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Automatic Controlling System of Drip Irrigation Based on GSM

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Due to the population increase over the world, every field and every of a department of life are updating themselves to increase the efficiency and output product. So the development of agriculture and agriculture-related sections must also be developed. Lack of rain and ultimately a lack of water scarcity is being observed in many areas of the world. The other side aspect is that there are a numerous number of leakages in the line, which waste much water. There is a need for automation, which is the ultimate solution of the problems. This paper emphasizes on this issue and resolves the issues and gives the valuable practical solutions. Automated techniques are the best solution for minimizing the power, reduce waste of water and increase the efficiency.

To obtain the optimal method to irrigate crops, the Automated irrigation system is developed. The system contain to a temperature sensor, humidity sensor and soil moisture sensor, which is put in the root region of the plants. The significance of this paper includes the propose an efficient method in the field of irrigation systems by automatically monitor and control system. We suggested an innovative GPRS (general packet radio service). Which controlled embedded system for irrigation. the automatically system dependent on some parameters such as temperature, humidity and the water level in the soil by reading from the sensors and can automatically irrigate in the field without the involvement of farmer. Information is exchanged between far end and designed system via GPRS module.

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Keywords: Senor; GSM; GPS; GSM based mobile system.

ABBREVIATIONS

SMS : Short Message Service.
GPRS : General Packet Radio Service.
GSM : Global System for Mobile Communications.

1. INTRODUCTION

Even in these years of modern science and technology, in most of the country in the world, the agriculture is manual. Only in few countries, the agriculture operated automatically. Now some of the countries are wishing to have some modern techniques for the operation of agriculture. Nowadays they are using manual or semi-automatic. The automation irrigation can increase the application efficiency for crops irrigation to be higher efficiency from the traditional irrigation, It was estimated that the widespread use of affordable micro irrigation technique has the potential to boost annual net income among the rural poor [1]. Ditch irrigation, terraced irrigation, and drip irrigation are the most popular techniques are used in this field. These are the systems are used and also in use, but this field cannot give the full satisfaction over the problems mentioned. The significance of the automatic in irrigation is used without use interfere of any person, therefore human error is omitted easily. The system can be easily operated without any intervention. The system is easily understandable, because of modern technology and systematic also. Can use the right amount of water at the right time, increases efficiency and reduces the wastage of water and time [2]. This system is used to measure the quality of water as well as it assists of water scarcity.

The automated irrigation system developed proves that the use of water and future enhancement system by the use of pesticide detection sensor which helps to detect the range of pesticide used in a field. This will be useful for cultivators to check the level of chemical fertilizers etc.

The irrigation system can be adjusted to a variety of specific crop needs and requires minimum maintenance. The modular configuration of the automated irrigation system allows it to be scaled up for larger greenhouses or open fields. The Internet controlled duplex communication system provides a powerful decision-making device concept for adaptation to several cultivation scenarios. Besides the monetary savings in water use, the importance of the preservation of this natural resource justify the use of this kind of irrigation system.

2. LITERATURE REVIEW

These types of systems change the management of water and other aspects at every level. They developed the software dependent on android system, the mobile operating system software. GPRS technology is used in the automation of irrigation system. Therefore latest technology is very useful for this issue too. The android-based app is used for the irrigation automation and for making the system more smart and efficient. Nutrition of the soil cannot be compromised therefore automation in irrigation system makes it more viable and smart [2]. It is based on GSM (RS-232) Module. GSM is used to give the information about irrigation and send it by the android mobile. So that correct decision may take related to the level of the water in the tank. Therefore management related to the water in and out may be done under the supervision of this system. Further information is related to the other parameters sensing and monitoring. Temperature and humidity of soil are the parameters to check. It's a very cheap system comparatively. It's a system controlled via SMS using a GSM using android mobile [3]. Some irrigation systems are used to implement efficient irrigation scheme for the field having different crops. The system can be improved by using the fuzzy logic controller. The fuzzy logic system is used to increase the accuracy of the measured value and assists in decision making [4].

The paper surrounds valves which perform the important job in the automation purpose. Therefore we cannot eliminate the importance of the valves. Automated irrigation system uses valves to turn motor ON and OFF. Controllers can handle these valves and manage all the related issues. This system allows the farmer to ON the system or OFF the system when he wants the water in the field and how much water he wants the system will give that amount of water. There is no timing of system to work. Therefore any time farmer can have the service for the field. This system also increases the production from the field due to the efficient services are given to the field [5]. The work discussed in this paper having various aspects.

They mentioned that the field of farming or irrigation is equipped with the sensors and connected with the wireless network. Wireless sensor network and communication is more viable than others and can work efficiently. Sensor information and work are described in detail. They just not show the theory but they gave the statistical data even related to the point. The user can also control Drip Irrigation from anywhere via Android mobile [6]. In the Micro-controller based drip irrigation mechanism, this is a real-time feedback control system for monitoring and controlling every the action of drip irrigation system more efficiently [7]. The main work of this paper is about the automation in irrigation. It states. The system discussed here the microcontroller 8051. It is about the drip irrigation system with wireless means. It is depending on about the automation and about its applications. The programming is designed based on the signal from the sprinkler. The further actions will be dependent upon this signal [8]. Internet-based irrigation is the future aspect of the system. But that system must rely on solar power making the system more economical, cost effective and efficient. The system not only transfer water to the field, but it also is able to transfer other related things which are necessary for the field of agriculture like fertilizers and chemicals. The system has used a network of valves, pipes, and emitters through narrow tubes that transfer water directly to the base of the plant to drip the water slowly to the roots of many various plants either onto the soil surface or directly onto the root region [9].

These can also be possible to transfer to the field through automation only easily [10]. It reduces the seaweeds and another form of non-useful plants, so all these counts as the advantages of this system.

3. THE IRRIGATION CONTROL SYSTEM

MAX232 is used to connect the GSM module and microcontroller. When the moisture of the soil become low the moisture sensor gives a signal to the microcontroller and then to the called mobile (which is kept in the auto answering mode). The function of the called mobile is to activate the buzzer by calls of the called mobile where the buzzer heard represent the valve should be open. the signal orders to the microcontroller by pressing the button in the called function. The microcontroller gives the signal to the valves which cause 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.

3.1 The Mechanism of Drip Irrigation

In the zone of the plant, a root is put a wetted profile where the little amount of water lead to deep percolation this is the main merits of this technique [11,12].

3.2 Android System

The Android system follows as:

3.2.1 Applications

The applications are written in Java. The main applications include a calendar, email client, SMS program, maps, making phone calls, accessing the Web browser, accessing your contacts list and others [11,13].

3.2.2 Application framework

This system should every android developers has to follow it. Where the developers able to reach to every framework applications to control and manage the main functions phone such as telephone applications, programs control and managing the physical location phone.

3.2.3 Libraries

The libraries include of Android libraries written in C, C++, and used by difference systems. The libraries system represent by dealing with the various types of data which exposed to Android developers by means of an Android Application framework. Some of these libraries include media, graphics, 3d, SQLite, web browser library etc [11,14].

3.2.4 Runtime Android

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

3.2.5 Linux-Kernel

The Linux-Kernel includes Android's memory management programs, security settings, power management software and several drivers for hardware, file system access, networking and inter-process communication. The kernel also acts as an abstraction layer between hardware and the rest of the software stack [11,15].

3.2.5.1 GSM

GSM is a standard set developed by the European Telecommunications Standards institute (ETSI) which show technologies (2G and 3G).

3.2.5.2 GPRS

GPRS General packet radio service (GPRS) is a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications (GSM). GPRS was originally standardized by European Telecommunications Standards Institute (ETSI) in response to the earlier CDPD and i-mode packet-switched cellular technologies. It is now maintained by the 3rd Generation Partnership Project (3GPP) [11,16].

3.2.5.3 ARM7

ARM7 is a generation of ARM processor designs. This generation introduced the Thumb 16-bit instruction set providing improved code density compared to previous designs. The most widely used ARM7 designs implement the ARMv4T architecture, but some implement ARMv3 or ARMv5TEJ. All these designs use Von Neumann architecture, thus the few versions comprising a cache do not separate data and instruction caches [11,17].

Some ARM7 cores are obsolete. One historically significant model, the ARM7DI is notable for having introduced JTAG based on-chip debugging; the preceding ARM6 cores did not support it. The "D" represented a JTAG TAP for debugging; the "I" denoted an ICE Breaker debug module supporting hardware breakpoints, and letting the system be stalled for debugging. Subsequent scores included and enhanced this support [11,18].

3.3 Master Controller

LPC2129 is an ARM7TDMI-S based high-performance 32-bit RISC Microcontroller with Thumb extensions 256KB on-chip Flash ROM with In-System Programming (ISP) and In-Application Programming (IAP) 16KB RAM. Also, there are Vectored Interrupt Controller, Two UARTs, I2C serial interface, 2 SPI serial interfaces Two timers (7 capture/compare channels), PWM unit with up to 6 PWM outputs, 4-channels 10bit ADC, 2 CAN channels. In addition to that, there is Real Time Clock, Watchdog Timer and General-purpose I/O pins. CPU clock up to 60 MHz, on-chip crystal oscillator and on-chip PLL [11,19].

3.4 Solenoid Valve

A solenoid valves an electromechanically operated valve. The valve is controlled by an electric current through a solenoid. Here, in this case, a two-port valve is used in which the flow is switched on or off. It basically works as an actuator for the system.

A solenoid valve consists of two main sections: the solenoid and the valve. The solenoid converts electrical energy into mechanical energy which, in turn, opens or closes the valve mechanically. The signal to open or close the valve is given by the master controller. Solenoid valve dependent on the pressure between input and output as the pressure at the input must always be greater than the pressure at the output for it to work. If the pressure at the output, for any reason, rise above that of the input then the valve would open regardless of the state of the solenoid and pilot valve [11,20].

3.5 GSM Module

The GSM (Global System for mobile communication) module (mobile) is used for Remote Control (for example Gate Control, Temperature Control etc.). GSM/GPRS module contain to a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc.) for computer [11,21].

The MODEM is the soul of such modules [11,22]. They generate, transmit or decode data from a cellular network, for establishing communication between the cellular network and the computer. These are manufactured for a specific cellular network (GSM/UMTS/CDMA) or specific cellular [11,23].

3.6 MAX232IC

We can define the MAX232 as an integrated circuit, which converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. It's a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals [11,24].

The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 VTTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V [11,25].

When an MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15 V, and changes TTL Logic 1 to between -3 to -15 V and vice versa for converting from RS232 to TTL. Since the exposed wire is porous so it allows transmission of the vapors water 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. The sensor should be housed I keep and protect the sensor [11,26].

3.7 Software Implementations

3.7.1 Android software development kit

Android software development means to create new applications to Android operation system which be written with Java language using the Android Software Development kit (SDK) [11,27]. SDK consists of the set of development instruments such as a debugger, libraries, a handset emulator based on QEMU, documentation, sample code, and tutorials. Development tools are download instruments, 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 app 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 executables), resource files, etc. [11,28].

3.8 Eclipse (Software)

Eclipse is a system of a multi-language software which including the main workspace and an extensible plugin of the controlling environment.

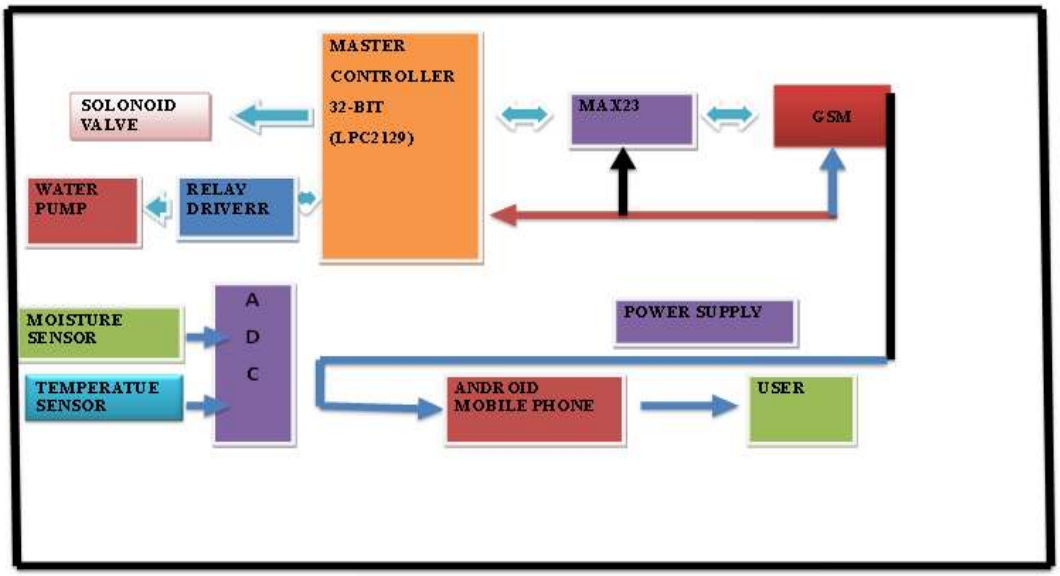

Fig. 1. Block diagram of theirrigation control system

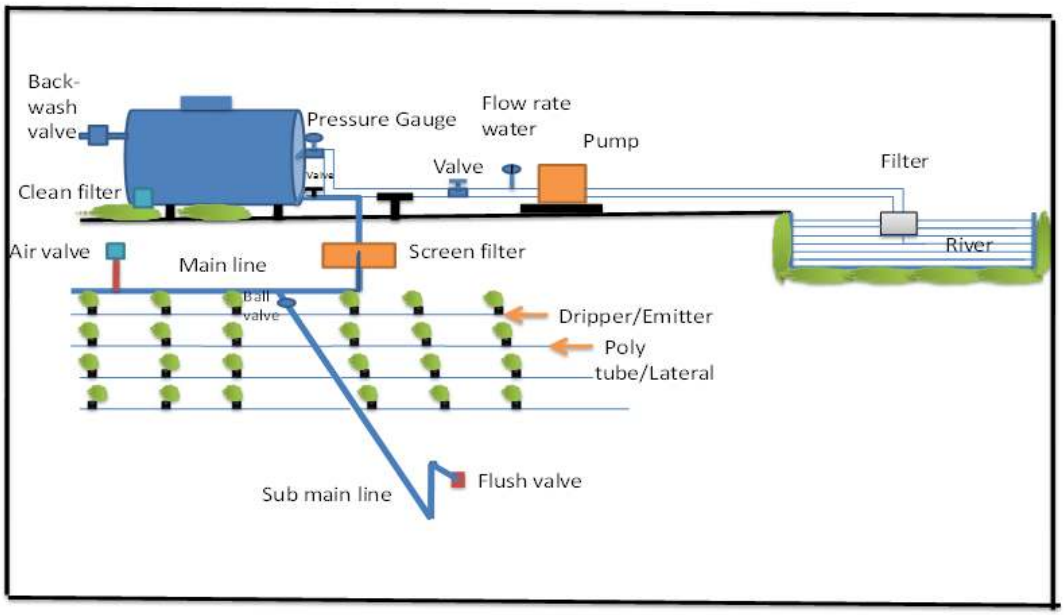

Fig. 2. System diagram

Since it is written mostly in Java. It is very important to advance application in Java via different plug-ins, other programming languages including Ada, C, C++, COBOL, Fortran, Haskell, Perl, PHP, Python, R, Ruby (including Ruby on Rails framework), Scala, Clojure, Groovy, Scheme, and Erlang. Development of environments include the Eclipse Java development tools (JDT) for Java and Scala, Eclipse CDT forC/C++and Eclipse PDTforPHP, among others [11,29].

The Eclipse software advancement kit(SDK), which includes the Java development instruments, is meant for Java developers. Users can extend its abilities by installing plug-ins written for the Eclipse Platform, such as development toolkits for other programming languages, and can write and contribute their own plug-in modules [11,30].

4. TECHNIQUES

The system is like that, a pipe is attached to the rain gun of irrigation system. The gun is connected to the water pump. This pipe long enough to reach to the roots of the plants. In the last the flow of water is managed by the electronic means. Solenoid valve is involved in this process to the opening and closing of the motor. Opening and closing of valves is dependent on signal sent by the microcontroller. Sensor is doing its job for sensing the moisture level again and again. When it senses that it send a signal to microcontroller and the value is then closed. The two mobile are connected using GSM. The GSM and microcontroller are connected using MAX232. When the moisture level comes down the microcontroller send the signal to the system. Depending upon the signal received from the micro controller. That signal not only activate the buzzer system and also opened the valve and than eventually water system.

This system based on the methodology of a broad based system. This is a tremendous system based on the app based on the android based operating system. The wireless sensor is used in the field and working in the field and giving the result. This system is shown in the figure. The system may contain different kinds of sensors which are monitoring different parameters like temperature, moisture and etc. The base station receives those data from the sensor of different kinds and aggregate those data and send to the microcontroller took the decision on the data and gives certain directions to the system to do.

5. CONCLUSION

This paper proposed to the directions towards the modern techniques for water management for the agriculture and other agricultural activities. Computer-based and Microcontroller based

systems are the prominent systems which can be used for the improvement of the system. Automation facility can also be used not only for agriculture but also for the other purposes like cricket stadium, hockey stadium etc. automation has a large purpose used and likeability. Almost all solution are provided by automation like time-saving, power saving, wastage of water and there are many reasons to chose it instead of surface irrigation, there are including concern about minimizing evaporation etc. we can conclude that the using this method give the higher efficiency of saving water and monitor system. It also saves the time and work of the farmer. As the entire application is a photovoltaic Powered automated irrigation system it can be operated even in geographically separated areas where the energy grid is isolated.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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