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Soil Dynamics Monitoring and Control for Agriculture Application

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***Abstract*----:Agriculture contributes a major part in Indian economy. Over fertilization and irrigation is a serious issues faced by farmers globally. It occurs due to the unplanned use of water and fertilizers also leads to various environmental problems like soil contamination, soil salinity, bio-magnification, contamination of ground water and poor food quality. To implement sustainable precision agricultural system, a better understanding on soil parameters at increasingly finer scales is needed. This paper aims to study and report accurate soil dynamics status in hourly or daily basis in both winter and summer season for future irrigation scheduling and nutrient management operation.This system is designed to overcome the large number of sensors used to predict the soil moisture whereas it designs a transmitter and receiver embedded soil to predict the moisture content by passing high speed data through the soil. IOT system is proposed to monitor the soil moisture and to improves the productivity of the crop.**

Keywords---- Precision Agriculture Irrigation system, IOT, PIC Microcontroller, real time monitoring, efficient water management.

I . INTRODUCTION

If the moisture content of a soil is optimum for plant growth, plants can readily absorb soil water.Much of water remains in the soil as a thin film.soil water dissolves salts and makes up the soil solution,which is important as medium for supply of nutrients to growing plants.Soil moisture is a measure of how wet or dry the soil is.The needs of the plants differ from one plant to another in which some of the plants need very wet roots while others need very dry roots with minimum moisture.Hence there is a need for a system to measure and report the soil moisture continously.

II. HARDWARE DESCRIPTION

PIC16F877A

It is a high-performance RISC CPU and its Operating speed is DC - 20MHz and clock input isDC - 200ns instruction cycle.It has 8K x 14 words of FLASH Program Memory and 368 x 8 bytes of Data Memory (RAM) , 256 x 8 bytes of EEPROM data memory. It consumes low-power, high-speed CMOS FLASH/EEPROM technology , In-Circuit SerialProgramming(ICSP).Wide operating voltage range from 2.0V to 5.5V.

Fig:1 PIC16F877A

Power unit

All digital circuit require regulated power supply. In this paper we are going to learn how to get a regulted positive supply from the main supply.

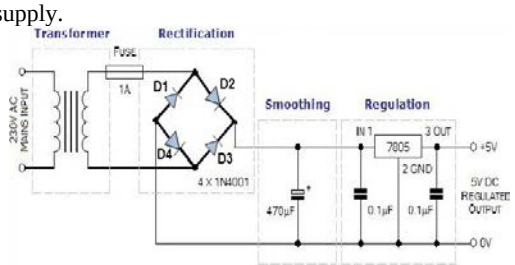

Fig:2 power unit

IOT Module

Internet of Things (IoT) is an environment in which objects, animals or people are defined to be a unique identifiers and it has the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT board featured with SIM900 GPRS modem to activate internet connection also equipped with a controller to process all input UART data to GPRS based online data.The user can able to access the data which may be updated to a specific site or a social network.

Fig:3 IOT module

RELAY

A relay is an electrical switch which opens and closes under the control of another electrical circuit. It is used to control the A.C motors from the controlled DC signal.

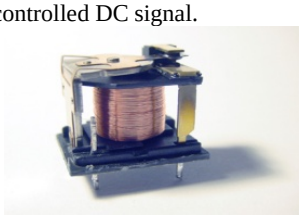

Fig:4 Relay

DC MOTOR

A DC motor is used to convert the electrical power into mechanical power. The principle behind the DC or direct current motor is when a current carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move. This is called as motoring action. If the direction of current in the wire gets reversed, the direction of rotation also reverses. When electric field and magnetic field interact they produce a mechanical force.

Fig:5 DC Motor

LCD

Liquid Crystal Display (LCD) screen is an electronic display which is preferred in wide range of applications. A 16x2 LCD display is very basic module a which has many application in various devices and circuits. These modules are more preferred over seven segments and other multi segment LEDs. Each pixel that present in the LCD consists of a layer of molecules aligned between two transparent electrodes, and is perpendicular to the

axes of transmission and two polarizing filters (parallel of which are in most of the cases) perpendicular to each other.

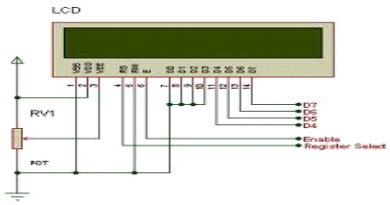

Fig:6 LCD

SOFTWARE USED

MPLAB is a integrated development environment for the development of embedded applications on pic and dspic microcontrollers and is developed by microchip. MPLAB is designed to work with MPLAB ICD3, for programming and debugging pic microcontroller using a personal computer.PICkit programmers are also supported by MPLAB. It also serves as a single, unified graphical user interface for additional microchip and third party software simulator to hardware debug and programming is done in a flash because it has the same user interface for all tools.

III . BLOCK. DIAGRAM

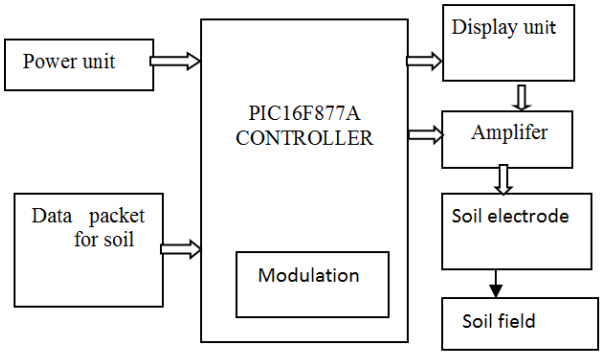

Fig.7 Block diagram of Transmitter

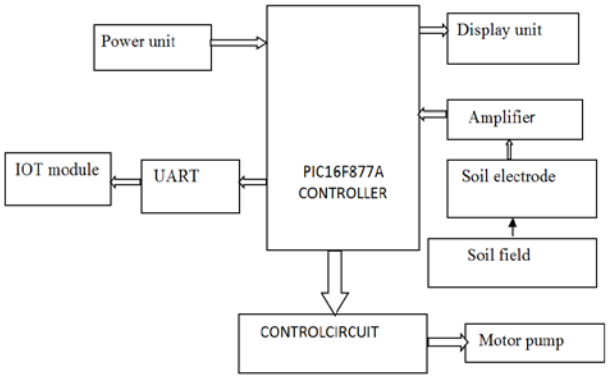

Fig: 8 Block diagram of receiver

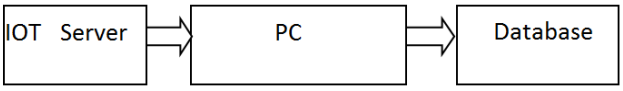

Fig: 9 IOT Server

CIRCUIT DIAGRAM

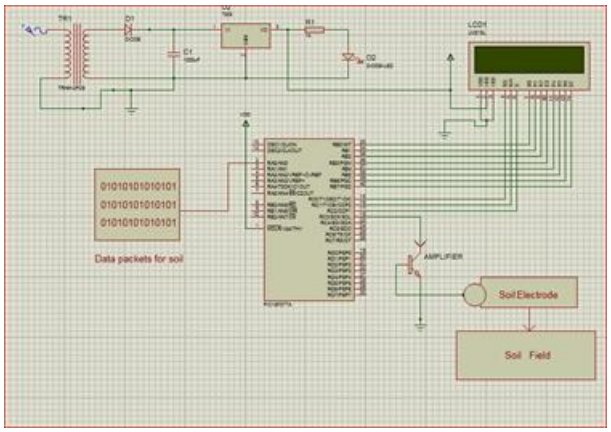

Fig:10 Circuit diagram of transmitter

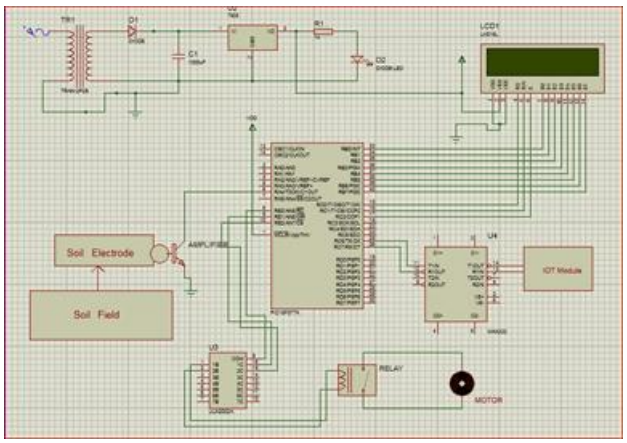

Fig:11 Circuit diagram of receiver

Transmitter and receiver are fixed into the soil field. Initially a high speed data is passed from the transmitter node to the receiver node through the soil in which the water content and air particles in the soil act as a medium for that transmission. Once the data gets reached to the receiver it displays the condition of the soil whether it is wet or dry. The value is then compared with threshold value obtained for that soil. The threshold value for the soil is 1.75. If the value is greater than the threshold value then the soil field is considered as wet and if it is below the threshold value then it is considered as dry.It is monitored in hourly and daily basis to know the present status of the soil.The motor will be automatically on or Off with the help of control circuit according to the condition of the soil moisture.

IV.RESULTS

The designed hardware kit is shown in fig.12&13.The real time result is shown in fig.14.The data obtained from the receiver is passed to the IOT server and it can be monitored by the farmer through his mobile or PC. The system provide the accurate value and is observed by farmer with his intervention at his crop fields the irrigation ran automatically. Microcontroller processed and correlated huge data then it checks at every time to the threshold value.The system displays the condition of the soil moisture.The status of the system can able to check remote place and the complexity of the system is less.

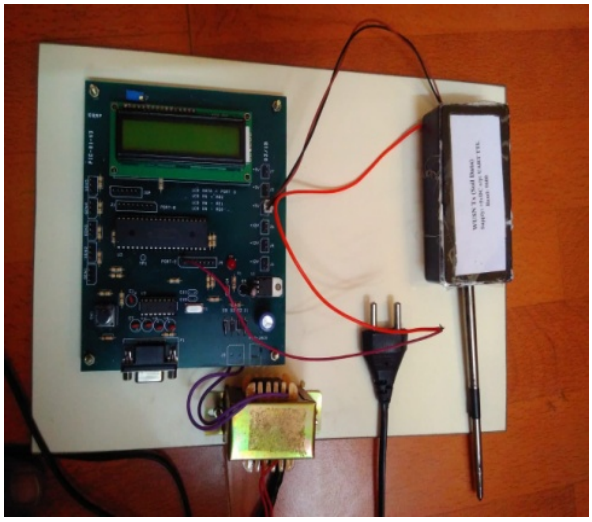

Fig:12 Hardware kit of transmitter

Fig:13 Hardware kit of receiver

ID	Soil Status	Time	Date
1	DRY	03:59:31	03/17/2019
2	DRY	03:59:43	03/17/2019
3	WET	03:59:56	03/17/2019
4	WET	04:00:08	03/17/2019
5	DRY	04:00:20	03/17/2019
6	WET	04:00:33	03/17/2019

Fig:14 Mobile phone displays the status of the system

V.CONCLUSION

In order to promote sustainability in agriculture, particularly in the irrigation sector more research has to be done on measures that can save water and manage the nutrient supply. These technology is beneficial in lowering the cost of production due to reduced pumping cost and leaching of nutrients. Microcontroller based agriculture monitoring system serves as a reliable and efficient system for monitoring agricultural parameters. The corrective action can be taken to improve the crop fields. Wireless monitoring of field helps the user to reduce the human power and also allows the user to see accurate change in it .It is a cheaper in cost and consumes less power.

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