IJMTST

Volume: 2 | Issue: 05 | May 2016 | ISSN: 2455-3778

Garden Environmental Monitoring & Automatic Control System Using Sensors

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ABSTRACT

Many people have gardens in their homes. But due to their busy schedule they don't have time to take care of the garden. The automated garden control system achieves monitoring and control of a garden environment by using sensors and the controller of a microcontroller running a computer program. The WSN is the recent emerging technology in the various filed. So that by using the WSN concept we can make this paper more reliable. The various sensors senses the garden environmental factors , microcontroller process those data and by using ZBee protocol the data can be transmit to remote locations and demodulated by the another Zbee, which then passes the information to the serial port. The approach of creating a GUI requires no coding by the user and the information is still presented in a visually appealing format. The aim of our paper is to minimize this manual intervention by the workers. Automated garden system will serve the following purposes: 1) As there is no un-planned usage of water, a lot of water is saved from being wasted. 2) The irrigation is the only when there is not enough moisture in the soil and the sensors decides when the motor should be turned on/off, saves a lot time for the works. This also gives much needed rest to the workers, as they don't have to go and turn the motor on/off manually.

KEYWORDS: *WSN, Sensors, Zigbee, Microcontroller*

I. INTRODUCTION

Gardens are common in most of the houses in India. In urban cities people grow plants in pots on their balconies. Maintenance of these gardens is done in an unscientific method.

Many a times the potted plants in our homes are watered in an untimely manner. Sometimes we tend to water the plants more than they require. Too little water as well as too much water is harmful for the plants. If the water provided is less, plants are unable to develop and become susceptible to damage from pests. On the other hand if watered too much, the plants are prone to get rots and other diseases. Plants require specific amount of sunlight, water and temperature to grow.

By controlling these factors using an automated gardening system, plants can be grown in a better and faster way. Automating the garden would reduce time and energy of the user in maintaining the garden. The Project presented here waters your plants regularly when you are out for vocation. The system uses low cost efficient soil moisture, humidity and temperature sensors to decide when and how much water will be provided to the potted plants. The soil moisture sensors to sense the whether the Soil is wet or dry. The comparator monitors the sensors and when sensors sense the dry condition then the switch on the motor for water supply. And it will switch off the motor when the sensors senses wet condition of soil. The temperature sensor gives the temperature of the surrounding in which the potted plants are placed. The humidity sensor used for sensing the humidity. Relative humidity is a measure in percentage of the vapour in the air compared to the total amount of vapour that could be held in the air at a given temperature. The comparator does the above job it receives the signals from the sensors. The WSN technology is used in this paper. And zigbee is used to send the data wirelessly from one location to another or to base station. The sensor readings that are obtained by the microcontroller are displayed the user to monitor the system. There is also an LCD screen in the system to display the data.

II. System Analysis and Requirements

A. System Design

The automated garden control system, whose block diagram is depicted in figure 1, is made up of two principal units: Sensors location and Remote Monitoring location. These two units consist of sensors for soil moisture, temperature, humidity, ARM7 microcontroller board, ZigBee MODEMs, ZigBee adapter board; and a personal computer (PC). The sensors location is the heart of the system that is responsible for regulating the garden environment. The sensors acquire the environmental data. After the data have been filtered to remove noise they are made available to the ARM7 board which then computes the current values of the controlled variables and compares them with the set thresholds. If any of the controlled variables is outside a safe limit the corresponding actuator is activated to restore the optimum condition. The ARM7 board also reads the states of the actuators and transmits the information along with the current values of the controlled variables to the remote monitoring location via ZBee radio frequency (RF) MODEM pair that operate at a frequency of 2.4 GHz. A large number of wireless linking devices exist, however ZBee has been used for this work primarily because of its suitability for low power data transmission.

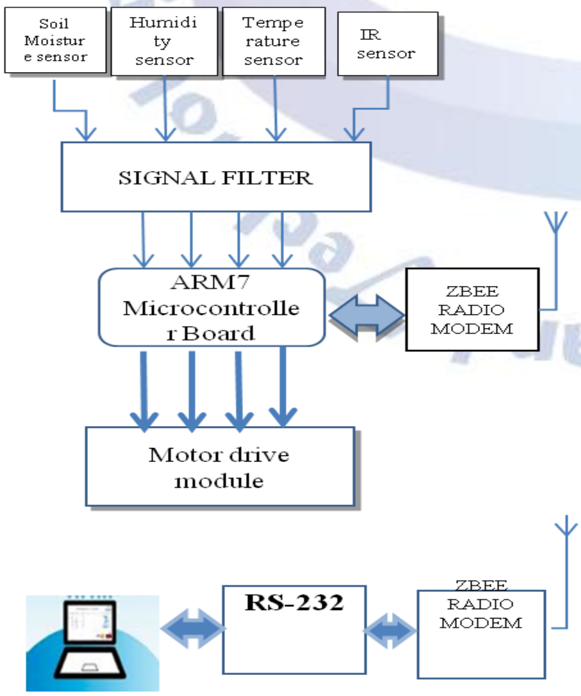

Fig 1: Block Diagram

B. Soil Moisture Sensor

In this paper, a capacitive soil moisture sensor has been developed based on Frequency Division Reflectometry (FDR). The concept of FDR is explained as follows:

• The electrical capacitance of a capacitor that uses the soil as a dielectric depends on the soil water content.

• When connecting this capacitor (made of metal plates or rods imbedded in the soil) together with an oscillator to form an electrical circuit, changes in soil moisture can be detected by changes in the circuit operating frequency.

• This is the basis of the Frequency Domain (FD) technique used in Capacitance and Frequency Domain Reflectometry (FDR) sensors.

• In Capacitance sensors the dielectric permittivity of a medium is determined by measuring the charge time of a capacitor made with that medium.

• In FDR the oscillator frequency is swept under control within a certain frequency range to find the resonant frequency (at which the amplitude is greatest), which is a measure of water content in the soil.

C. Temperature Sensor

A simple temperature sensor using one LM35 precision Integrated-circuit temperature device with an output voltage linearly-proportional to the centigrade temperature. It can measure temperature from -55c to +150c. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature. LM35 can be operated from a 5V supply and stand by current is less than 60μA.The purpose of this sensor in this system is to monitor the temperature and to regulate Air Cooler system .It is designed that whenever the temperature goes beyond 35˚ C the Air Cooler system has to turn on. Temperature sensor LM35 is interfaced to the microcontroller. The conversion of Celsius and Fahrenheit is done by certain formula. The output is displayed in the serial monitor. When the temperature goes above 35C the cooler system gets ON automatically.

D. IR Counter Measurement

An infrared sensor is an electronic instrument which is used here to detect and count the motion of cones on conveyer. IR sensors are capable of detecting motion of object and heat emitted by an object. IR detectors are specially filtered for Infrared light; they are not good at detecting visible light. On the other hand, photocells are good at detecting yellow/green visible light, not well at IR light.

E. Humidity Sensor

The humidity sensor SYS-1used for sensing the humidity. It delivers instrumentation quality RH (Relative Humidity) sensing performance in a low cost, solder able SIP (Single In-line Package). Relative humidity is a measure, in percentage, of the vapour in the air compared to the total amount of vapor that could be held in the air at a given temperature.

III. Flow Diagram

The main dataflow diagram of the automated garden control system is shown in figure 2.

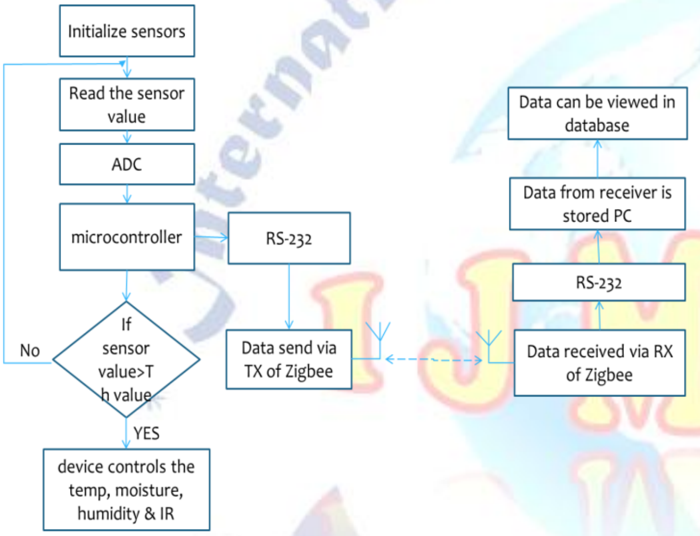

Figure 2.overall dataflow for the Automated garden Control System

IV. Results

The proposed system is successfully implemented and desired outputs are obtained. When the power supply is given through a dc battery, the process starts and the sensors start sensing the corresponding parameters and are displayed on the LCD. And simultaneously the results are stored in PC The authorized person has access the data from any place at any time and can monitor the parameters successfully.

The figure 3 shows the overall project module and the desired outputs are successfully obtained.

The figures 4 and 5 show the variation in temperature, soil moisture and humidity with the time and are captured using MATLAB simulator.

The figure 6 shows the data sheet of temperature, soil moisture and humidity for each arying time 2-3 seconds and is monitored continuously using WSN.

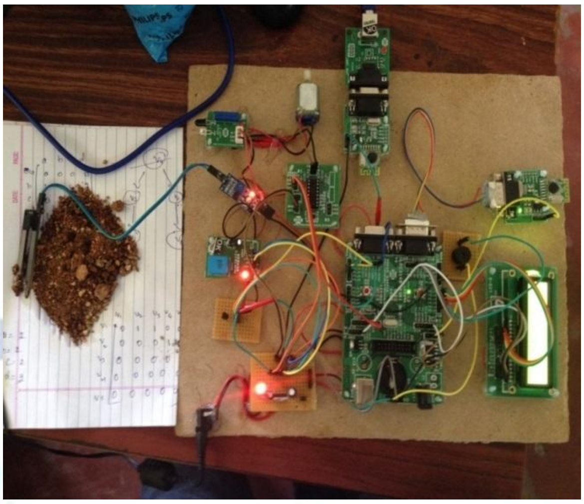

Fig 3.Project module

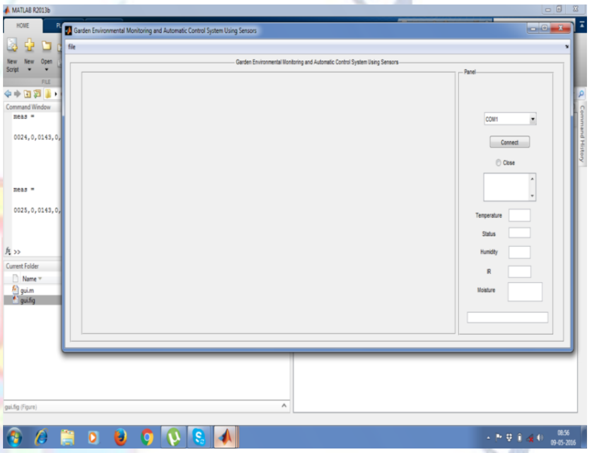

Fig 4. Main page of GUI

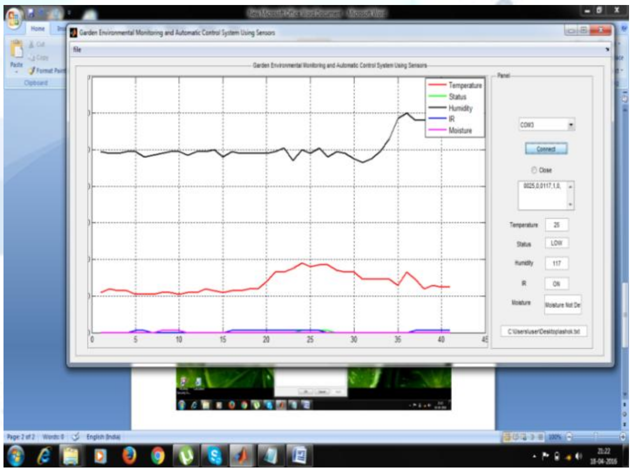

Fig 5 variation in temperature, soil moisture and humidity with the time and are captured using MATLAB simulator

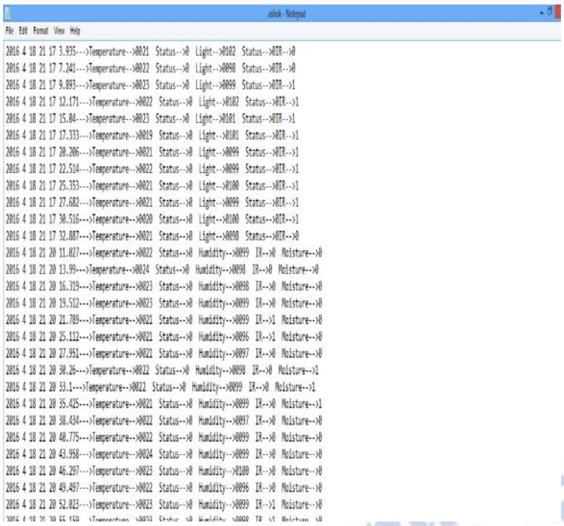

Fig 6. Values stored in database.

V. Conclusion

A step-by-step approach in designing the microcontroller based system for measurement and control of the four essential parameters for Garden growth, i.e. temperature, humidity, soil moisture, and IR Sensor, has been followed. The results obtained from the measurement have shown that the system performance is quite reliable and accurate.

The system has successfully overcome quite a few shortcomings of the existing systems by reducing the power consumption, maintenance and complexity, at the same time providing a flexible and precise form of maintaining the environment.

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