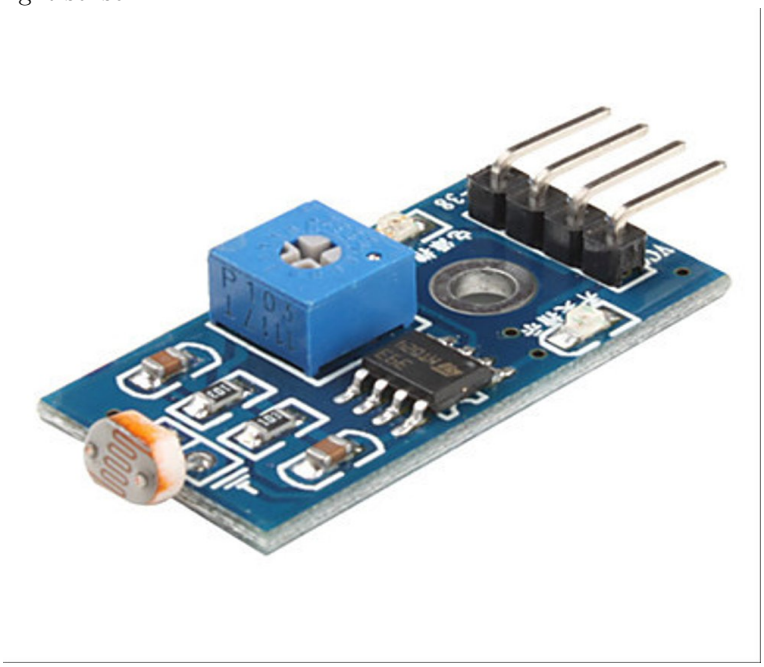
esp8266 mini NodeMCU



dht11 temperature and humidity sensor



light sensor



4.2 System Design:

Parts of system:

1. Two rail for two axis.
2. Cells (that will represent the soil).
3. Water pump.
4. Light and Fan/Heater

4.2.1 Two rail for two axis

This part is the (we will call them X-axis & Y-axis) part that responsible for moving the system to the cell that has specific humidity, we have two axis so it won't be only one big cell, this is more realistic because we always have individual planting. This parts containing Two stepper motor, threaded screw, wooden stands and micro switches. First of all electricity might be lost at any

time while system is ruining, and unfortunately maybe stop while system position not first point(0,0), so every time power on the system keep returning steps backward until micro switches is pressed in this way we make sure system will move to needed position without any error. Once System is in initial state, it will keep read value of soil moisture sensor and every sensor has an position with (X&Y-axis) and stay at this position unless condition is false, when finished of one sensor it also will read value of the next one and take new position from that point not from initial point, and so on until all sensor value read is done. The position is calculated like this: if in initial value there will be an x-position - 0 , y-position - y if not in 0,0 position then new position will be calculated : New x-position - Current x-position and New y-position - Current y-position the sign will be indication for direction. stepper motor has speed of 70.

4.2.2 Cells

Agricultural points, in each one containing a separate moisture plant and soil, and also containing a separate soil moisture sensor, irrigated by a hose installed on the top of the wooden base that moves by means of a stepper motor. The humidity value is read by a soil moisture sensor and goes to the controller (if the value is less than 500, it will send a digital signal, indicating that the humidity is sufficient. Otherwise, the location will be sent to the stepper motor)

4.2.3 Water pump

Simply containing the pump and water container that connected to the driver which give the power when in current position to irrigate current cell.

4.3 Light and Fan/Heater

This part simply uses the light sensor to detect according to the configured cutoff value which can be configured in the android application to run the light or not and u can override the sensor value and make the output to be always on/off, and the same goes to the temperature sensor which can be configured to turn either a fan/heater.

5 Results and Discussion

we have built a grid system smart farm that is consisting of the following:

- two axis grid system with a moister sensor to water the plants

- light and fan/heater controller.

- a web server running on the esp controller that can be used to integrate other application to interact with the light/fan controller and the web server support Web Sockets to get a real-time reading.

- an android application as a client for the light/fan controller.

6 CONCLUSION, RECOMMENDATIONS & FUTURE WORK

6.1 Summary

we have learned a lot by doing this project, and there is some implementation of a smart farming and in most of them they use normal watering with a shutter to shut the water on or off while in our project we have used a grid system.

6.2 What we Learned

- we learned how to create a web server in the esp8266.
- we learned how to develop android applications that connect and get data from a REST web server.
- we learned how to step up the voltage from 3.3v to drive 5v logic items like the relays

6.3 Future work

- integrate the grid watering system with the android application
- using a cloud services like Azure IoT for IoT devices to collect the data and process it in the cloud

References

[1] Michael J. O'Grady and Gregory M.P. O'Hare. Modelling the smart farm. *Information Processing in Agriculture*, 4(3):179–187, 2017.

[2] Chiyurl Yoon, Miyoung Huh, Shin-Gak Kang, Juyoung Park, and Changkyu Lee. Implement smart farm with iot technology. In *2018 20th International Conference on Advanced Communication Technology (ICACT)*, pages 749–752, 2018.