A WIRELESS AUTO-AGRI SYSTEM USING RF MODULE AND SENSORS

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ABSTRACT

Irrigation using water resources in agricultural areas have an essential importance. Because highly increasing population demands for freshwater, best usage of water resources has been supplied with greater extent by automation technology and its fundamental apparatus such as drip irrigation, sensors. This paper describes an application of a wireless sensor network for wireless controlled irrigation solution for fields. An automated irrigation system was brought to upturn water use for agricultural crops. The system has a spread of wireless network of sensors (moisture, humidity and temperature). As the technology is rapidly thriving and changing in human life, Wireless sensing Network helps to improve the technology where automation is playing important role. It provides ease and increases efficiency but also reduce energy and time.

Keyword: - *Drip irrigation, Wireless soil moisture sensor, temperature sensor, automation.*

[1] INTRODUCTION

Agriculture is the backbone of Indian economy. Conventional methods leads to soil saturation and it stays wet for long time after irrigation is completed. The continuously increasing population in India demands for the rapid improvement in food production technology. The Agriculture sector is the biggest user of fresh water resource, followed by the sectors like domestic and industrial sector. "Subsoil water" contributes to around 65 per cent of the country's total water resource demand, and plays a key role in casting the nation's economic and social development. On the other hand, feeding population of our own country, which is 17 per cent of the world with 4 per cent of world's water resources at hand, is a difficult task. Automation significantly reduces cost of production by systematic usage of energy, labour pool and material. The quality of product can be achieved with automated machines that gives distinctness and processes that cannot be achieved with manual operation is automated; the same quality would be achieved for several crops with little variation.

Agricultural processes, basically, produce quality crop from seeds using water, fertilizers, pesticides, energy, manpower, equipment and infrastructure. Since agriculture is essentially an economic activity, the fundamental objective of any farmer is to make profit by reducing investment, expenditure and manpower and obtaining good quality product. This can be achieved by using to automation.

A site-specific wireless sensor-based irrigation control system is a potential solution to optimize yields and maximize water use efficiency for fields with variation in water availability due to different soil characteristics or crop water needs and site-specifically controlling irrigation valves. Decision making process with the controls is a viable option for determining when and where to irrigate, and how much water to use. An irrigation controller is used to open a solenoid valve and apply watering to plants when the volumetric water content of the substrate drops below a set point. Automatic irrigation scheduling consistently has shown to be valuable in water use efficiency with respect to manual irrigation based on direct soil water measurements.

[2]BLOCK DIAGRAM:

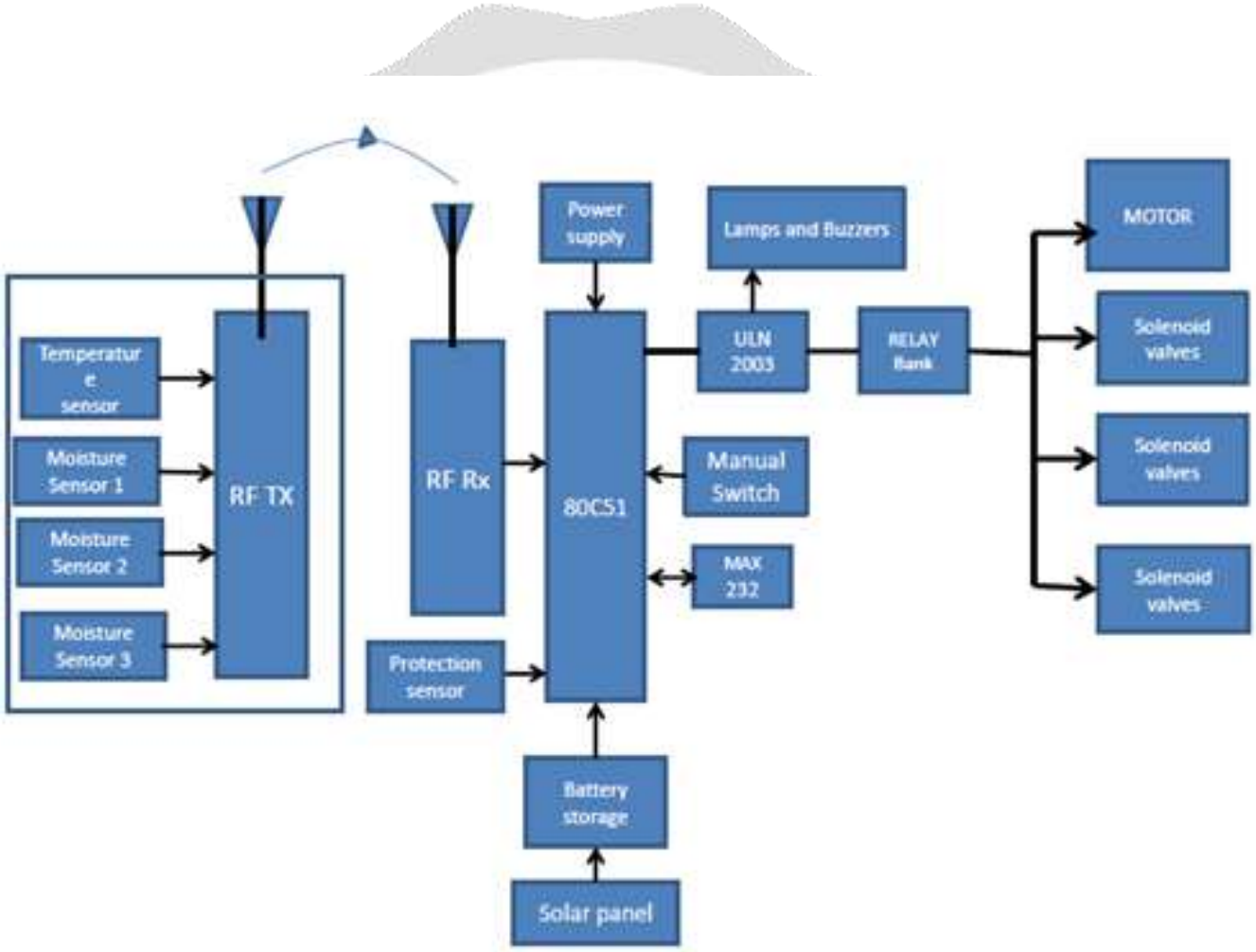

Fig 1: Block diagram of Auto-Agri system

[3] MATERIALS AND METHODS:

Our project consist of four stages namely sensor circuit i.e. input, 805C1 based microcontroller circuit motor drive circuit i.e. output and power supply unit. In input section consist of sensors and manual switches. Different sensors are used to detect the different parameters of the soil like moisture and temperature. Depending upon the sensors output the 8051 processor will take the necessary action. The switches are used for manual operation. In output section motor driver circuit is used. Motor driver circuit consist motor for taking the fresh water from well or another water. Solenoid valves are used in the system which is controlled through relay bank. In power supply unit 5v power is supplied to the system from the battery .Otherwise, the solar system is used to supply the energy if sunlight is available, which saves the electricity. Buzzers and LEDs are basically for protection purpose.

[4] HARDWARE:

There are four different units which were designed and applied in this project: Sensor circuit which consist of temperature sensor (thermistor base) and moisture sensors (surface sensor and root sensor), 8051 Micro-controller family IC (P89V51R02), Motor drive circuit, Power supply unit. All of these units contain a RF module (transmitter and receiver), a 5V and solar panel (optional). All the electronic devices, sensors, and solenoid valves were selected to meet the low power and economical cost requirement for the system. The units used in the application were designed as a transportable device. It concludes which part of unit must be measured and/or controlled.

The input section consists of sensors and manual switches. Different sensors are used to detect the different parameters of the soil like moisture and temperature. Depending upon the sensors output the 80C51processor will take the necessary action.

In output section consist of motor driver circuit. Motor driver circuit consist motor that take the water from well. Solenoid valves are used in the system which is controlled through relay bank. The output from the sensors and manual switches are fed to RF transmitter. RF receiver on the second hand receives the data from transmitter and feds to microcontroller. The programming procedure takes place in microcontroller and we get the required output.

As the water or we say moisture comes in contact with the sensors ,the LEDs at the transmitter section glows, simultaneously LEDs at the base station starts to blink which indicates that moisture has being sensed and thus disables the solenoid valve (or water supply). Similarly when the temperature sensor senses the heat, it enables the solenoid valves, which is verified by the LEDs.

In power supply unit 5v power is supplied to the system from the battery. For future modification, the solar system can be used to supply the energy if sunlight is available, which saves the electricity. The solar can be further used if power supply is currently off.

Buzzers and LEDs are used to protect fields from unwanted disturbance. Usually wild animals enter inside the field and destroy number of crops and other issue can be of theft. So to protect our field from such problems we need to provide some protection to our field. We are using two parallel conducting wires one as a fencing and other as an obstacle detector for protection. When both the wire comes in contact with each other, buzzer and LED’s comes into working.

[5] CIRCUIT DIAGRAM:-

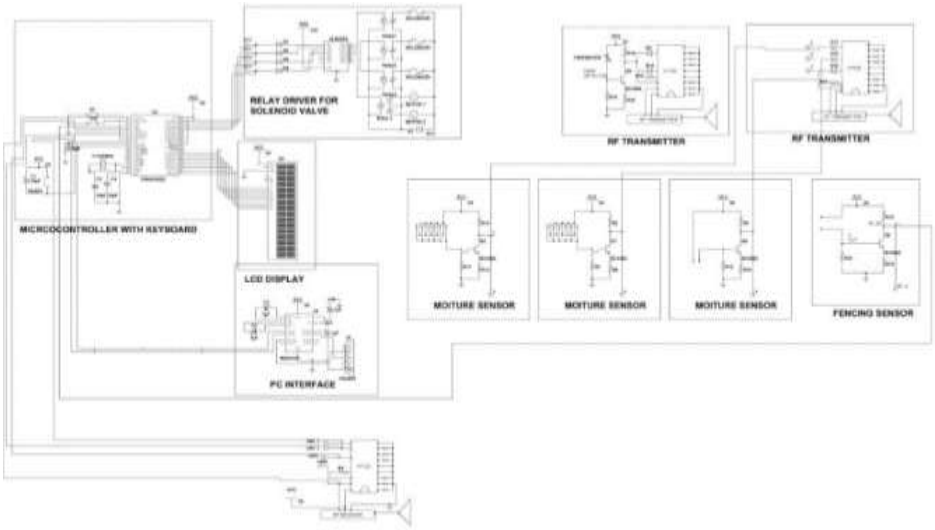

Fig 2: Circuit diagram of Auto-Agri system

[6] SOFTWARE:-

The flowchart based of the software is shown in the fig b. The whole program is basically divided into two parts, first part shows the working of wireless sensors and other part shows the working of manual switches. The programing is pursued in RIDE software. As soon as power is up, Base-station checks the outputs of temperature and moisture sensors in continues loop. If the output is 1 (i.e. if the field is dry or temperature is hot or if both), solenoids valves starts working. And if output is 0 (i.e. if the field is wet or temperature is cool or both) the solenoids valves stay close. In the manual part, the output of the crops (onion and cotton) is checked and solenoid valves works in the respective way. Base-station checks the output of protection unit also in continues loop.

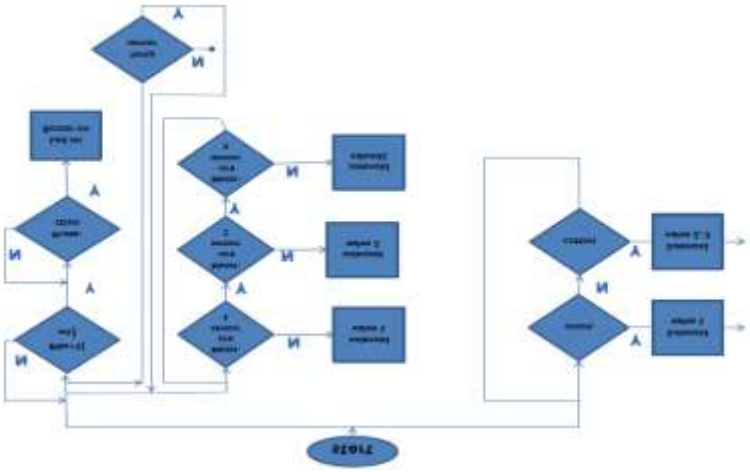

Fig 3: flowchart of Auto-Agri system

[7] COMPONENTS:-

Microcontroller:-

The P89V51RD2 is an 80C51 microcontroller with 64 Kb Flash and 1024 bytes of RAM. The main feature of the P89V51RD2 is its X2 mode. The design user can go with the conventional 80C51 clock rate (12 clocks per machine cycle) or can select the X2 mode (6 clocks per machine cycle) to reach dual throughput at the similar clock frequency. Other advantage of this feature is to keep the same performance by reducing by half the clock frequency, simultaneously reducing the EMI. Both parallel and serial programming is supported by the Flash program memory. Parallel programming mode offers gang programming at high level of speed, diminishing programming costs and time to market. ISP allows a device to be reprogrammed under software control in the end product. The ability to update the application firmware (software for hardware) makes a wide range of applications possible. The P89V51RD2 is also an IAP (In Application Programmable), which allows the Flash program memory to be reconfigured even while the application is in progress. It is operating 5V voltage from 0 to 40 MHz. It supports 12-clock (default) or 6-clock mode selection via software/ISP. It has SPI (Serial Peripheral Interface) and enhanced UART.

ULN 2003 (HIGH CURRENT DARLINGTON PAIR) :-

ULN2003 is the high voltage, high current Darlington arrays which consist of seven open collector Darlington pairs with common emitters. Each channel rated at 500 mille-amperes and can withstand peak currents of 600 mille-amperes. For inductive load driving, suppression diodes are included and to simplify board layout, the inputs are pinned opposite the outputs. These versatile devices are useful for driving a wide range of loads that includes solenoid valves, relays, DC motors, and high power buffers. The ULN 2003 is supplied in 16 pin plastic DIP packages with a copper lead frame. Copper lead frame reduces thermal resistance.

Voltage Regulator(IC 7805):-

The voltage regulator (12VDC to 5VDC) is designed to maintain automatically a constant voltage level, so that the DC voltages used by the processor and other elements are stabilized.

Wireless Module (UART RF Module 434):-

An RF module (radio frequency module) is basically a small electronic device which is used to transmit and/or receive radio signals among devices. The Base station continuously checks the output of sensors (moisture and temperature) and simultaneously data is communicated between the RF transmitter and RF receiver. The principle used is Amplitude-shift keying (ASK). ASK is a form of amplitude modulation which represents digital data as variations in the amplitude of a carrier wave. In an ASK system, the binary symbol 1and 0 are used for representing transmitting situations of carrier wave for fixed amplitude carrier wave and fixed frequency for a bit duration of few seconds (T). If the signal value is 1 then the carrier signal will be transmitted, or a signal value of 0 will be transmitted. Both ASK modulation and demodulation processes are relatively cheap.

Fig 4: RF module

MAX 232 (TRANS-RECEIVER):-

In our project it is acting as a mediator between any interfacing system and microcontroller for serial communication. It is transceiver IC to convert voltage level. The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5-V supply.

SENSORS:-

Sensors used in our project are temperature sensor and moisture sensors. In our project we are using two types of moisture sensor one is the root sensor and anther is surface sensor. As water come in contact with the sensor they get short and hence they give signal to the microcontroller. Microcontroller makes the solenoid valves stop. Similarly we also come to know whether the moisture content is low or zero in the soil.

Fig 5: Surface sensors

A thermistor is not costing a great deal and easily available temperature sensitive resistor. Its resistance is depends upon temperature that is its working principle. When temperature varies according to the atmosphere, the resistance of the thermistor changes in a noticeable way. Accuracy and stability are the benefits of using a thermistor. In our project temperature sensor enables when the surrounding temperature increases and it gives signal to the microcontroller which opens the solenoid valves for water supply to the crop.

Fig 6: Temperature sensor

Relay:-

Relay is a switching device. To perform switching action relay is used. The relay is use for protection of circuit from high and low voltages and to operate solenoid valve on 24 volts.

[8] APPLICATIONS:-

This project has number of applications such as, Irrigation in Fields, Irrigation in Garden, Parks. It is very efficient and effective for (Paddy) Rice Fields and also for Pisciculture. Also it is used for maintaining the temperature according to requirement.

[9] FUTURE SCOPE:-

The project can be enhance in future by using solar panel as the source of power supply; so it will help to reduce the consumption of electricity at great extent.

[10] CONCLUSION:-

The main objective of this presentation is to design a fully automated drip irrigation system. Using this system, one can save labour pool, fresh water resource to improve production and ultimately enhance profit. In this project, a wireless data accretion network was implemented and applied to irrigate a field (model). The automated system can be proposed to be used in various commercial field productions since it was obtained in economical rates and in reliable operation. This application of sensor based AUTO-AGRI system has some advantages such as preventing moisture stress of crops, diminishing of extreme usage of water, ensuring rapid growth of weeds and denigrating salinization. If in future, different sensors like temperature and moisture are implemented, it can be said that an internet based remote-control automation of various agricultural field will be possible.

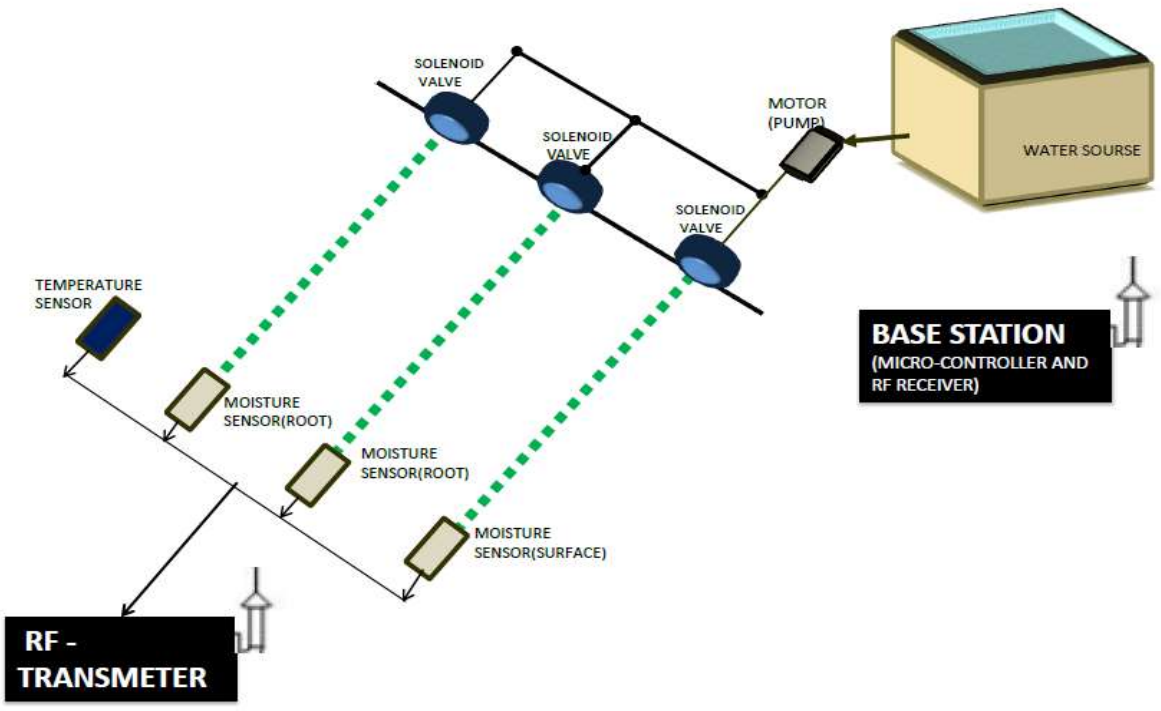

Fig 7: Overview of a system installed in the model field

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