DESIGN AND IMPLEMENTATION OF AUTOMATIC PLANT WATERING SYSTEM BY USING WIRELESS SENSOR NETWORK

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ABSTRACT: **- The proposed work takes advancing new devices based on the wireless networks that use GSM network and Infra- red communications. The main contribution of this work is to offer automatic water supply for plants to saving time as well as water. The proposed system is controlled by microcontroller 16F877A to turn ON/OFF of pump by checking the moister level with the help of moisture sensors. In this work, the global system mobile technology is also used to switch ON/OFF of the pump using mobile phone by sending the commands to the kit through the GSM modem.**

Index Terms**- Moister sensor, GSM, Infra-red communication, Micro-controller, Switch, Water supply, Agriculture, Automation, Internet, Irrigation system, Wireless Sensor Network (WSN).**

I. INTRODUCTION

There are abundant plants that remain very sensitive to water and they required specific amount of water for good development. If the plants are not receiving sufficient water, then they will die or result in inadequate growth. It is barely possible that everyone must have the perfect information about growing specifications of plants in case of amount of water needed. In Indian economy, 70% of people are depending on the agriculture. If there is any model to provide specific level of water to plants, then it will certainly advantageous for farmers. To help them, we are making an attempt by introducing automatic water supply system for plants by using moisture sensor and GSM network. The GSM system is one of the most crucial wireless communications that can be accessed and used very easily [1]. The cost of GSM module and subscription charge of its services is very little and cost effective. Embedded system is linked with the GSM can widen the opportunity of embedded design and improves the application areas of governing and monitoring structures to a great level. The automatic water supply for plants by using moisture sensor and GSM network are convenient, because they allow cost effective plant supervision, where water is always supplied on time and shut off on-time with no wastage, it leads to saving water up to 50%. Also there is no man power required. It is able to go on rest or to lease the property without losing the garden, the water is supplied at a time of user optimal and not only when user is open to switch ON-OFF the motor [1].

The main objective of proposed work is to provide automatic water supply for plants by using moisture sensor and GSM network for plants. It helps in saving time and water. The whole system is controlled by microcontroller 16F877A to turn ON/OFF of pump by checking the moister level using the moisture sensor. In section 1, it discusses about the existing systems. The proposed model and it components are presented in section 3. In section 4, it discusses about the experimental results of the proposed system. Finally, section 5 presents the conclusion and further research work [1].

II. EXISTING PROBLEMS

The automated water systems are helped to assisting in the rising of agricultural harvests, maintenance of landscapes and re-vegetation of disturbed soils in dry places and during periods of inadequate rainfall. It is the artificial application of water to the land or soil. Presently, automated-water-supply system is affected by unawareness in method of growing plants, lack of use in technology, etc. However, some automatic systems exist in market, but it is costlier and mostly not suitable for small gardens. Therefore, the new system needs to pour water automatically that can be used in day-to-day life and can be manufactured easily. The advantage of this idea includes low cost, easy to handle, low maintenance, low power consumption. In manual system overwatering of the garden will affect the growth of the plant. This can be overcome by automated system using moisture sensor, which keeps measure of the water content in the soil. It will run the pump only when moisture content in the soil is below the desired level [2].

In the conventional system, it is necessary that someone is required to turn ON-OFF of the pump so that the agriculture becomes very tedious process in day to day life. In current available system reads only the moisture sensor value. Sometimes these values are correct as per the design, but as per the atmospheric condition manual corrections also required. In these situations, manual operations like start- stop required to the currently available systems also these operations control at the field only. This adds additional man power. By using GSM technology, user can turn ON-OFF of the pump from any place as required by sending appropriate command through the mobile phone. One more important feature missed out in the current systems; dry run

protection for the motors. In summer season, sometime well will dry if the motor runs continuously without pumping the water, then motor will burn out. And checking the line voltages before start the motor is also crucial. If the line voltage is not in the specified limit of the motor, then the motor will damage [3]. Different plants require different moisture levels. It cannot be changes the threshold value of currently available systems easily. Some plants require different moisture levels in different seasons so that threshold value is an option to change the upper value and lower value. There are no extra logical input-output ports. It is helpful to get the status of different components used in the agriculture system. If any reverse logic condition occurs while running system, it should notify the admin so that he can solve the problem easily and immediately. If there is an option to connect these sensors with field programmable logic condition, then it makes the system ideal. Another important part for any automatic system is status notification. Currently, available systems are also facing lot of problems. The system is automatically running but the former or the admin wants to know the status of different components, it is not available so they should go to the field and check the states of components. It needs huge time and manpower. So if user gets a system with all above mentioned corrections in one device itself, then it makes system as ideal and working for real time in practical conditions. Price is an important role, because it is used for mainly agriculture purpose. Currently, available systems are not fulfilling all the conditions, but cost is also more [3].

III. WORKING MODEL OF PROPOSED WORK

The proposed system operates in the stable way by considering two different data types from the moisture sensor device. One is the system works by measuring the moisture in the soil by using moisture sensor. The threshold values for the moisture content are set to prescribed value by programming the microcontroller. The moisture sensor electrode and one standard resistance are in series to make the voltage divider network. The moisture sensor electrodes sense the moisture continuously by passing the small amount of current through soil. The magnitude of the current depends upon the total effective resistance .The effective resistance also depends on the soil moisture, because the soil resistance depends on the water content in the soil. The voltage across the standard resistance varies linearly with the moisture level in the soil. For example, when soil moisture is low, voltage across the standard resistance is also low. If the soil moisture is high, then voltage drop across the standard resistance is also high. The voltage drop across the normal resistance is connected with IC LM393. It amplifies the signal from the sensor electrode and gives to the microcontroller ADC channel AN0. This value is converted into the digital form. This digital output is used to processing like comparing and displaying. Another data type is analog comparator output. The LM393 is having 2 OP-AMP; one is used for amplifying and another one used for comparing analog signals. The output of the amplifier compares with the reference voltage set by the variable pot. The comparator output is connected with RC1 of the microcontroller. Then the microcontroller processes both data and will give accurate output and stable condition [4]. The comparator is set to a value in between the upper and lower threshold values. For example, if the lower threshold value is 40% and upper threshold value is 70%, then the comparator value lie between 55-60. The microcontroller compares both the analog and digital values to decide the operation. If the difference between analog and digital value is more than 20%, then it will wait for some more time for any change. If there is no change, then it will control operation as per the priority. That is energized the relay coil and so that the motor will turn ON, if the output of the microcontroller is low, then motor will be OFF. The motor will be OFF and displays in the LCD if it detects dry run while running the motor. The proposed system is designed in such a way that the motor will be turned ON automatically when the moisture content is low. The motor will be mechanically turned OFF when the moisture level is above the prescribed value [4].

The proposed system can also be controlled using GSM technology. The motor can be turned ON/OFF whenever user is required by sending a start/stop message from user mobile phone. The modem receives the message and compares the data in the microcontroller and takes proper action to execute the task as it is desired by the user. The status of the system such as moister level, turn ON/OFF of the motor, start/stop message sent by the user is displayed in the LCD screen GSM will also supports “dry run protect” for the motor as shown in fig.1. The proposed system used components namely micro controller (ATMEL89V52RD2), moisture sensor, LCD, voltage regulator, relay, SIM300 based GSM modem, power supply 230v/12 v, motor [4].

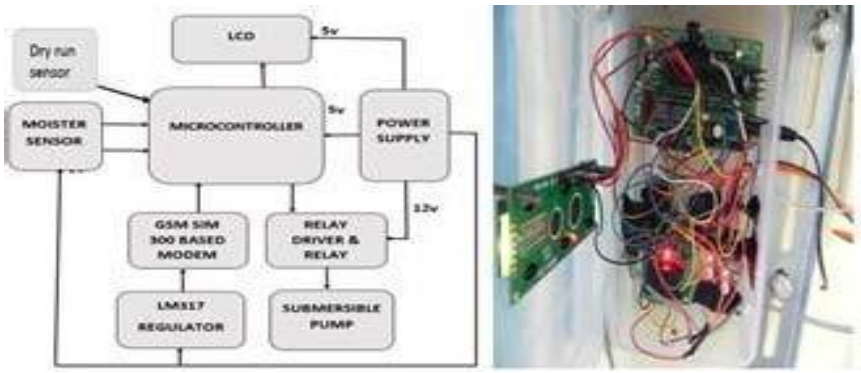

fig.1: Block diagram of the proposed system

The soil moisture sensor node measures the water level in the soil. The soil moisture probe is made up of several soil moisture sensors. It consists of 2 electrodes gauging the resistance of the soil. User uses 2 bare (galvanized) cables, but there are also probes with cable rooted in gypsum. The bare- wire sensor is extremely affected by soil salinity and Ph. fig.2 (a) shows the moisture

sensor, having two electrodes, which is dipped into the soil to measuring moisture level. fig.2 (b) shows the deployment of the sensor in the field or plant [5].

a) Moisture sensor b) Moisture sensor in pot

fig.2: Block diagram of the proposed system

The LCD is a horizontal panel display unit that uses of light modulating properties of liquid crystals. The liquid crystal does not produce light straight is shown in fig.3. A 16x2 LCD display unit is very basic module and is identical normally used in different devices and circuits. These units are favoured over 7 sections and other multi sections LEDs. A 16x2 LCD displays 16 characters per line and there are 2 such lines. In this LCD, each character is presented in 5x7 pixel matrix. It uses 2 registers such as data and command. In this proposed system, character is used to display the status of moisture, pump status and GSM status [4].

fig.3: LCD display

In fig.4, GSM modem accepts any GSM SIM card and functions like a mobile device with individual unique phone number. Advantage of using this modem is that user uses RS232 port to send message and improve embedded applications. Applications like SMS, message transfer, remote control and logging is established effortlessly. This modem can either be linked with personal computer using serial port directly or microcontroller. It helps to send/receive SMS or make/receive voice calls also. This GSM modem is a very flexible plug and play quad band GSM modem for direct and easy mixing with RS232 ports. It supports voice, SMS, data/fax, GPRS and integrated TCP/IP stack [6] [5].

In the proposed work, GSM receives the commands sent by the admin. These commands are transferred to microcontroller by serial communication (using Rx and Tx). It is required to send the particular AT commands to the GSM modem to retrieve the particular information stored in the modem. Once the information is transferred to the microcontroller, it will process as per the coding. Example if the admin sends the 'START' command to the GSM modem through the registered mobile number. The microcontroller compares the code if the command matches, it gives the signal to relay driver. So that relay will energize and pump will start [7].

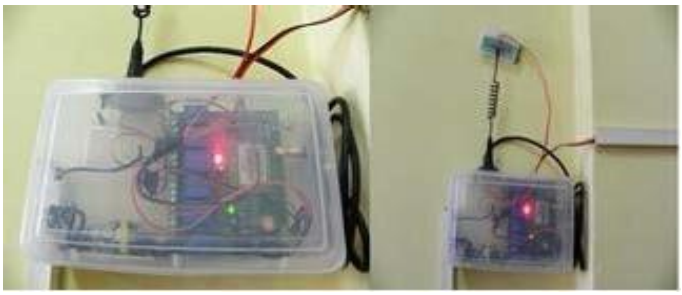

fig.4: SIM300 based GSM modem

IV. EXPERIMENTAL RESULTS

We executed proposed system in our wireless laboratory by setting the moisture level 40% to turn ON the motor and 70% to turn OFF the motor automatically. Initially, when the moisture level is low, the effective resistance across the potential divider circuit increases depending on the moisture content thus increasing the sensor output voltage [8]. This corresponding voltage signal is given to the IC393, where it is amplified and compared with the reference voltage [6]. If the output signal is above the threshold

value, which is set in the microcontroller, then the microcontroller sends the control signal to the relay, which will close the contact to turn ON the motor, corresponding status displayed in the LCD has shown in the fig.5 [11].

a).Moisture is low b).Moisture increase c).Moisture high motor OFF

fig.5: Displays status in different condition of moisture.

The motor continues to run and pumps water to the plants till moisture content is high. If the moisture level is high, then the effective resistance of the potential divider circuit decreases since effective resistance depends on the water content in the soil. Voltage across it decrease, this decreased-output-voltage from the sensor is amplified and is compared with the reference signal [13]. If output from the sensor is less than the threshold value by the microcontroller, then the microcontroller will send the control signal to relay to open the contact thus turning off the motor. The corresponding status displayed in the LCD has shown in the fig.6. As mentioned above, the system can also be turned on using GSM. fig.6 (a) shows the LCD display indicating that the motor is turned ON using the GSM. This shows that the motor can be turned ON as we intended from anywhere as we wish by just sending a message from our mobile phone. The GSM modem receives data and sends it to microcontroller [14][15].

a).When GSM command ON b) .When GSM command OFF

fig.6: GSM status displayed in second line

Here, the microcontroller compares the data with the data in it and it will send the signal to relay thus it turns ON the motor. Similarly, the motor can be turned OFF by sending the message to the GSM modem, the microcontroller will send desired signal to turn OFF the motor. In fig.6 (b) shows the LCD display indicating that the motor is turned OFF using GSM. If any dry run occurs, it will stop the motor. And display the error massage. fig.7 (a) shows the error massage. So the motor protects from dry run. fig.7 (b) shows the error massage due to low voltage. So the motor will protect from important problems occurs in the practical real time systems [10].

a) Dry run indication b) Low voltage

fig.7: Displays status in different condition of moisture

V. CONCLUSION

In case, the water in the tank is empty and if the microcontroller sends the control signal to turn ON the motor checking the moisture level, then the motor will run dry that is without pumping the water. This may cause anomalous temperature rise in the motor and damage it. By providing dry run protection the damage to the motor can be avoided. If the power supply of the system goes OFF, we cannot get the status of the system so a backup power supply system can be provided for the microcontroller and the GSM unit. It will give the system information even if the power supply is not available. It helps us to control the system as necessary. This work can be further improved to obtain better performance. The system can be designed in such a way that the user can get all the status of the system through his mobile phone. Dry run protection for the motor can be providing, which is essential, when motor is used to pump the water from the storage tank. Further the system can be designed to provide better and accurate result by using the hardware of high quality a high quality sensors can revamp the performance of the system which will decrease the delay time in the system and also increases the efficiency of the system. A provision for the manual change in the moisture

level can be provided so that the user can set the moisture level as required for the different types of the systems cultivated by him. A voltage protection system can be provided when the system is installed on single phase or three phase lines so that the system is not affected with the high or low voltage profile occurring in the power supply system.

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