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Environment Controlled, Automated Green House for High Valued Agro Produce in Vidarbha Region

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***Abstract* - Environment in Vidarbha region is not predictable for farming. Certainty of rainfall and appropriate environmental conditions are necessary for optimum plant growth and improved crop yields. In the conventional cultivation system, the farmer has to keep a watch on proper rain & light intensity, which is different for different crops. Dearth of water and uncertainty in rainfall in Vidarbha region are the prime reasons for low /no crop. This situation is persisting from year to year. The farmers takes loans to get a rid of this and could not pay in time. These are the reasons for their suicide under depression. If technology could assist in creating appropriate environmental conditions required for the crops, farmers will improve the crop yield and become economically strong.**

Hence proposed project will produce an ultimate solution for developing good quality, high valued crop yield by developing double layered Environment controlled, Automated Green House with light dependent flipped roof system. Complete Greenhouse will fully automated. All the functions to be performed by the Fan, dripping, Sprinkler and flipping of roof of inner layered Polly green house to control the climatic conditions like temperature, relative humidity, soil moisture levels and light for photo synthesis in the Greenhouse environment are all maintained as per requirement of proposed high Valued fruits without human intervention. The proposed project nothing but the one time investment, All times gain.

By cultivating fruits like Strawberry, litchi and cherry of good quality by generating required environment condition without human intervention & electricity in Vidarbha region we have to improve the economy of farmers. It will be the actual role model for education system as well as technology intervention in rural area.

1. INTRODUCTION

A greenhouse is a building in which plants are grown for commercial or research purposes. These structures range in size from small sheds to very large buildings, with different types of covering materials, such as a glass or plastic roof and frequently glass or plastic walls. But, nowadays, the rising demands for crop production and quality have significantly increased the utilization of high quality and productivity of greenhouse. The quantity and quality of growth made by landscape plants is dependent on interactions between their genetic potential and the above- and below-ground environment in which they are growing. The principal environmental requirements for plant growth include adequate space for root and canopy development, sufficient light, water, oxygen, carbon dioxide, and mineral elements, and temperature suitable for essential physiologic processes. Developing a landscape maintenance schedule that provides for timely pruning, watering, mulching, pest control, and fertilizing when necessary, will promote individual plant health and ultimately protect and enhance the entire landscape.

1.1 ENVIRONMENTAL FACTORS AND PLANT GROWTH

As a plant grows, it undergoes many developmental changes, including formation of tissues and organs such as leaves, stem, flowers and roots. The main source of nutrients used to aid this development process is often found in its surroundings. In other words, the development of a plant is solely dependent on the conditions of the environment in which plants are grown. The environment consists of many different factors including light, ambient temperature, soil temperature, humidity, soil moisture, and CO2. These climate factors play an important role in the quality and productivity of plant growth. Either directly or indirectly, most plant problems are caused by environmental stress. In some cases, poor environmental conditions can either damage a plant directly or indirectly. In other cases, environmental stress could weaken the plant and strip off its immunity and protection against diseases and harsh weather conditions. A good understanding of these climate factors allows the grower to be more aware of any potential problems that may affect the development of the plants and appropriate actions can be drawn to prevent these problems from happening.

1.2 TEMPERATURE EFFECTS

Temperature influences most plant development process including photosynthesis, transpiration, absorption, respiration and flowering. In general, growth is promoted when the temperature rises and inhibited when temperature falls. The growth rate of a plant will not continue to increase with the increasing of temperature. Each species of plant has a different temperature range in which they can grow. Below this range,

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processes necessary for life stop, ice forms within the tissue, tying up water necessary for life processes. Above this range, enzymes become inactive and again process essential for life stop. Therefore, the temperature should be maintained at optimum level whenever possible.

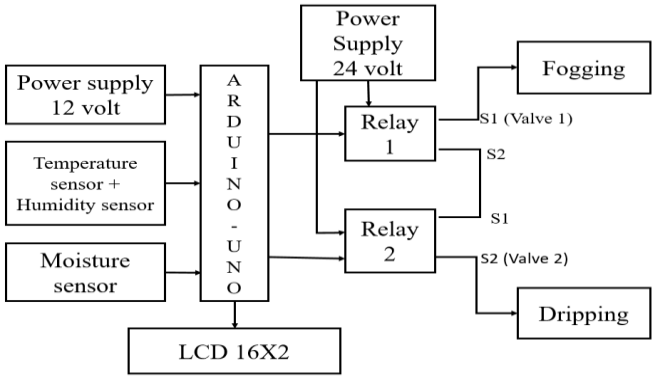
2. WORKING OF THE PROJECT

The working of the project is such that the two LDRs present on either side of the solar panel measures the amount of sunlight. The comparator in the two LDR's measures and compares the values of the amount of light falling on the east-faced and the west-faced LDRs.

The solar panel rotates towards the direction with the maximum amount of incident light. The tilting of the solar panel is done with the help of a stepper motor used in conjunction with the solar panel. The stepper motor is driven by a current driver, ULN2003.

The other sensors that are used in the project are temperature sensor, humidity sensor and soil moisture level sensor. These sensors are implemented to measure the temperature, relative humidity and the soil moisture level respectively, of the greenhouse. The values detected by the sensor are displayed on an LCD display which enables the farmer or the person accessing the greenhouse to monitor the values of the respective sensors. With respect to the crops or plants grown, certain thresholds are defined for the values of the temperature, humidity and soil moisture level, if these threshold values are crossed, then, the system will automatically take some necessary action to bring it down to the allowable level or value which is preprogrammed in the Microcontroller, PIC16F877A. For example, when the temperature of the greenhouse crosses the threshold temperature then, a fan is automatically switched on inside the greenhouse. Similarly, when the soil moisture content is below certain threshold, the sprinter automatically gets activated and the plants are watered.

2.1 BLOCK DIAGRAM AND DESIGN



We are developing Greenhouse over 20000 square meter of land which will be automatically controlling the weather conditions and will maintained appropriate environment for agro produce. For automation and of green house, the proposed system is an embedded system which will closely monitor and control the microclimatic parameters of a greenhouse on a regular basis round the clock for cultivation of crops or specific plant species which could maximize their production over the whole crop growth season and to eliminate the difficulties involved in the system by reducing human intervention to the best possible extent. The system comprises of sensors, Analog to Digital Converter, microcontroller, servo motors and actuators. When any of the above mentioned climatic parameters cross a safety threshold which has to be maintained to protect the crops, the sensors sense the change and the microcontroller reads this from the data at its input ports after being converted to a digital form by the ADC. The complete system will be operated with solar energy. The Novel automated Green house of around 4000 square feet will be developed for our college campus.

The modules taken and integrated to meet specific needs are Light Sensor: Light Dependent Resistor (LDR), Temperature Sensor: Lm35, Humidity Sensor, Soil Moisture Sensor, Stepper Motor, Dc Motor , Microcontroller: PIC16F877A, Solar Tracker, Regulator 7805, ULN2003, Liquid Crystal Display- LCD. Solar Panels are also required to supply electricity.

The working of the project is such that the pairs LDRs present on either sides of the roof panel measures the amount of sunlight. The comparator in the two LDR's measures and compares the values of the amount of light falling on the east-faced and the west-faced LDRs. And based on threshold light intensity panel will flip automatically.

The solar panel rotates towards the direction with the maximum amount of incident light. The tilting of the solar panel is done with the help of a stepper motor used in conjunction with the solar panel. The stepper motor is driven by a current driver, ULN2003.

The other sensors that are used in the project are temperature sensor, humidity sensor and soil moisture level sensor. These sensors are implemented to measure the temperature, relative humidity and the soil moisture level respectively, of the greenhouse. The values detected by the sensor are displayed on an LCD display which enables the farmer or the person accessing the greenhouse to monitor the values of the respective sensors. With respect to the crops or plants grown, certain thresholds are defined for the values of the temperature, humidity and soil moisture level, if these threshold values are crossed, then, the system will automatically take some necessary action to bring it down to the allowable level or value which is preprogrammed in the Microcontroller, PIC16F877A. The flipping of roof panels as per the requirement of light will be the main innovation to keep agro produce healthy and fresh. This roof will be controlled by relay and servomotor/steeper motors depending on the output of LDR sensors.

2.2 Graphical Representation

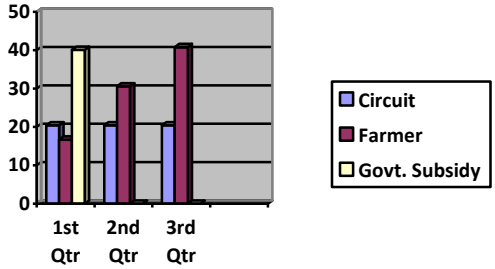


Chart – 2.2: Graphical representation of the project.

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The final expected outcome of this project is the development and use of technology for rural development. Farmers will trained to perform advanced farming with good economy. They will not have to depend on electricity and rainfall. The main impact of this project is that complete Greenhouse will fully automated. All the functions to be performed by the Fan and Sprinkler to control the climatic conditions like temperature, relative humidity , sun light and soil moisture levels in the Greenhouse environment are all maintained as per requirement of proposed high valued fruits and it does not require any human intervention. This project wills an ultimate solution to produce high valued agro products in Vidarbha region. It will be the best role model for all farmers to cultivate high valued fruits like strawberry, Cherry and litchi in Vidarbha region. It will foster a new dialogue within the larger community on science, society and the environment and to develop a sense of dignity and collective destiny. This project wills strengthening the economy in rural areas which will ultimately help to develop economy of India. It will be the one time investment and all time gain.

2.3 Cost benefits analysis:

(For 20*10 sq.mtr arena only.)

- **For one kind of fruits like strawberry**

Capital Investment: Rs. 1800000/-

Fixed cost @ 10%:Rs. 180000/- per annum Rs. 45000/- per: Season

Total cost = Fixed cost + Variable cost

Per plant variable cost = Rs. 12 (Cost of Plant) + Rs. 2 (Transportation) + Rs. 120 (Labor charge) + Rs.8 (Electricity) + Rs. 2 (Other expenses) = Rs. 144

Therefore **Total cost for 300 plants** = Rs. 45000+ Rs (300*144) = Rs. 88, 2000/-

Total cost incurred from 300 plants = 300*600= Rs. 180000/-

Therefore **Net PROFIT = Rs.180000 – Rs.88,200 = 91,800/- (Achieved more than 100% profit Gain) Per season.**

Total profit per annum for three kind of fruits => 91800*3*3 = Rs.8,26,200/- against amount invested Rs.180000/- Payback period = 18,00,000 / 8,26,200 = 2.17 Years.

3. CONCLUSIONS

Successfully implemented Environment controlled automated Green house with embedded system developed with PIC controller PIC16F877A. Proposed greenhouse maintained condition of temperature, moisture and humidity as per the requirement of product. A very tasty, colorful, juicy, dense and good quality strawberry product is possible with automated, environment controlled Green house in Vidarbha region. Three times different kinds of agro produce can be cultivated within one year with Mentioned Green house. Hence proved, this project is nothing but one time investment all time gain. This project is a role model for all the farmers in Vidarbha region to take such kind of initiative to cultivate high valued agro produce independent of natural environmental calamities and strengthening his economy which will strengthens the economy of India.

4. ACKNOWLEDGEMENT

As plant grows, they need certain environmental parameters for its proper growth like humidity, temperature, light. Also, Automated Greenhouse Monitoring ignores the need of human operators to take care of the plants. To monitor the Greenhouse parameters like humidity, temperature, soil moisture and light properly, a control system is needed. This control system is comprised of greenhouse data acquisition PIC Microcontroller along with temperature, humidity and light and pH sensor. For monitoring and storing the values of these environmental parameters PIC18F452 based circuit is used. Based on the values stored, the above system will compare the stored values with threshold values set for particular plant and control the actions of cooler, heater, and water pump. Greenhouse monitoring and control software can collect, display and record the collected data i.e., values of various parameters, also can control greenhouse environment. In addition to this the system also consists of solar inverter for backup.

5. REFERENCES

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5.2 Books:

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2) National Semiconductors, *CMOS Logic Datebook.*
3) *SENSOR- The Journal of Allied sensing Technology, Advanstar Communication Inc.*

5.3 WEB Resource:

1) htpp://www.google.com
2) htpp://www.keil.com/appnotes
3) htpp://www.roboticsindia.com
4) htpp://www.electro-tech-online.com
5) htpp://www.datasheetdirect.com
6) htpp://www.ferrwebs.com/maheshwankhede
7) htpp://www.faludi.com