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SMART VERTICAL FARMING

Sheetal Patil, Priyanka Bagale, Aditi Adunagi
Department of Electronics and Telecommunication, A G Patil Institute of Technology,
Solapur,Maharashtra,India

Abstract— Smart farming makes a tremendous contribution for food sustainability for 21st century. Our project vertical farming is the practice of producing food in vertically stacked layers, vertically inclined surfaces and integrated in other structures using Controlled environment agricultural technology, where all environmental factors are controlled. These facilities utilize artificial control of light, environmental conditions like humidity, temperature, gases. Controlled-environment agriculture (CEA) is a technology-based approach toward food production. The aim of CEA is to provide protection and maintain optimal growing conditions throughout the development of the crop. Production takes place within an enclosed growing structure where the growth conditions are maintained. The crops are grown based on hydroponics method of soilless farming.

Keywords—IOT, Grow Light, Hydroponic, Temperature Sensor, Humidity Sensor, Soil Moisture Sensor.

I. INTRODUCTION

This Smart farming is the logical advancement of precision farming. Moreover, smart farm is about empowering today's farmers with the decision tools and automation measurement technologies that seamlessly integrate products, knowledge and services for better productivity, quality and profit. The most important things of smart farming are environmental measurements and water management. The reason is that the environmental and water management affects plant growth directly. Vertical farming is considered as a modern tool for feeding large world population by year of 2050. Vertical farming according discounts the value of natural landscape in exchange for the idea of "skyscraper as spaceship. Plant life is mass-produced within hermetically sealed, artificial environments that have little to do with the outside world sense. They could be built anywhere regardless of the context. Hydroponics is a subset of hydro culture, the method of growing plants without soil, using mineral nutrient solutions in a water solvent. Therefore a combination of smart vertical farming and hydroponics would help to double the advantages of each separate system. The temperature, humidity inside the module is continuously monitored using sensors. LED strips of blue and red light were pasted on side walls of the frame to produce a pink light which is absorbed by the plant during photosynthesis.

II. INTERNET OF THINGS

Internet of Things" was coined by Kevin Ashton in 1999 during his work. Ashton who was working in supply chain optimization, wanted to attract senior management's attention to a new exciting technology called RFID. Because the internet was the hottest new trend in 1999 and because it somehow made sense, he called his presentation "Internet of Things". The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. IOT is an entity or physical object that has a Unique identifier, an embedded system and the ability to transfer data over a network. These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices.

IOT Lifecycle:

- Collection :-
  Devices and Sensors are collecting Data everywhere.
- Communication :-
  Sends data and events through networks to some destination
- Analysis :-
  Creating Information from data.
- Action :-
  Taking action based on information and data.

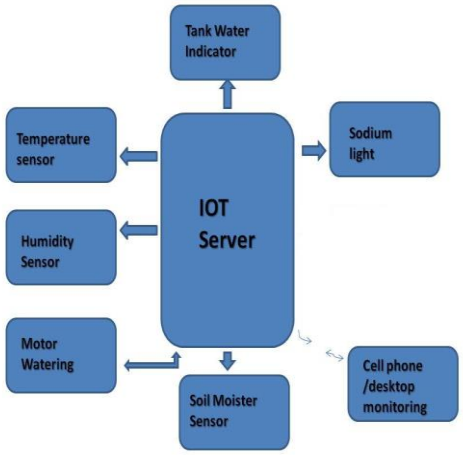
III. HYDROPONIC

Hydroponics is a subset of hydro culture, which is a method of growing plants without soil by using mineral nutrient solutions in a water solvent. Terrestrial plants may be grown with only their roots exposed to the mineral solution, or the roots may be supported by an inert medium, such as perlite or gravel. The nutrients used in hydroponic systems can come from an array of different sources; these can include, but are not limited to, byproduct from fish waste, duck manure, or purchased chemical fertilisers. PVC pipes are stacked horizontally to form vertical layers. Holes of fixed diameter are drilled at equidistant points on each pipe row where the plants are to be placed. The pipes are connected using solenoid valves to regulate the water flow between the pipes. On top water tank is placed and a hole is made at its bottom to allow flow from tank to the below PCV pipe layer. Two separate tanks of smaller capacity compared to the main tank were placed on either side of the main tank that stores alkaline and acidic solutions.

IV. GROW LIGHT

A grow light or plant light is an artificial light source, generally an electric light, designed to stimulate plant growth by emitting a light appropriate for photosynthesis. Grow lights are used in applications where there is either no naturally occurring light, or where supplemental light is required. For example, in the winter months when the available hours of daylight may be insufficient for the desired plant growth, lights are used to extend the time the plants receive light. If plants do not receive enough light, they will grow long and spindly. Grow lights either attempt to provide a light spectrum similar to that of the sun, or to provide a spectrum that is more tailored to the needs of the plants being cultivated. Outdoor conditions are mimicked with varying colour, temperatures and spectral outputs from the grow light, as well as varying the lumen output (intensity) of the lamps. Depending on the type of plant being cultivated, the stage of cultivation (e.g. the germination/vegetative phase or the flowering/fruiting phase), and the photoperiod required by the plants, specific ranges of spectrum and colour temperature are desirable for use with specific plants and time periods.

V. IMPLEMENTATION



It is an IOT based setup where in, an IOT based application will be installed in a mobile phone and will be controlled from the same. Modules such as temperature sensor module, humidity sensor module, soil moisture sensor module and nutrient sensor module will be controlled using this Arduino. All the sensor modules will be set at a required set point value. If the parameters vary above or below the set point level then a message will be sent on the mobile phone. After receiving the message the user can set the parameters on the set point again. For example humidity can be increased by opening the water sprinkler valve by the user an hence set point can be achieved. In the same manner nutrient level in the water of hydroponic setup can also be controlled in the same manner.

Arduino is real time based microcontroller and a open source. It supports High Speed Flash Memory. It has no of facilities for communicating. Due to its size and features it is good to use.

Temperature Sensor An analog temperature sensor is easy to explain, It's a chip that tells you what the ambient temperature is. Typically, a thermocouple or RTD, that provides for temperature measurement through an electrical signal. Here we are using LM35.

Humidity Sensor Humidity is the amount of water present in the surrounding air. Humidity is also a major factor for operating sensitive equipment like electronics, industrial equipment, electrostatic sensitive devices and high voltage devices etc. Such sensitive equipment must be operated in a humidity environment that is suitable for the device. Here we will be using hygrometer.

Soil Moisture Sensor It measures the volumetric water content in soil. This sensor measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. We will be using VH400.

Tank water indicator gives the indication of the water level in tank.

VI. RESULT

In this project we implemented a smart vertical farm module in which plants are grown in a controlled atmosphere that suits its growth. We have developed the module based on hydroponics technology. All the parameters like temperature, humidity, ph and liquid level were sensed and controlled automatically. Maximum yield can be cultivated from minimum land and also it helps to reduces global warming. Allows crops to be grown at all times throughout the year as it is not weather dependent. Here water can be used in controlled manner.

VII. CONCLUSION

As technology enables new farming opportunities in indoor, warehouse-based settings, food production can be retooled to accommodate high-density urban living and maintain food security despite a future of increasing climate instabilities and vulnerabilities. In future by in cooperating image processing and mobile applications we can control this module remotely by the using mobile application software.

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