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Automatic Solar Powered Irrigation System Based Prototype titled 'Inno- Village'

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***Abstract*— This paper focuses on the development of advanced irrigation model which will improve the quality of life and help in irrigation, green house effect, and solar powered electricity. Depleting fossil fuels and alarming environmental concerns have propelled the mankind to explore for non- conventional energy source such as solar energy, wind energy, among others. Since, countries like India receive direct sunlight through out the year therefore, this paper emphasizes on use of solar powered energy to solve the energy crisis. This project consists of a village model, Inno-village. Inno village or innovation village employs solar energy for solving energy problems of farmers. This model involves use of vivid advanced sensors and microcontroller for irrigation of fields, cultivation of green- house crops, control of moisture, and electricity for village, among others.**

***Keywords*— Inno-Model, Solar Based Irrigation System, Automatic Irrigation System, Irrigation System Using Arduino Uno, IOT Based Irrigation System, Solar Panel, Moisture Sensor**

I. INTRODUCTION

According to World Bank Group, agricultural sector covered 60.4% of the India's land in 2015. Major share of people are involved in farming directly or indirectly and agriculture serves as one of the significant sectors in the country. There are four major types of crops that are cultivated in India such as food crops, cash crops, plantation crops and horticulture crops among others. Agricultural based countries required vast amount of water for their watering or irrigation. Irrigation may be defined as the science of artificial application of water to the land or soil that means depending on the soil type, plant are to be provided with water. Nowadays for irrigation different Techniques are available which is used to reduce the dependency of rain[1]. And mostly this technique is driven by electrical power and on/off scheduling controlled. Also, according to the survey conducted by the Bureau of Electrical Energy in India in 2011, there are around 18 million agricultural pump sets and around 0.5 million new connections per year are installed with average capacity 5HP. Total annual consumption in agriculture sector is 131.96 billion KWh (19% of total electricity consumption)[2]. When the countries from around the world are facing water crisis then, Irrigation through direct pump sets is highly inefficient and ultimately leads to wastage of water, therefore farmers have already devised other irrigation methods like drip irrigation, sprinkler irrigation, surface irrigation among others. Sprinkler irrigation being the preferred choice has several advantages including reduced leaching and less wastage of water. There are also some smart irrigation systems which makes use of microcontrollers and sensors to help in reducing consumption of water with suitable irrigation in real time applications. These advanced microcontroller based irrigation systems employ following techniques:

1. Utilization of different kinds of sensor nodes
2. Microcontroller for controlling the operations
3. Solar panel for solving the energy crisis
4. IOT based device for monitoring
5. Designed system can be used for watering introduced plants and plant pots

II. LITERATURE OVERVIEW

In this model various sensors are used in order to collect as much information as possible so that we can consider every factor from moisture, temperature to humidity making it practical for the varied environmental changes. ultrasonic sensor, humidity and temperature sensor, and moisture sensor are placed in the root zone of the plants or crop in the field while rain sensor is placed at a higher place from land. Various information are collected from these sensor nodes transmitting it to the microcontroller. Algorithm is designed in such a way that it allows water to flow into the field when any of these conditions satisfy:

1. if the water level in the pot or field is greater than 25cm
2. if all the moisture sensors in the field detect no moisture
3. if there is no rain detected by the rain sensor and there is moisture
4.if the value of the humidity and temperature is higher than a certain point in algorithm

In order to drive the motors for irrigation, photovoltaic panels are used to solve the energy demand.

This paper design a automatic irrigation system with the help of solar panel and sensors. Although, this model only controls the pump sets based on the information sent to the microcontroller by the nodes but it gives you detailed information about the soil in real time.

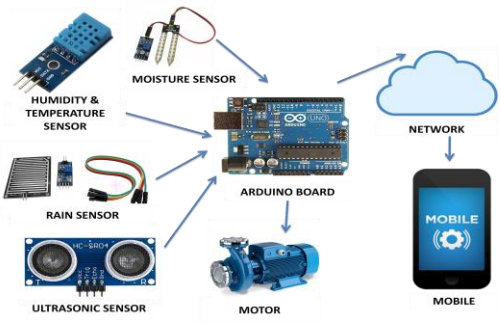

Fig. 1 Example of IOT based solar powered automatic irrigation system

III. The Proposed Work

Conventional irrigation systems consume large amount of water and particularly when water scarcity is such a notable issue we cannot afford to waste water. This model is a nascent approach towards minimizing the water usage by providing water only when the soil is dry. Sensors collect data and as a consequence of the collected information sent to microcontroller the pump set gets turned on or off. When there is sufficient amount of water in the soil as conveyed by the moisture sensors, the pump set is turned off by the microcontroller.[3] Since, irrigation is done only when it is required as a result preventing overflow and flooding of crop. Following are the major components that are used to for the proposed system:

1. arduino uno v3.0
2. diode
3. solar panel
4. LCD 20x4
5. ultrasonic sensor
6. humidity and temperature sensor
7. moisture sensor
8. rain sensor
9. relay
10. node MCU
11. relay
12. capacitor
13. motor

IV. System Description

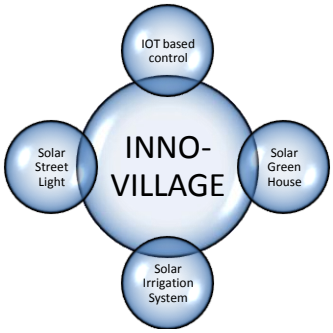

Fig. 2 Different applications of Inno-Village

Inno–village is inspired by the Jawaharlal Nehru National Solar Mission and Digital India with the vision to create a model that has automated irrigation system, green house farming, solar street lights, internet-based farming. This project makes the use of clean renewable solar energy to drive the motor for irrigation. It has two modes automated mode and IOT based mode. It takes into consideration the environmental condition. Our project has a rain sensor, a moisture sensor, humidity and temperature sensor, ultrasonic sensors to consider all the factors of the environment. This automated project turns on pump set for irrigation in the field when ever there is low moisture in the soil, low humidity or high temperature in the surrounding. While when there are enough moisture and humidity or there is rain it

automatically turns off the motor. The leftover solar energy is stored in batteries to drive the household lightning or street lights. It can also be sold to the power plant to earn a profit. Since, we have taken into account the humidity, temperature and moisture. Therefore we can also use it for the green house farming which requires sensitive environmental conditions. All of the above-described model is automated so that farmers can engage themselves in other work. The best part of the project is IOT mode in which farmers can access the various parameters such as humidity, temperature, distance, moisture on the application of their smart phones. Blynk app uses the Internet to access data and we can control the fan and motor pump from across the world. Blynk app is available on the play store and can be downloaded for free and has easy customization option.

V. CONCLUSION

INNO VILLAGE helps to achieve the National Solar Mission by making automated, smart, digital, solar powered, self-sufficient, power generation model of the village. By using the automatic irrigation system we can optimizes the usage of water by reducing wastage and by minimizing the human intervention for farmers.The excess energy produced using solar panels can also be given to the grid with small modifications in the system circuit which can be a source of the revenue of the farmer, thus encouraging farming in India and at the same time giving a solution for energy crisis.[3] This model is reliable, cost efficient, and a long term advantageous approach with only one time investment.

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