

# Microcontroller Based Automatic Sprinkler Irrigation System

Jagdeep<sup>1</sup>, Ritula Thakur<sup>2</sup>, Daljit Singh<sup>3</sup>

<sup>1</sup>(M.E, I & C, Student, Electrical Engg. Dept., NITTTR, Chandigarh, India)

(Lecturer, Electrical Engg., B.K.N Govt. Polytechnic, Narnaul, India)

<sup>2</sup>(Assistant Professor, NITTTR, Chandigarh, India)

<sup>3</sup>(Sr. Lecturer, Govt. Polytechnic, Jhajjar, India)

**ABSTRACT:** Microcontroller based Automatic Sprinkler System is a new concept of using intelligence power of embedded technology in the sprinkler irrigation work. Designed system replaces the conventional manual work involved in sprinkler irrigation to automatic process. Using this system a farmer is protected against adverse inhuman weather conditions, tedious work of changing over of sprinkler water pipe lines & risk of accident due to high pressure in the water pipe line. Overall sprinkler irrigation work is transformed in to a comfortable automatic work. This system provides flexibility & accuracy in respect of time set for the operation of a sprinkler water pipe lines. In present work the author has designed and developed an automatic sprinkler irrigation system which is controlled and monitored by a microcontroller interfaced with solenoid valves.

## I. Introduction

### 1.1 Conventional Manual Work in Sprinkler Irrigation

In conventional sprinkler irrigation a farmer lay down an auxiliary water pipe line in the crop field. Auxiliary water pipe line is consisting of 10 Nos. or 20 Nos. of pipes made of PVC or Aluminum connected in series. Length of each pipe is 20 feet & at the end of each pipe a nozzle sets is fitted. No. of pipes in an auxiliary water pipe line depend upon the water pressure in the main water pipe line. Starting point of auxiliary pipe line is connected to the main water pipe line while open end of last pipe of auxiliary water pipe line is closed using a stopper. Pipes & nozzles are interlocked using a latching lock system. After finishing above work, underground water at high pressure is pumped in to the main water pipe using a centrifugal pump driven by an induction motor. Water at high pressure comes out of nozzles installed on the auxiliary water pipe lines and hit the one arm of the sprinkler rotational mechanism which convert the water jet in to drops. Water drops covers an area of 20 feet in diameter around it. This process continues for a time period decided by the farmer, after which auxiliary water pipe line is re-assembled at 20 feet forwarded location and whole process is repeated till all crop field is irrigated.

### 1.2 Hardships in Conventional Sprinkler Irrigation

In manual sprinkler irrigation work a farmer faces a no. of serious problems which adversely effects the health of farmer, underground water reservoir & yield of the crop. During running time of a sprinkler water pipe line a farmer remain in idle mode without any option but to wait till running time of sprinkler line get over. This time remain unutilized which a farmer can use in some other useful work.

### 1.3 Eradication of Hardships

An optimal quantity of water supplied to the soil for the crops yield out maximum while less or more water quantity supply adversely affects the yield. Assembly and reassembly of sprinkler water pipeline causes a huge wastage of water and require hard manual work. These associated problems can be resolved by developing & designing an automatic sprinkler system, which automatically perform sprinkler water pipe line changing process & run a sprinkler water pipe line for a set time period.

### 1.4 Advantages Using Microcontroller based Automatic Sprinkler System

- Saving of manpower
- Saving of water
- Saving of time
- Optimal water supply to crop
- Automatic operation
- Protection against adverse weather conditions

- Protection against high pressure in the water pipe line
- Improved yield of crop

## II. Basic Scheme & Design of the Automatic Sprinkler System

The basic design of the Automatic Sprinkler Irrigation is shown in Fig.2.1. The system uses a microcontroller that acts as the decision taking unit of the system. Microcontroller takes decision based upon the input set by a farmer as per his requirement & water flow sensor. It controls the operation of solenoid valves & continuously monitors the run time of sprinkler water pipe line. The system open one solenoid valve at a time while keeping others closed & run opened valve water sprinkler line for a time interval set by the farmer. All solenoid valves are opened in sequence for the irrigation of the crop.

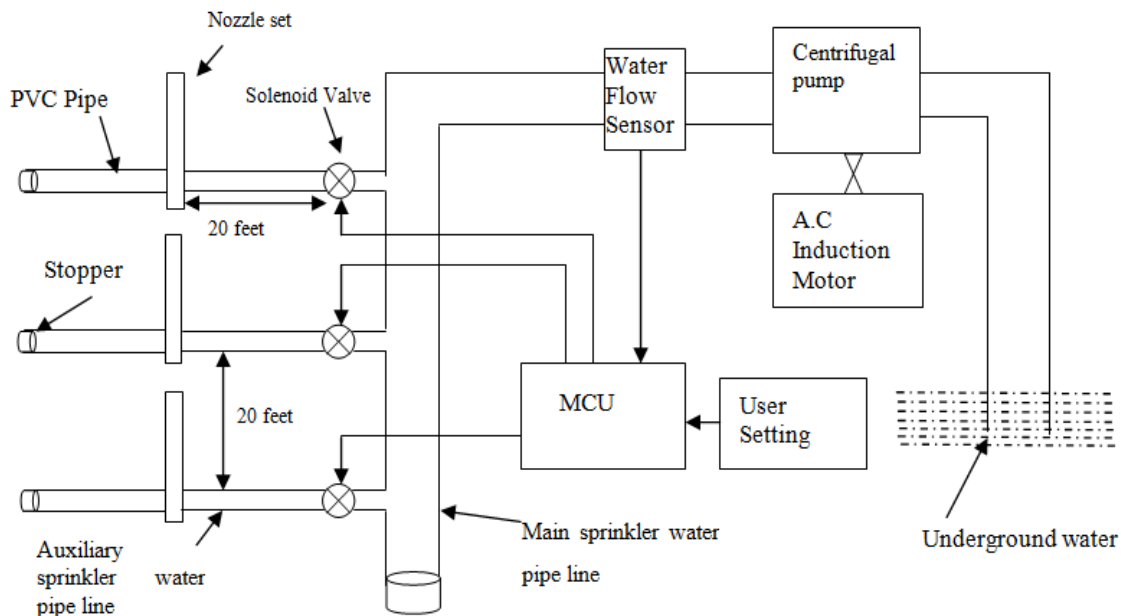


Fig.2.1. Basic Scheme of the System

## III. Literature Review

Genghuang Yang et al. in [1] Designed GSM based automatic irrigation system using GSM & radio communication technology for command, control & monitoring of irrigation work. Automation of irrigation work depends upon the moisture amount in the soil.

Venkata Naga et al. in [2] Developed automatic irrigation system used for the plants. This system is controlled by 8051 micro controller programmed to give the interrupt signal to the sprinkler. Temperature sensor and humidity sensor are connected to internal ports of micro controller via comparator, Whenever there is a change in temperature and humidity of the surroundings these sensors senses the change in temperature and humidity and gives an interrupt signal to the micro-controller and thus the sprinkler is activated.

Chaitali R. Fule et al. in [3] Proposed Microcontroller and soil moisture sensor based irrigation system which can prove to be a real time response control system which monitors and wheel all the activities of irrigation system.

Anil et al. in [4] Developed a fully automated system which optimizes the use of energy and water resources for the need of the day for a small garden. This paper propose the design and implementation of a highly energy efficient, multimode control for an automated irrigation system. The system uses an in-situ soil moisture potential measurement and the programmed data to irrigate a desired area. The soil moisture content is monitored by a microcontroller-based data acquisition and distribution system. An integrated GSM module provides critical information to the user during system failure. The proposed microcontroller based system was programmed and tested for its performance.

## IV. Block Diagram

Embedded technology is used in designing of Microcontroller Based Automatic Sprinkler Irrigation system designed by the author. Designing steps are based upon the block diagram shown in Fig.4.1. Microcontroller scan status of all the run time switches set by the farmer and based upon the no. of selector switches in ON state decide the total run time for a water sprinkler line. Microcontroller takes over

control of sprinkler system and controls operation of solenoid valves. One run time selector switch in ON state provide a running time period of one hour to a sprinkler pipe line. Flow sensor is interfaced with the microcontroller to detect the flow of water in the sprinkler water pipe line. Relay current drivers are interfaced with the microcontroller to turn ON/OFF the electromechanical relay which further is used to energize & de-energize solenoid valves. Solenoid valves are fitted at the beginning of first pipe of the auxiliary water pipe line. Auxiliary water pipe is connected to the main water pipe line in which water at high pressure is pumped by a centrifugal pump coupled with an AC induction motor. Microcontroller is powered by a 12V DC source. Operating coils of solenoid valves are also powered by 12 V DC supply. DC supply is obtained from AC using a bridge rectifier.

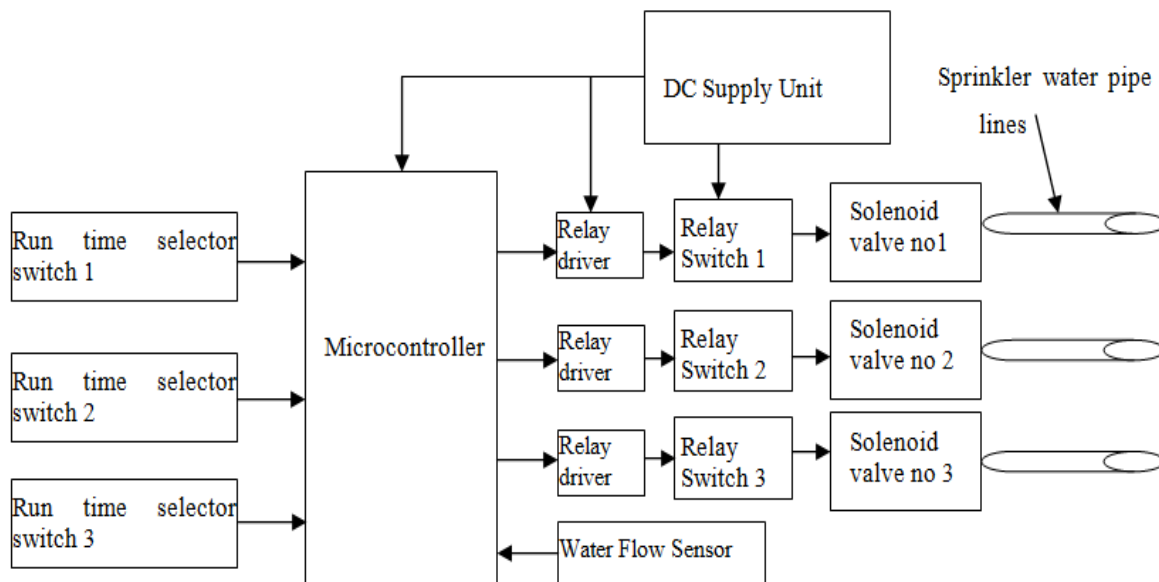


Fig.4.1. Block Diagram of Microcontroller Based Automatic Sprinkler Irrigation

### V. Scope of the work

It is observed that lots of problems & hardships are faced by the farmer while doing sprinkler irrigation work at fields. Crop fields are normally far away from the home so while doing irrigation work domestic important works of the farmer remain unnoticed to him. However farmer after assembly & laying a new sprinkler line in the field has no work except to wait till water sprinkler line runs for a fix time period. Above idle time period of the farmer can be utilized properly in some useful work if farmer posses technology of monitoring & controlling the water sprinkler line automatically. Microcontroller Based Automatic Sprinkler Irrigation system provide the solution to above problem. Using this system a farmer not only saves his precious time but also is benefited in respect of more yield of crop, saving of water, saving of labour work. Installing of this system in sprinkler irrigation is an easy task for a farmer. Requirement of power for designed system at fields which are normally not electrified can be fulfilled using a 12 V, 100 W solar plate. For night irrigation work a 12V, DC battery can be used. This system is highly reliable, after installing it farmer need not to get worry about any problem in sprinkler irrigation work at field. With a little change in hardware, system can becomes compatible with AC supply also. Microcontroller Based Automatic Sprinkler Irrigation system is user friendly. The system is adaptable to the requirement of the farmer. The software of the microcontroller can be customized & can be moulded as per the requirement of the farmer without any change in the hardware of the system or basis design of the system. Flexibility & adaptability provides versatility to this system.

### VI. Methodology

Flow Chart of Microcontroller Based Automatic Sprinkler Irrigation is designed by following sequential steps mentioned in flow diagram Fig. 6.1.

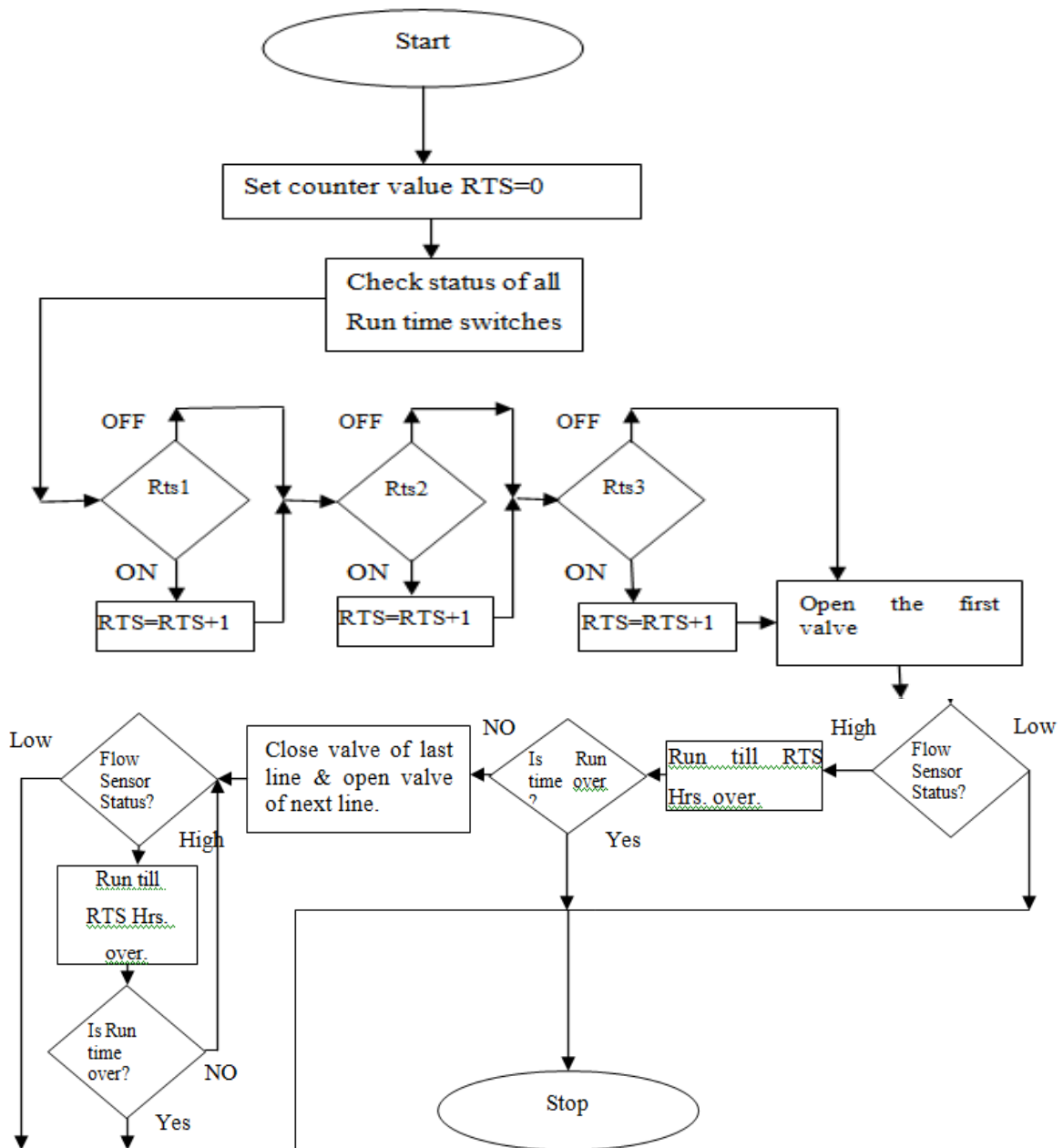


Fig.6.1. Flow Diagram of Microcontroller based Automatic Sprinkler System

### VII. Results

Design & development of Microcontroller based Automatic Sprinkler System successfully completed as shown in Fig.7.1. Several testing were performed to ensure its flawless working & to certain its reliability. Output of the implemented system produced the intended results. The system is designed to accept farmer requirements of time for which he want to run each sprinkler water pipe line. A farmer can set desired run time of sprinkler water pipe line using run time switches interfaced with the microcontroller. The system was tested with ¼ HP induction motor coupled with mono block centrifugal pump.



Fig.7.1. Complete Assembly of Microcontroller based Automatic Sprinkler System

### VIII. Discussions

Developing a Microcontroller based Automatic Sprinkler System is a foundation work toward introduction of embedded technology in the agriculture sector. It has a vast scope in the irrigation work. Developed system will help farmers to reduce their work load. Using this system a farmer can save his precious time and can get more crop yield. Certainly it will be helpful to the farmer in strengthening his economical condition. Automatic operation capability of this system will utilize optimal quantity of water for irrigation work extending its contribution in conservation of water.

### IX. Conclusion

Designed & developed Microcontroller based Automatic Sprinkler System successfully achieved the desired objectives. The system automatically controls sprinkler water line change over process by switching On/OFF solenoid valves installed in auxiliary water pipe line. The integration of software and hardware performed good task in producing the output exactly according to the requirement of the farmer in the sprinkler irrigation work. Interfacing of run time switches with microcontroller makes it flexible in respect of time settings for running a sprinkler water pipe line. A farmer using this system while doing irrigation work get protection against extreme odd weather conditions, tedious work of repeated assembly of sprinkler auxiliary water pipe line & risk of encounter with poisonous reptiles. Designed system enables a farmer to keep on irrigation work in the night hours. This system eliminates the requirements of physical presence of a farmer during irrigation in the fields, as the system itself continuously monitor & control the sprinkler auxiliary water pipe line automatically.

### X. Future Scope

Microcontroller based Automatic Sprinkler System run smoothly satisfying process stability criterion. System implements all the desired and planned function. With a little change in software & using data logger water quantity delivered to crops can also be controlled as per the requirement of crop based upon the scientific data. Developed system can be used in chemical industries in controlled processes of solution preparation. System can also be used in sugar industries in a process where controlled quantity of solutions is mixed.

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