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Precesion Agriculture for Drip Irrigation Using Microcontroller and GSM Technology

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ABSTRACT
Drip irrigation is now a common phenomenon gaining popularity especially in the states like Rajasthan where water scarcity is a day to day affair. For drip irrigation a small over head water tank in used which supply water to the drip system. Usually the geographic systems as well as the cost do not permit a bigger tank. This tank generally gets vacated and a farmer needs to be always attentive to refill the over head tank from his well or cannel by an electric pump, mostly this need arises in the night as the availability of power is not whole day. This involved a lot of risk and cost on the part of farmer. The simple and low cost gadget that has been work upon, not only control the starting and stopping of motor by sending a simple SMS through a GSM mobile but also gets the return SMS showing level of water in overhead tank. The application of the gadget is not only limited to the use for a farmer & but can be beneficial for any process industry in which level of a chemical or any liquid need to be crucially controlled and monitored from far end, may be even from the home of a supervisor with no constraints of time or place for controlling the operations.

***Keywords*—** GSM Drive ,Microcontroller AT89s52, Sensors,.

I. INTRODUCTION

India is basically a rural nation, and all its gross assets depend on the agricultural output. With the rapid growth of agriculture in India, many innovative technologies have been introduced into farming productions especially in the field of precision agriculture. The total rainwater in particular areas like Rajasthan may be either scarce, or badly timed. In order to get the maximum yield, it is essential to supply the best possible quantity of water, and sustain exact timing of water. This is possible only through an organized irrigation system-by collecting water during the periods of overload rainfall and releasing it to the crop as and when it is planned and necessary. In this direction drip irrigation is the science of planning and designing an efficient, low-cost, economic irrigation system personalized to fit expected conditions [11]. By the creation of proper circulation system, production of crop may be increased because of prescribed water supply. The different methods of supplying water to the fields are shell irrigation, Sub-surface irrigation [7]. The stored or abstracted water is conveyed to the farming fields through some appropriate circulation system. In the present era when food security has become a right of citizen there is vital need for planning an intellectual irrigation structures. The proposed Drip irrigation system model comprises of simple microcontroller 8051, water level sensor, and serial communication IC and GSM modules. This system is capable to control the water altitude in the overhead reservoir through GSM technology as described in the paper.

1.1 Drip irrigation system: A Theoritical Perspective

Drip irrigation is a method of applying slow, steady, and precise amounts of water and nutrients to specific areas of trees, vines, ground covers, potted plants, or shrubs. At a slow application rate, water seeps into the soil and moves laterally by capillary action beneath the soil's surface. An adequate section of the root zone of the plant is maintained with moisture close to soil capacity, providing a soil-to-water-to-plant relationship which is conductive to better plant growth. [11]

Fig.1 A schematic sketch deplicting a Drip Irrigation system.

1.2 Embedded System.

The simple control system using embedded technology is interfaced with GSM (Global System for Mobile communication) module to amplify scale and advance the application area to a larger extent [3]. Even though the GSM was initially designed for voice, it can be used to serve other purposes than conversation. GSM is indestructible since this communications has been deployed in many countries. GSM is used as the communicator to receive signals captured by machines in inaccessible places, and also to send control signals to remote machines. Particularly in the field of the process control that requires the critical control performance such as, high accuracy, high rate and superior linearity. at the present time a variety of parameters in industrial processes are controlled such as temperature, pressure, level etc. altitude control is usually used in almost every process system[4,5].

1.3 GSM MODEM SIM300 V7.03

This GSM facility plays an essential part for controlling the irrigation on field and sending the results to the farmer using SMS to a mobile device which indirectly controls the entire farm irrigation system. The processor or the controller works as a central core for functioning of the automated process after it has been initiated by the GSM based device and finally presents the output to the device.

The GSM modem task is of a modem which has a SIM card that operates on a subscriber's mobile number over any network, just like any cellular phone. The modem sim300 is a triband GSM/GPRS engine that works on EGSM900MHz; DCS1800MHz and PCS1900MHz frequencies.MAX232 is used to convert TTL into RS232 logic level converter used between the microcontroller and the GSM board [3, 6]. The signal of the microcontroller is sent to the GSM modem through max232.This signal is received of the GSM modem. The GSM modem transmits the signal from to the microcontroller through MAX232.

Fig.2 GSM Modem with a SIM card.

II. PROPOSED SYSTEM

Earlier, human labor plays a very important role in monitoring farm and water level during the course of irrigation. For some decisive situation farmer has to stay at farms throughout the night. In this proposed work, if the water level in an overhead tank drops below the threshold level for pumping its pump motor may get air locked or more burn out due to dry running. It is inconvenient for farmers to walk all the way to their fields at night just to switch the pump motor off. Due to increasing size in farming areas, this type of manual practice, is apparently time consuming and labor intensive.

These problems can be solved by using the GSM based system that will automatically give the user a SMS on his mobile phone when the water Level in the overhead tank drops below threshold or rises to the threshold level for pumping. The user can also remotely switch on or off the pump motor by sending SMS through his mobile.

2.1 System Description

The schematic sketch of automatic drip irrigation system is shown in the fig.3.1. When the water tank is empty, the low level sensors sense the level of water and send a signal to microcontroller. Microcontroller give a command to GSM module, this module ask to controller that which message may be sent, then controller again give a command and the module sent a message according to level to particular mobile number which is coded in controller. The GSM board has a valid SIM card with sufficient recharge amount to make outgoing SMS.As the GSM modem gets the applicable signal about the threshold water level of the tank from Microcontroller its send that packet of data to user mobile in the form of SMS, thus the user gets the current status of the level of water and now user either switched ON or OFF the both motor as per requirement.

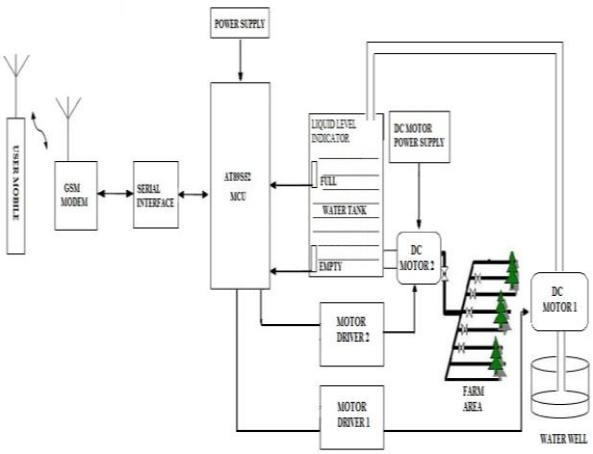

Fig.3 A schematic sketch of Automatic Drip Irrigation System.

III. DESIGN AND IMPLEMENTATION

The foremost element of circuit is controller IC AT-89S52. The controller IC is programmed to execute a particular job. It is connected to a crystal

oscillator which generates a stable frequency for Controller and the some pins are connected to relay which will enable the pump ON /OFF.

3.1 System Prototype

In this system under envisaged, we have made a prototype using an 8 bit microcontroller, a reserve tank, water tank and water pump. The transistors are used as a switch with two respective resistors. The used sensors [9] detect the level of water in the tank and forward the threshold level to microcontroller through the transistor. The microcontroller receives the information sends to GSM module through Rx, Tx according to the code programmed in the microcontroller. GSM (Global system for mobile communication) module has some pre-coded mobile numbers. These mobile numbers get the message as "Attention please, water tank is full" or "Attention please, water tank is empty" according to the received information. The above message is received on user mobile in response user sends ON/OFF message to the GSM module again which enable the motors to ON/OFF.

Fig.4 Prototype Simulator Board.

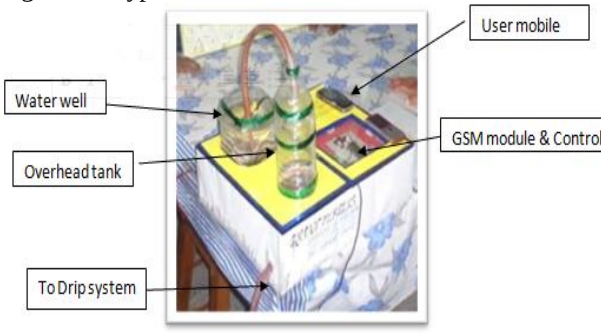

Fig.5 System prototype.

3.2 Software Program and Testing

At the first stage of design a water level sensor is been made for sensing water level accurately. Microcontroller is used to control the overall system automatically that reduces the design and control complexity. Microcontroller takes input from the sensor unit which senses the water level through transistor. After processing input variables, resultant output decides the water pump's action (on/off) with respect to current water status of the tank.

A small prototype based on the above conditions is written in embedded C programming language and compiled using Keil software [10]. Compilation process generates Hex code. That is later dumped into the micro controller and the whole hardware design is implemented and the serial communication is handled by the serial buffer register of the microcontroller with the help of external RF module connected to the TX and RX pin. The flow of the program can be well understood with the help of flow chart given below

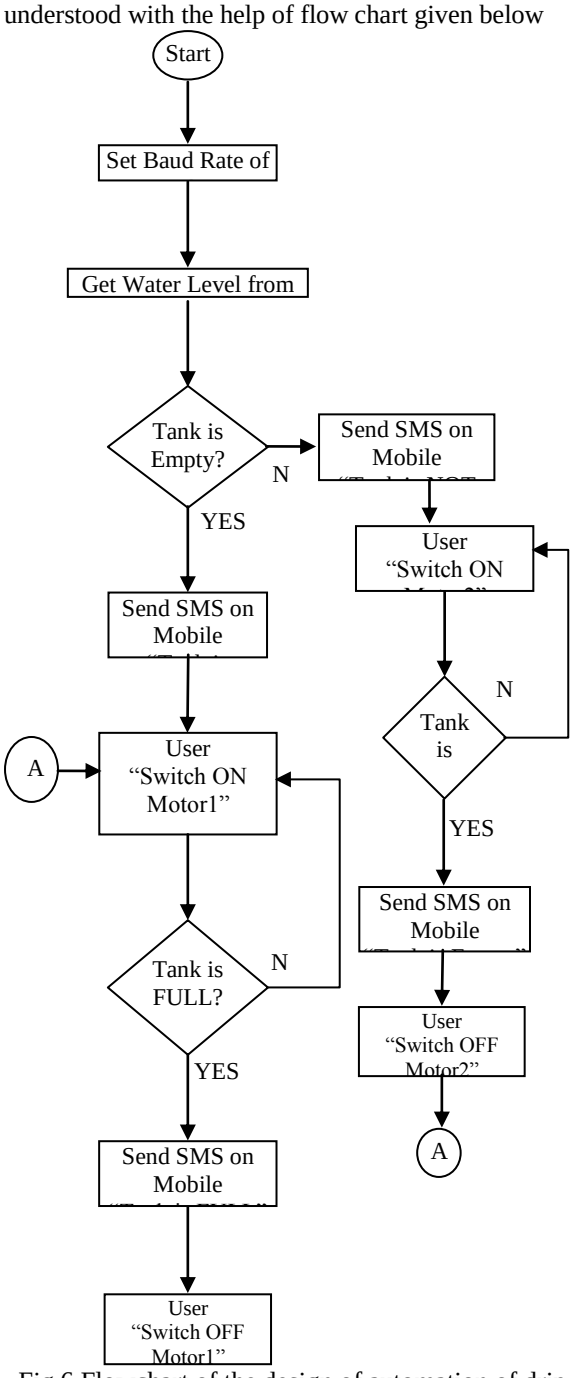

Fig.6 Flowchart of the design of automation of drip irrigation system.

1.3 EXPECTED RESULTS

TABLE 1.

Water tank	**Water level**	**Mobile**	**Motor 1**	**Motor 2**	**Remarks**
Full	Above Point H	SMS from modem "Attention please, water tank is full"	OFF	ON	SMS operation to turn on/off the motor
Empty	Below point L	SMS from modem "Attention please, water tank is Empty"	ON	OFF	SMS operation to turn on/off the motor

IV. CONCLUSION

There is a vital need for a system that makes the agricultural process easier and burden free from the farmer's side. To save farmer's effort, water and time has been the most important consideration. Hence systems are required to be designs to provide this ability efficiently using wireless sensor networking, sprinkler irrigation, GSM, SMS technology, with readily available mobile phone. The implementation of this automatic Precession agriculture with drip irrigation system using microcontroller and GSM technology had successfully been done in this research, which lead to the development of a reliable and cost effective system. The proposed system utilizes the leveling sensor for detecting the water level, as well as GSM and SMS technologies for sending alert notification message to the farmers. By testing we obtain the expected performance and reliability.

V. FUTURE SCOPE

The research may be extended for controlling any soil parameters to be monitored. For example, other than water, temperature, acidity level (pH) in the agricultural also play important role to the quality of products. The research work also may be enhanced to produce an automatic system that can trigger self actions of related components such as the sprinkler, lighting and air ventilators, rather than just send alert notification message.

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