International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075, Volume-1, Issue-1, June 2012

Microcontroller Based Closed Loop Automatic Irrigation System

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Abstract— In last few decades, electronics and communication have become an integral part of our lives, always expanding into new realms, to provide ways to do things in precise manner. With the recent developments in wireless networks especially regarding power requirements and cost, it has become possible to conceive a comprehensive model for precision agriculture. In this paper we present a closed loop automatic irrigation system along with the temperature and water usage monitoring. The system can be used in greenhouses as well as open fields. The real time values of soil moisture, temperature(useful in greenhouse cultivation) are wirelessly transmitted using Zigbee technology from field to substation which controls the state of the motor and irrigation valves according to the desired moisture levels set by the user. A flow sensor is also interfaced to the main water supply which continuously tracks the water applied to the field. All the information viz. temperature, current soil moisture level in field, upper and lower moisture levels to be maintained in field (set by user), motor status, water usage and flow rate are displayed on LCD.

Index Terms— Automatic irrigation, Zigbee, closed loop, Wireless, Precision agriculture.

I. INTRODUCTION

India is an agriculture based economy. Most of the people depend on agriculture for their livings. But the per capita income of most of the Indian farmers is very low due to which lots of the farmers commit suicide. It is necessary to avoid the unnecessary or excess application of water, fertilizers etc. in the field so as to make farming more profitable which in turn will help India grow more rapidly and that too from grass root level. This paper aims to present a closed loop irrigation system which periodically monitor and control the various parameters of farming such as soil moisture, temperature, water flow etc., so as to optimize the application of various resources such as water, fertilizers etc. for maximum production. The system presented here makes the irrigation automatic with the use of low cost sensors and the simple circuitry, thereby making it a low cost product, which can be bought even by a poor farmer. The soil moisture level is one of the critical parameters of agriculture, which controls the quality of the crops grown in any type of field. The system monitors soil moisture and perform automatic irrigation management. Besides automatic irrigation the system also monitors temperature of greenhouse and water usage in irrigation. The system can be divided into two main blocks:

1) Sensor Module
2) Substation

The substation and sensor module communicate to each other via wireless Zigbee network as shown in Figure1.

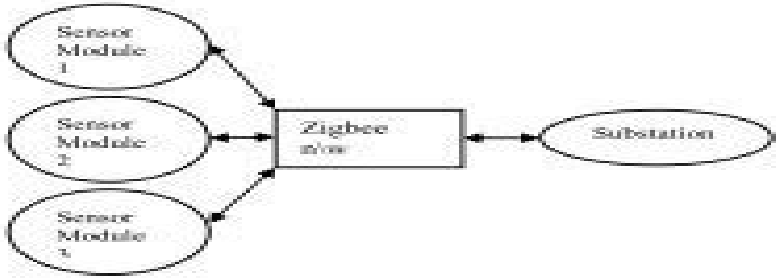

Figure1: Block Diagram of System

II. RELATED WORK

In [1] limitations of the conventional PLC based irrigation control systems is discussed and a new approach to automate the irrigation is presented. This system uses a Single Board Computer (SBC) using the Linux operating system to control solenoids connected to individual or groups of nozzles based on prescribed application maps. The main control box houses the SBC connected to a sensor network radio, a GPS (Global Positioning System) unit, and an Ethernet radio creating a wireless connection to a remote server. A C-software control program control the overall working of system. A wireless drip irrigation system using soil moisture sensors is presented in [2]. This paper describes an application of a wireless sensor network for low-cost wireless controlled irrigation solution and real time monitoring of water content of soil. Data acquisition is performed by using solar powered wireless acquisition stations for the purpose of control of valves for irrigation. The designed system has 3 units namely: base station unit (BSU), valve unit (VU) and sensor unit (SU). The system is energy efficient. Various technologies used for soil moisture sensors are discussed and compared and required characteristics of the soil moisture sensors are also discussed in [3]. Precision water-saving irrigation automatic control system by plant physiology is discussed in [4]. This project is one of the Olympic Games

Manuscript received on May 30, 2012.
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