Remote Controlled Embedded System for Irrigation

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Abstract — This paper mainly focuses on reviews in the field of remote monitoring and control, the technology used and their potential advantages. The paper proposes an innovative GSM/Bluetooth based remote controlled embedded system for irrigation. The system sets the irrigation time depending on the temperature and humidity reading from sensors and type of crop and can automatically irrigate the field when unattended.

Information is exchanged between far end and designed system via SMS on GSM network. A Bluetooth module is also interfaced with the main microcontroller chip which eliminates the SMS charges when the user is within the limited range of few meters to the designated system. The system informs users about many conditions like status of electricity, dry running motor, increased temperature, water content in soil and smoke via SMS on GSM network or by Bluetooth.

Keywords: Bluetooth, GSM, irrigation, SMS

I. INTRODUCTION:

Embedded System is a combination of hardware and software used to achieve a single specific task. An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market.

Global system for mobile communication (GSM) is one of the most trustable wireless communication systems that can be accessed and used very easily. The price of it transreceiver module and subscription fee of its services is very low so it is very cost effective also. Embedded system interfaced with GSM module can widen the scope of embedded design and enhanced the application areas of controlling and monitoring systems to a great extent. During the past decade network services has extended beyond speech communication to many other custom specified embedded design application. The interface and communication between user and designed system is via SMS on GSM network or by Bluetooth if the user is within the range of 10m of designed system.

India is a country of agriculture and it is backbone of Indian economy. Irrigation is heart of agriculture. Irrigation is used to assist growing crops in the field land during the inadequate rainfall period. Pesticide is used preventing, destroying or mitigating any pest. Both of these are very important for good productivity and both need time to time application in the farm field. In India approximately 20% of farmers are dependent on electric water pumps for irrigation in their field.

There are many problems associated with irrigation:

1) Normally agricultural lands are very far from the farmer’s house so farmers have to go farm land for irrigation that causes inconvenience and fuel consumption (if used any vehicle).
2) Farmers are enabling to know the status of electricity at the farm field as the nature of supply of electricity is quite unpredictable.
3) There are frequent instances of burning of motor due to unpredictable voltage fluctuations and dry running.
4) Farmers are present in farm field when pesticides are sprayed. These pesticides are very harmful for farmer’s health.

All these issues are handled in the proposed system. The system will send status of power supply via Bluetooth/SMS on GSM network to user. The system will check the water flow from the pump. If electricity is there but no water supply is available, system will send information to user via Bluetooth/SMS on GSM network. Temperature sensors and humidity sensors installed in the field take the measurement of humidity level of soil and environmental temperature and send this information to users. The user sends data in the form of SMS on GSM network to start or stop the irrigation according to received information.

The smoke sensor sends emergency information to user in case of fire in field or burning of motor. The use of Bluetooth module in the proposed design made the design low power, low cost, small size and robust. Bluetooth is a highly versatile and attractive technology among other short range wireless technology available in market. Bluetooth is an unlicensed technology that operates globally at 2.4 Ghz. It can link different digital devices within a range of 10m to 100m at a speed up to 3 mbps. This paper gives a review of various work done in the field of remote monitoring and control, the technology used and there potential advantage for agriculture irrigation as a specific application area. With this also proposes an innovative GSM-Bluetooth based remote controlled embedded system for irrigation.

II. CLASSIFICATION OF REMOTE CONTROL AND MONITORING SYSTEMS

To understand the method and technique used for the design of a generic remote control and monitoring systems wide variety of remote control and monitoring systems based on different technologies for different applications have been studied [1]-[10]. From technical point of view this system can be classified on the basis of technology, processor used, tools, programming code etc. Table 1 shows the
classification of existing system based upon different criteria.
A very efficient system that uses miscall/SMS for different message and command indication from system cellphone and user cell phones respectively was developed by Vasif Ahmed[3]. This system uses Bluetooth for data communication between microcontroller system and system cellphone but with a range of 10m. In this work, the temperature sensor gives output directly in digital form and have error detection capability. The system has real time clock to provide timing information. The system results in uniform distribution of water in fields at regular interval of time reduced Labor cost, minimization of occurrence of motor faults, efficient use of water resources. Intimation about completion of task to the user can be send through miscall/SMS. The system can be implemented to any cell phone model. The system is convenient and of low operating cost due to use of miscall compared to SMS.
Li Wenyan proposed a design of wireless water saving irrigation system based on solar energy [4]. The system in work is composed of wireless sensor node, routing node and gateway node with lead acid battery that is recharged by solar cell panel. The main advantage of system is that sensor node can be added and deleted arbitrary and very easily and user can change the threshold of the irrigation according to the specific need of crop.

Another WSN based greenhouse monitoring and control system[9] where WSN, gateways, 14 sensor nodes, a management subsystem, 1 actuator node and 2 sink nodes are deployed in greenhouse. The system in work has WLAN Aps that give long range wireless link between WSN and management sub system which is about 0.5 km far away from greenhouse. The system provides easy and user friendly interface to farmers with hand held devices like PDA and PC. Diagram for irrigation in greenhouse is shown in figure (2)
From the above discussion, it is concluded that designing a remote monitoring and control system that fulfills all the requirements simultaneously is a complicated task. Every proposed system has its own merits and demerits. However, still there is possibility of designing an innovative cost effective and high performance system that can work optimally in different applications. An innovative GSM-Bluetooth based remote controlled embedded system for irrigation is proposed in this paper.

**III. DRIP IRRIGATION**
Drip irrigation is the process which involves dripping water into the soil at very low rates (2-20 liters/hour) from a system of small diameter plastic pipes fitted with emitters and drippers. In this system water is applied close to the root of the plants which provides right amount of water required for the growth of the plant and avoid excessive wastage of water, unlike surface and flood irrigation, which wets the whole soil profile and sometimes causes soil erosion and soil nutrients loss. With drip irrigation water applications are more frequent (usually 1-3 days) than with other methods and this provides a very favorable high moisture level in the soil in which plants can flourish. Automation in drip irrigation means using all automated techniques such as solar power, microcontroller, sensors, remote control, embedded system and etc. to irrigate the field conveniently sitting in one place.

Equipment used in drip irrigation system is very important. The various equipment included in the drip system are plastic hose/pipe, spaghetti hose, emitters, pressure regulators, pressure gauges, valves, fertilizer tanks, filter-
both sand and screen, time clocks, tensiometers, evaporative pans, meters, fertilizer injectors.

One of the most important items in the hardware for drip irrigation is the filter.

The block diagram of the proposed system has been shown in figure 5. The system consists of 8-bit PIC microcontroller (16F877A) that is interfaced with different types of sensors. The PIC microcontroller has inbuilt ADC so no need of external ADC in the system. The designed system has provision of keys for manually selecting the irrigation mode (for farm field / garden) and for spraying of pesticide in farm Field/garden. The same operation can be done by sending SMS on the GSM network by the user. Depending on the reading from the temperature and humidity sensor and type of crop the designed system decides the on/off time of pump motor for precise irrigation. Water flow sensor is used to check the condition of dry running of motor. The smoke sensors are used to check emergency conditions like fire in field or burning of motor. The analog data from temperature sensor is converted to digital using inbuilt A/D converter. It provides this data to the microcontroller for analysis when requested and an alarm is raised in emergency conditions depending upon this data and an SMS on GSM network is send to the user’s mobile. The measured values of sensors are displayed on the LCD. The GSM and Bluetooth modules which are the most important part of this designed system are interfaced with the microcontroller using a RS232 interface. The GSM module must have a SIM (Subscriber Identity Module) card to make the network identify to the user. The microcontroller communicates with the GSM module using the AT commands. These AT commands are used to send and receive SMS. The programming code for the microcontroller is written in some high level language (C language).

V. CONCLUSION

This paper proposes the design of the innovative GSM Bluetooth based remote controlled embedded system for irrigation. The proposed system is a low cost system where information is exchange via SMS on GSM network. As we know the appropriate level of water in the farm field contributes to the quality of grains and highly affects the incidence of pests and diseases on crops. By using this system the farmers can get the information of electricity status at farm field, warning message like smoke in farm field due to fire or due to burning of motor in the farm field and the environmental temperature exceeds information from home or anywhere using a mobile phone. With this the farmer can switch on the motor for irrigation/pesticide spray from anywhere far from the actual field. The system has advantage of using Bluetooth if the user is within the 10m range of designed system. The use of Bluetooth technology cuts down the cost of SMS if the user is within the limited range of designed system. The availability of the GSM network is a prerequisite for the system implementation. The system is highly beneficial for precise irrigation in farm

**Fig. 4**

**Fig. 5**
fields and thus responsible for efficient utilization of water resource and men power.

REFERENCES:

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<td>[1]</td>
<td>Wired</td>
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<td>[3]</td>
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<td>[4]</td>
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<td>PC</td>
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<td>[8]</td>
<td>WSN, GPRS, Internet</td>
<td>ATmega128</td>
<td>PC, mobile</td>
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<td>[9]</td>
<td>WSN, LAN, Internet</td>
<td>JN5121</td>
<td>PDA, PC</td>
<td>Kiel IDE</td>
<td>JAVA, interactive C</td>
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<td>[10]</td>
<td>WSN, Zigbee, GPRS</td>
<td>8051, S3C2410</td>
<td>Mobile, PC</td>
<td>WinCE 5.0, Kiel IDE</td>
<td>Embedded visual c++ 4.0</td>
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Table 1: Classification of Existing Remote Monitoring and Control System