

Microcontroller Based Closed Loop Automatic Irrigation System

Neelam R. Prakash, Dillip Kumar, Tejender Sheoran

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.

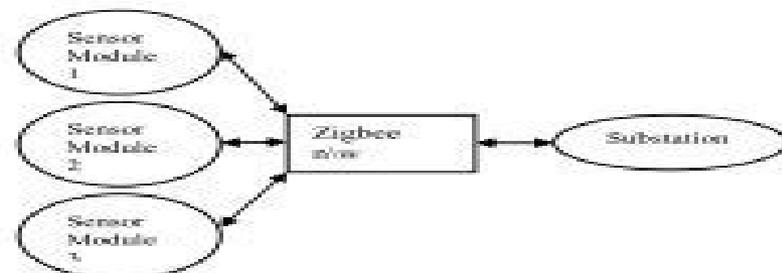


Figure1: Block Diagram of System

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

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Table of Contents Microcontroller Based Closed Loop Automatic Irrigation System

1. Understanding the eBook Microcontroller Based Closed Loop Automatic Irrigation System
 - The Rise of Digital Reading Microcontroller Based Closed Loop Automatic Irrigation System
 - Advantages of eBooks Over Traditional Books
2. Identifying Microcontroller Based Closed Loop Automatic Irrigation System
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Microcontroller Based Closed Loop Automatic Irrigation System
 - User-Friendly Interface
4. Exploring eBook Recommendations from Microcontroller Based Closed Loop Automatic Irrigation System
 - Personalized Recommendations
 - Microcontroller Based Closed Loop Automatic Irrigation System User Reviews and Ratings
 - Microcontroller Based Closed Loop Automatic Irrigation System and Bestseller Lists
5. Accessing Microcontroller Based Closed Loop Automatic Irrigation System Free and Paid eBooks
 - Microcontroller Based Closed Loop Automatic Irrigation System Public Domain eBooks
 - Microcontroller Based Closed Loop Automatic Irrigation System eBook Subscription Services
 - Microcontroller Based Closed Loop Automatic Irrigation System Budget-Friendly Options

6. Navigating Microcontroller Based Closed Loop Automatic Irrigation System eBook Formats
 - ePub, PDF, MOBI, and More
 - Microcontroller Based Closed Loop Automatic Irrigation System Compatibility with Devices
 - Microcontroller Based Closed Loop Automatic Irrigation System Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Microcontroller Based Closed Loop Automatic Irrigation System
 - Highlighting and Note-Taking Microcontroller Based Closed Loop Automatic Irrigation System
 - Interactive Elements Microcontroller Based Closed Loop Automatic Irrigation System
8. Staying Engaged with Microcontroller Based Closed Loop Automatic Irrigation System
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Microcontroller Based Closed Loop Automatic Irrigation System
9. Balancing eBooks and Physical Books Microcontroller Based Closed Loop Automatic Irrigation System
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Microcontroller Based Closed Loop Automatic Irrigation System
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Microcontroller Based Closed Loop Automatic Irrigation System
 - Setting Reading Goals Microcontroller Based Closed Loop Automatic Irrigation System
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Microcontroller Based Closed Loop Automatic Irrigation System
 - Fact-Checking eBook Content of Microcontroller Based Closed Loop Automatic Irrigation System
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

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