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Automated Irrigation System Using WSN& GSM Module

V Madhu[1], V Viswanadha[2]
[1]PG Scholar, SIETK, Puttur, Andhra Pradesh, India, madhu.vataparthi25@gmail.com
[2] Assistance Professor M.Tech (Ph.D.), SIETK, Puttur, Andhra Pradesh, India, vissuvnl@gmail.com

ABSTRACT

An automated irrigation system was developed to optimize water use for agricultural crops. The system has a distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants. In addition, a gateway unit handles sensor information, triggers actuators, and transmits data to a web application. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity. The system was powered by photovoltaic panels and had a duplex communication link based on a cellular-Internet interface that allowed for data inspection and irrigation scheduling to be programmed through a web page. The automated system was tested in a sage crop field for 136 days and water savings of up to 90% compared with traditional irrigation practices of the agricultural zone were achieved. Three replicas of the automated system have been used successfully in other places for 18 months. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated areas.

Agriculture uses 85% of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial, and institutional improvements. There are many systems to achieve water savings in various crops, from basic ones to more technologically advanced ones. For instance, in one system plant water status was monitored and irrigation scheduled based on canopy temperature distribution of the plant, which was acquired with thermal imaging. In addition, other systems have been developed to schedule irrigation of crops and optimize water use by means of a crop water stress index (CWSI).

The empirical CWSI was first defined over 30 years ago. This index was later calculated using measurements of infrared canopy temperatures, ambient air temperatures, and atmospheric vapor pressure deficit values to determine when to irrigate broccoli using drip irrigation. Irrigation systems can also be automated through information on volumetric water content of soil, using dielectric moisture sensors to control actuators and save water, instead of a predetermined irrigation schedule at a particular time of the day and with a specific duration. An irrigation controller is used to open a solenoid valve and apply watering to bedding plants (impatiens, petunia, salvia, and vinca) when the volumetric water content of the substrate drops below a set point.

1. INTRODUCTION

Irrigation is a scientific process of artificially supplying water to the land or soil that is being cultivated. Traditionally in dry regions having no or little rainfall water had to be supplied to the fields either through canals or hand pumps, tube wells. But this method had severe problems such as increase in workload of farm labor and often it lead to problem such as over-irrigation or under-irrigation, and leaching of soil. Further there were issues like weeding, lesser yield of crop as an effect of above mentioned problems. Hence there was a need for a way to test the soil condition before supplying water to the fields. This mechanism would reduce the workload of the farmer and help maintain proper soil conditions for improved and better crop production. Hence with the advance of technology it was possible to design systems that eliminated the direct involvement of the farmer with respect to irrigation of their fields.

2.EXISTING IRRIGATION SYSTEM

The system continuously monitors the soil moisture, water level of the well, temperature, humidity, dew point, weather conditions and provides the details about the field to user though SMS. The system consists of a centralized unit having a subscriber number which forms a link between user and device and acts as a primary node for sending and receiving the data though SMSs by the user.

The centralized unit communicates with the system through SMSs which will be received by GSM with the help of SIM card; the GSM sends this data to ATMEL Controller, after processing it displays it on the LCD. The activation command is given to start the motor and indirectly activate the transistorized relay circuit to constantly monitor the environmental factors and once the required level is reached the motor is turned off and the message is sent to the farmer.

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The heart of the automatic irrigation system is the 80S52 microcontroller. The Intel 80S52 incorporates therein a 128×8 read/write data memory, which has 4K bytes of EPROM and is expandable to 64K bytes via RAM module. The microcontroller also includes four 8-bit ports (32 I/O lines), two 16-bit timer/counters, a high performance, full-duplex serial channel and on chip oscillator and clock circuits.

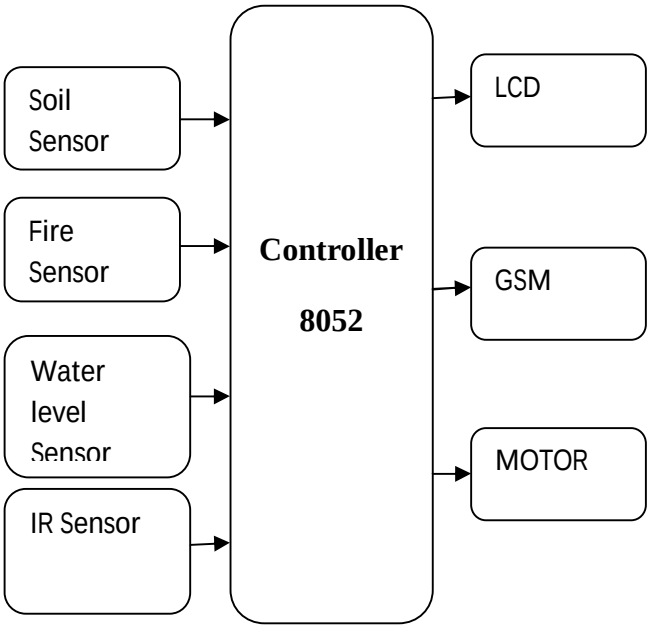

Fig 1: Existing system

Eight of the I/O lines comprising Port 0 function as an address bus 20 and a data bus. Address information at Port 0 may be applied, via an address latch, to the address bus. A moisture sensor is associated with each of the plurality of zones. Each such sensor is periodically interrogated by a pulse signal provided by the microcontroller via a driver or buffer circuit. This interrogation signal causes the moisture sensors to output an analog voltage which is proportional to the amount of moisture in the soil in which the sensors are embedded.

3.PROPOSED SYSTEM

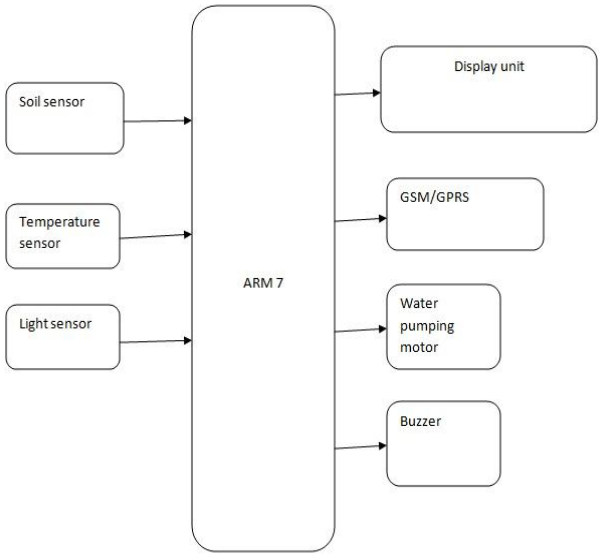

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Fig 2: Proposed System

The automated irrigation system implemented was found to be feasible and cost effective for optimizing water resources for agricultural productionThe automated irrigation system hereby reported, consisted of two components wireless sensor units (WSUs) and a wireless information unit (WIU). A WSU is comprised of a RF transceiver, sensors, a microcontroller, and power sources.WSUs can be deployed in-field to configure a distributed sensor network for the automated irrigation system

4.CIRCUIT DIAGRAM

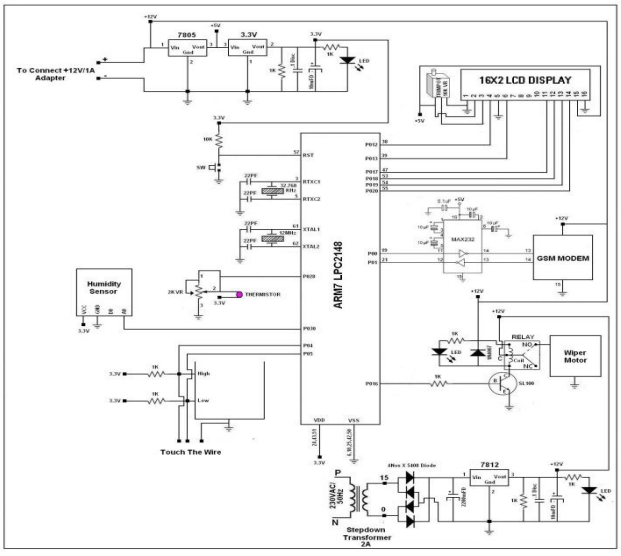

Fig 3: Circuit Diagram

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4.1 Result

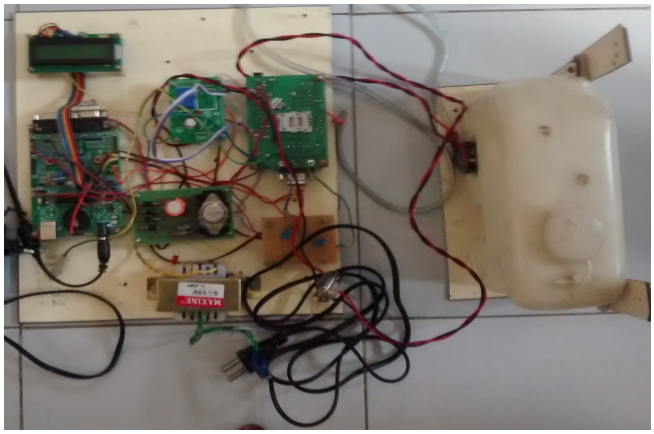

Figure 4: Kit Image

In this project we have sensors to monitor the temperature and humidity and water level in the field and as well in the Tank Using the sensor data. This project comprises of a microcontroller unit to accomplish the task. When the water level in the tank is below low level a motor is switched on to fill the water level in the tank.

4.2 Arm Embedded Board

Basically ARM embedded board is a compact design of CPU which is incorporate with processor, memory and IO devices. This ARM embedded boards are mainly manufactured for multiple applications. The main factor to choose Which ARM board is suitable for specific application is depends upon its features. The ARM embedded board which is used in this UGV mainly manufactured with an ARM7TDMA core micro processor (W90N745) with 128 MB of SDRAM. The description of ARM architecture and W90N745 processor with 128MB SDRAM is explained as follows.

The ARM7TDMI is a member of the Advanced RISC Machines (ARM) processor family of general purpose 32-bit microprocessors which offer features like very low power consumption, high performance and low cost.

The ARM architecture design is based on principles of Reduced Instruction Set Computer (RISC), and the instruction set and related instruction decode mechanism of processor are mostly similar than those of micro programmed Complex Instruction Set Computers (CISC) processors.

This architecture provides a simplicity results with a high instruction throughput and impressive real-time interrupt response which is from a small and cost-effective chip.

4.3 LCD Display

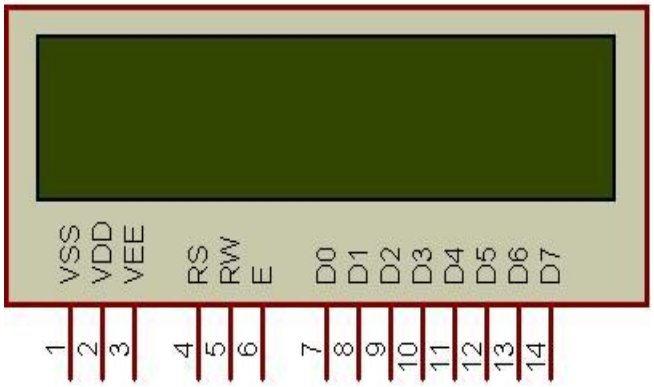

Figure 5: LCD Display

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. In this tutorial, we will discuss about character based LCDs, their interfacing with various microcontrollers, various interfaces (8-bit/4-bit), programming, special stuff and tricks you can do with these simple looking LCDs which can give a new look to your application.

4.4 Power Supply

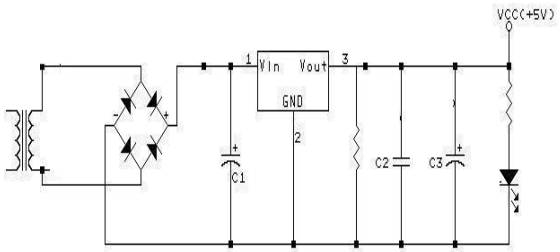

Fig 6: Power Supply

As we all know any invention of latest technology cannot be activated without the source of power. So it this fast moving world we deliberately need a proper power source which will be apt for a particular requirement. All the electronic components starting froma DC supply ranging from -+5v to -+12v. We are utilizing for the same, the cheapest and commonly available energy source of 230v-50Hz and stepping down, rectifying, ltering and regulating the voltage. This will be dealt briefly in the forth-coming sections.

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5. RELAYS

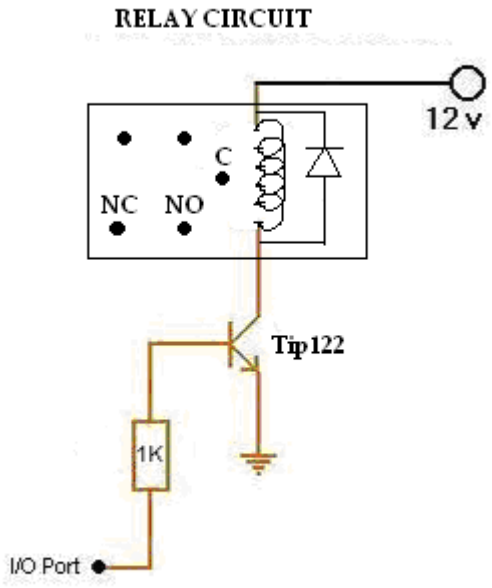

Figure 7: Relay Circuit

Relays are electromagnetic switches,which provides contact between two mechanical elements. Relays have a coil which works on 12V dc power supply and provides DPDT action as an output. In general relays provide potential free contacts which can be used for universal function like DC, AC voltage switching and to control bigger electrical switch gears.

The electromechanical relays are based on the comparison between operating torque/force and restraining torque/force. The VA burden of such relays are high.

The characteristics of these relays have some limitations. Each relay can perform only one protective function. Such relays are used for simple and less costly protection purposes.

6. WIRELESS SENSOR NETWORK

Designing, implementing, and operating a wireless sensor network involves a wide range of disciplines and many application-specific constraints.

6.1 Temperature Sensor

Temperature sensor senses the information about temperature in the soil or atmospeaur.In this project temperature sensor senses the values and gives to the arm processor.The processor process the values with a model of program based and this values can be takes by actuators are connectd to ouyput port of the processor.

6.2 Soil Sensor

Soil sensor is used to caluculate soil moisture values in the land crops.soil sensor can be placed in the root zone of the plants for automated irrigation purpose

6.3 Water Level Sensor

Water level sensor can be used in the agriculture systems.In the crops the water can be filled with motor pumping system and the water cannot seefor all levels of crops.these sensors can be placed withih the root zone and can be easily senses wayer level content information through sms of gsmtechnique.In this the water can be saved and use to other activities.

7. ADVANTAGES OF AUTOMATED IRRIGATION

1. Increase of food production
2. Modify soil or climate environment
3. Lesser risk of catastrophic damage caused by drought
4. Increase income & national cash flow
5. Increase labor employment
6. Increase standard of living
7. *Increase value of lanNational security thus self sufficiency*

8. CONCLUSION

This system concluded that automated irrigation system using wsn and gsm module as the water resources use can be optimized and the water can be saved

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