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RESEARCH ARTICLE

IRRIGATION SCHEDULING PERFORMANCE IN WIRELESS SENSOR

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Abstract: The motivation for this project 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. Even if the farm land has a water-pump, manual involvement by farmers is required to turn the pump on/off when on earth needed. The purpose 0f this paper to measuring the moisture of agricultural soils by real-time method and to minimize this manual involvement by the farmer, which is why we are using a micro-controller (AVR ATMEGA-16L),RF module. The sensor senses the amount of moisture present in the soil and presents an output in the form of analog voltage ranging between 1.7V (fully saturated condition) to 4.5V (completely dried condition) respectively.

Keywords: water-saving irrigation, WIRELESS SENSOR NODE, WATER RESOURCES, ATMEGA 16L, Soil moisture sensor.

I. Introduction

The micro-controller based automated real time Irrigation system will supply the following:
As there is no unexpected usage of water, a lot of water is saved from being wasted. The irrigation system is use only when there is not sufficient moisture in the soil and the microcontroller decides when should the pump be turned on/off, saves a lot time and water for the farmers. As there is no unanticipated usage of water, a lot of water is saved from creature wasted. This also gives much wanted rest to the farmers, as they don't have to go and revolve the pump on/off automatically. The constant increasing command of the food provisions requires a rapid improvement in food production technology. In a lot of countries like India where agriculture and the climatic conditions are isotropic, at a standstill we are not able to make full use of agricultural possessions. The main reasons is the not have of rains & insufficiency of land lake water. The continuous removal of water at normal intervals from earth is dropping the water level as a result of which the zones of un-irrigated land are frequently increasing. Also, the unexpected use of water accidentally results in wastage of water.
In an Automated Irrigation System using (AVR ATMEGA-16L), the most significant advantage is that water is supplied only when the moisture in soil goes below a determined threshold value. In current times, the farmers have been using irrigation system through the labor-intensive control in which the farmers irrigate the land at regular intervals by turning the water-pump on/off when essential. These procedures sometimes consume more water and sometimes the water supply to the land is delayed due to which the crops dry off. Water shortage deteriorate plants enlargement before visible wilting occurs. In addition to this slow development rate, lighter mass fruit follows water shortage. This problem can be absolutely rectified if we use Automated Irrigation System in which the irrigation will take place only when there will be strong requirement of water, as optional by the moisture in the soil. Irrigation is the artificial application of water to the soil usually for supporting in

rising crops. In crop manufacture it is mostly used in waterless areas and in periods of rainfall shortfalls, but also to protect plants against hoarfrost.

II. AUTOMATED IRRIGATION SYSTEM

There are different types of irrigation system

- Surface irrigation
- Localized irrigation
- Drip Irrigation
- Sprinkler irrigation

The conformist irrigation methods like overhead sprinklers, flood type feeding systems usually wet the lower leaves and stem of the plants. The entire soil surface is soaked and often stays wet long after irrigation is completed. Such condition promotes infections by leaf mold fungi. On the different the drip or trickle irrigation is a type of modern irrigation method that slowly applies less amount of water to part of plant root zone. Water is supplied regularly often daily to preserve constructive soil moisture situation and avoid moisture stress in the plant with proper use of water resources.

Drip irrigation is artificial method of supplying water to the roots of the plant. It is also called micro irrigation. In past few years there is a rapid growth in this system. The user communicates with the centralized unit through SMS. The centralized unit communicates with the system through SMS which will be received by the GSM with the help of the SIM card. The GSM sends this data to ARM7which is also continuously receives the data from sensors in some form of codes. After processing, this data is displayed on the LCD. Thus in short whenever the system receives the activation command from the subscriber it checks all the field conditions and gives a detailed feedback to the user and waits for another activation command to start the motor. The motor is controlled by a simple manipulation in the internal structure of the starter. The starter coil is indirectly activated by means of a transistorized relay circuit. When the motor is started, a constant monitoring on soil moisture and water level is done & once the soil moisture is reached to sufficient level the motor is automatically turned off & a massage is send to subscriber that the motor is turned off. The water level indicator indicates three levels low, medium, high and also empty tank. The GSM based irrigation system [Fig.1] may offer users the flexibility to regulate and control the operations of their irrigation systems with little intervention to reduce runoff from over watering for improvement in crop yield. This enables users to take advantage of the globally deployed GSM networks with its low SMS service cost to use mobile phones and simple SMS commands to manage their irrigation system. It will be possible for users to use SMS to monitor directly the conditions of their farmland, schedule the water needs of crops, automatically control watering, and set control operational conditions in accordance with the water needs of crops. This will help minimize overwatering and crop production cost.

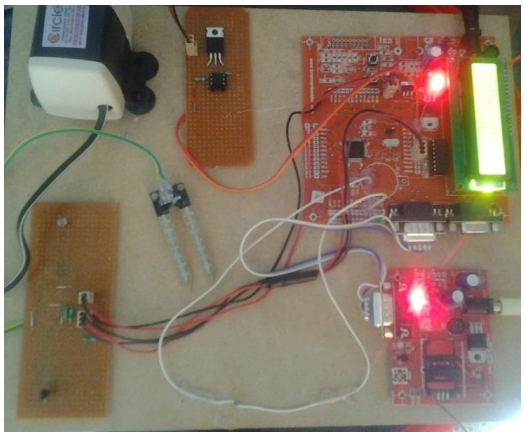

Fig.1: GSM based automatic irrigation control

System by using an android mobile Further, it will help users to take advantage of the prevailing GSM networks to provide value added services. The pump switching system was tested for functionality using a simple code to perform on-and-off operation of the LED. The functionality of the GSM was tested by connecting it to the microcontroller board which was programmed to turn on-and-off an LED using SMS from a mobile phone. The major objectives of the present work are,

- The system supports water management decision, which determines the controlling time for the process and monitoring the whole system through GSM module
- The system continuously monitors the water level in the tank and provide accurate amount of water required to the plant or tree (crop).
- The system checks the temperature, humidity and dew point so as to forecast the weather condition.
- Low cost and effective with less power consumption using sensors for remote monitoring and controlling devices which are controlled via SMS using a GSM using android mobile.

III. Android Architecture

Android is a mobile operating system that is based on a modified version of Linux. It was originally developed by a startup of the same name, Android, Inc. In 2005, as part of its strategy to enter the mobile space, Google purchased Android and took over its development work (as well as its development team).The following Fig.2 shows the major components of the Android operating system. The main advantage of adopting Android is that it offers a unified approach to application development and their applications should be able to run on numerous different devices, as long as the devices are powered using Android Applications: These are applications written in Java. Some of basic applications include calendar, email client, SMS program, maps, making phone calls, accessing the Web browser, accessing your contacts list and others. Application Framework: This is the skeleton or framework which all android developers have to follow. The developers can access all framework APIs an manage phone's basic functions like resource allocation, switching between processes or programs, telephone applications, and keeping track of the phone's physical location. GSM: The Global System for Mobile Communication is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies (2G and 3G). Libraries: This layer consists of Android libraries written in C, C++, and used by various systems. These libraries tell the device how to handle different kinds of data and are exposed to Android developers via Android Application framework. Some of these libraries includes media, graphics, 3D, SQL, web browser library etc. The Android runtime layer which includes set of core java libraries and DVM (Dalvik Virtual Machine) is also located in same layer.

Runtime Android: This layer includes set of base libraries that are required for java libraries. Every Android application gets its own instance of DVM. Dalvik has been written so that a device can run multiple VMs efficiently and it executes files in executable (.Dex) optimized for minimum memory.

IV. GSM Based Irrigation Control System

The connections between the two mobiles are done using GSM. The GSM module and microcontroller are connected using UART (universal asynchronous receiver / transmitter). When the moisture sensor senses the low moisture content of the soil, it gives a signal to the microcontroller. The microcontroller then gives a signal to the called mobile (which is kept in the auto answering mode). The called mobile activates the buzzer.

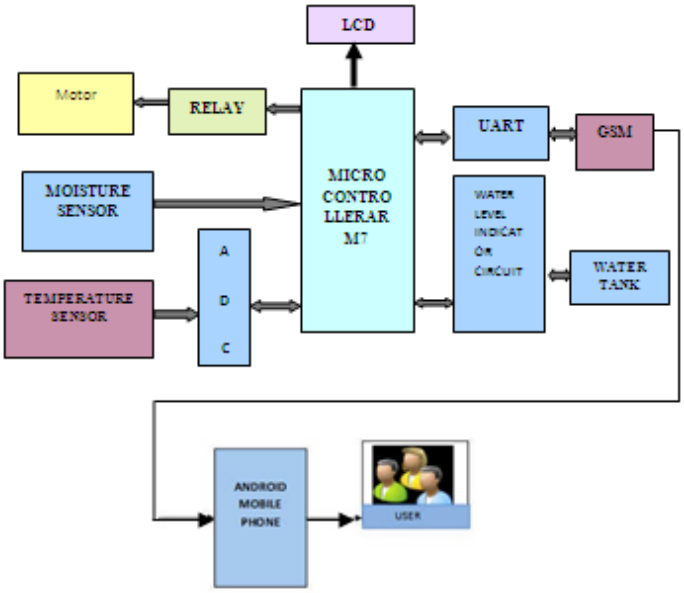

Fig.3: Block Diagram of the Irrigation Control System

Therefore when calling mobile calls, that buzzer is heard indicating the valve needs to be open. By pressing the button in the called function, the signal is given back to the microcontroller. The microcontroller gives signal to the valves which causes it to get open. The water is given to the root of the plant drop by drop, and when the moisture content becomes sufficient, the sensor senses this and gives back the signal to the microcontroller and the buzzer becomes off. Then by pressing the button in the calling function again, the valve is made off. The power supply needed by the controlling system is +5V. The entire unit is as shown in Fig.3. An UART is responsible for performing the main task in serial communications with computers. The device changes incoming parallel information to serial data which can be sent on a communication line. A second UART can be used to receive the information. The UART performs all the tasks, timing, parity checking, etc. needed for the communication. The only extra devices attached are line driver chips capable of transforming the TTL level signals to line voltages and vice versa. The Microcontroller ARM7 structure is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. Can be used to control water flow

V. Structure Of GSM Module

At present the GSM module is used for Remote Control activities such as Gate Control, Temperature Control etc. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB) for computer. The MODEM is the soul of such modules. They generate, transmit or decode data from a cellular network, for establishing communication between the cellular network and the computer. These are manufactured for specific cellular network (GSM/UMTS/CDMA) or specific cellular data standard (GSM/UMTS/GPRS/EDGE/HSDPA) or technology (GPS/SIM). They use serial communication to interface with the user and need Hayes compatible AT (Attention) commands for communication with the computer (any microprocessor or microcontroller system).

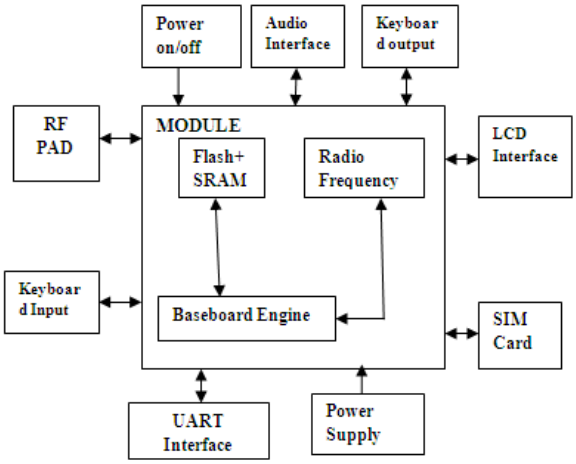

Fig.4: GSM module structure

An RS-232 port was once a standard feature of a personal computer for connections to modems, printers, mice, data storage, un-interruptible power supplies, and other peripheral devices. However, the limited transmission speed, relatively large voltage swing, and large standard connectors motivated development of the universal serial bus which has displaced RS-232 from most of its peripheral interface roles. Many modern personal computers have no RS-232 ports and must use an external converter to connect to older peripherals. Some RS-232 devices are still found especially in industrial machines or scientific instruments. Liquid/moisture sensor and precision centigrade temperature sensors Detects presence of liquid or moisture between two wire leads and gives active High output. The exposed wire is porous; therefore it allows transmission of water vapors into the sensor. These exposed areas are engineered very thinly. Therefore the sensor responds very rapidly to changes in applied moisture, both when being dried (on process start-up) and when called into action if there is moisture ingress into a process. These are the types of sensors mainly used for, •Interfacing with Microcontroller to detect liquid levels. •Moisture detection for automatic watering of plants. •Liquid level detection by putting multiple probes at each liquid level.

Water level indicator The model consists of a series of tanks arranged one below the other. The volume of the tanks is in descending order. Water flows from the top tank through outlets at the bottom. Three tanks or tropic levels chosen for the model is the optimum number required to analyze the effect of top down and bottom up controls. Each tank has two outlets, outlet A and outlet B. Each outlet has the water flow through it regulated by means of valves. These valves are controlled by floats in the tanks. The system used microcontroller to automate the process of water pumping in an over-head tank storage system and has the ability to detect the level of water in a tank, switch on/off the pump accordingly and display the status on an LCD screen.

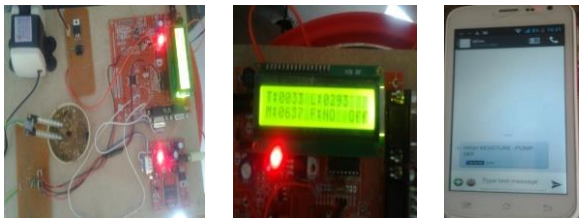

Fig 5 shows the position of the motor. The location of the motor is demonstrated as a schematic diagram in Figure **5** with irrigation drippers. The irrigation system entirely has started to work and the ordinary data has been received by sms during irrigation.

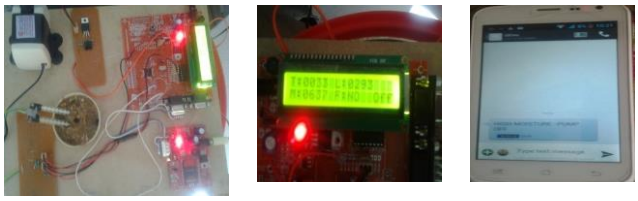

Fig 6 shows the position of the soil moisture sensor. The location of the mounted sensor is demonstrated as a schematic diagram in Figure6 with irrigation drippers. The irrigation system entirely has started to work and the ordinary data has been received by sms during irrigation.

VI. Software Implementations

Android Software development kit Android software development is the process by which new applications are created for the Android operating system. Applications are usually developed in the Java programming language using the Android Software Development Kit. The Android software development kit (SDK) includes a comprehensive set of development tools. These include a debugger, libraries, a handset emulator based on QEMU, documentation, sample code, and tutorials. The SDK also supports older versions of the Android platform in case developers wish to target their applications at older devices. Development tools are downloadable components, so after one has downloaded the latest version and platform, older platforms and tools can also be downloaded for compatibility testing. Android applications are packaged in.apk format and stored under /data/app folder on the Android OS (the folder is accessible only to the root user for security reasons). APK package contains.dex files (compiled byte code files called Dalvik executable), resource files, etc...

Conclusions

Irrigation has been the backbone of human civilization since man has started agriculture. As the generation evolved, man developed many methods of irrigation to supply water to the land. In the present scenario on conservation of water is of high importance. Present work is attempts to save the natural resources available for human kind. By continuously monitoring the status of the soil, we can control the flow of water and thereby reduce the wastage. By knowing the status of moisture and temperature through GSM with the use of moisture and temperature sensors, water flow can be controlled by just sending a message from our mobile. Conservation of water and labor: Since the systems are automatic, they do not require continuous monitoring by labor. System and operational flexibility: As desired, any valve can be controlled along with the pump and increases the efficiency of water use. If water is stored in tanks at irrigation lands, one can get the status of the status of the water level, temperature sensor and moisture content in soil through SMS generator by microcontroller present at the irrigation land. The system has an incorporated Bluetooth for remote monitoring which reduces the problem of range with GSM network and saves SMS cost for the farmer. The smoke sensors used to send

emergency information to user incase of fire in field or burning of motor. The design is low power, low cost, small size, robust and highly versatile. Thus, this system avoids over irrigation, under irrigation, top soil erosion and reduce the wastage of water. The main advantage is that the system's action can be changed according to the situation (crops, weather conditions, soil etc.). By implementing this system, agricultural, horticultural lands, parks, gardens, golf courses can be irrigated. Thus, this system is cheaper and efficient when compared to other type of automation system. In large scale applications, high sensitivity sensors can be implemented for large areas of agricultural lands. A stand by battery or solar cells can be implemented which comes into use in case of power cuts. A secondary pump can be used in case of failure of the pump.

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