Smart Irrigation System through Wireless Sensor Networks

(Unmanned Irrigation System)

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***Abstract*-Irrigation is one of the most powerful sources in India but it is hard for an individual person to monitor continuously and regularly. This is due to laziness of mankind. In order to make this irrigation easier our system comprises some changes in the usual irrigation system. The newly developed project controls water supply automatically in water crisis areas through moisture sensor. This paper covers the application of Sensor based Irrigation system through wireless sensor networks, which uses a renewable energy as a source. In this system Wireless Sensor Networks Plays a major role in Environment monitoring system and provides unmanned irrigation. WSN consists of moisture sensors, Energy harvesting systems, embedded controllers and uses Super capacitors as storage device.**

Keywords- Wireless sensor Network; xbee modules; Energy Harvesting; Boost converter.

I. INTRODUCTION

In today's world agricultural areas are getting reduced due to laziness of mankind in irrigation. Irrigation which is of current technology is a time consuming and also requires high maintenance during the yielding. Further the quality of the crops is also depends on the human management. In today's world most of the water is used for the irrigation system. In order to minimize this, a system has to be developed to perform irrigation automatically which acts dynamically upon the weather conditions. This system mainly concentrates on the conservation of the water resources by watering the crops whenever it is needed and it is made through moisture sensor in the fields. This paper concerns the Dynamic and Unmanned irrigation system which reduces the wastage of water and to avoid the pesticide in the crops. This system intelligently adapts the water flow and irrigation based on the weather and moisture content of land. It reduces the maintenance cost and this system is more suitable for the complexity of high crops generation. The system consists of various subsystems such as moisture sensor, soil sensor, energy harvesting systems and microcontroller. In our research we mainly focussed on the conservation of water resources and unmanned irrigation system. An additional feature has also been included in the system to identify the insects in crops and pesticide is sprayed only in that portion using the on stream video camera via image processing.

II. ARCHITECTURE OF WSN PLACED IN AGRICULTURAL FIELDS

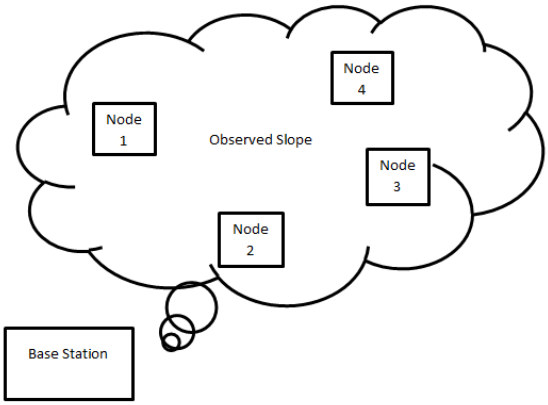

Fig.1. WSN nodes Placed in observed Slope

The Architecture consists of various WSN nodes placed in the field area under irrigation and a base station located nearer to the field which is at a particular defined distance to record, monitor and analysis the data received from the multiple WSN nodes. The base station is microcontroller in which the operations have been performed. The Implementation of WSN nodes provides easy way to measure the field information data and communicates with each other through wireless communication during the operations and results in more effective irrigation system. The implementation of Unmanned Irrigation system provides an easy way to monitor the crops and reduces the wastage of water resources. This system is also capable of real time monitoring control over the crops. The sensors connected to the microcontroller which processes the data and performs a particular action in the field. Due to the

reduction in water resources, this will play major role in the irrigation system.

A. Basic Block Diagram of WSN Agricultural System

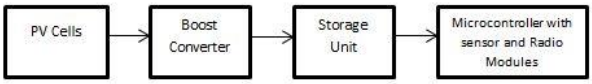

Fig.2. Block Diagram of WSN Agriculture system

The block diagram consists of various Subsystems such as Solar Energy harvesting PV cells, Boost converter, storage devices for the storage of energy in future and Low power Microcontroller is attached with Radio modules. The sensing unit is within the microcontroller circuit used to detect the moisture content in the soil. Low power microcontroller processes the data and performs the operation. The operations are the water filling and pesticide spraying. Each nodes implemented in the observed zone has the same subsystems mentioned in the above block diagram.

III. ENERGY HARVESTING AND POWER MANAGEMENT SYSTEM.

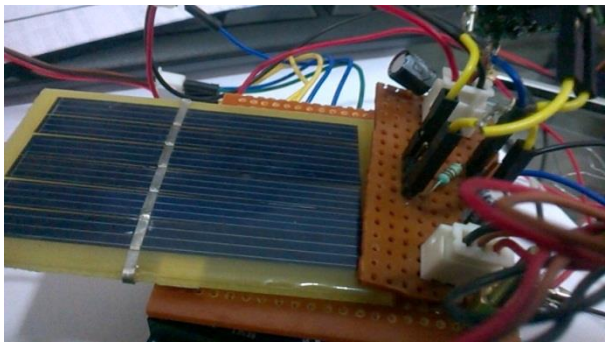

Fig.3. Solar panel

Energy Harvesting is defined as the process of acquiring small amounts of energy from natural resources like solar and wind, processing them and storing those harvested energy in storage devices for further usage. This system powers the whole microcontroller and sensor units. Wireless Sensor Nodes Energy harvesting overcome the barriers of real world implementation of wireless sensor networks (WSN).By implementing this in our system overcomes the frequent replacement of batteries in the field. The energy produced from the photo voltaic cells is not enough to drive the microcontroller operation so we are using a boost converter to maximize the voltage and the circuit diagram of the boost converter is shown below in Fig.3. Boost converter circuit diagram. The electrical energy harvested from the Photo voltaic cells are amplified using the Boost converter Circuit. The boost converter increases the harvested Voltage to a desired output voltage. In each and every node these energy harvesting system are placed for powering the apparatus

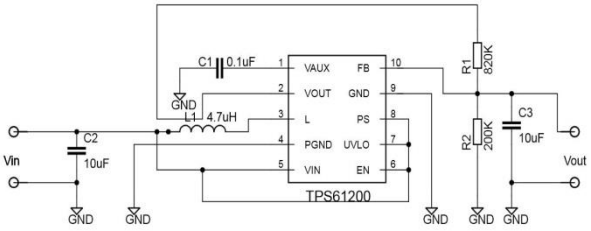

Fig.4. Boost converter Circuit Diagram

IV. DETECTION AND UNMANNED IRRIGATION

Detection unit consists of moisture sensor, soil fertility sensor and on stream camera. It is placed at calculated zones to monitor and analyse the data and sends the data to the microcontroller for processing which perform the operations. These sensing units will communicate with each other during its operation through wireless sensor networks. Suppose the particular location is dry then it transfer information to the microcontroller through the various nodes and microcontroller processes the data. Depending upon the processed data the motor is turned on and water is made to flow through a particular location through canals. The on stream camera which always records the crops continuously which compares the data with reference data. Suppose if any mismatch occurs then it send the signal to the microprocessor. Depending upon the data corresponding motor is turned on and water flows to the particular location through canals. This is achieved due to the communication between the sensors. This Dynamic Irrigation system overcomes the wastage of water and energy, which is the most needed one in the today's crisis. Energy storage is must essential for Energy harvesting wireless sensor networks due to continuous sensing operation. In this Dynamic control, the detection unit plays a major role for the unmanned irrigation.

Unmanned irrigation refers to automatic generation of crops without the intervention of mankind. By this way, the field can think themselves according to the condition then corresponding water and pesticide sprinkling is performed. In order to this we can able to maintain the quality of the crops without spraying the pesticide throughout the field,

because pesticide affects the healthiness of crops and reduces the vitamins in it.

V. EXPERIMENTAL SETUP

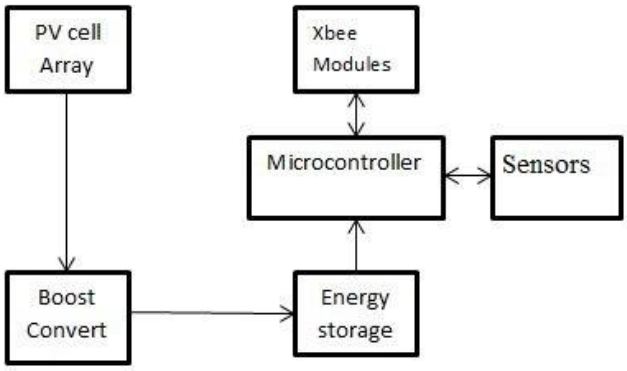

Fig.5. Remote Sensor Node Block diagram

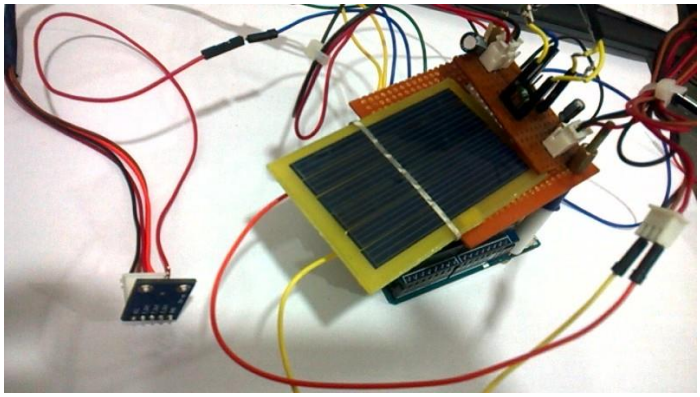

Fig.6. Remote Sensor Node.

A. Sensor Nodes Remote station

The Wireless Sensor Node in the observed field with various subsystems. Sensor is used to detect the moisture content and soil fertilities. The output of the sensor is in form of digital, it may be either 0 or 5v. These values are processed through the microcontroller. Whenever the corresponding sensor gives high output then corresponding motor is turned on and water flows to that field. The on stream camera that monitor all through the fields gives one of the input to comparator. The output values are efficiently processed by the Atmega128 Microcontroller, The microcontroller is programmed efficiently to analyse the sensed data and it sends the value to the Base station through Xbee Radio Modules integrated in the nodes. The Microcontroller remains in sleep mode when the soil is wet and no pesticide is detected. It switches to active mode if soil is dry and pesticide is detected; this energy efficient programming algorithm saves as much as harvested Energy in the storage device for the future use. The experimental setup is simulated through proteus7 software.

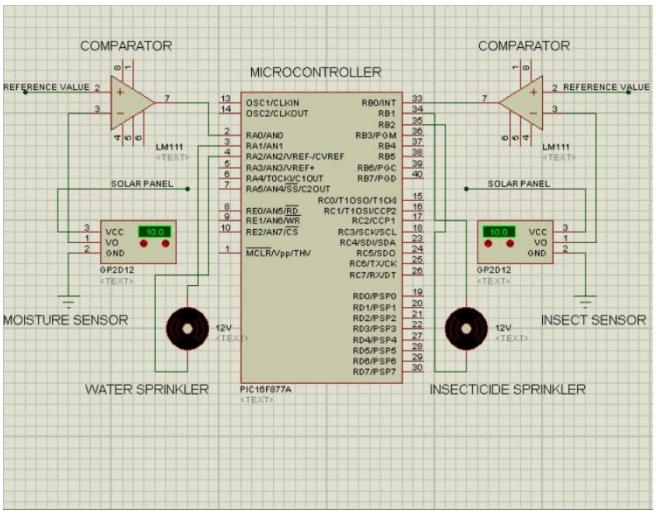

Fig.7.Simulation through proteus7

VI. RESULTS

The result includes the successful operation of Smart Irrigation System (Unmanned Irrigation). This system is able to conserve the water resources and controls the overall operation of irrigation. This system is also called as a Dynamic Irrigation system which can think of themselves.

VII. CONCLUSION

This paper presents the Dynamic Irrigation system through sensors and on stream camera for the conservation of water resources and pesticide avoidance. This system is experimented through sensors and outputs are obtained through proteus7 simulation software. By this way, we can able to step into an unmanned irrigation.

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