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OPTIMIZING IRRIGATION BY REDUCING WATER WASTAGE AND MINIMIZING MANUAL LABOR IN AGRICULTURE USING RASPBERRY PI

Future of Agriculture through IOT

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ABSTRACT:*Internet of Things(IOT) is a new revolution of the Internet. IOT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between physical world and computer-based systems. Irrigation has been the backbone of human civilization since man has started agriculture. As the generation evolved, man developed many methods of irrigation to supply water to the land. In the present scenario on conservation of water is of high importance. Present work is attempts to save the natural resources available for human kind.*

Drip irrigation is artificial method of supplying water to the roots of the plant. It is also called micro irrigation. In past few years there is a rapid growth in this system. The user communicates with the centralized unit through internet. The centralized unit communicates with the system through SMS which will be received by the IOT with the help of the smart phone. It sends this data to Raspberry Pi which is also continuously receives the data from sensors in some form of codes. After processing, this data is displayed on the LCD. Raspberry pi acts a central coordinator and end devices act as various routers. Low-cost and energy efficient drip irrigation system serves as a proof of concept. The design can be used in big agriculture fields as well as in small gardens via just sending an email to the system to water plants. The use of ultrasound sensors and solenoid valves make a smart drip irrigation system

Keywords: Raspberry PI, PH, temperature, soil, humidity, water level sensor, 16X2 LCD display, android app, Arduino software.

I. INTRODUCTION

Agriculture is considered as the basis of life for the human species as it is the main source of food grains and other raw materials. It plays vital role in the growth of country's economy. It also provides large ample employment opportunities to the people. Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming which results in low yielding of crops and fruits. But wherever automation had been implemented and human beings had been replaced by automatic machineries, the yield has been improved. Hence there is need to implement modern science and technology in the agriculture sector for increasing the yield. Most of the papers signifies the use of wireless sensor network which collects the data from different types of sensors and then send it to main server using wireless protocol. The collected data provides the information about different environmental factors which in turns helps to monitor the system. Monitoring environmental factors is not enough and complete solution to improve the yield of the crops. There are number of other factors that affect the productivity to great extent. These factors include attack of insects and pests which can be controlled by spraying the crop with proper insecticide and pesticides. Secondly, attack of wild animals and birds when the crop grows up. There is also possibility of thefts when crop is at the stage of harvesting. Even after harvesting, farmers also face problems in storage of harvested crop. So, in order to provide solutions to all such problems, it is necessary to develop integrated system which will take care of all factors affecting the productivity in every stages like; cultivation, harvesting and post harvesting storage.

This paper therefore proposes a system which is useful in monitoring the field data as well as controlling the field operations which provides the flexibility. The paper aims at making agriculture smart using automation and IoT technologies. The highlighting features of this paper includes smart GPS based remote controlled robot to perform tasks like; weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance, etc. Secondly, it

includes smart irrigation with smart control based on real time field data. Thirdly, smart warehouse management which includes operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with micro-controller and raspberry pi.

II. METHODOLOGY

Atomization of agriculture system using raspberry Pi and android apps will be made in the following steps:
1. Complete layout of the whole setup will be drawn inform of a block diagram for each node.
2. The temperature sensed by sensor is displayed on LCD
3. The soil condition is checked by moisture sensor, depending upon the soil condition & water level, water pump motor is turned on or off.
4. The motor thefting can be prevented by Raspberry Pi controller by informing the farmer by sending SMS & buzzer alarm.

5. The humidity sensor checks the presence of water in air and value displayed on LCD display.
6. The PH sensor checks the contents of water.

7. The status of the whole farm can be checked & updated wirelessly with help of internet using smart mobile phone android app technology.

III. SYSTEM DESIGN AND IMPLEMENTATION

A. *PROPOSED AUTOMATION OF IRRIGATION SYSTEM.*

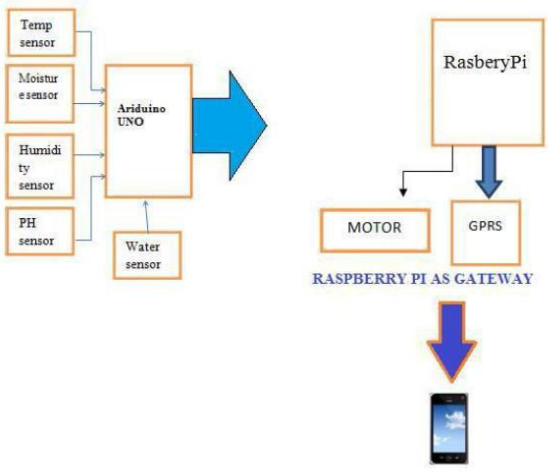

Figure 1.Proposed Automation of Irrigation System

The proposed system consists of the Wireless Sensor Network for acquiring climate data locally. In WSN various weather monitoring sensors are placed inside the field, sensors include soil moisture ,water level sensor , humidity sensor, temperature sensor. Using this information, irrigation requirement is calculated remotely at central computer and control irrigation controller module wirelessly. Wireless Senor Unit (WSU) consists of a Radio Frequency transceiver, soil moisture sensors, a microcontroller, and power sources. Several WSUs can be deployed infield to configure as a distributed sensor network for accurate irrigation control. Each unit is based on the microcontroller raspberry Pi that controls the ZigBee module and processes information.

B. THE PROPOSED AGRICULTURE AUTOMATION SYSTEM FUNCTION

The proposed agriculture automation system function has ability to control the following components in users.

1. Temperature and Humidity
2. Soil sensor
3. Water level detector
4. Motor on/off and alarm
5. PH sensor
6. Software design
7. Android app

IV. IMPLEMENTATION SETUP

Each WSN consist of Moisture sensor ,humidity, Temp, Ph sensor water level Sensor which to be interface with PIC18F4520 controller .A data from sensor process by PIC controller and sent to central base station through Zigbee module

.All the WSN node are connected to Moisture content in the soil will be measured by the sensor, if the sensor detects the soil as dry this information send to rasberyPi as a base station this data process by rasberyPi and send over GPRS unit to famer mobile application then he takes decision to ON /OFF farm Motor .Both theabove information is given to the microcontroller which exchanges data with the server to provide information to the farmer.

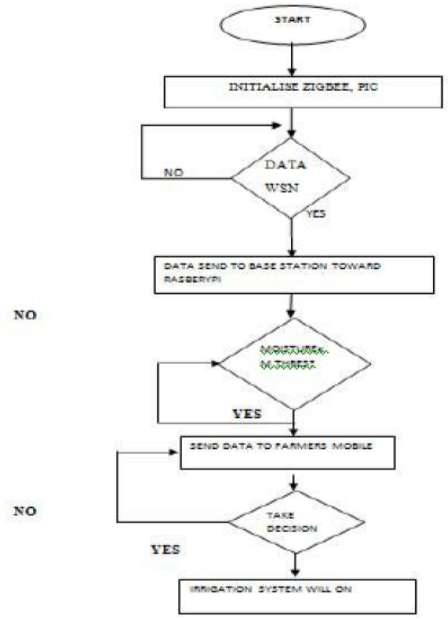

Figure 2. Implementation setup

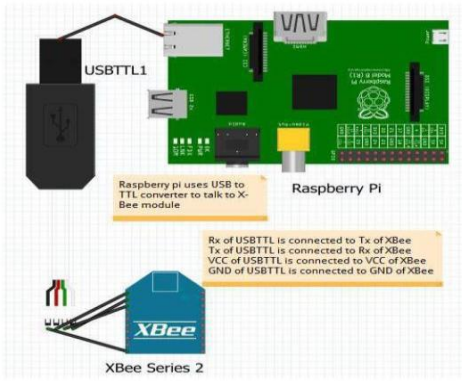

Figure 3.Proposed Hardware Automation of

Irrigation System.

V. HARDWARE DESCRIPTION

1. Temperature Sensors: Temperature sensors are devices used to measure the temperature of a medium. There are two kinds of Temperature sensors contact sensors and non-contact sensors. However, the three main types are thermometers, resistance temperature detectors and thermocouples. All three of these sensors measure a physical property (i.e. volume of a liquid, current through a wire),which changes as a function of temperature.

2. Humidity Sensor: This sensor checks the presence of water in air. The amount of water vapor in air can affect the plants growth. The presence of water vaporal so influences various physical, chemical, and biological processes.

3. Raspberry Pi controller: Raspberry Pi controller is used to control and interface the Sensors, Motor and internet. This is a low-power, high-performance controller

4. Water Level sensors: This sensor detects the level of substances that flow including liquids, slurries, granular materials and powders. Fluids and fluidized solids flow to become essentially level in their containers (or other physical boundaries) because of gravity whereas most bulk solids pile at an angle of repose to a peak. The substance to be measured can be inside a container or can be in its natural form (e.g., a river or a lake).The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place, while point-level sensors only indicate whether the substance is above or below the sensing point. Generally the latter detect levels that are excessively high or low.

5. PH sensor: the PH sensor is used to calculate the content of water and it is displayed on LCD display.

6. Motor pump theft detector: This sensor checks the presence of the motor and if motor is absent then

ARM activates the buzzer alarm and sends SMS to the farmer's mobile.

7. Android system: Android is that it offers a unified approach to application development and their applications should be able to run on numerous different devices, as long as the devices are powered using Android. These applications written in Java programming.

VI. RESULTS

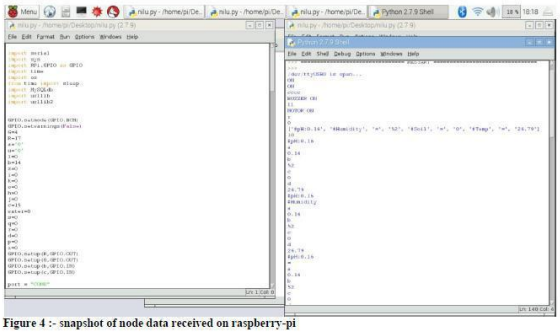

Figure 4 :- snapshot of node data received on raspberry-pi

VII. CONCLUSION

Irrigation has been the backbone of human civilization since man has started agriculture. As the generation evolved, man developed many methods of irrigation to supply water to the land. In the present scenario on conservation of water is of high importance. Present work is attempts to save the natural resources available for human kind. By continuously monitoring the status of the soil, we can control the flow of water and thereby reduce the wastage. By knowing the status of moisture and temperature through internet with the use of moisture and temperature sensors, water flow can be controlled by just sending a message from our mobile. Conservation of water and labor: Since the systems are automatic, they do not require continuous monitoring by labor. System and operational flexibility As desired, any valve can be controlled along with the pump and increases the efficiency of water use.If water is stored in tanks at irrigation lands, one can get the status of the water level, temperature sensor and moisture content in soil through SMS generator by microcontroller present at the irrigation land. The PH sensor is use to continuously finding the content of water it is used for plant growth. The proposed system is very usefull for regular monitoring of farm status without visiting manually, and saves time and also use full to monitor hilly areas and remote areas, which were hard to visit manually. The system not only saves the energy consumption significantly, but also reduces a large number of inputting on the human and material resources in the management. Applying embedded technology and wireless transceiver technology using mobile to the rapid deployment system of the incident detection of emergency food storage environment without complicated connections, it enhances the system's flexibility, small size, low cost and good effective, so it is easy to install and migrate.

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