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# Advanced Water Deployment System for Irrigation using WSN & GSM Module

#1Mr Nilesh D. Kuchekar, #2Prof. R. A. Pagare

1nileshkuchekar9@gmail.com

2rapagare@rediffmail.com

#1 PG Scholar, Department of Electronics & Telecommunication Engineering, Trinity College of Engineering & Research, Savitribai Phule Pune Univercity,Pune, India

## ABSTRACT

**The irrigation based modern agriculture is the recent requirement in every part of agriculture in India. With developments in technology, efforts are being channeled into automation of irrigation systems to facilitate remote control of the irrigation system and optimize crop production and cost effectiveness. This paper demonstrates how an advanced water deployment system (AWDS) can practically be implemented by Wireless sensor network (WSN) which consists of Wireless sensor unit (WSU) & Wireless information unit (WIU). Specifically it will be developed to minimize water use for agriculture crops. The implemented system ensures that water is distributed to field properly. The system incorporated a remote monitoring mechanism via a GSM module to report soil temperature, soil moisture & humidity. In the irrigation area automatic system, high performance embedded micro-controller and low-power technology is used to design the wireless sensor network. The wireless network is placed in the root zone of the plants. In addition, WIU unit handles sensor information and transmit data to a smart phone. The objective of the work is to provide an approach that helps farmers to easily access, manage and regulate their irrigation systems for the water needs of crops.**

**Keywords— Wireless Sensor Network, automatic irrigation, Zigbee, sensors, microcontroller, GSM module, regulated power supply.**

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## I. INTRODUCTION

The Irrigation is the artificial application of water to the soil for assisting in growing crops. It minimizes the use of water & fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone due to which a large quantity of water is saved & also the fertilizer which comes to the plant with the water. In agriculture, various parameters including soil type and temperature vary dramatically from one region to the other and therefore any irrigation system must be flexible. [3].

Agriculture uses freshwater resources worldwide, which is dependent on the monsoons, and it is not a reliable source of water, so there is an urgent need for water deployment system to sustain use of water & provide water to the farms according to their moisture, temperature and soil types & fertilizers. [3]

In this project, a wireless sensor network based intelligent system is implemented and applied for monitoring of soil, temperature & humidity. The motivation of developing this system came from the countries where economy is depends on agriculture and the climatic conditions lead to lack of rains. The farmers working in the farm lands are dependent on the rains and bore wells.

The network consists of sensing stations & a weather station. Each of the sensing station contained data logger, a soil temperature sensor & zigbee communication. The development of WSN based on microcontrollers & communication technologies can improve the current methods of monitoring to support the response in real time. The aim of implementation was to demonstrate that the water deployment system can be used to reduce water use. The soil moisture & temperature sensors deployed in plant root zones. The sensor measurements are transmitted to a microcontroller based receiver. This gateway permits the automated activation of irrigation when the threshold values of soil moisture & temperature are reached. The communication between the sensor nodes & data receiver is via Zigbee protocol. Zigbee is the new wireless technology

it uses 2.4 GHz frequency band with having IEEE 802.15.4a protocol. When we are receiving this information from the wireless sensor network we want to monitor the parameters & control this parameter wirelessly form remote station. The internet connection allows the data inspection in real time on a website, where soil moisture & temperature levels are displayed through an application interface & store in database server. [1, 4].

## II. IMPLEMENTAION

*Advanced Water Deployment system And System Description*

Fig.2 shows Configuration of the Advanced Water Deployment system, i.e. the whole system architecture, which consists of two components, wireless sensor units (WSUs) and a wireless information unit (WIU), and linked by radio transceivers that allowed the transfer of soil moisture and temperature data, implementing a WSN that uses ZigBee technology. The WIU has also a GSM module to transmit the data to a smart phone via the public mobile network. The information can be remotely monitored online through a graphical application through Internet access devices. [1].

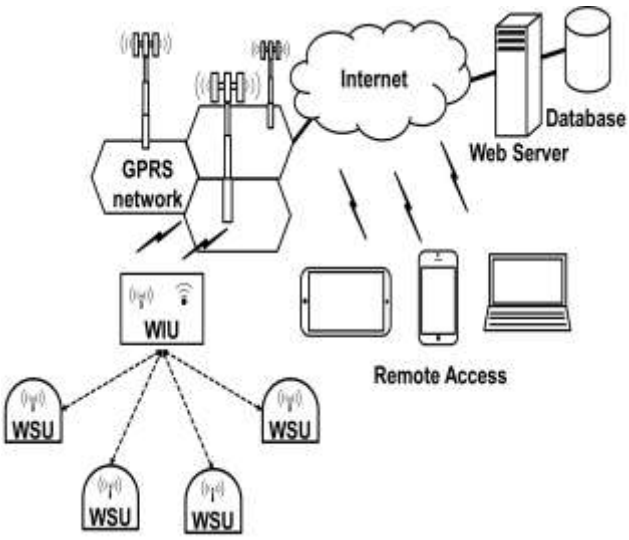
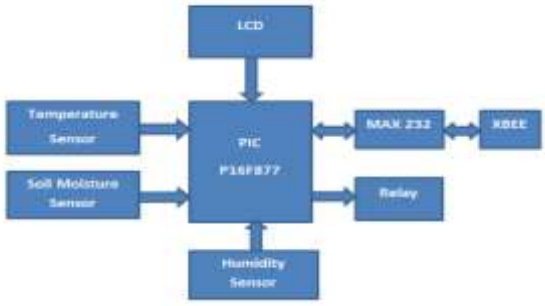



**FIG2: Configuration of the Advanced Water Deployment system**

## II. HARDWARE DESIGN OF WSU

A. *WIRELESS SENSOR UNIT*:

A WSU is comprised of a RF transceiver, sensors, a microcontroller, and power sources. Several WSUs can be deployed in-field to configure a distributed sensor network for the advanced water deployment irrigation system. Each unit is based on the microcontroller PIC16F877 that controls the radio modem ZigBee and processes information from the soil-moisture sensor and the temperature sensor. These components were selected to minimize the power consumption for the implemented application. [4]




1. *PIC16F877 Microcontroller*:

8-bit microcontroller with 40-pins flash microcontroller that operate in a range 2.0 to 5.5 V at 20 MHz with internal oscillator. It has high performance RISC CPU, interrupt capability, direct, indirect and relative addressing modes, 8K flash Program Memory,368 bytes of data Memory (RAM), 256 EEPROM data Memory, Programmable code protection, power saving sleep mode, 8-bit analog to digital converters (ADC), serial peripheral interface modules, USRT, 3 timers & 5 ports. The microcontroller is well suited for this remote application, because of its low-power consumption, high speed, power on reset facility, in circuit programming & debugging. [1].

2. *Zigbee Modules* :

ZigBee (over IEEE 802.15.4) technology is based on short range WSN and it was selected for this sensor network because of its low cost, low power consumption, and greater useful range in comparison with other wireless technologies. The ZigBee devices operate in industrial, scientific, and medical 2.4-GHz radio band and allow the operation in a networking architecture.

From a wide range of commercial ZigBee devices, the ZigBee-PRO is an appropriate original equipment manufacturer module to establish communication between a WSU and the WIU because of its long-range operation and reliability of the sensor networking architecture. [1,4].

3. *Soil Moisture Sensor* :

Soil moisture sensor is a sensor connected to an irrigation system controller that measures soil moisture content in the active root zone. It is used to measure volumetric content of soil & measure the loss of moisture over time due to evaporation & plant intake. [4].

4. *Humidity Sensor SY-HS-220* :

This sensor module converts relative humidity (30-90 % RH) to voltage & can be used in weather monitoring application. It has high accuracy, rated voltage is 5.0v DC, current consumption is less than 3.0 ma, operating humidity range (30-90 % RH) & standard output voltage is DC 1.980mv.This sensor is suitable for this remote application because of its high accuracy, less current consumption, high operating temperature and humidity range. [1].

5. *Temperature Sensor LM 35* :

LM35 Series are precision integrated temperature sensors, with an output voltage linearly proportional to the centigrade temperature. It does not require any external

calibration or trimming to provide typical accuracies. It has low cost, low output impedance, linear output, precise inherent calibration, linear scale factor, suitable for remote application.it operates from 4 to 30V, rated for -55°C to 150°C range, require less than 60µA drain current, low self-heating 0.08°C in still air & low output impedance 0.1Ω for 1ma load. [1].

## IV. HARDWARE DESIGN OF WIU

B. *Wireless Information Unit*:

The soil moisture and temperature data from each WSU are received, identified, recorded, and analysed in the WIU. The WIU consists of a master microcontroller ARM7 LPC2138, a Zigbee radio modem, a GSM module SIM900, an RS-232 interface. The WIU can be located up to 100-m line-of-sight from the WSUs placed in the field. All the WIU processes can be monitored through the RS-232 port. The WIU includes a function that synchronizes the WSUs at noon for monitoring the status of each WSU.

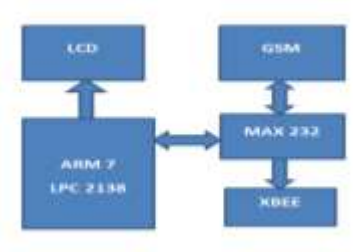



**FIG 4.1: Block diagram of the Wireless Information Unit.**

1. *Master Microcontroller ARM7LPC 2138*:

ARM7 LPC 2138 designed to enable easy development of real time applications, testing & monitoring of various solutions. The LPC 2138 µC are based on a 32/16 bit ARM7 TDMI CPU with real time emulation & embedded trace support, that combines the µC with 32 KB, 64 KB & 512 Kb of embedded high speed flash memory. Due to their tiny size & low power consumption this µC are ideal for this application. [2].

2. *GSM Module SIM900*:

The SIM900 is a complete quad band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. It can communicate with controllers via AT commands. This module support software power on & reset. It is designed with a very powerful single chip processor & it has low power consumption. [3]. the hardware implementation of WSU & WIU with GSM module is shown in fig.

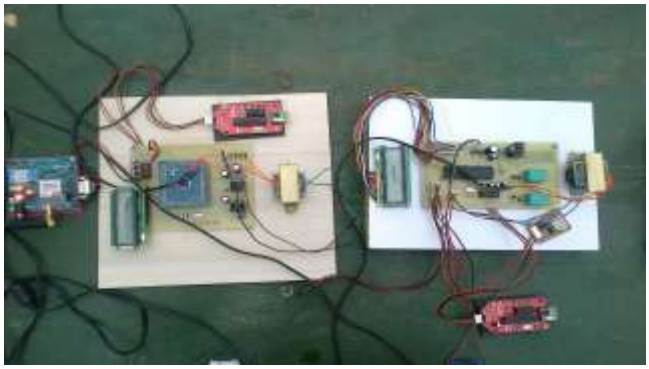


**FIG4.2: Hardware setup**

## V. SIMULATION

Proteus is one of the most famous simulators. It can be used to simulate almost every circuit on electrical fields. It is easy to use because of the GUI interface. Proteus PCB design combines the ISIS 7.7 SP2 with advanced simulation schematic capture and ARES PCB layout programs to provide a powerful, integrated and easy to use suite of tools for professional PCB. It is a handy tool to test programs & embedded design.

Proteus is one of the must tools for circuit designing & simulation which includes application framework, common parts database, live net listing, 3D viewer, VM studio & many more features. Thus it is good solution for reasonably complex design.

*IRRIGATION ACTION-1*

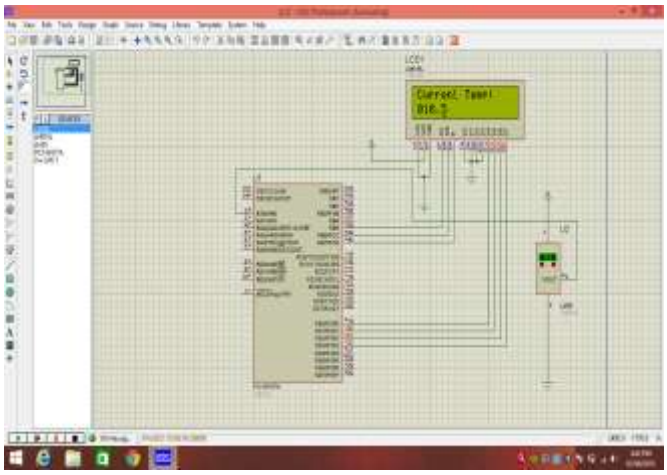


**FIG 5.1 ISIS Schematic view of IA-1**

Proteus is used as simulation tool. The ISIS schematic view of irrigation action-1 is shown in fig 5.1. The LM 35 will sense the temperature at the root zone of the plant continuously. The temperature value shown in fig is 10.5°C.

The ISIS schematic view of power supply is shown below:

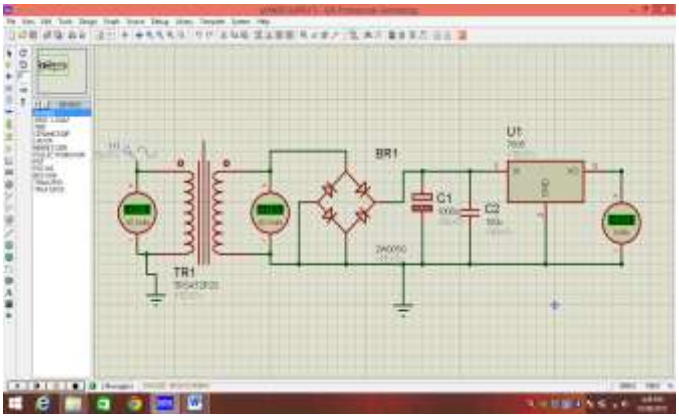



**FIG 5.2 ISIS Schematic view of power supply**

## VI. RESULT & DISCUSSION

The app inventor is a visual, drag & drop tool for building mobile apps on the android platform. App inventor is used to design the user interface of an app using a web-based graphical user interface builder, then it specify the app's behaviour by piecing together "blocks". The app is a text "answering machine". We launch it when we're driving & it auto responds to the texts you receive. It is possible to immediately see & interact with the app building on the phone, it is freely available for anyone to use, it runs online & is accessible from any browser so it is used in this project. The schematic view of an android app created for AWDS is shown in fig.

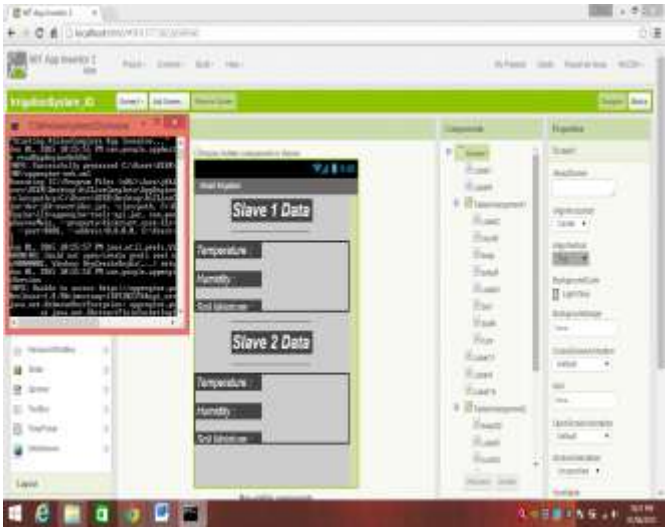



**FIG6.1: APP Inventor Schematic view**

At the time of parameter receiving on smart phone it shows the following display.

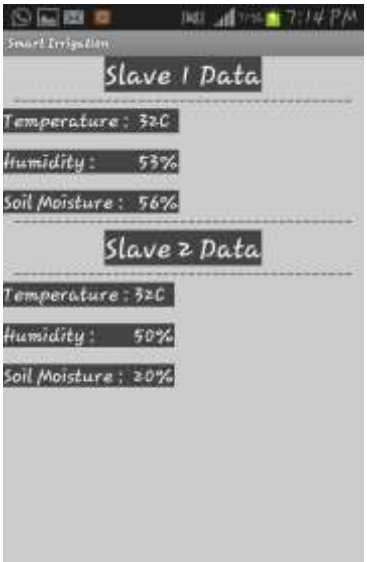



**FIG6.2: Smart phone displaying actual parameter**

## VII. CONCLUSION

By using Zigbee technology it is possible to send as well as receive all the information without any intervention of any environmental condition. That means there is no problem of line of sight. By using ARM7 microcontroller the system response we are getting is very good. In this paper, a sensor network based Advanced Water Deployment system implemented for monitoring of soil, temperature & humidity. This implemented system consists wireless sensor units (WSUs) and a wireless information unit (WIU), and linked by radio transceivers that allowed the transfer of soil moisture and temperature data, implementing a WSN that uses ZigBee technology.

## ACKNOWLEDGMENTS

The goal of this paper is to design "Advanced Water Deployment System for Irrigation using a Wireless Sensor Network & GSM module "The function has been realized successfully. I wish to place on record my sincere thanks and whole hearted thanks to my guide Prof. Pagare R. A. under whose supervision this dissertation work has been carried out. It was his keen interest encouraging disposition and full co-operation that has made it possible for me to complete this work. I wish to place on record my sincere thanks and also acknowledge my indebtedness to Prof. Hendre V. S., Head of Electronics & Telecommunication Department, whose critical analysis, careful comments and valuable suggestions have been immense help in completing this work. Lastly, I am thankful to all those persons, who have contributed directly or indirectly in the completion of this project.

## REFERENCES

[1] Joaquin Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta-Gándara "*Automated Irrigation System Using a Wireless Sensor Network and GPRS Module "* , IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, VOL. 63, NO. 1, JANUARY 2014.

[2] Chandrika Chanda1, Surbhi Agarwal2, Er. B.Persis Urbana Ivy, " *A Survey of Automated GSM Based Irrigation Systems"* International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, Volume 2, Issue 10, October 2012)

[3] Aniket H. Hade, Dr. M.K. Sengupta, "*Automatic control of Drip Irrigation System & Monitoring of soil by Wireless*" IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 7, Issue 4 Ver. III (Apr. 2014), PP 57-61.

[4] Million Mafuta, Marco Zennaro, Antoine Bagula, Graham Ault, Timothy Chadza*,"Successful Deployment of a Wireless Sensor Network for Precision Agriculture in Malawi –WiPAM"*, A Electrical Engineering Department, University of Malawi .

[5] Siddharth A Ladhake, "*Design of Ultra Low Cost Cell Phone Based Embedded System for Irrigation*", 2010 International Conference on Machine Vision and Human-machine Interface.

[6] Pavithra D. S1, M. S .Srinath2, "*GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning by Using an Android Mobile*", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 11, Issue 4 Ver. I (Jul- Aug. 2014), PP 49-55 www.iosrjournals.org.