Vertical Farming—An Agriculture Management and Controlling System

S. V. Devika, S. Arvind, Gogadi Kavya, Harshitha Akkineni, and Himan Varma

Abstract Farming is one of our country's important sources of income. But, how successful has it been over the last few years? This is one of the most debatable topics in the present scenario. We all know the importance of farming and we are also very well aware of threats that it has due to today's changes in environment, new crop production and industrialization. It is predicted by the United Nations that by the year 2050, the world will not have enough livestock and food. What are we doing to contribute to the industry of food production? What are the ways we increase the food production and make sure we have year-round crop production, all of this and more can be attained by Vertical Farming. A lot of farming practices based on vertical farming have proved that, it is one of the most effective ways of producing the crops with more favourable outcomes. This is possible because of controlling environment in which the crops are growing and providing supplants to them accordingly. In order to do so, we control factors like humidity, nutrition to the plants, the amount of light it receives naturally and through other external resources. In this way, we tend to create an artificial environment to the plants and ensure the year-round cultivation which ultimately results in better crop production (Li et al. in International conference on information systems and computer aided education (ICISCAE), 2019 [1]). Thus, increase in the crop production which leads to betterment in the farming practices. Additionally, we also use various types of sensors in order to ensure that plants receive full nutrition and proper supplants through man made sources which yields in the better outcome.

Keywords Vertical Farming · Sensors · Food production

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1 Introduction

What exactly is the concept of Vertical Farming, and why do we even need to adapt it? It can be explained as an agricultural practice with controllable environmental conditions that promotes the growth the of the crop better than the conventional method. To be more precise, why do we use air conditioners in summer? and warm clothing in the winters? To make ourselves comfortable right? Similarly, to promote the better growth of the crop we provide with some favourable conditions. This should ensure some quality and quantity improvements over a short scale of farming. This project helps in controlling the environment around the crops. The humidity, moisture, etc. can all Initially set or can be manually controlled with the help of a remote [2]. Also, in this method a large number of crops can be cultivated over a small area when compared with the conventional method. This should interest even the common people to start vertical farming over a small scale and help the society with good health in this scenario.

2 Working

The working model of this farming technique mainly involves the usage of the following components: 1. Arduino (ATMEGA 328P), 2. Humidity sensor (DHT11), 3. Soil moisture sensor, 4. Relay module (5 V), 5. DC motor, 6. LCD: 16 * 2, 7. IR receiver, 8. IR remote, 12 V adapter, jumper wires.

Software used to write this program is Arduino IDE 1.8.13 running on Windows 10 operating system.

The working is not very complex and can be easily achieved by anyone who is practicing farming. The temperature sensor turns on the fan if the temperature is greater than the requires temperature by the plants. And similarly, it turns on the heater if the temperature is below the required level. Moreover, it turns of the cooling fan if the required temperature is attained and similarly turns of the heater as well. We use pulse modulation techniques for the above sensors to work accordingly. Moving on to the soil moisture sensor, it measure the percentage of moisture in the plants and its main function is to turn on the pumps if the moisture content is less than the required and turns the pumps off once it reaches the required level. A very similar working is taken place in the humidity sensor, but it works with the exhaust fan and switches it on if the humidity is more than the regular required rate and turns it off otherwise. The program that we implemented for the sensors to work are mentioned below in detail.

3 Code

3.1 *Defining of Parameters*

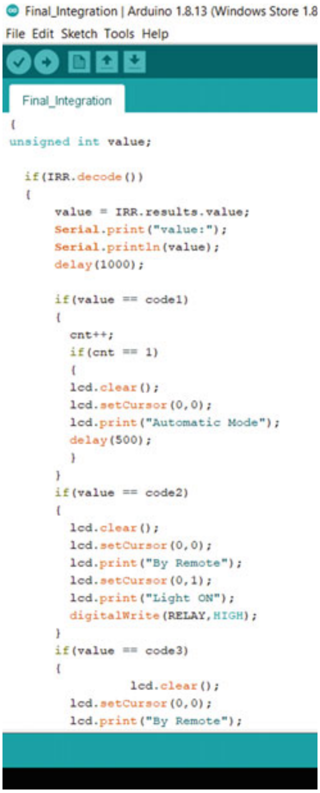
Final_Integration | Arduino 1.8.13 (Windows Store 1.8.42.0)

File Edit Sketch Tools Help

Final_Integration

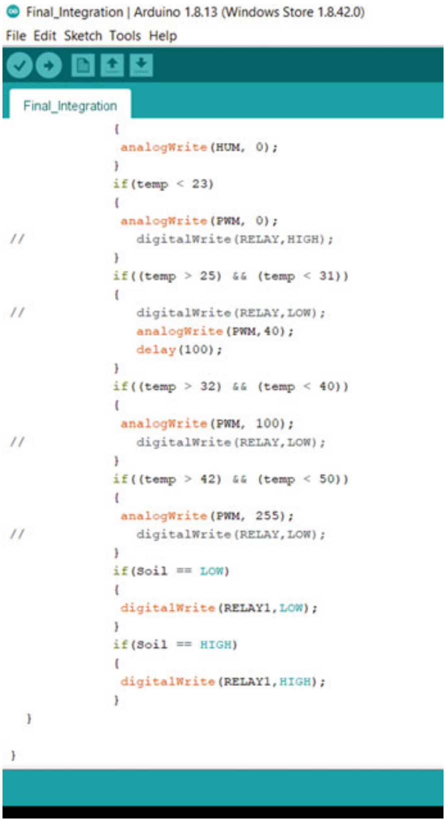
```
#include <LiquidCrystal.h>
#include <IRremote.h>
int input_pin = 2;
IRrecv IRR(input_pin);
#include "DHT.h"
#define DHTPIN 6
#define DHTTYPE DHT11

#define SOIL 3
#define RELAY 4
#define RELAY1 A0
#define TEMP A1
#define HUM A2
int PWM = 5;

#define code1 18615 //15328
#define code2 20655 //15330
#define code3 55335 //15314
#define code4 63495 //15346
#define code5 12495 //15306
#define code6 45135
#define code7 28815

const int rs = 12, en = 11, d4 = 10, d5 = 9, d6 = 8, d7 = 7;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

DHT dht(DHTPIN, DHTTYPE);
int cnt,cnt1;
float vout;
float temp;

void setup()
{
  Serial.begin(9600);
  lcd.begin(16,2);
```

3.2 LCD Interfacing




```
{
unsigned int value;

  if(IRR.decode())
  {
      value = IRR.results.value;
      Serial.print("value:");
      Serial.println(value);
      delay(1000);

      if(value == code1)
      {
        cnt++;
        if(cnt == 1)
        {
        lcd.clear();
        lcd.setCursor(0,0);
        lcd.print("Automatic Mode");
        delay(500);
        }
      }
      if(value == code2)
      {
        lcd.clear();
        lcd.setCursor(0,0);
        lcd.print("By Remote");
        lcd.setCursor(0,1);
        lcd.print("Light ON");
        digitalWrite(RELAY,HIGH);
      }
      if(value == code3)
      {
                lcd.clear();
        lcd.setCursor(0,0);
        lcd.print("By Remote");
```

3.3 Temperature Sensor Interfacing



3.4 Final Integration of All the Components

4 Result

Ultimately, our main aim for this project is help the growth of the farming sectors. The usage of various types of sensors has shown a positive result when tested. This project can be used in any indoor areas provided with right equipment. We have also observed that this project can be easily put into use as most of the farmers are already aware of the functioning of exhaust fans and pump as well as the functioning of the motors (Figs. 1 and 2).

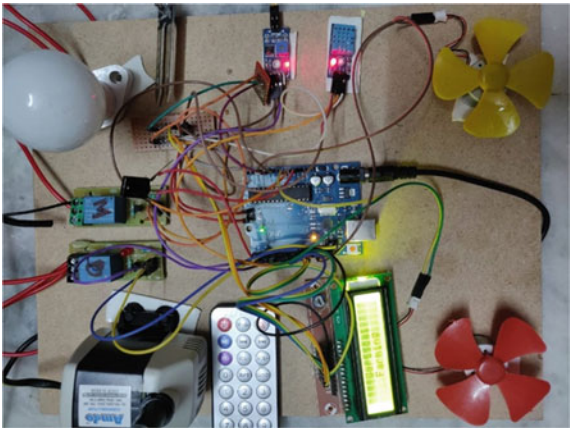


Fig. 1 Demo of the interfacing

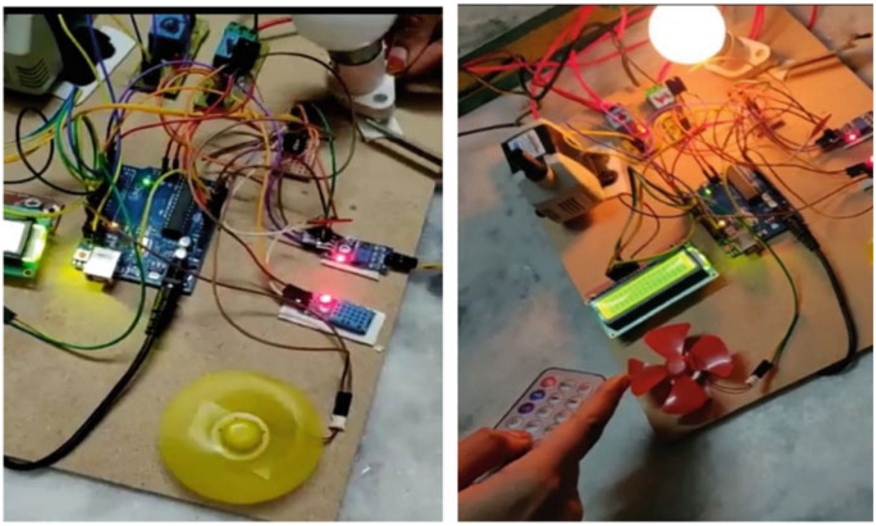


Fig. 2 Working of the fan in accordance to the temperature

5 Conclusion

The concept of vertical Farming is of great advantage and when implemented on a large scale it can be of great use to the farming sector. The combination of farming using the current technology is where we believe the future of the farming sector lies in [3]. This method when put to usage can show extremely good results as it mainly functions on controlling the environment in which the plants grow and ensures the proper functioning of plants. All of this and some more can be attained and we can see the increase of growth of many rare crops using this emerging technique. We certainly believe, this project can bring the change in the farming practices. This project's ultimate goal is to increase the food production and increase the growth of the crops in the off season as well along with the growth in the rare breed crops when horizontally we cannot grow. This farming is trending now a days due to unavailability of land space due to more residential occupancy in India.

References

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