INTELLIGENT MICROCONTROLLER-BASED IRRIGATION SYSTEM WITH SENSORS

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ABSTRACT

In farming, irrigation is a very indispensable factor. Most farmers apply irrigation by manual means which is effective for small scale farming. But the larger the farmland, the greater the need for a better means of irrigation, hence, an automated irrigation system. This paper discusses the design and implementation of an Intelligent Microcontroller-based Irrigation System. This system of irrigation uses soil humidity and water level sensors to ensure adequate application of water on time and when needed. Farming flexibility, conservation of time and water, preservation of soil structure and nutrients and avoidance of land wastage due to erosion are all the farmer/user of this system stands to gain [1].

KEYWORDS: microcontroller, irrigation system, sensors

INTRODUCTION

Irrigation has always been an ancient practice which has evolved through so many stages over the years [3]. Our ancestral farmers in a bid to irrigate their farm sought for various methodologies. Manual irrigation using buckets and watering cans, flood irrigation, drip irrigation, sprinkler irrigation were and is still being used today [4].

The existing system has several limitations; leaching off of soil nutrients, erosion due to flooding, loss of water from plant surfaces through evaporation, water wastage which can result to water scarcity in drought areas and production of unhealthy crops [2]. But with the new system-the intelligent microcontroller-based irrigation system, all these limitations are corrected.

The Intelligent microcontroller-based irrigation system mainly consist a microcontroller, two sensors, an alarm, and two pumps. The sensors, the soil humidity sensor and water level sensor measure the soil humidity and tank water level respectively. The data from the sensors are sent to the microcontroller in order to take the proper action/output through the irrigation and/or the water pump. An alarm is triggered at threshold point on both sensors. The microcontroller is programmed using assembly language, to oversee these operations.

On implementation of this system, production of healthy and bountiful crops is ensured in the long run.

OVERVIEW OF THE PROPOSED SOLUTION

The System includes the microcontroller (AT89C52), the soil humidity sensor, the water level sensor, the irrigation pump, the reservoir pump, the 16x2 LCD, and the alarm. This section specifies what the new system will achieve:

- The new system is automated. In this sense, it automatically, without the aid of a supervisor, supplies water to the farm when needed.
- The new system is intelligent in that it perceives when the soil needs water and triggers water application. It also ensures constant water storage in the tank or storage unit available.
- It responds and acts in real-time.
- This system better conserves energy, time and water.

- It exercises system and operational flexibility.

WORKING OF THE SYSTEM

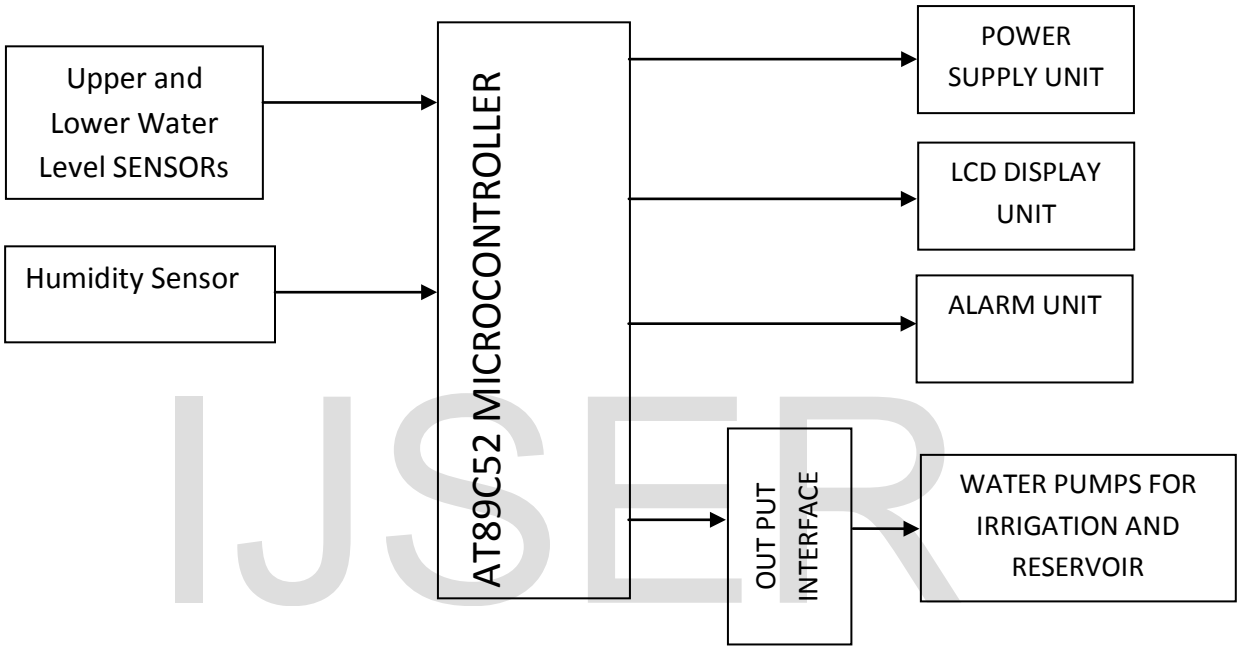
The Intelligent Microcontroller-based Irrigation System basically consists of the microcontroller, the soil humidity sensor, the water level sensor, the irrigation pump, the water pump, and the alarm. The soil humidity sensor is staked into the ground and it measures the humidity of the soil, such that once the soil becomes dry or saturated, the sensor sends a signal to the microcontroller by which it takes subsequent action. This action is either starting or stopping irrigation, which is carried out by the irrigation pump.

On the other hand, the water level sensor is put into the tank and sends input to the microcontroller based on the status of the tank, whether low or high water level. For the former, the microcontroller signals the relay for water pump and water pumping starts, whereas the latter stops the pumping.

The alarm is triggered when any of these happens; high water level, low water level, high humidity, and low humidity.

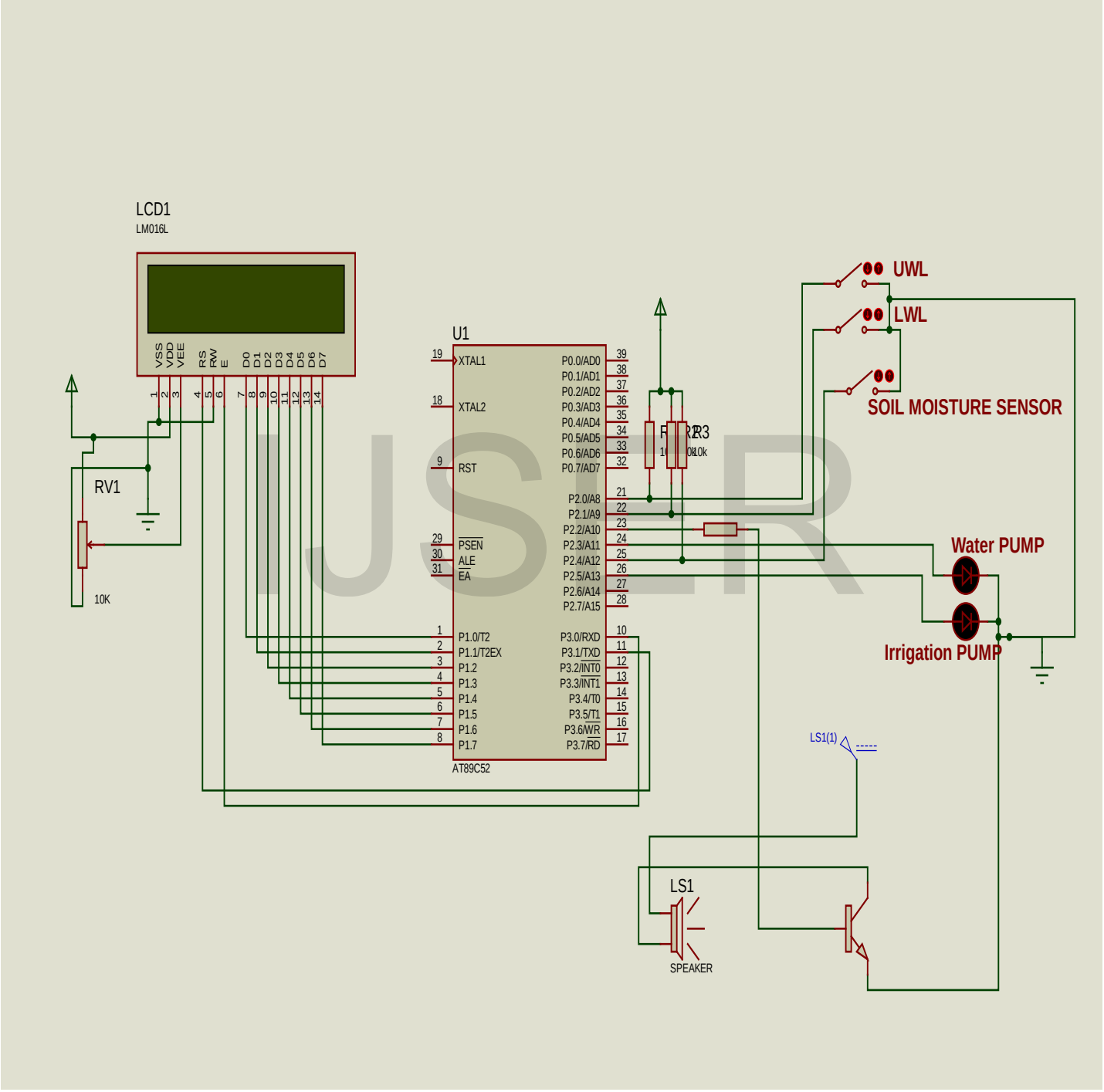
The LCD displays every process going on in the system, from the initializing to the monitoring, to the pumping etc.

THE BLOCK DIAGRAM OF THE PROPOSED SYSTEM



The block diagram shows the entire system. The left hand side is the transmitting/input module, the right hand side is the receiving/output module and the centre is the control system. The transmitting module consist the water level and soil humidity sensors, which are responsible for inputting data to the control system. Whereas, the receiving module consists the alarm, LCD, irrigation and reservoir pump, which acts as a result of the output from the control system. The microcontroller is the control system or otherwise called 'the heart of the system'.

THE CIRCUIT DIAGRAM OF THE PROPOSED SYSTEM



THE PSEUDOCODE OF THE PROPOSED SYSTEM

START

Assignment of i/o bits and ports to their desired labels

Initialize all memory locations and bits to their starting values

Check the reservoir for UPPER WATER LEVEL, signal input bit (UWL) for a low

If bit is low Then report UPPER WATER LEVEL REACHED STOP PUMPING is ddisplayed on the LCD

Also, Activate the alarm and switch OFF the relay that controls the pump that pumps water into the reservoir.

Check the Humidity sensors signal input bit (soil_sensor) for a low

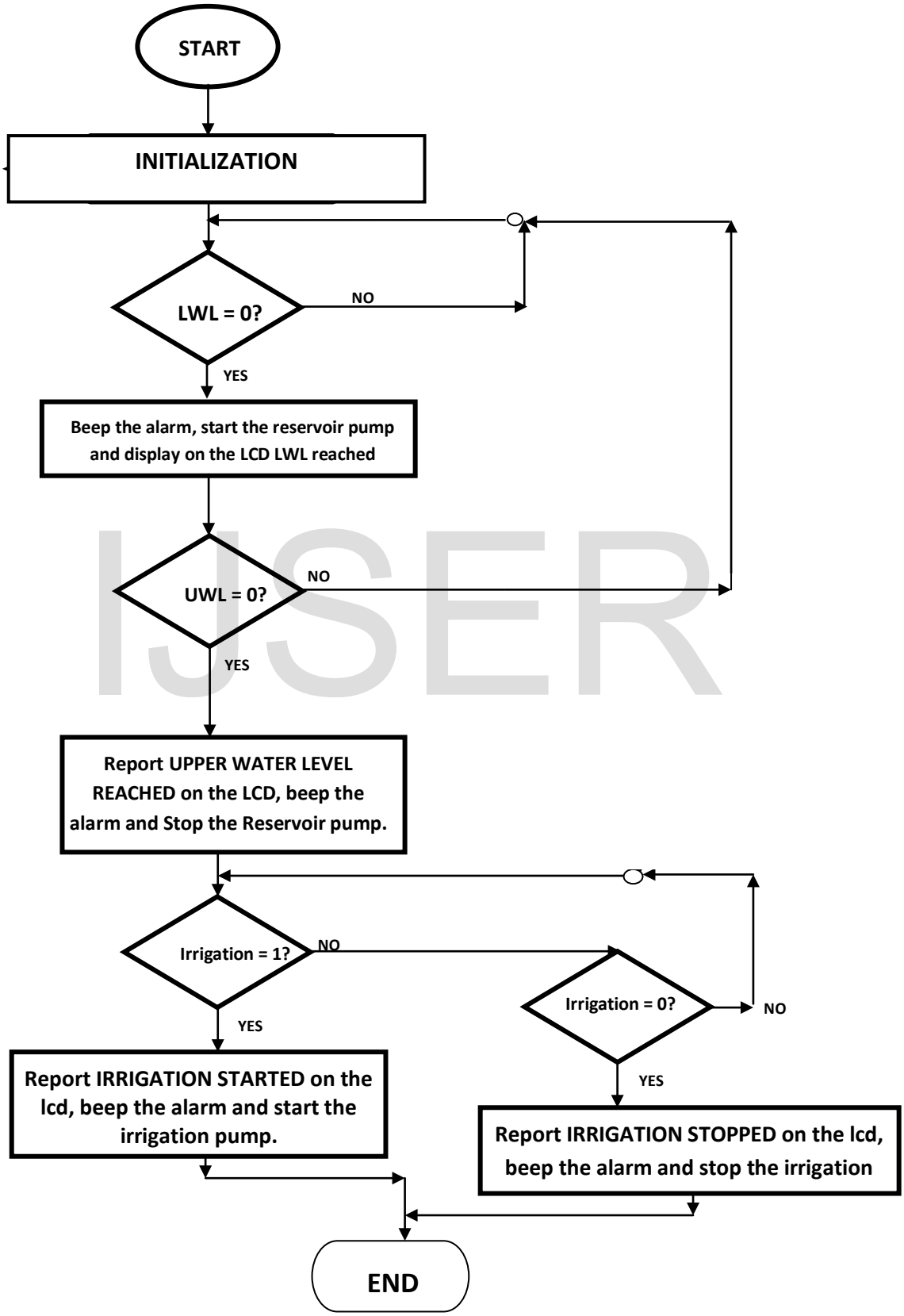
If bit is low Then Stop Irrigation. Report irrigation Ok on the LCD

Check the lower water level sensors signal input bit (sensor_lower) for a low

If bit is low Then Water needed.Give a bip on the alarm, and start the reservoir pump.

END

THE FLOWCHART OF THE PROPOSED SYSTEM



MAIN PROGRAM

```
start:
call lcd_monitoring
jb soil_sensor,moisture_detect
jnb soil_sensor,irrigation_OFF
jnb UWL_sensor,UWL_detect
jnb LWL_sensor,LWL_detect
```

CONCLUSION

The Intelligent Microcontroller-based Irrigation System was designed to be able to supply water to farms with or without the presence of the farmer/farm owner and also reduce waste of water by incorporating into it, sensors which monitors the humidity of the soil and the tank water level. The project features an alarm which is sounded on reach of high water level (in tank) and high humidity (in soil). All these were achieved through the use of microcontroller which is the brain of the project, which monitors all operations of the system.

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