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SMART FARM-AN INTELLIGENT AUTOMATIC IRRIGATION AND ANIMAL INTRUSION PROTECTION SYSTEM

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Abstract

Automation has only proven to be beneficial in day to day life. It not only saves energy, labor and materials, it also improves quality, accuracy and precision of work. Sensor Network (SN) has proven to be very efficient when deployed over a region where some phenomenon is to be monitored without any human aid. Using the principles of both automation and SNs we aim to automate the process of maintenance in agricultural lands. Agricultural lands are vast and often far from the farmer's residence in which case monitoring the land is a tedious job. By using SNs to detect moisture content of soil, animal intrusion and transmitting this information to the control room, a farmer will have complete control over the irrigation, security of his land .

I. INTRODUCTION

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. It has to support almost 17 per cent of world population from 2.3 per cent of world geographical area that is cultivable and 4.2 per cent of world's water resources available for use. Indian agriculture is characterized by agro-ecological diversities in soil, rainfall, temperature, and cropping system. Intensive cultivation as a result of introduction of high yielding requires higher energy inputs and better management practices. Land preparation, harvesting, threshing and irrigation are the operations, which utilize most of the energy used in agriculture. Irrigation water is becoming a scarce commodity. Thus proper maintenance and efficient utilization of water is of great importance. Automating the maintenance process is of high importance.

In agricultural field human labors are required to monitor the farm and plants. Some plants require 24 hours care and attention from the human labor for the quantity and quality management of the productivity. Due to large farm field and lack of labors the maintenance of a farm is very difficult. This problem leads to fewer yields in the farm. To overcome from this problem wireless sensor nodes are used to measure the certain critical points at the farm lathe sensor nodes measure the moisture level in soil, intrusion of animals

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and communicate with the main node. According to the received information, irrigation systems are automated.

In this system different sensors are used to measure the parameters at the farm land such as moisture, intrusion of animals and l6F877A microcontroller is used as centralized control system.

II. LITERATURE SURVEY

[1] Recent developments in technologies provide a new way of networking and automation in agriculture. An experimental project in Hainan province of China aimed to grow off season crops by providing controlled environmental conditions.

This agricultural monitoring system is based on WSNs along with IP Cameras. WSNs help to collect sensor data such as temperature and humidity and the IP Cameras can be controlled remotely to have a close vision of the plants. Remote sensors are deployed to periodically collect data. These sensors cannot be connected over a serial bus due to the deterioration caused by temperature and pH. Thus wireless communication can be used.

The wireless IP Cameras can be used to check the growth of the plants but also increases the cost of implementation and can be efficiently used for a small area, but not for large farmlands. Here, IEEE 802.15.4 is selected instead of Zigbee as it was more suited for collecting environmental parameters.

[3] Irrigation is a very important aspect of agriculture. By collecting environmental data from the soil moisture, air humidity and air temperature sensors, we can control the irrigation system via smart phone. By using the data, the watering system can turn on and off the solenoid valve. The WSNS collect and process on a computer server and notify the farmer through the application. Automated irrigation system can notify the farmer through SMS, website or voice mail alert. The device used to transmit the data is a Microcontroller and Zigbee is used to send the data signals from source to destination. By automating the process, the system becomes much simpler, cheaper and run at low costs.

III. PROPOSED SYSTEM

ANIMAL INTRUSION DETECTION

A capacitance switch needs only one electrode to function. The electrode can be placed behind a non-conductive panel such as wood, glass, or plastic. The switch works using body capacitance, a property of the human body that gives it great electrical characteristics. The lamp keeps charging and discharging its metal exterior to detect changes in capacitance. When a person touches it, it increases the capacitance and triggers the switch.

The touch sensor monitors the field continuously and if there is any certain threshold caused due to animal, intrusion is detected, it sends the signal. Upon receiving this signal, the control system sends a command for the relay to make the alarm circuit which sets off the alarm. After a specified period of time this alarm stops on its own. While the alarm is set off, immediately

AUTOMATIC IRRIGATION

We place sensors to sense the wetness/dryness of soil. If the owner is out of town, then by

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sensing the dryness of soil, the control system will turn on/off the pump to water the crops.
If the sensor reading is less than the set threshold (indicating dryness),

The control System sends a command to the microcontroller to open the solenoid valve by passing current directly to the solenoid from the microcontroller. When a signal is received that is higher than the threshold of wetness of soil, the solenoid valve is turned off by the control system.

BLOCK DIAGRAM

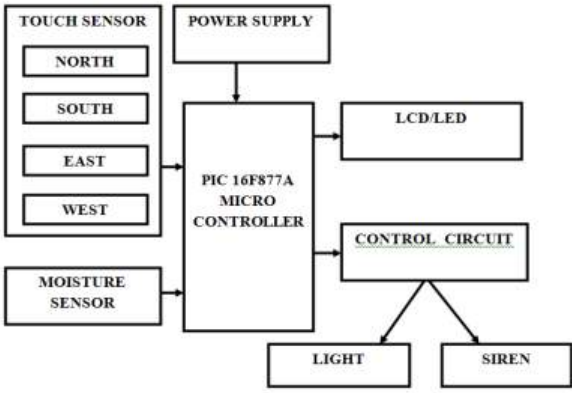

Fig:1 Block Diagram

MICROCONTROLLER PIC16F877A

1. High-Performance RISC CPU:

2. Only 35 single-word instructions to learn

3. All single-cycle instructions except for program branches, which are two-cycle

4. Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle

5. Up to 8K x 14 words of Flash Program Memory.

6. Up to 368 x 8 bytes of Data Memory (RAM).

7. Up to 256 x 8 bytes of EEPROM Data Memory.

8. Pin out compatible to other 28-pin or 40/44-pin

PERIPHERAL FEATURES

1. Timer0: 8-bit timer/counter with 8-bit prescalar

2. Timer1: 16-bit timer/counter with prescalar, can be incremented during Sleep via external crystal/clock

3. Timer2: 8-bit timer/counter with 8-bit period register, prescalar and postscalars

4. Two Capture, Compare, PWM modules

5. Capture is 16-bit, max. Resolution is 12.5 ns

6. Compare is 16-bit, max. Resolution is 200 ns

7. PWM max. Resolution is 10-bit

8. Synchronous Serial Port (SSP) with SPI™ (Master mode) and I2C™ (Master/Slave)

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9. Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection

ANALOG FEATURES

1. 10-bit, up to 8-channel Analog-to-Digital Converter (A/D)

2. Brown-out Reset (BOR)

3. Analog Comparator module with:

4. Two analog comparators

5. Programmable on-chip voltage reference (VREF) module

6. Programmable input multiplexing from device inputs and internal voltage reference

7. Comparator outputs are externally accessible.

MOISTURE SENSOR

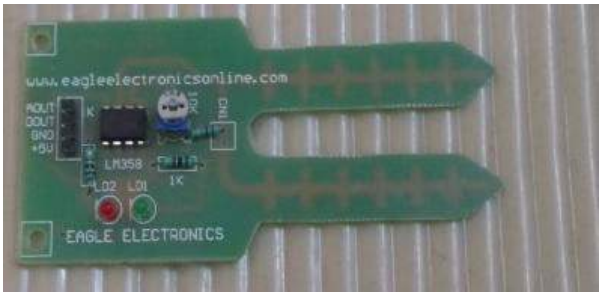

Fig:2 Moisture Sensor

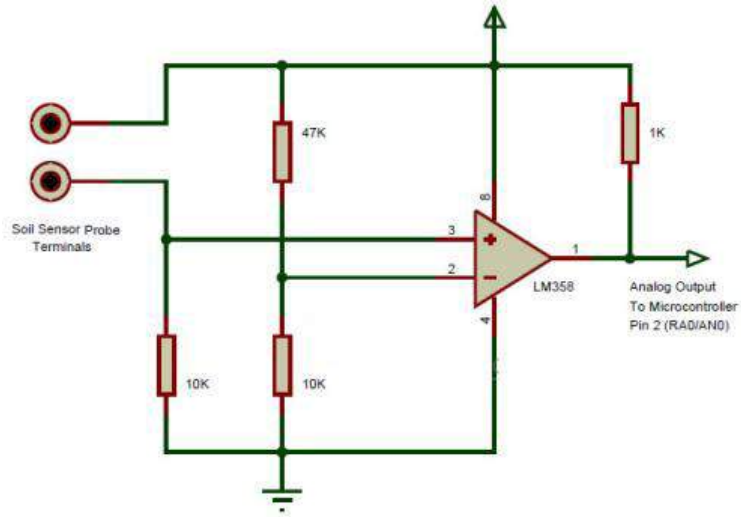

Fig:3 Circuit Diagram of Moisture Sensor

It consists of two prongs, which must be inserted in the soil, an LM358, which acts as a comparator and a pot to change the sensitivity of the sensor.
If the soil moisture sensor is not available, the following circuit can be used as an alternative. The circuit shown below has a fixed sensitivity.

This can be changed by implementing a pot in place of one of the resistors connected to the non-inverting terminal of the comparator.

TOUCH SENSOR

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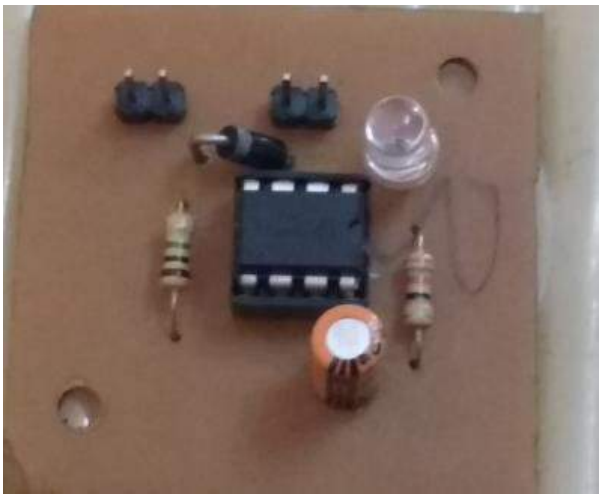

Fig:4 Touch Sensor

This is a very simple touch sensor switch that is build with the 555 timer IC. You just need to touch the metal plate and the relay gets energised and is kept in this state for about 100 seconds, then is released.

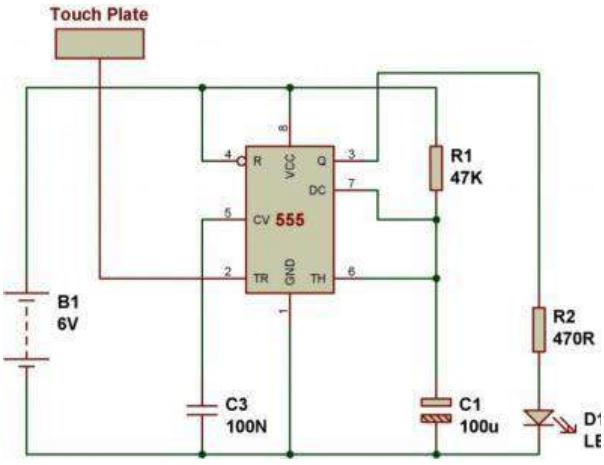

Fig:5 Circuit Diagram of Touch Sensor

The input impedance of the trigger is very high and the touch sensor switch can be triggered by the voltage induced in the human body. The relay is a 12 V DC relay operating at currents less than 200 mA.

RESEARCH METHODOLOGY TO BE EMPLOYED

The idea of the project is to implement an automatic irrigation system by sensing the moisture of the soil. The working of the circuit is as follows.

The soil moisture sensor is inserted in the soil. Depending on the quality of the sensor, it must be inserted near the roots of the plant. The soil moisture sensor measures the conductivity of the soil. Wet soil will be more conductive than dry soil. The soil moisture sensor module has a comparator in it. The voltage from the prongs and the predefined voltage are compared and the output of the comparator is high only when the soil condition is dry.

This output from the soil moisture sensor is given to the analogue input pin (Pin 2 – RA0) of the microcontroller. The microcontroller continuously monitors the analogue input pin.
When the moisture in the soil is above the threshold, the microcontroller displays a message mentioning the same and the motor is off.

When the output from the soil moisture sensor is high i.e. the moisture of the soil is less. This will trigger the microcontroller and displays an appropriate message on the LCD and the output of the microcontroller, which is connected to the base of the transistor is high. When the transistor is turned on, the relay coil gets energized and turns on the motor. The LED is also turned on and acts as an indicator. When the moisture of the soil reaches the threshold value, the output of the soil moisture sensor is low and the

motor is turned off. The system is also designed to warn when the moisture is very high than the threshold and the soil is too wet, which is dangerous for the plant.

The touch sensor monitors the field continuously and if there is any certain threshold caused due to animal, intrusion is detected, it sends the signal. Upon receiving this signal, the control system sends a command for the relay to make the alarm circuit which sets off the alarm. After a specified period of time this alarm stops on its own. While the alarm is set off, immediately

V. CONCLUSION

Contrary to the monitoring system that has been implemented only on greenhouses which have small area, this paper proposes a system to look after vast agricultural lands which are far away from the farmer's residence. Using cost-effective and efficient SN's to monitor different parameters that are mentioned in this paper, the workload of the farmer is highly reduced. Also by using this system, the farmer can save considerable amount of water and power supply. It is a one-time investment whose benefits can be reaped life-long.

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