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# Monitoring of agricultural fields based on drip irrigation with wireless sensors

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**ABSTRACT**: *The control of irrigation operation and monitoring of different parameters involved in crop growth are useful to crop production and to save water resources. The automated drip irrigation system is proposed which continuously monitor moisture , water level , temperature and water flow rate. The signal conditioning is done and after that microcontroller processes further. The moisture level and temperature values are transmitted to receiver side using wireless RF module. The receiver controller activates respective valves and simultaneously system checks water flow rate. The collected data is displayed on LCD display.*

***KEYWORDS***: *Microcontroller, Moisture sensor , Temperature sensor, Level sensor, Pressure sensor, RF module.*

## I.INTRODUCTION

Large amount of water is needed for agriculture. Hence there is need for efficient water management to avoid water wastage. Several irrigation methods are used for agriculture such as sprinkler, terraced, ditch , rotary etc. But this irrigation methods leads to water wastage. The drip or trickle irrigation requires less water as compare to other methods which provides water drop by drop to root zone of plants due to which large quantity of water is saved.

The irrigation is highly important in crop production everywhere in the world. There is requirement of new water saving techniques in irrigation. To increase water efficiency and optimize yields , automated irrigation system with wireless sensor is powerful solution.

The objective of system is conservation of water, irrigate the plants with sufficient water, reduce human intervention, manage different fields automatically and to avoid pipe break down because of overflow, animal and human intruders or emitter blockage due to soil, sludge.

## II. LITERATURE SURVEY

In [1], author proposes the automated irrigation system using wireless sensor network which include GPRS module to send message containing soil characteristics such as soil moisture and soil temperature. An energy efficient method for the wireless sensor communication used in an automated irrigation system is proposed in [2] which is based on the Time Division Multiple Accesses (TDMA) scheduling that allows nodes to turn ON/OFF their radio according to scheduled slots. In [3] authors present automated irrigation system using WSN to optimize water use in fields in which distributed sensor network of soil moisture and temperature are deployed in fields. The sensor information is collected by using gateway which triggers actuators and transmits data to web application. Photovoltaic panels are used to supply power. The entire system is monitored through web page which help to program irrigation schedule and performs a data inspection. The automated irrigation system using equalized cluster head election routing protocol for WSN is proposed in [4]. This system aims at efficiently manage water supply.

In above work, author do not consider pressure sensor to monitor irrigation operation as well as irrigation system works correctly or not.

## III. PROPOSED SYSTEM

The proposed system includes ARM7 Microcontroller , Soil Moisture sensor , Temperature sensor , Float level sensor , pressure sensor, solenoid valves and wireless RF module. The specifications of all components are given as follows:

**ARM7 Microcontroller :**

LPC2138 microcontroller is used as central processing unit in the proposed system. It is 16/32-bit ARM7TDMI-S microcontroller. The microcontroller processes data coming from transmitter . The measured values of sensors are send to receiver controller from transmitter side . Based on measured values of sensors, microcontroller controls respective solenoid valves and also measures water pressure.

**Soil moisture sensor :**

The soil moisture sensor measures volumetric water content by using other soil property. The sensor has a low power requirement and very high resolution. It use LM393 comparator chip to compare the soil moisture level with the preset threshold.

**Temperature sensor :**

LM35 temperature sensor is used to monitor environmental temperature . It is precision integrated-circuit temperature sensors. It possess low self heating and does not cause more than 0.1 $^{o}$C temperature rise in still air. The operating temperature range is from -55 $^{o}$C to 150 $^{o}$C .

**Pressure sensor :**

It is used to measure a pressure of gases or liquids and change it into a quantity that can be processed electronically.

**Solenoid valve :**

It is an electromechanically operated valve for use with liquid controlled by running or stopping an electrical current. It offers high reliability, fast and safe switching, long service life , low control power and compact design.

**Wireless RF module:**

CC2500 RF module is low cost 2.4 GHz transceiver. RF modules are basically 433MHz RF transmitter and receiver modules. It has low power consumption.

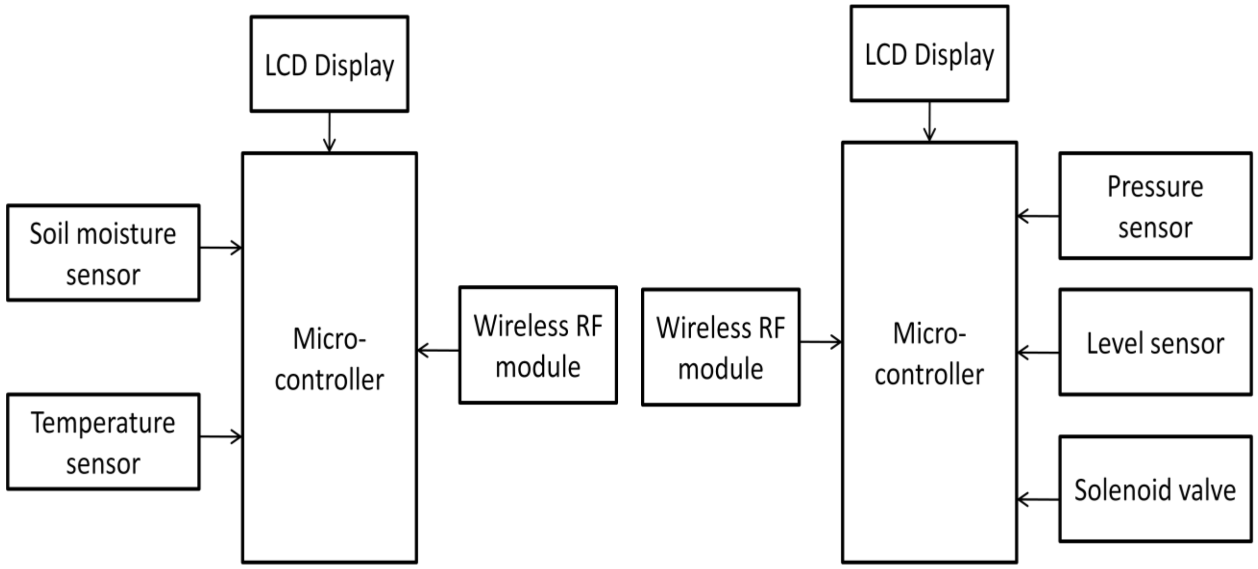


Fig 1: Block Diagram of Transmitter and Receiver Section

Figure shows block diagram of transmitter and receiver section of automated drip irrigation system. The receiver section consists of LPC2138 microcontroller , soil moisture sensor to measure water content in soil , temperature sensor detects temperature of environment and wireless RF module. The transmitter section consists of LPC2138 microcontroller , float level sensor to detect water level, pressure sensor to be selected to monitor water flow rate and solenoid valves.

In receiver section, the moisture sensor continuously checks water content in soil at the root zone of plants and temperature sensor checks environmental temperature. Once the level of moisture and temperature reaches to specified threshold level. This values are given to microcontroller which converts sensors output to digital using ADC convertor and LPC2138 microcontroller transmits sensor output to receiver section using wireless RF module and displays data on LCD display. In transmitter section, when moisture and temperature values are received by controller using wireless RF module, respective solenoid valves gets opened or closed. Simultaneously pressure sensor checks water flow rate. The solenoid valves status as well as level and pressure sensor values also displays on LCD display. Different moisture and temperature conditions are taken into consideration for controlling and monitoring irrigation operation.

## IV. RESULTS

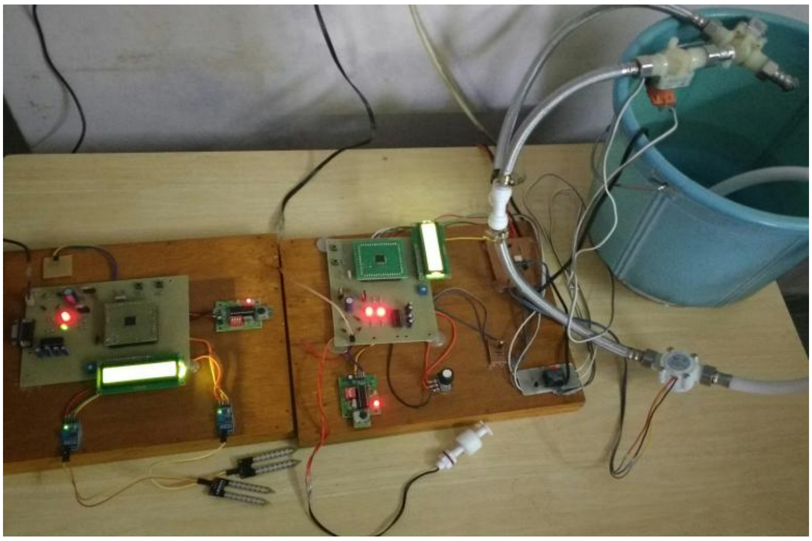

Fig 2 : Proposed systems hardware

Fig 2 shows that the soil moisture , temperature , level and pressure sensor will send input to ARM LPC2138 microcontroller and values are displaying on LCD display. The soil moisture and temperature sensor senses the soil moisture and environmental temperature . This values send to receiver by using wireless RF module. According to received data , microcontroller controls valves and simultaneously monitor pressure of main pipeline.

Fig 3 shows various parameters values on LCD display.


Fig 3 : LCD displaying status of parameters

## V.CONCLUSIONS

The proposed system is monitoring and controlling the irrigation operation for efficient water management.The system is able to determine necessity of water to crop using soil moisture sensor in order to supply enough amount of water to maintain the moisture level around the levels set by the user. This system also measures water flow pressure using pressure sensor in order to avoid pipes break down or emitters blockage due to sludge, soil. It helps to do the efficient water management in order to get more profit.

 

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