Vertical Farming

Next Generation Techno-Enabled Farm

Ms. Pritam Deshmukh ASSISTANT PROFESSOR MMCOE, PUNE

Piyush P. Khodke BE ELECTRICAL MMCOE, PUNE piyushkhodke5@gmail.com

Pradnya U. Kulal BE ELECTRICAL MMCOE, PUNE pradnyakulal2018.elect@mmcoe.edu.in

Hritik U. Dhore BE ELECTRICAL MMCOE, PUNE hritikdhore2018.elect@mmcoe.edu.in

Sarthak R. Kide BE ELECTRICAL MMCOE, PUNE sarthak.kide20@gmail.com

A. ***Abstract— In agriculture dominant countries like ours, innovation in the farming methodologies have been witnessed. These innovations were observed in the areas of irrigation, use of pesticide by the result of soil testing etc. Our proposed method and initial experimental trials addresses towards upcoming method of vertical farming and its subsequent requirements. Technology used in our experimentation involves farming structure and artificial photosynthesis method by LED. Growth of crop with our structure and methodology shows promising results as compared to traditional farming in terms of inherent advantages like requirement of less space, reduction in hazardous consequence due to pesticides and proposes feasible economic model of farming. The vertical farming is the advanced level of agriculture technology which is different from our tradition farming methodology. This type of farming is practiced when there is unavailable of land. The main purpose of this methodology is harvesting technique, water management, crop cultivation and yielding process.***

B. ***Keywords- DHT-11, BMP180, ARDUINO, FRITZING, GSM, MQ135***

II. INTRODUCTION

In today's growing world, crop cultivation is essential in making sure that the food supply to human need is sufficient to survive. The problems faced by the farmers in traditional farming are waste of land, waste of water, seasonal farming and harvesting methods. Vertical farming which is a sunless and soilless farming which can be the best solution to overcome these problems. As the world's population is expected to grow by 2 billion by 2050 and feeding it is a huge challenge. It is marked that one third of the arable lands are lost in last forty years. Due to industrialization and urbanization we are losing arable lands day by day. This increases the food demand and decreases arable land which is a major challenge and can be overcome by vertical farming. Also in traditional farming continuous monitoring of water supply to the crops is not feasible for the farmers so hydrophonics can be implemented in vertical farming. Seasonal farming imposes restrictions on the crop cultivation. Instead of sunlight it uses horticulture led which consists of all the necessary electromagnetic spectrum for the growth of plant. As it is a soilless farming so instead of soil we use waste of catfish for the nutrition [1].

Vertical farming is the method of creating an artificial environment for the growth of plants which can control the inner atmospheric parameters [2]. Vertical farming is the practise of growing plants in vertically stack layer such as in warehouse, skyscraper or shipping container.

The horticulture led has three colour namely blue of wavelength 750 nm, red having wavelength 650 nm and pink of wavelength 450 nm. It is not possible to control the intensity of sun but in case of horticulture led, we can control its intensity using AC controlled circuit. By controlling the intensity it is thus possible to control the inner environment temperature.

According to the survey, in traditional farming the rate of growth cycle is 90% while in vertical farming it is 30%. Hence the growth rate in vertical farming is faster than in traditional farming. Also one more advantage of vertical farming is less water consumption as compared to traditional farming. As per the research, water required per crop is 33 litre in traditional farming while it is 3 litre. So water can be consumed at a greater rate.

As per the survey, the crop harvesting rate of vertical farming is more than traditional farming. The percent of crop harvested is 50% in traditional farming while it is 90% in case of vertical farming. This is a very important factor to be considered in cultivation of crops. Also the nutrition value is more in vertical farming as compared to traditional farming. The crop purity is 30 percent in traditional farming while the crop purity is 80 percent in vertical farming.

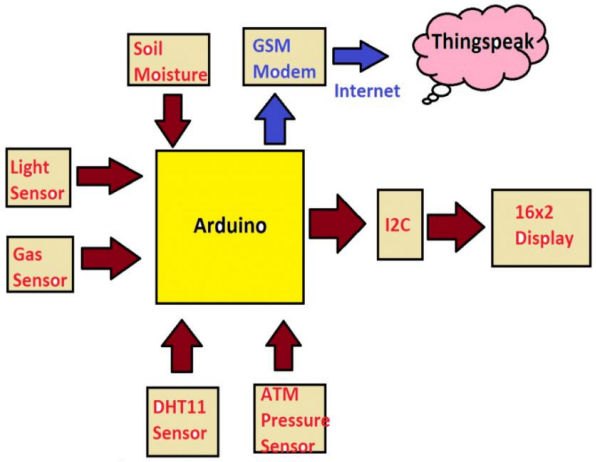
In this project, hydrophonics is being implemented, it is process of growing plants without soil instead water solvent mineral nutrients are used for the growth of plants [1]. The nutrients can be waste of catfish or many different chemical fertilizers.

The main advantage of using hydrophonics system is large decrease in water usage required for agriculture. So in areas having less water accessibility this system can be implemented and can be used conveniently due to lack of water required for growth of plants. So considering all the above factors and constraints vertical farming is best suited in all the cases as compared to traditional farming for the appropriate growth of plants and large cultivation rate [1].

III. SYSTEM DESCRIPTION

A. Block Diagram

As depicted in figure 1, this system consists of DHT-11, height detection circuit, pump, display, horticulture led, exhaust fan and servo motor. DHT-11 is used to detect temperature and humidity of indoor environment. It senses current temperature and humidity, compares it with predefined values and display it on LCD. For monitoring the height of crop height detection circuit is used. Depending upon the compared temperature output the fan will be ON or OFF.



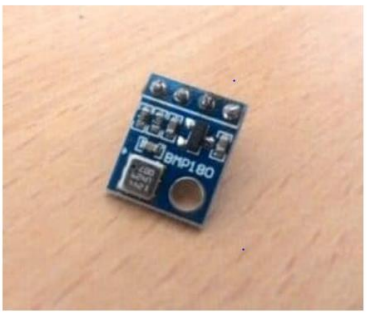
B. DHT- 11

The cost of DHT-11 is low and it is a humidity and temperature sensor. It consist of a capacitive humidity sensor and thermistor to sense physical quantities such as temperature and humidity. It also includes 8 bit microcontroller which digitizes data and sends it to arduino. This data is of 40 bits out of which 8 bits are temperature digital value, 8 bits of temperature integer, 8 bits of humidity digital value, 8 bits of humidity integer and 8 bits of checksum.

C. MQ-135

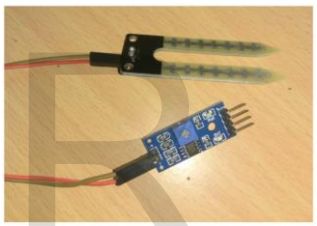
It is obvious that plants need good sun shine to prepare its own food and this process called photosynthesis. Plants need optimum amount of light not less or not too much. The amount of light received on a plot of land can be measured using LDR or photoresistor.The LDR changes its electrical resistance depending on amount of light incident on it. The amount of light is converted to 10-bit digital value and further converted to percentage out of 100.

D. BMP-180



A barometric pressure sensor can be used for measuring atmospheric pressure. Using atmospheric pressure data you can predict weather for short term and also can be used for studying how plants behave in different atmospheric pressure conditions. BM180 is a digital sensor and connects to I2C bus and **operates at 3.3V**; it can measure ATM pressure, Altitude and temperature. We are going to extract only the ATM pressure data but you can edit the code and include altitude data to see how plantations behave at different altitude. Temperature data is ignored from this sensor because we already use DHT11 which can measure temperature.

E. SOIL MOISTURE SENSOR



We are going to use only the analog output of this sensor, just like other analog sensors mentioned here; the output is converted to 10-bit digital value and finally to percentage out of 100. 0% means the soil is dry 100% means the soil wet. But with this sensor we found that anywhere between 50% to 70% reading, the soil was fully wet.

D. HORTICULTURE LED

The sun produces all electromagnetic spectrum, but only few of them are required for photosynthesis process. Horticulture leds provide only the necessary spectrum that are required by the plants [3]. As shown in figure 4, the horticulture leds are of three colours namely blue of wavelength 750 nm, red having wavelength 650 nm and pink of wavelength 450 nm. Depending upon the wavelength of the light particular leds are used for the growth of plant.

IV. PRACTICAL SETUP

A setup consisting of two crops are been tested for few days out of which one is soilless and the other is soiled plant.

V. CONCLUSION

Vertical farms in urban areas are relatively new phenomenon.Due to variety of new innovations tested in vertical farming there is increase in new innovation and technology. As this technique is pesticide free we get pure food which is requirement of upcoming generation. Agro processing on small scale is also possible due to vertical farmingwhich will be at local and national level.

REFERENCES

[1] Mahesh PJ, Minhas Naheem, Razak Mubafar, Shyba S, and Sunitha Beevi, "New Aspect for Organic Farming Practices: Controlled Crop Nutrition and Soilless Agriculture," in proc. of 2016 IEEE Global Humanitarian Technology Conference, Seattle, USA, Oct. 2016.

[2] Muhammad Ikhwan, Hanif bin Ismail and Norashikin M. Thamrin, "IoT Implementation for Indoor Vertical Farming Watering System," in proc. of 2017 International Conference on Electrical, Electronics and System Engineering , Kanazawa, Japan, Nov. 2017.