GSM BASED DRIP IRRIGATION AUTOMATION SUPPORTED BY MOISTURE SENSOR

Deshvir Malik*

Abstract—

Agriculture is the backbone of economic system of a country like India. The continuous increasing demand of the food requires the rapid improvement in food production technology. Timely and sufficient supply of water is the most important requirement for agriculture. There is a continuous need of monitoring the moisture level at agriculture lands. Focus is on developing low cost product module based on GSM module for effective irrigation system. This paper introduces an automatic module to supply appropriate amount of water to the field by sensing the crop humidity requirement. The system also measures the temperature and water level of the tank, to prevent dry run and damage to the pump. It even reduces probability of soil erosion and protects the crop rotting due to over irrigation during heavy rainfall with advanced rainfall unit. In addition, the developed irrigation method removes the need for workmanship for flooded irrigation.

Keywords— **GSM, humidity, moisture,soil, automation, crop, controller, mobile, automatic drip irrigation.**

* E&TC Department, MITCOE (PUNE), PUNE,INDIA

I. INTRODUCTION

Agriculture irrigation is highly important in crop production everywhere in the world. The continuous increasing demand of the food requires the rapid improvement in food production technology. In a country like India, where the economy is mainly based on agriculture and the climatic conditions are isotropic, still we are not able to make full use of agricultural resources. The main reason is the lack of rains & scarcity of land reservoir water. The continuous extraction of water from earth is reducing the water level due to which lot of land is coming slowly in the zones of un-irrigated land. Therefore, efficient water management plays an important role in the irrigated agriculture cropping systems.

Another very important reason of this is due to unplanned use of water due to which a significant amount of water goes waste. In the modern drip irrigation systems, the most significant advantage is that water is supplied near the root zone of the plants drip by drip due to which a large quantity of water is saved. At the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. Water deficiency can be detrimental to plants before visible wilting occurs. Slowed growth rate, lighter weight fruit follows slight water deficiency. This problem can be perfectly rectified if we use automatic microcontroller based drip irrigation system in which the irrigation will take place only when there will be intense requirement of water.

Irrigation system uses valves to turn irrigation ON and OFF. These valves may be easily automated by using controllers and solenoids. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn valves on and off. In addition, farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate water and nutrients when needed. Automatic Drip Irrigation is a valuable tool for accurate soil moisture control in highly specialized greenhouse vegetable production and it is a simple, precise method for irrigation. It also helps in time saving, removal of human error in adjusting available soil moisture levels and to maximize their net profits.

II. SYSTEM DESIGN

A. Block Diagram

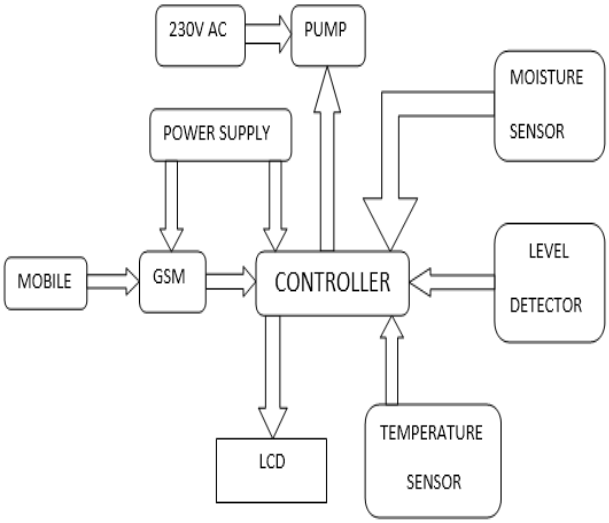

Fig .1 Block diagram of GSM based automated irrigation system.

As shown in Fig.1, GSM module coordinating with Atmega328 is the heart if this system. Data acquired by three sensors i.e. moisture sensor, level detector and temperature sensor is given to the controller. Data is displayed on LCD for testing purpose and also sent to the user through GSM and accordingly user will switch ON or switch OFF the pump.

B. Algorithm

Step1: Display the status of sensors on LCD.

Step2: Send the message to the user.

Step3: User will give command according to the status of the sensors.

Step4: Check the level of water. If LOW, go to step 10.

Step5: If the soil is DRY and water level is high, turn ON the pimp.

Step6: If the soil is wet, go to step9.

Step7: Check the temperature.

Step8: Go to step 1.

Step9: Turn OFF the pump after ‘x’ min.

Step10: Turn OFF the pump.

C. Flowchart

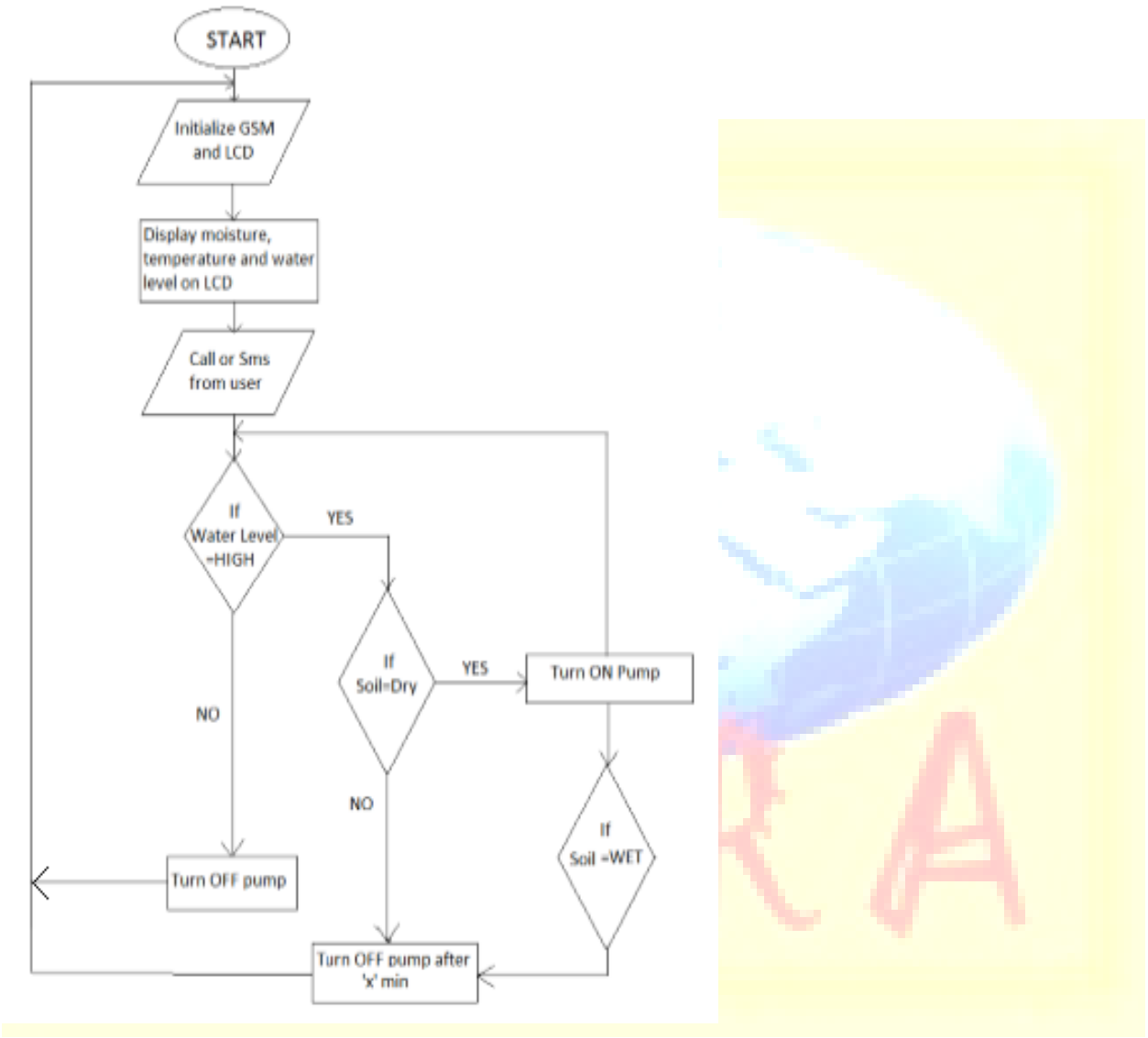

Fig. 2 Flowchart of the system.

III. SYSTEM CONFIGURATION(HARDWARE)

ATmega 328 Controller

The **ATmega328** is a single chip micro-controller created by Atmel and belongs to the megaAVR series.The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash

memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughputs approaching 1 MIPS per MHz.

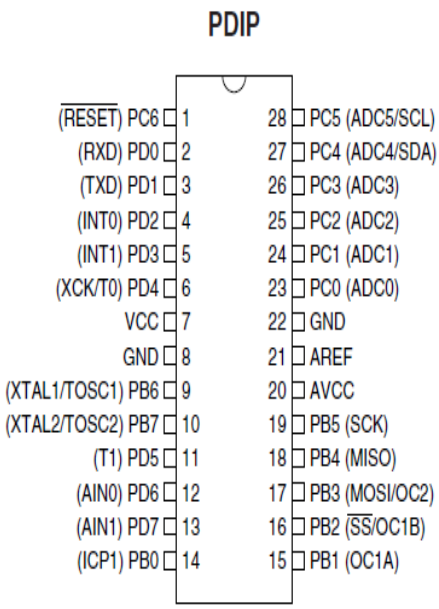

Fig. 3 ATmega328 Pin map

- ATMEGA 328 has three ports namely PORT B, C, and D.
- It has an advanced RISC architecture.
- It has a USART port with SPI interface.
- The input voltage required is +5V.

GSM Modem

Fig. 4 SIM300 GSM Module

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

SIM300 is a Fixed Cellular Terminal (FCT) for data applications. It is a compact and portable terminal that can satisfy various data communication needs over GSM. It can be connected to a computer with the help of a standard RS232C serial port. SIM300 offers features like Short Message Services (SMS), Data Services (sending and receiving data files), Fax Services and Web Browsing. Remote login and data file transfer are also supported. It is the perfect equipment for factory plants, resorts, dams and construction sites where wired connectivity is not available or not practicable. GSM modems support an extended set of AT commands. With the extended AT commands, various things can be done.

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoringthe signal strength.
- Monitoring the charging status and charge level of the battery.
- Reading, writing and searching phone book entries.
- The number of SMS messages that can be processed by a GSM modem per minute is about six to ten SMS messages per minute.

Sensing Units

1) Temperature Sensor

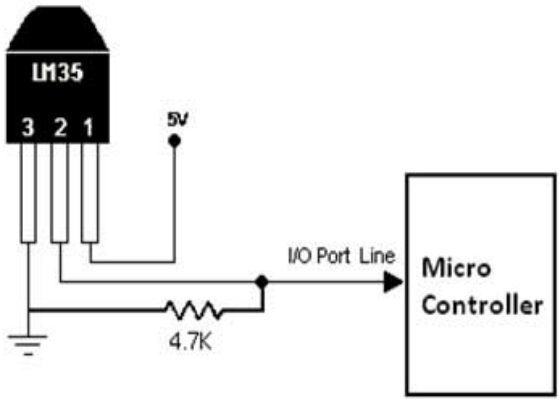

Fig. 5 LM35 connected to microcontroller

It has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/^{0}C. The LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4 ^{0}C at room temperature and +/- 0.8 ^{0}C over a range of 0 ^{0}C to +100 ^{0}C. Another important characteristic of the LM35DZ is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The sensor self heating causes less than 0.1 ^{0}C temperature rise in still air.

The output voltage is converted to temperature by a simple conversionfactor. The sensor has a sensitivity of 10mV / ^{0}C. Use a conversion factor that is the reciprocal that is 100 ^{0}C/V.

The general equation used to convert output voltage to temperature is:

- Temperature (^{0}C) = Vout * (100 ^{0}C /V)
- So if Vout is 1V, then, Temperature = 100 ^{0}C
- The output voltage varies linearly with temperature.

2) Moisture Sensor

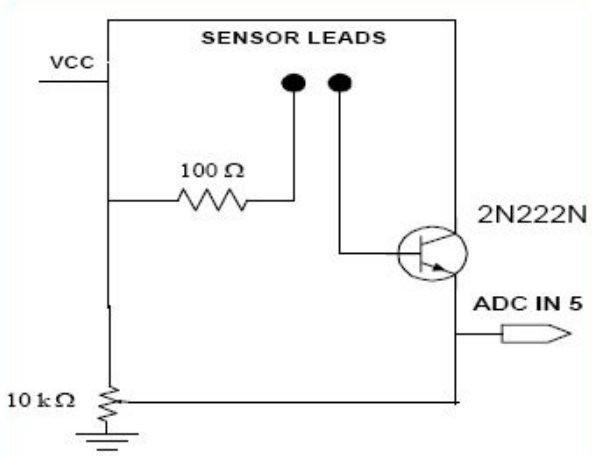

Fig. 6 Moisture Sensor

Moisture sensor detects the amount of moisture content in the soil and gives the feedback to controller which is displayed on LCD. It works on 5V DC. Conductivity of soil depends on its moisture content. Thus, soil acts as variable resistor. This variable resistor is used to drive transistor2N222N through its base. Thus, we get output across emitter which is directly proportional to the conductivity if the soil. As conductivity of soil is directly proportional to moisture content so output across emitter which is also directly proportional to the moisture content.

3) Water Level Detector

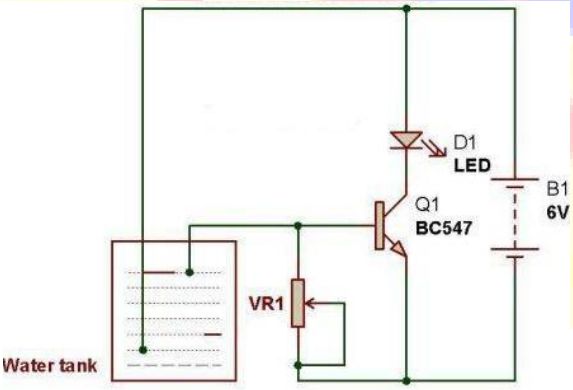

Fig. 7 Water level detector sensor circuit

When the water level in the tankor well goes below the required level, the pump automatically turns off and stops the pumping process thus preventing dry run and damage to the pump. It uses a relay to cut off the power supply to the water pump. It uses the BC547 in

comparator mode. It detects the level of water in the well and gives the feedback to the controller which is displayed on LCD. It works on 5V DC.

Relay Circuit

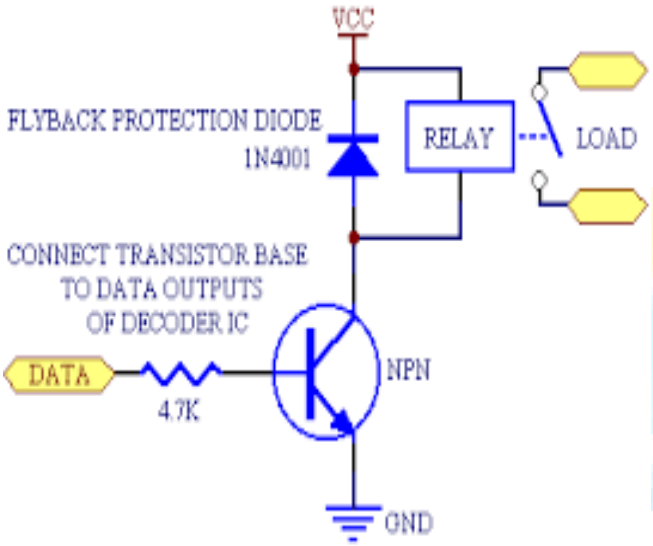

Fig.8 Relay circuit

Data is received from the controller on the basis of inputs from temperature sensor, water level detector and humidity sensor. Once the relay gets energized, Normally Open (NO) contact closes the circuit i.e. load circuit gets completed and water pump starts. A flyback **diode** is used to eliminate flyback, which is the sudden voltage spike seen across an inductive load when its supply voltage is suddenly reduced or removed. 12V VCC is given for relay to operate.

IV. CONCLUSION

This paper presents an approach for implementation of the real time product which can be used not only for farming purpose but also for greenhouses, nurseries, lawns, garden, housing estates and roadside landscaping.This low cost embedded system will reduce manual work and also saves electricity. It also has advantages such as preventing moisture stress of crop and diminishing of excessive water usage.

If different kind of sensors i.e. temperature, humidity, and etc. are involved in such irrigation in future works, it can be said that an internet based remote control of irrigation will be possible. The developed system can also transfer fertilizers and other agriculture chemicals (calcium, zinc, magnesium) to the field with adding new valves and sensors.

V. REFERENCES

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