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IOT BASED ROOFTOP FARMIING MODEL FOR URBAN AGRICULTURE

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ABSTRACT

Presently, the urban world is switching to rooftop farming with technology support to cope with the increasing food demand and effective utilization of various resources. But the monitoring of farming in high raised building (rooftop)is little challenging. This paper presents an IoT based smart rooftop irrigation system to efficiently manage water dispersal and provides improved urban based rooftop farming productivity. The proposed model regularly monitors soil temperature and moisture level, i.e., rooftop farming is irrigated automatically without physical presence of planter and it also uses smart mobiles for irrigation control. The proposed automatic irrigation farming modal uses sensor technology, communication technology and embedded hardware technology. That is, the atmospheric weather data such as moisture level and water level are collected periodically from different part of rooftop farm area and it is analyzed, which will trigger the switching of water motor/overhead tank pump and send status updates to the planter.

Rooftop farming is a practical solution of smart urban agriculture to Furnish diverse socio-environmental benefits and short food supply chains, especially in densely populated cities. This study aims to raise urban food security with less use of public water and energy in food production, through utilizing green water and energy for sustainable management. A system dynamics (SD)model framed across the nexus of climate, water, energy and food (WEF) sectors is developed fora rooftop farm in Taipei City of Taiwan. The urban WEF Nexus is structured to address how local weather affects water and energy utilization to grow vegetables.

In day-by-day activities identified with cultivating or garden watering are the most significant social practice and the most labour - intensive task. No mater whichever climate it is, either hot, dry, cloudy or wet, we need to have the option to control the measure of water that arrives at our plants. Present day watering frameworks could be successfully used to water plants when they needed it.

***Keywords**: Rooftop farming · Urban agriculture · IoT in agriculture · IoT · Smart agriculture.*

1. INTRODUCTION

Cultivation of plants is generally termed as farming. In countries like India the gross irrigated crop area is around 82.6 million hectares, which is the highest for a country in the entire world. Due to gradual shift in population from rural areas to the urban areas this has in return caused a gradual reduction in the produce. Thus, increasing the demand for fresh fruits, vegetables and so on. The solution to overcome this problem by the people living in urban areas is roof top gardening, where few crops required over a daily basis were cultivated in pots in the roof tops of the houses. But the inexperience in the field/farms has led to many dilemmas like which plant to choose for which soil or what must be the optimal fertilizer quantity for a certain type of plant and soil or what must be the approximate soil moisture for the best growth of the plant. For Measuring various parameters like soil moisture and guiding the user for its maintenance, the automatic plant watering system is the utilization of controlled measure of water to plants at required spans. Presently, the urban world is switching to rooftop farming with technology support to cope with the increasing food demand and effective utilization of various resources. But the monitoring of farming in high raised building (rooftop)is little challenging. This paper presents an IoT based smart rooftop irrigation system to efficiently manage water dispersal and provides improved urban based rooftop farming productivity.

2. METHODOLOGY

The replacement of the demonstrative instrument kit with Automotive IoT runs less time for updating ECM information. It is conceivable to utilize Wi-Fi for organizing other regions of the vehicle. The recommended strategy for diagnosing the vehicle is not at all like the existing OBD prototypes. This prototype does not require a check device, specialist, or benefit center as specified earlier. This works withserver-client design as cloud is the server. The distinctive parts of the vehicle are associated with each other with different sensors and these sensors have sensors joinedfor monitoring. All sensors are associated with the vehicle collects the data of every individual part and justifies the normal and abnormal conditions. So, the user can know the status of the required parameter through the utilization of cellular phone.So, the client knows the condition and working of the vehicle when driving. The prototype is pre-installed with high and low values of every parameter. The prototype shows an abnormal condition of vehicle in the display.

3. BLOCK DIAGRAM

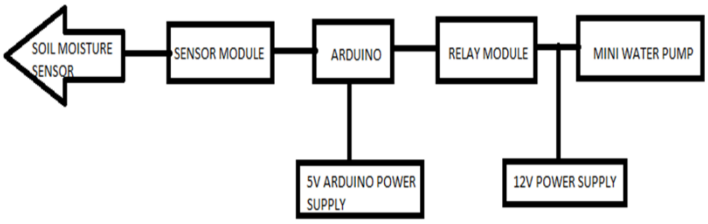

Fig . 1 . Block diagram

Figure.1Shows the Block diagram proposed system the components of block diagram as follows

- Soil moisture sensor
- Arduino
- Relay module
- Power supply and Mini water pump

SOIL MOISTURE SENSOR: The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil. As the straight gravimetric dimension of soil moisture needs eliminating, drying, as well as sample weighting. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content. The relation among the calculated property as well as moisture of soil should be adjusted & may change based on ecological factors like temperature, type of soil, otherwise electric conductivity. The microwave emission which is reflected can be influenced by the moisture of soil as well as mainly used in agriculture and remote sensing within hydrology.

ARDUINO: The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analogy input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analogy I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

SINGLE CHANNEL RELAY: Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not. As you can see in the circuit diagram, the internal circuit of 5V single-channel relay module consists of a transistor, two resistors, two light emitting diodes and one 5V relay. There are two types of relay modules according to a type of control signal used for relay activation.

POWER SUPPLY: A power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power.

WATER PUMP: This is a low-cost mini submersible type water pump that works on 3-6V DC. It is extremely simple and easy to use. Just immerse the pump in water, connect a suitable pipe to the outlet and power the motor with 3-6V to start pumping water.

4. APPLICATIONS

1. Irrigation in garden and parks.
2. Very efficient for paddy rice fields.
3. It can be agricultural fields, lawns and as drip irrigation systems.
4. It can be used for provide water in nursery planting areas.
5. Pond water management and water transfer.

5. ADVANTAGES

1. This makes increase in productivity.
2. Conservation of water and labour: Since the systems are automatic, they do not require continuous monitoring by labour.

3. System and operational flexibility: As desired, any valve can be controlled along with the pump and increases the efficiency of water use.
4. The design is low power, low cost, small size, robust and highly versatile.
5. By implementing this system, agricultural, horticultural lands, parks, gardens, golf courses can be irrigated.
6. In large scale applications, high sensitivity sensors can be implemented for urban rooftop agriculture.

Results: If the soil is dry, then sensor senses low moisture level and automatically switches on the water pump to supply water to the plants.

6. CONCLUSION

The research work presented in this paper provides IoT based smart agriculture solution for irrigation of rooftop vegetation in different climates. This automatic irrigation system uses sensor technology with micro controller to create smart switching mechanism and this model displays simple switching tool of water motor/pump using sensor from any part of ground or soil by sensing moisture existing in the soil. This work used humidity, soil moisture sensors, Raspberry Pi and ESP8266 Wi-Fi microchip to make smart switching of various components to ensure automatic water dispersal in rooftop farming area. The main advantages of proposed work are optimum use of water resources, minimum use of human labor, energy saving, cost saving, automation etc. than traditional irrigation techniques. The applications of rooftop farming will up-rise the creative green roofs conglomerate food production with natural sustainability, such as abridged rainwater run-off, temperature aids such as latent reduction of heating and cooling necessities, biodiversity, enhanced aesthetic significance and also air quality in urban vicinity.

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