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# Smart Irrigation System using GSM Module

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**Abstract:** With the water requirements in irrigation being large, there is a need for a smart irrigation system that can save about 80% of the water. This prototype aims at saving time and avoiding problems like constant vigilance. It also helps in water conservation by automatically providing water to the plants/gardens depending on their water requirements. Circuit construction was done on a Vero board. Simulation is done using Proteus™ circuit simulation software. This prototype has many advantages which make it a good alternative to the current approaches since it facilitates the farmers to assist them in daily needs of the monitoring and controlling the field environmental parameters with minimum cost and user friendliness.

**Keywords:** Climatology sensors, GSM, irrigation, water.

## I. INTRODUCTION

The soil moisture based irrigation control uses Tensiometric and Volumetric techniques, which are relatively simple but these quantities are related through a soil water characteristic curve that is specific to a soil type. Also the sensors used require routine maintenance for proper performance. Intelligent automatic plant irrigation system concentrates watering plants regularly without human monitoring using a moisture sensor. The circuit is build around a comparator Op-amp (LM324) and a timer which drives a relay to switch on a motor. The system uses a hardware component, which is subjected to variation with the environmental conditions. A real-time wireless smart sensor array for scheduling irrigation prototyped a real-time, smart sensor array for measuring soil moisture and soil temperature that uses off-the-shelf components was developed and evaluated for scheduling irrigation in cotton. This system is specific for a crop and hence its usage is limited. Proper scheduling of irrigation is critical for efficient water management in crop production, particularly under conditions of water scarcity. The effects of the applied amount of irrigation water, irrigation frequency and water use are particularly important. To improve water efficiency there must be a proper irrigation scheduling strategy. In this paper a simple system is mentoined using a microcontroller to automate the irrigation and watering of small potted plants or crops with minimal manual interventions.

## II. PROBLEM STATEMENT

In the present era one of the greatest problems faced by the world is water scarcity and agriculture being a demanding Occupation consumes plenty of water. Therefore a system is required that uses water judiciously. Focus of this paper is to overcome this problem by using smart irrigation system. Smart irrigation systems estimate and measure diminution of existing plant moisture in order to operate an irrigation system, restoring water as needed while minimizing excess water use.

## III.OVERVIEW

### A. The History Of Irrigation

Archaeological investigation has found evidence of irrigation where the natural rainfall was insufficient to support crops for rain fed agriculture. Perennial irrigation was practiced in the Mesopotamian plain whereby crops were regularly watered throughout the growing season by coaxing water through a matrix of small channels formed in the field. Ancient Egyptians practiced Basin irrigation using the flooding of the Nile to inundate land plots which had been surrounded by dykes. The flood water was held until the fertile sediment had settled before the surplus was returned to the watercourse. There is evidence of the ancient Egyptian pharaoh Amenemhet III in the twelfth dynasty (about 1800 BCE) using the natural lake of the Faiyum Oasis as a reservoir to store surpluses of water for use during the dry seasons, the lake swelled annually from flooding of the Nile. Sophisticated irrigation and storage systems were developed by the Indus Valley Civilization in present-day Pakistan and North India, including the reservoirs at Girnar in 3000 BCE and an early canal irrigation system from circa 2600 BC. Large scale agriculture was practiced and an extensive network of canals was used for the purpose of irrigation.

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B. Present Extent of Irrigation
In the mid-20th century, the advent of diesel and electric motors led to systems that could pump groundwater out of major aquifers faster than drainage basins could refill them. This can lead to permanent loss of aquifer capacity, decreased water quality, ground subsidence, and other problems. The future of food production in such areas as the North China Plain, the Punjab, and the Great Plains of the US is threatened by this phenomenon. At the global scale, 2,788,000 km² (689 million acres) of fertile land was equipped with irrigation infrastructure around the year 2000. About 68% of the area equipped for irrigation is located in Asia, 17% in the Americas, 9% in Europe, 5% in

Africa and 1% in Oceania. The largest contiguous areas of high irrigation density are found:
- In Northern India and Pakistan along the Ganges and Indus rivers
- In the Hai He, Huang He and Yangtze basins in China
- Along the Nile river in Egypt and Sudan
- In the Mississippi-Missouri river basin and in parts of California

3. Smart Irrigation
SMART Irrigation is Sustainably Managed, Accountable, Responsible and Trusted irrigation. SMART irrigators aim to minimize their environmental footprint through efficient water use, and must also run a profitable business. This allows them to reinvest in new and improved technologies which ensure sustainable and responsible irrigation over time. New irrigation technologies and decision support tools are continually being innovated in New Zealand and globally. Water use efficiency and energy use efficiency are the main focuses of these innovations. Fortunately, efficiency is linked to better quality production and improved profitability. Over the last two decades there has been a major change in the irrigation technology used in New Zealand. There has been a general move from manual flood irrigation to remotely controlled spray irrigation such as centre pivots, drip line and micro sprinklers.

## IV. METHODOLOGY

In this paper a system has a Controller, Soil moisture sensor, temperature sensor, Driver IC, Relays and Voltage level converter IC as shown in fig.1. A switch is used for the mode switching of the system. There is a manual mode in which PUMP and FAN will be controlled manually by sending message to a system while another mode is automatic n which controller will get the inputs from Sensors and as per that Controller will make the PUMP or FAN ON or OFF. And at the same time will send the same status to the system for maintaining log.
Initially when system is made on controller will keep the Relays OFF. And check for the Mode switch whether to work in MANUAL mode or AUTO Mode.

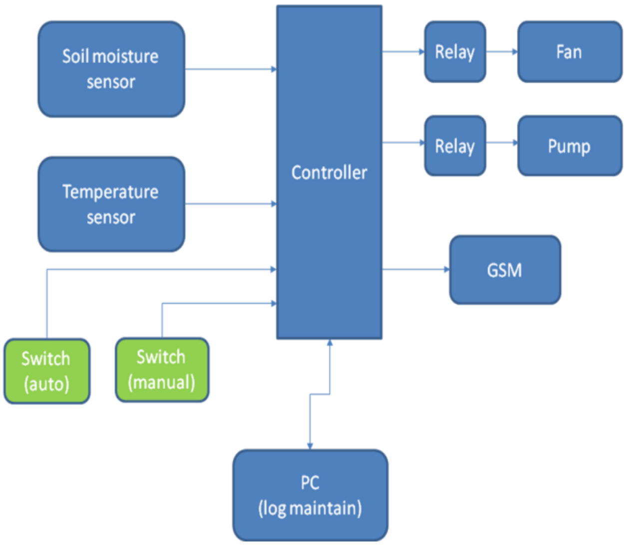


Fig.1. Flow chart for the system

If it's a manual mode then controller keep checking for the incoming message and if it gets a new message then controller reads the content of the message and if it contains ON then it makes the respective Relay ON by sending the high signal to the driver. If it contains OFF then controller sends low signal to the driver so that respective Relay becomes OFF and as a result Applications is turned ON or OFF.

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The automatic irrigation system was designed to continuously sense the moisture level of the soil. The system responds appropriately by watering the soil with the exact required amount of water and then shuts down the water supply when the required level of soil moisture is achieved. The reference
level of soil moisture content was made to be adjustable for the three most common soil samples (sandy, loamy and clayey soils – the samples used for this project were taken from around the Covenant University EIE building, Nigeria). Also the amount of irrigation, the moisture sensors was designed using probes made from corrosion-resistant material which can be stuck into soil sample. Voltage levels corresponding to the wet and dry states of the soil sample were computed by measuring the resistance between the moisture detector probes and matching them to output voltages of a comparator circuit. A submersible low-noise micro water pump was developed to deliver the water to the appropriate parts of the soil (the base of the plants). The volume of water required for irrigation per time was computed by considering the capacity of the water pump and the water channels. The required irrigation time was determined by considering the response time of the water pump and the water volume required per irrigation instance. A timing circuit was designed to use the required irrigation time to control the duration of each irrigation instance. Simulation is done using Proteus™ circuit simulation software. Flow chart for simulation is as shown in fig 2. Circuit construction was done on a Vero board.

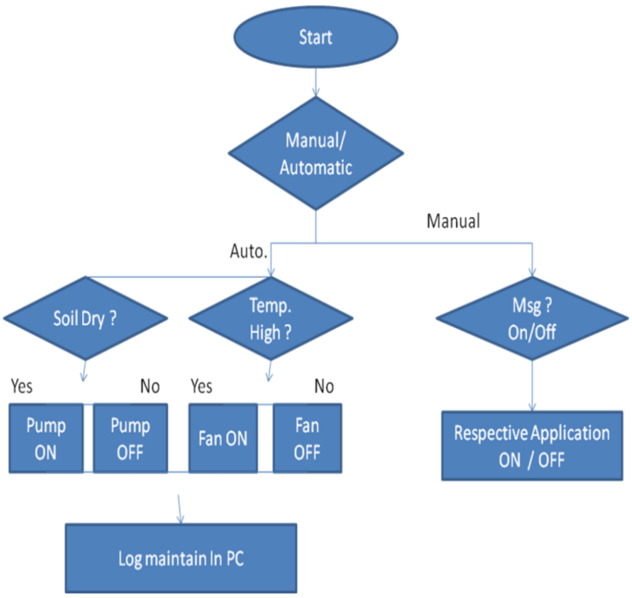


Fig. 2. Example of an image with acceptable resolution

## V. RESULT

Results Obtained from Operational Tests are as shown in table 1.

| Soil Sample | Soil Type | Initial Soil State(% dryness) | Irrigation Time (seconds) |
|---|---|---|---|
| A | Sandy | 100 | 5.0 |
| B | Sandy | 70 | 3.0 |
| C | Sandy | 50 | 1.5 |
| D | Loamy | 100 | 12.0 |
| E | Loamy | 70 | 7.5 |
| F | Loamy | 50 | 2.0 |
| G | Clay | 100 | 15.0 |
| H | Clay | 70 | 8.0 |
| I | Clay | 50 | 2.5 |

Table 1: Results Obtained from Operational Tests

## VI.CONCLUSION

More than half of the population in the world has an occupation of farming and if we consider the people who do businesses depending upon farming the population will increase manifold. Nowadays a lot of farmers in India are

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committing suicides due to debts caused by loss in their farming due to crisis in the natural environmental conditions. Helping farmers to get familiar with technology in order to become more independent in their daily life from the environmental crisis is a necessity that everyone should be aware of. Thus, this prototype presented a new approach to monitoring and controlling the field parameters with the help of GSM module.

This prototype has many advantages which make it a good alternative to the current approaches since it facilitates the farmers to assist them in daily needs of the monitoring and controlling the field environmental parameters with minimum cost and user friendliness. With this added device the whole life of those people will change and now they can contribute positively to their society and can overcome their weakness of totally depending on environmental conditions. Also, the financial analysis showed that the components of such a system are cheaper than the other systems; however the performance is almost the same.

## VII. APPLICATIONS

1. With little modification, this project can be used in Mechanical companies to measure various parameters of operating machines like temperature and light. Many industries also require proper controlled environment for manufacturing of good and products which ensures quality and workers efficiency.
2. Temperature monitoring and controlling action can be used in home or various halls like conference room, seminar hall to control the temperature of room making everyone present there feel minimum fatigue
3. To monitor more parameters like Humidity, PH of soil, pressure, and water level adding additional feature and more efficiency to the whole system
4. By using ARM 7 and ARM 9 we can increase the range of system using internet or Wi-Fi. There processers will benefit addition of features such as GSM module, pH level sensor, automatic threshold level controlling, etc. Also with these processor robots can be added to the system making it roam about in the greenhouse detecting values at different places or spots.

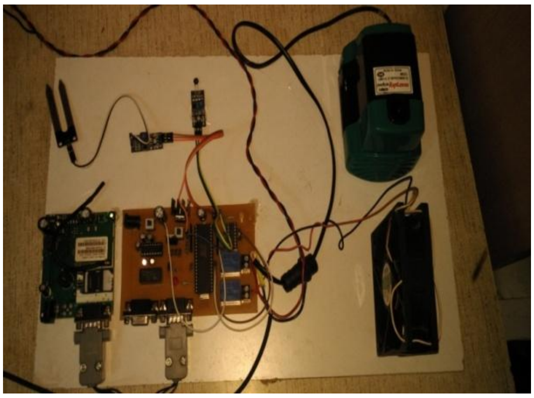

Fig. 1. Example of an image with acceptable resolution

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