



# International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

## Soil Moisture Control Using RF Transceiver

A. C. Birajdar<sup>1</sup>, M. G. Poddar<sup>2</sup>

Assistant professor, Dept of Instrumentation Engg, M. B. E. Society's C.O.E Ambajogai, Maharashtra, India.<sup>1</sup>

Assistant professor, Dept of Instrumentation Engg, M. B. E. Society's C.O.E Ambajogai, Maharashtra, India.<sup>2</sup>

**ABSTRACT:** This is an attempt to maintain soil moisture at desired level for better yield, by taking control action using Radio Frequency transceiver technique. This avoids the problems due to connecting leads. At remote location a sensor is placed in soil at root zone of the crop. Location of the sensor from the surface varies as per the type of crop. Soil moisture is measured along with related electronics. Soil moisture data is sent through UHF signal and the same is received at the receiving station. The system was designed and tested for different inputs

**KEYWORDS:** Soil moisture, RF Signal, Transceiver.

### I.INTRODUCTION

The availability of adequate food and fiber for future generations will depend greatly on our ability to manage and conserve our soil water and air resources. To meet these responsibilities, it is necessary to improve our ability to precisely and accurately measure variables, which affect the status of these resources. Knowledge of the soil water is of primary importance in hydrology, soil and irrigation science, civil engineering, recreation, and many other areas where people, soil and water interact. The ever-increasing competition for water and over drafting of groundwater resources dictate that irrigated agriculture, which diverts the greatest amount of water must increase its irrigation efficiency.

Here is an attempt made by using advance technology to improve results i.e. optimum crop growth is achieved in which the RF transceiver technique is used to control the soil moisture.

Keeping in view, the economic viability of the proposed system, a large number of farmers would co-operatively use a single central station for control and management of the drip irrigation system. Such central system has required database for optimum irrigation profiles for the various crops in different zones.

### II.METHODOLOGY

The following elements are used in our system: computer, sensors, solenoid valves, transducing circuits, A/D (analog to digital), D/O (digital output), interfacing board, microcontroller and transceivers. The hardware configuration is as shown in Fig. [1].

Measurement of soil moisture is achieved by Gypsum block, which is specially designed. It has a principle of change in resistance with soil moisture inversely. A circuit called actuating and sensing unit is designed to provide and interface between soil moisture sensor and A/D converter. The sensor's DC voltage output is proportional to the resistance of the sensor and its functional block diagram is as shown in Fig. [2].

The AC (alternating current) wave generator provides AC voltage to activate soil moisture sensors. A reference resistor with known value is in place of soil moisture sensors, when sensors are not measured. This provides a means to calibrate the circuit.

The obtained results from actuating and sensing unit are transferred to the central station using RF transceiver module (CC1000), which has microcontroller compatibility. The central station has huge data base and its beauty is that it increases the data base. Based on this, the appropriate control action is taken for the crop growth.

CC1000 is single chip very low power RF transceiver. The module is mainly intended for the ISM (Industrial, Scientific and Medical) and SRD (Short Range Device) frequency bands at 315, 433, 868 and 915 MHz, but can easily be programmed for operation at other frequencies in the 300 to 1000 MHz range. Very few external components are required for the operation of CC1000. An application circuit is as shown in the Fig. [3]. Components values are shown in table 1.

# International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

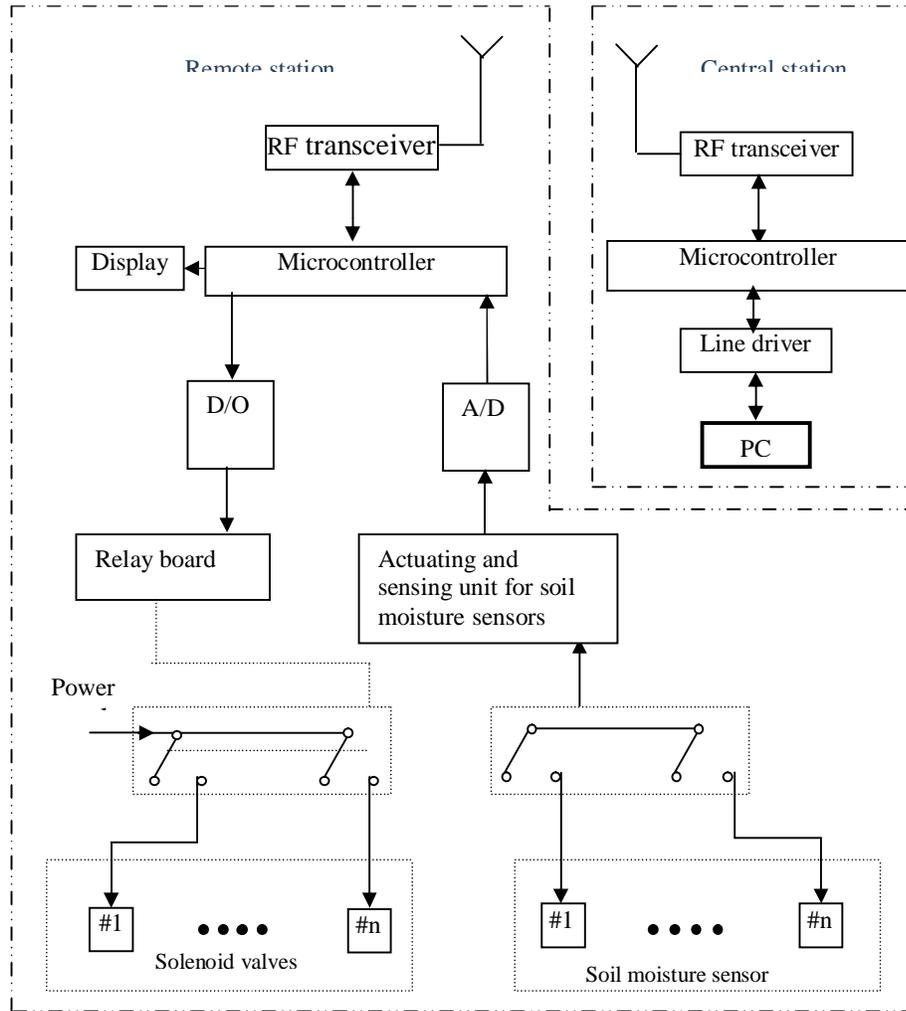


Fig. [1] Configuration of the system

CC1000 is configured through a 3-wire interface (PDATA, PCLK, PALE). There are 28 8-bit configuration registers, each addressed by a 7-bit address. A Read/ Write bit initiate a reception and transmission operation respectively.

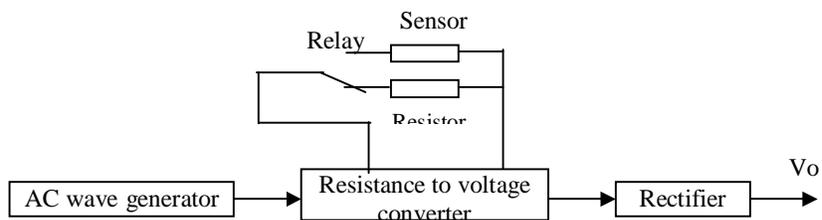


Fig. [2] Functional block diagram of actuating and sensing unit

## International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

To obtain CC1000 in transceiver mode with current consumption (receive mode: 7.4 mA, transmit mode: 26.7mA), power consumption 10mW, at frequency 433 MHz and data transmission rate 76.8 k Baud we configured the 28 8-bit registers as shown in table 2.

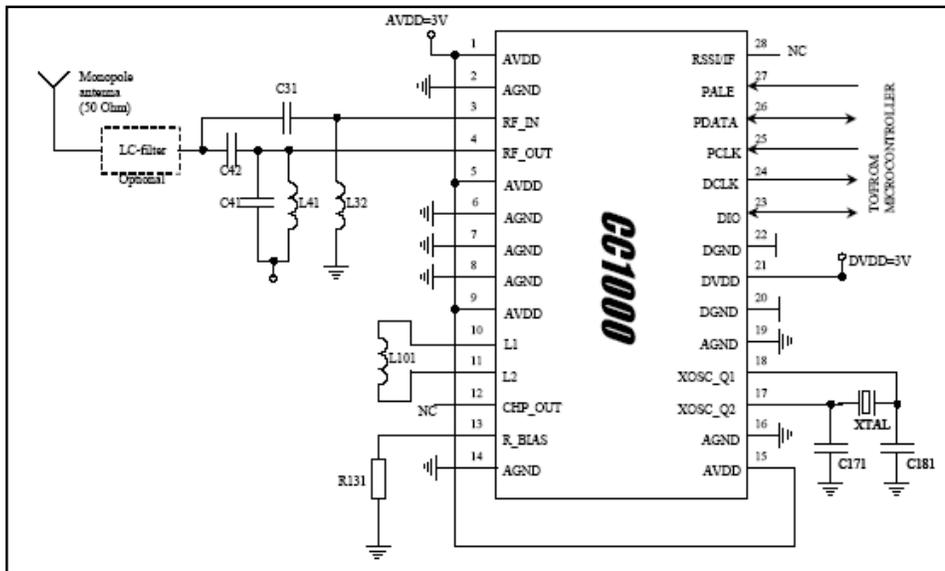


Fig. [3] CC1000 application circuit

As far as the interfacing is concerned with microcontroller it has serial data transmission and reception. The configuration details with timing diagram are shown in Fig. [4] and Fig. [5].

Table 1. Bill of materials for the application circuit

Item	433 MHz	Item	433 MHz
C31	15 pF	L32	68 nH
C41	8.2 pF	L41	6.2 nH
C42	5.6 pF	L101	33 nH
C141	18 pF	R131	82 kΩ
C151	18 pF	XTAL	14.7456 MHz crystal

Table 2. 8-bit configured registers

R	C	R	C	R	C	R	C
R1	66	R8	80	R15	8E	R22	8E
R2	C0	R9	41(TX),44(RX)	R16	67	R23	69
R3	00	R10	12	R17	47	R24	47
R4	41	R11	0F	R18	70	R25	70
R5	FB	R12	48 (TX),70(RX)	R19	01	R26	01
R6	2D	R13	10	R20	00	R27	00
R7	02	R14	26	R21	26	R28	3F

Resister; C: Configuration; TX: Transmit mode; RX: Receive mode

# International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

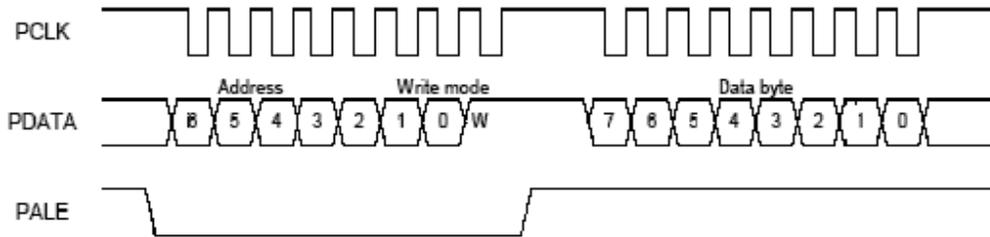


Fig. [4] Configuration registers write operation

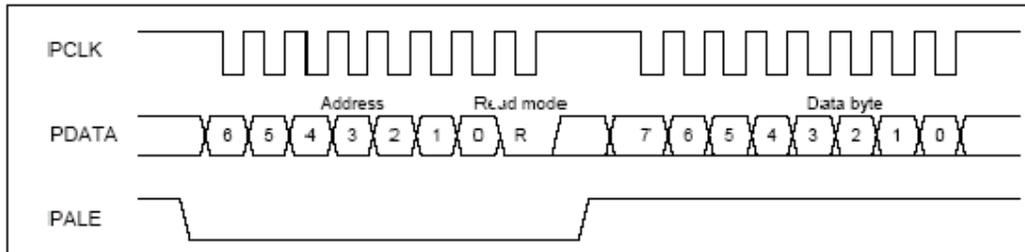


Fig. [5] Configuration registers read operation

### III. RESULTS AND CONCLUSION

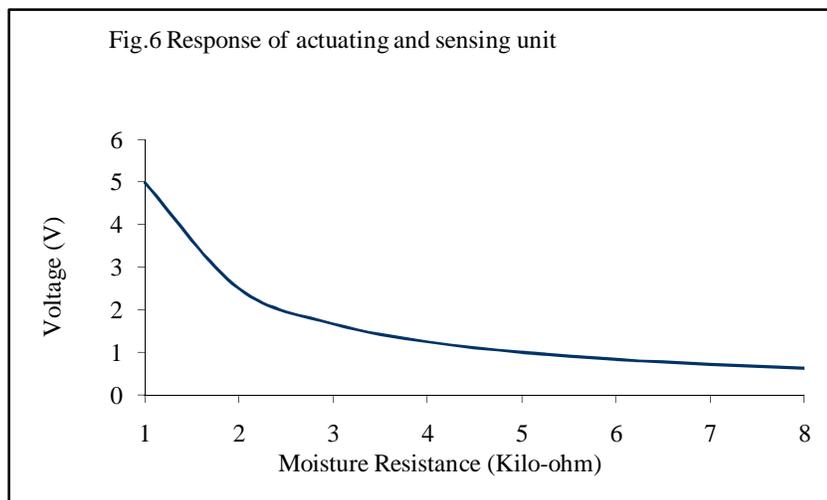


Fig. [6] The response of actuating and sensing unit

Here by controlling soil moisture of a field remotely and comparing it with the available data, effective utilization of water source is achieved through RF transceiver module. Hence it saves energy. Due to availability of previous data optimization of irrigation system is possible.

Initial investment is more but gives better yield. Utilization of the system in co-operative basis avoids the high initial cost.



ISSN (Print) : 2320 – 3765  
ISSN (Online): 2278 – 8875

# International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

*(An ISO 3297: 2007 Certified Organization)*

**Vol. 3, Issue 6, June 2014**

## REFERENCES

- 1] [www.chipcon.com](http://www.chipcon.com)
- 2] Majumdar D.K.(ed.) 2002. Irrigation Water Management Principles and Practice. 2<sup>nd</sup> ed. Prentice Hall of India pvt.ltd.
- 3] Mazidi M.A., Mazidi J.G., 2002, The 8051 Microcontroller and Embedded Systems, Low Price Edition.
- 4] Thool V.R., T.Srivastava, Thool R.C., P.B.Ullagaddi, 2003, Automation in Drip Irrigation System IETE Special Issue on Agriculture Electronics, vol 20,3 May –June 2003, , pp 205-210.
- 5] Yasar K. Natarajan T.S.Dec.2004 “Measurement of temperature using wireless communication technique”, International Conference On Instrumentation.