

# DESIGN AND IMPLEMENTATION OF AUTOMATIC IRRIGATION SYSTEM USING ARM7

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**Abstract**— The Automatic Irrigation system is designed to optimize the water use for agriculture crop. The system has represented the wireless sensor network of soil-moisture, temperature and humidity sensor placed into root zone of the plant. Agricultural sector is playing vital role in Indian economy where irrigation method is key concern. The system is designed to find the exact field condition, to control the wastage of water in the field and to provide exact controlling of field by using the automatic irrigation and automizing the agricultural environment by using the components and building the necessary hardware. This system includes the monitoring of the system using zigbee and GSM.

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**Keywords**— GSM, Irrigation system, sensors, zigbee.

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## I. INTRODUCTION

About 85% of available freshwater resources is used for agricultural purposes[2]. This percentage of water will continue to be dominant in water consumption because of increased population and increased food demand. So there is an urgent need to create strategies based on science and technology for sustainable use of water.

Irrigation is the artificial application of water to the land or soil. It is used to assist in the growth of agricultural crops, maintenance of landscapes, and during periods of inadequate rainfall[3]. In a country like India, where the economy is mainly based on agriculture and the climatic conditions are isotropic, still agricultural resources are not fully being used [3]. The main reason is the lack of rains and scarcity of land reservoir water.

Another very important reason is due to unplanned use of water which results in a wastage of significant amount of water. At the present era, the farmers are using irrigation technique in India through the manual control in which the farmers irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried.

So for this reason, many methods of irrigation are being used so that crop gets proper water. In irrigation system, use of sensor and microcontroller exclusive instrument is done that can automatically feed water to plant according to their need without farmer's interference. So the intelligence irrigation system will manage the flow of water into the field uniformly in desired ratio deserved by the plant automatically.

The further section describes about the technology and the method that is being used to design the system.

## II. TECHNOLOGY TO BE USED

Wireless technology recently has gained the popularity in the research field along with the greenhouse effect considering different types of sensors for precision agriculture. Now a day for agriculture parameter, consideration of embedded system has become important in control process and even monitoring of the system.

High quality environment can be obtained by monitoring of temperature and humidity. Remote monitoring is proving to be the efficient method in order to evade the interference of environment. Today, utilizing Ethernet network, RF module and zigbee wireless network can be used to transmit data in remote monitoring system. This paper describes about GSM-ZIGBEE predicated remote control and monitoring system with automatic irrigation system. The design represented has advantage of zigbee technology.

The below section outlines the designing of the system along with the description of the components that are being used.

## III. SYSTEM DESIGN

Irrigation system includes LPC2148 microcontroller, Temperature, humidity and soil moisture sensors, LCD, Zigbee and GSM. It uses wireless sensor network. A WSN is a network that includes following components: radio frequency (RF) transceivers, sensors, microcontrollers and power sources. Recently, the wireless sensor network technology consisting of multifunctional sensor nodes which has low cost and low power is being utilized. The task of sensor node is to sense the environment together along with data processing. In WSN, use of variety of sensors is made such as temperature, humidity, allows monitoring of different environment. They are capable to connect the network with another sensor

network and exchange data with external users. Currently, two standard technologies are available for WSN: ZigBee and Bluetooth. Both operate in 2.4GHZ Band. The system is low cost & low power consuming so that anybody can afford it. It can be used in precision farming and therefore easily the irrigation of the farm can be done without need of farmer monitoring. The system represents different sensors which measure the humidity, temperature and soil moisture level and this data is given to the microcontroller which controls all the parameters which are displayed on the LCD so accordingly the parameter variation motor will be on and off. In this system zigbee and GSM are used for sending data to control station or pc and hence the system is very efficient if we want to irrigate large area.

#### BLOCK DIAGRAM DESCRIPTION

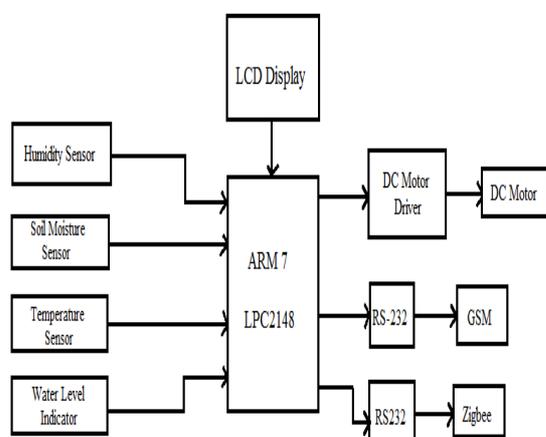


Fig 1. Block Diagram of Automatic Irrigation System

#### a) LPC2148 MICROCONTROLLER

Microcontroller is a heart of system. The LPC2148 microcontroller has both 16/32bits. It has 64 pins. It provides real-time emulation and embedded support so that combine microcontroller and embedded gives high speed flash memory of 512kb. A 128-bit wide memory interface and unique accelerator architecture enables 32-bit code execution at the maximum clock rate.

#### b) LCD DISPLAY

Lcd display is used for displaying image and text which we get from sensors or other component [3].

#### c) SOIL MOISTURE SENSOR

Soil moisture sensors measure the water content in soil. Most of soil moisture sensor are proposed to measure soil volumetric water content base on the dielectric constant of soil [3]. By the electric constant

the transmitted electricity can be measured. Dielectric constant depends on the dihydrogen monoxide content of soil so if dielectric constant increases, the dihydrogen monoxide content of the soil increases additionally. Thus, quantification of the dielectric constant gives a prognosticable estimation of dihydrogen monoxide content. Soil moisture sensors measure the dihydrogen monoxide content in soil. A soil moisture probe is composed of multiple soil moisture sensors.

#### d) TEMPERATURE SENSOR

Temperature sensor is used to measure the temperature in any field. Most commonly used temperature sensor is LM35 [1]. LM35 is a series precision integrated-circuit temperature sensor with an output voltage lineary proportional to the centigrate temperature. It operates at 4 to30V.

#### e) HUMIDITY SENSOR

Humidity is used to sense the amount of vapour in air. Higher humidity reduces the effectiveness of sweating in cooling the body by reducing the rate evaporation of moisture from skin. One of the humidity sensor is HS1101LF.

#### f) DC MOTOR AND L293D

DC motor is used to exhcange the electrical energy into mechanical energy. L293D is a driver used for driving the motor. DC motor has some specification like operating voltage 12V DC, current rating 500mA-1A, speed 100/200/300/1000 rpm. L293D operates on 5-12V and rating current is 600mA.

#### g) ZIGBEE

Zigbee standard is IEEE 802.14.5. This standard provides both physical and medium access control layer for low rate wireless sensor network [1]. The physical layer has three frequency bands with different data rates 450MHZ, 915MHZ, 868MHZ. Zigbee supports both physical and application layer. It is used in low data rate application that requires high battery power and secure system. Zigbee range is upto 300meter and rate of data transmission and reception is around 225kbps. Application of Zigbee is in wireless light switches, traffic management system and other application in agriculture and food demand.

#### h) GSM (GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS)

GSM is a transmission media which are being used to transmit data control station to server. GSM provide some basic services like Voice services, data services and short message services. It provides some additional services like emergency number, electronic mail.

#### i) ADVANTAGES OF IRRIGATION SYSTEM

Automatic irrigation provides effectiveness according to requirement of water and easy supply of water. All plants receive sufficient water and fertilizer also can be used with water which reduces the labour cost. System can be operated in night thus minimizing the evaporation. Irrigation process can be handled properly and started and stopped accordingly that results in optimization of the energy requirement.

#### j) OTHER ALTERNATIVES FOR SYSTEM

Automatic irrigation system is controlled through the internet so the internet link allows the supervision through the mobile communication like smart phone. And video capturing with ARM controller can be used by using MMS facility about the crop position and at the same time sending video to the farmer.

#### CONCLUSION

The proposed system has been found to be feasible and cost effective for optimizing water resources for agriculture production. This system can be adjusted to variety of crops and improve the maintenance. The system is feasible for all type of crops. It can be used for large scale up green house and open field.

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