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Sustainable Agriculture Using Wireless Networks

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ABSTRACT

Automization of agricultural system is very useful for farmers who reside far away from the agricultural field. In this paper we automize the following functions such as fog treatment, seeding, boundary leveling, water management, security systems, moisture control, weather monitoring. Automatic agricultural systems can even save us money and help in water conservation if it is fixed and programmed properly. Wireless sensor networks is employed in this system for specified location depends upon the authorized point of temperature, humidity and soil moisture. The fundamental aim is to brought a automatic monitoring of paddy crop field. Here how the sensors are effectively used in the field using wsn, IEEE 802.15.3 technology, Protocol stack of IEEE 802.15.**3.**

KEY WORDS: Agriculture, Paddy Crop.

1. INTRODUCTION

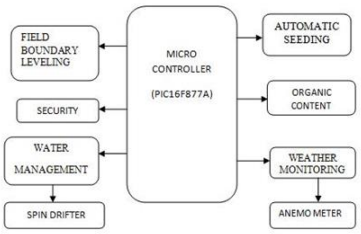
This project proposed a wireless system for automatic farming for cultivation field, which senses and control an irrigation system in real time by means of a wireless sensor network. This wireless system supports the cultivation field which has both plain and slope areas. Too much watering causes diseases to crops. The sensors employed in the system will sense the water level of the tank gives a sound alert and then motor is switched ON automatically whenever the level of the water is too low. The remote system switched OFF the motor when the water level reaches 90% of the tank. The signals from the wireless sensor network and irrigation controller is connected with Xbee-PRO communication. The operating frequency of wireless system module is within the range of 2.4 GHz frequency band and an outdoor RF line-of-sight (Keating, 2003; Ladgaonkar, 2011; Karthik, 2013; Jasmin, 2015; Philomina, 2014).

Functions to Be Implemented

- Fog treatment
- Seeding
- Boundary levelling
- Water management
- Security systems
- Moisture control
- Weather monitoring

This system is implemented by choosing wireless technology and sensor networking techniques. Economies of scale and competitive pressures of forcing are the two major factors which tend to force the farms to become larger. Systems which are automated may regulate and check the level of the water by complex systems and also it can be able send messages to the farmers.

Block Diagram



Consequently, the day to day activities of the farmer include irrigation of land, planting seeds in the field, harvesting of crops and grain drying, or look on domestic animals; sensors that senses the moisture of the soil and various devices; equipment for controlling the water pumps, closing the gates. For this farmers need to spend their valuable time and also their energy for passing between fields and also to communicate with employees. Due to advancement in technology it is very much easier to assemble and install wireless sensor and control networks for making the task to be performed automatically. Even though remote sensing technology is not available in many farms (Karthik, 2014; Saravanan, 2014; Gopalakrishnan, 2014).

Fog treatment: This methodology involves how to clean up the fog that are created by the winter season. Collection of liquid water droplets or ice crystals is Fog which reduces the production of starch in any kind of plants By removing these kind of Fog that are fetter with the crops will increase respiration and leads to better grow. Fog is nothing but an aerosol spray which is a distribution of droplets with a Volume Median Diameter- (VMD) and if has a range below 50 microns (mostly 5 15 microns), and the number of droplets per unit volume is such that visibility

is much more reduced. Visibility is reduced by thermal fog to maximum extent and it may possess traffic hazard. Fogging is explained in chemical control methods due to its limitations associated with this factors that include (Vijayaragavan, 2014; Karthik, 2014; Saravanan, 2014; Gopalakrishnan, 2014).

Water management: Normally in the field the water level will be uniform throughout the field. As per the need water wells can be made and the water level is monitored in each well. To sense the level of the water, water level sensors are employed or installed. Despite the fact that sensors are accessible because of the natural conditions of electro-mechanical gadgets are more pertinent. The electrical part will deliver the signals taking into account the portion of the floating device and the mechanical part present in the devices will swim on water (Kanniga, 2011).

The signals or values are transmitted to the farmers which is generated by the sensor. Because of the issues like media for transmission, consumption of power, security in the field etc, ordinary communication methods cannot be utilized. Low power is needed by low cost communication devices. Also it needs less cost for maintenance, due to its wireless architecture is the solution. The main method used for the real time monitoring of crop field, is the Wireless Sensor Network (WSN). Advantages of WSN has greater advantage over large scale deployment of system, low maintenance of the devices, less power needed for system etc. with the disadvantages of minimum amount of memory, lesser amount of power, lesser bandwidth etc.

The system consists of the sensor network is an example for a 3 tier system. The end sensor devices which have been installed in at the bottom of the field is in sleepy condition most of the time. Nodes are connected to the water level sensors. The function of the electrical sensor is to collect the values of water level and transmit the necessary information of data to FCC. The system consists of the routers or the cluster heads that is installed in the field is the 2 tier. The end sensor nodes in the field are connected together based on their positions of the sensors. There is a cluster node allocated for a group of end sensors. Occasionally the end or last sensor node send data to their appropriate cluster heads in the field. The entire wireless system is monitored and controlled by FCC (Field Control Center) .FCC is nothing but a software program for stored in the user computer. The sink node in the field transmit the data node to the FCC. The Field control center send the necessary commands for monitoring the network operation. Occasional checking of level of water in the field is important the water that is furnished to the plants is not the same quantity.

Seeding technology: So far, we don't have a proper equipment or device to do the seeding process. By constructing a user friendly robot which does the process of seeding in the fields. It is used as a single row-seeding device for sowing different crops by altering the fluted roller of the metering mechanism. Meanwhile farmers are struggling when they are seeding in summer. Designing a wheel based wireless robot to seed the crops in the fields. Under the principle of magnetism the seeds are going to drop down in field lines.

Salient features of our seeding robot:

- Uniformity in seed sowing and plant production
- Reduction in seed rate and the cost of thinning is reduced
- Hill dropping of seeds is achieved and continuous drilling is eliminated
- Convenient. Groundnut seeds are sowed as straight rows in the field; hence, mechanical weeding can be done between rows.

Usually, the seed is planted in the soil by a drag or harrow. More practice is needed to sow evenly at the desired rate in the field.

Boundary Levelling Robot: Normally the process of evacuating the boundaries of paddy is more difficult to do, in order to implement that we are making a robot will does the process of boundary restriction level.

Field boundary

A mechanical based vehicle with the principles of agricultural machinery is built to levelling the boundaries of crop fields. Mostly the adjacent sides of fields are levelled by manually. To reduce the man power we are in the process of mechanically based machine with the help of electronically enabled systems.

Security systems: To protect the paddy fields from the cattle like cows and goats a system will help us. An alarm system is introduced in the paddy fields.it consists of wired basis network. The plunge dip is one common methods of tick control in the field. The animal is totally immersed in the dipping compound. You need a dip tank, an electric

or diesel pump and access to water.

- Fire alarm
- Cattle alarm

Fire alarm: Astable multi vibrator oscillator works as a timer IC in this circuit which is used to oscillate in audio frequency band. Two transistors T1 and T2 drives the timer IC. Resistors R5 and R6 and capacitor C2 decides the frequency of timer IC 555. The loudspeaker is connected to the pin no 3 of timer IC through transistor T3 which is used for fire alarm. Power supply of 6V to 12V is needed for the fire alarm circuit. It has a single independent input to detect any fire or smoke indication from the sensor unit, and sets an alarm or an indication to alert people. The sensor will detect presence of smoke and generate an interrupt to the microcontroller. This will switch on the exhaust fan and a sound alarm with flashing light.

Cattle alarm: Cattles are threats to the paddy fields and they eat the crops. To improve the nutritive value rice straw can be treated in order to enhance feed intake digestibility. So, the cattle can be easily attracted by rice straw. In order to avoid cattle, we move on to introduce an alarm based system.

How it works:

- When cattle come like cows and goats the system will insist the cattle not to come over the field.
- It alerts the farmers immediately
- Once then cattle enters in the crop field it creates an high pitch sound which creates dread to the cattle.

Moisture Control: In order to check the water level of the field moisture sensors are deployed. To monitor the crop field IEEE 802.15.3 wireless sensor network is designed. Based on the result that particular place is chosen for cultivation. By doing so water is conserved. This method can reduces the problem of water stagnant in the field or land. Due to increase of fertilizer level in the crop is increased people face many health problems? To avoid this pH sensors are used. Also it analyzes the soils acid level in the field. Fertilizers can be applied to the field based on the need. Major problem include over fertilization of the crops can be avoided. Temperature will not be constant in the paddy field. Using Temperature sensors are deployed in the paddy field.

Hardware Design: For constructing an end-to-end system, each and every element that is to be used in WSN are chosen based on the requirements especially while constructing the hardware side. Soil water content in the soil ranges from 0 to 2 bars because of the linear relationship Resistance and temperature. The measurement of the resistance was approximated to degrees C by:

$R = Rs/ [1-(0.018.dT)]$

where,

R = Resistance at 21°C,

Rs = Measured resistance,

Ts = Soil Temperature,

dT = (Ts – 21).

The cluster head is the sensor that is nearer to the land. More power needed for the sink node. In the house of the paddy field owner sink node is installed. The sensors are installed in the column of the field which is connected to the wireless sensor node. The minimum distances between the sensor nodes columns in the field were roughly 50 mtrs. The output is received by the cluster head nodes It transmits the value to the sink node. The distance of the sink node which is deployed under the field was about 50 mtrs. FCC which is installed in the computer will run the program. The distance between the owner's house where FCC is installed and the field is nearly about 300 meters.

IEEE 802.15.3 Based Wireless Technology: IEEE 802.15.3 is a high-level communication protocols used to create personal area networks built from small, low-power digital radios. IEEE 802.15.3 is advance development of an IEEE 802.15.4 standard.

2. CONCLUSION

In this modern world, modern techniques are employed in the crop fields. Nowadays farming community is been reducing due to better opportunities for the farmers. This problem become worse when production is decreased. Farmers are getting more profit by the use of advanced machines and new farming procedure. This attracts many people to involve into farming and increasing the production.

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