

**Project Report  
Automated Irrigation System  
using MSP430  
by  
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**Abstract:**

The motivation for this project came from the countries where economy is based on agriculture and the climatic conditions lead to lack of rains & scarcity of water. The farmers working in the farm lands are solely dependent on the rains and bore wells for irrigation of the land. Even if the farm land has a water-pump, manual intervention by farmers is required to turn the pump on/off whenever needed.

The aim of our project is to minimize this manual intervention by the farmer, which is why we are using a micro-controller (MSP430G2231). The micro-controller based Automated Irrigation system will serve the following purposes:

- 1) As there is no un-planned usage of water, a lot of water is saved from being wasted.
- 2) The irrigation is done only when there is not enough moisture in the soil and the microcontroller decides when should the pump be turned on/off, saves a lot of time for the farmers. This also gives much needed rest to the farmers, as they don't have to go and turn the pump on/off manually.

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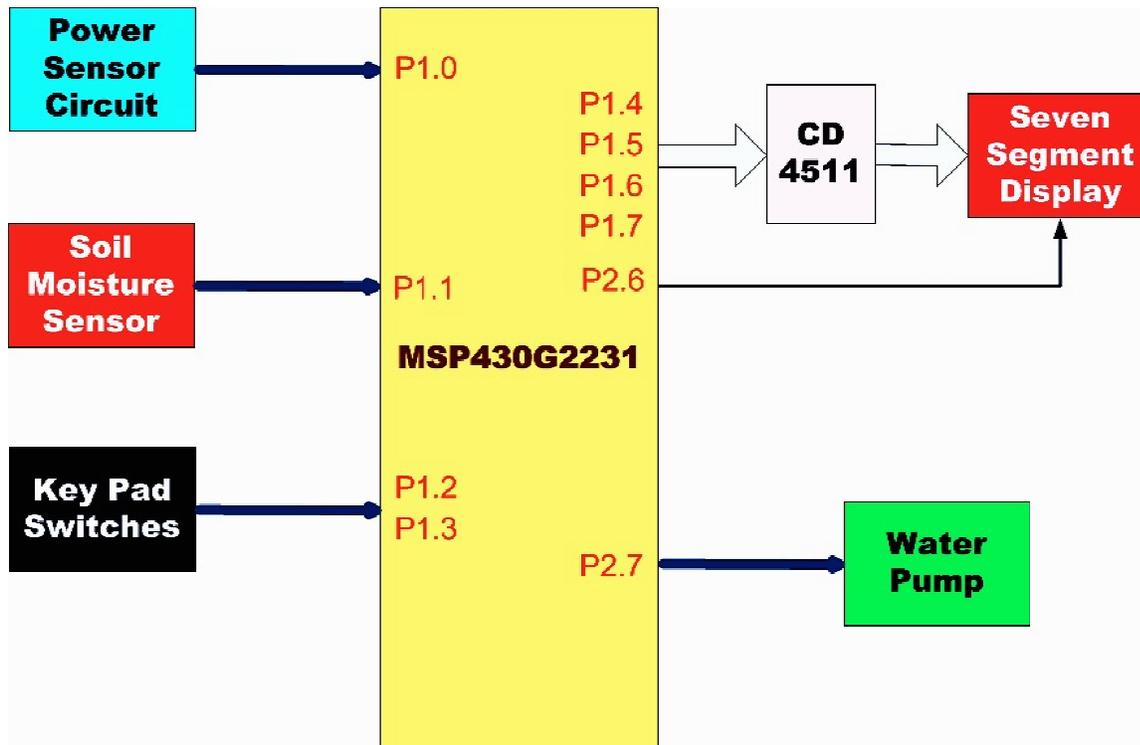
## **Motivation**

The increasing demand of the food supplies requires a rapid improvement in food production technology. In many countries where agriculture plays an important part in shaping up the economy and the climatic conditions are isotropic, but still we are not able to make full use of agricultural resources. One of the main reasons is the lack of rains & scarcity of land reservoir water. Extraction of water at regular intervals from earth is reducing the water level as a result of which the zones of un-irrigated land are gradually increasing.

Also, the unplanned use of water inadvertently results in wastage of water. In an Automated Irrigation System using MSP430, the most significant advantage is that water is supplied only when the moisture in soil goes below a pre-set threshold value. This saves us a lot of water. In recent times, the farmers have been using irrigation technique through the manual control in which the farmers irrigate the land at regular intervals by turning the water-pump on/off when required. This process sometimes consumes more water and sometimes the water supply to the land is delayed due to which the crops dry out. Water deficiency deteriorates plants growth before visible wilting occurs. In addition to this slowed growth rate, lighter weight fruit follows water deficiency.

This problem can be perfectly rectified if we use Automated Irrigation System in which the irrigation will take place only when there will be intense requirement of water, as suggested by the moisture in the soil.

**Solution with Block Diagram:**



**Solution:**

The core problems encountered is the manual intervention of farmers and the unplanned wastage of water. The solution to this becomes very much possible using the ultra low power 16-bit microcontroller and hence the MSP430.

As shown in the block diagram, the inputs to the MSP are the power sensor circuit, soil moisture sensor and the mini push button switches & the outputs are the 7-segment display and the water pump. When the soil moisture sensor detects that there is not enough moisture in the soil (0V-No moisture, 3V-Moisture present) it signals the MSP430 by sending it the analog input values as a result of the reading from the soil. These analog values are sampled and stored by the ADC in one of its registers (ADC10). If there is enough moisture, the water-pump does not start. But, if the sensor detects no moisture presence in the soil, it signals it to the MSP430, which in turn drives the water-pump. The function of the mini push button switches is described below. The changes in the 7-segment display are seen as and when the switches are pressed by the user (farmer). The time that is being displayed on the MAN72 is the amount of time for which the water-pump will be ON. This is achieved using the timer feature of the MSP430. To mitigate the limited port problem, a decoder (CD4511) is used along with the MAN72 displays. Usage of the decoder results in the complete utilization of all the ports on the MSP430.

### **Components used & their interfacing with MSP430**

### 1) Soil Moisture Sensor (VG 400):

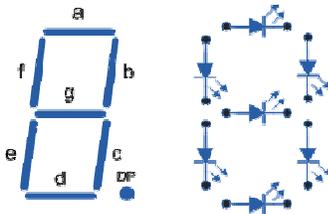
This sensor is one of the main parts of our project. It takes its input from the soil. If there is less moisture in the soil, the sensor would give an Analog input to the ADC inside the MSP430 (ADC explained later in report). The ADC (Analog to Digital Converter) which is one of the most important inbuilt features of the MSP, samples this Analog input value given by the sensor into a digital output and stores it into one of its registers (ADC10MEM).

### 2) 7- Segment Display (MAN-72):

There are two important types of 7-segment LED display namely common cathode display (CCD), the common anode display (CAD). For this system, we have used CAD.

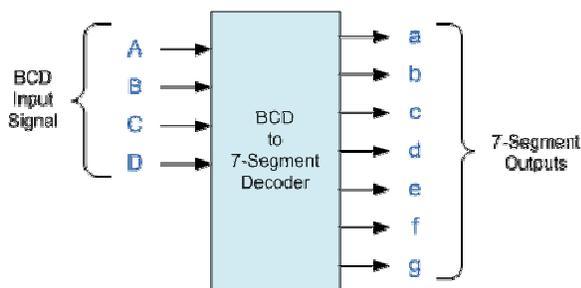
In the common anode display, all the anode connections of the LED's are joined together to logic "1" and the individual segments are illuminated by connecting the individual Cathode terminals to a "LOW", logic "0" signal.

Shown below is the 7-Segment Display Format:-



### 3) BCD – 7 Segment Decoder (CD4511):

The CD4511 is a BCD to 7-segment decoder driver. Its function is to convert the logic states at the outputs of a BCD, or binary coded decimal, counter like the CD4511 into signals, which will drive a 7-segment display. The display shows the decimal numbers 0-9.



#### **4) Mini Push Button Switches :**

Our system uses 3 mini push button switches.

How the user communicates with the MSP and 7-segment display using the switches is described below:

- Switch A is to increase the time(up)
- Switch B is to decrease the time(down)
- Switch C is to confirm selection

#### **References**

- **Web**

[http://en.wikipedia.org/wiki/TI\\_MSP430](http://en.wikipedia.org/wiki/TI_MSP430)

<http://www.ti.com/product/msp430g2231>

[http://www.electronics-tutorials.ws/combinational/comb\\_6.html](http://www.electronics-tutorials.ws/combinational/comb_6.html)

- **MSP430 Microcontroller Basics by John Davies**

## Appendix

### Team Members & their Tasks:

**Ajinkya Fotedar: Interfacing of 7 Segment LED (MAN-72)**

**Animesh Mathur: Interfacing of Mini Push Button Switches**

**Pavan Kumar Malka : Interfacing of Soil Moisture Sensor using ADC**

**Varun Polala : Interfacing of BCD to 7 Segment Decoder (CD4511)**

### Component Part List :

Name	Part Number	Hardware Interface	Software Interface
Soil Moisture Sensor	VG - 400	ADC Port A1 Pin 1.1	ADC
Seven Segment Display	MAN-72	Pin 1.4 - 1.7 Through BCD-Seven Segment Decoder	Timer
CD-Seven Segment Decoder	CD4511	Pin 1.4 - 1.7	Timer
Key Pad Switches	Mini Switches	Pin 1.2 - 1.3	Timer

### Results & Conclusion:

Finally, we were able to interface the soil moisture sensor with the MSP430 using ADC as the software interface.

The ADC was successfully sampling the analog values given by the soil moisture sensor and we could see the values being stored in the memory register of the ADC.

We emulated the soil using a wet tissue paper and when the soil moisture sensor was wrapped inside the wet tissue paper, one of the LED's of the MSP430 glowed which indicated that the moisture inside the soil was sufficient. But, when the soil moisture sensor was taken out of the wet tissue paper and dried thoroughly, the LED on the MSP430 stopped glowing indicating no moisture in the soil.

The integration was not a success but individually, we were able to interface the heart of the project that is the soil moisture sensor to the MSP430.