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Project Report
For
Microprocessors & Interfacing
Title

Smart Irrigation System

Under the Guidance of
Prof. Bhulakshmi Bonthu

Submitted By:
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Total Number of Pages: 23

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SCHOOL OF COMPUTER SCIENCE

Project

Microprocessors & Interfacing (CSE2006)

This is to certify that, the project entitled "Smart Irrigation System" is the bonafide work for Project component Microprocessors & Interfacing by the following students

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of **Computer Science and Engineering** branch under my supervision in **C2** slot during the Winter Semester 2019-20 at V.I.T. University, Vellore-632 014.

Faculty Signature:

Date:

ACKNOWLEDGEMENT

The members of our team would like to thank our professor Bhulakshmi Bonthu, for making us explore our innovative sides and come up with such an interesting project. Without your guidance and support our idea would have never been a reality. Thank you, ma'am! for encouraging us to empathize with the troubled people in our country which is why we came up with this project.

Furthermore, we would like to thank VIT for offering us a course different from others, where we don't learn theory but learn more about ourselves, build up our confidence and get a platform to showcase our ideas.

Individually, I would like to thank the rest of my team without whom this project would not be an easy task. It has been a fun

learning experience and I have definitely learnt a lot this semester.

Abstract

India is an agrarian economy, that is, its major revenue comes from the fields. Which is why it is essential to come up with newer technologies which save resources and money. A major problem is irrigation. The irrigation process is manual, where farmhands turn on/off the irrigation system when needed. This can be an issue, because watering is done purely on speculation and sometimes the fields could be overwatered.

Our solution is to build a smart irrigation system. It detects the moisture content of the soil based on which it turns the system on/off.

This works on the principle that when the soil is wet, electricity will start flowing through it and thus the potential drop across two points (sensing terminals) will decrease

When the soil is dry, there is no electricity flowing through the soil and the potential drop across two points will increase.

We will be using this increase and decrease in the potential drop to operate our system.

Objective of Project

- An effort towards providing a convenient, worry free, energy & cost-efficient irrigation system to the farmers.
- A promising water conservation technique.
- Smart Irrigation system that senses the wetness of the soil and accordingly waters the soil.
- Build a cost-efficient model.
- Easy to operate.
- Make lives of farmers easy.
- Use water efficiently.
- Instil importance of our diminishing resources to the users and encourage them to spread the word.

Motivation

During the 2011 census, India entered the league of water deficient nations. A nation is considered water deficient if the per capita water availability falls below 1700 cubic meters per person. The per capita water availability that fell by 15% during the first decade of this century to 1545 cubic meters per person, will be below 1400 cubic meters per person this summer. Though the rate of depletion has reduced in the last few years, we are still consuming much more than is being replenished by nature. And therein lies the danger. We will be leaving a troubled legacy for the next generation unless we take quick remedial actions to reverse the trend.

As per the Central Water Commission, 85.3% of the total water consumed was for agriculture in the year 2000. This is likely to decrease to 83.3% by 2025.

India does not spend any money in conserving water consumed in agriculture. Surprisingly, water conservation takes place in the industry and utility sectors, both of which consume less than 5% of the nation's water.

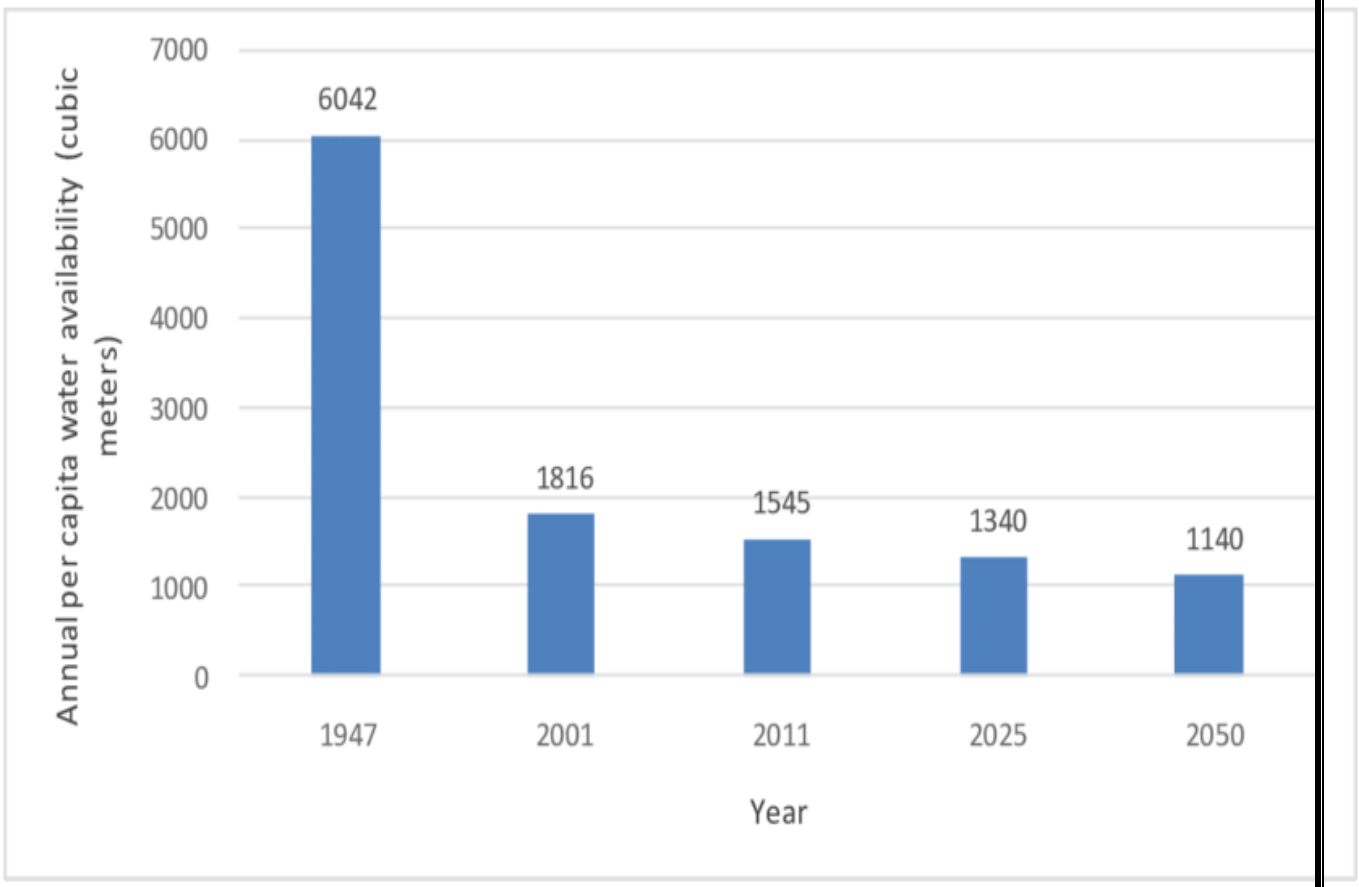
Our Project is a *Smart Irrigation System.*

As the name suggests, it will automatically water the plants when there is insufficient water for the crops, or the dryness crosses a certain threshold value; and will stop watering once there is enough water for the plants.

It monitors the wetness/dryness of the soil and activates accordingly to water the crops.

India is an agrarian economy; however, our farming technology is very outdated and is insufficient to meet the growing needs of the urban population.

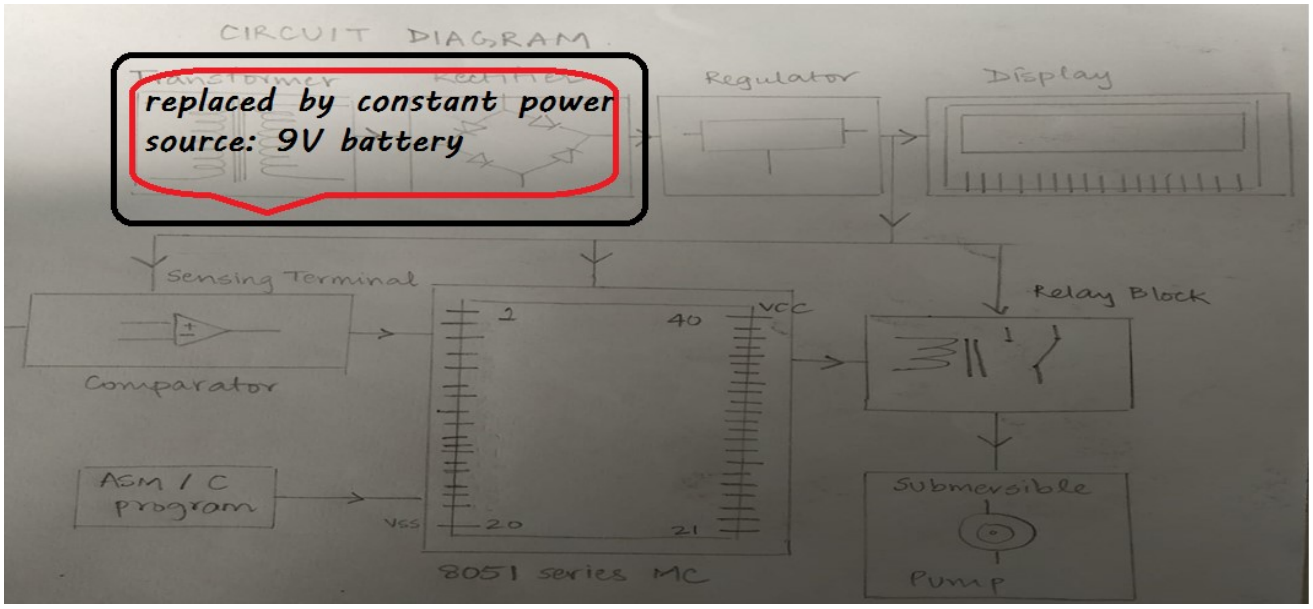
Hence, we have devised the system that lifts the burden off the farmers to water the crops. It saves water at the same time. It makes a farmer's life easy and relieves them of this redundant task. The machinery is not too complex, is inexpensive and can be easily implemented in farms.



Methodology

Our project comprises of mainly four units.

1. Power supply unit
2. Input unit (sensing part)
3. Processing unit (logical analysis)
4. Implementing unit (where output will be experienced).



Power supply unit

It consists of 9v batteries and voltage regulator (to convert 9v to 5v)

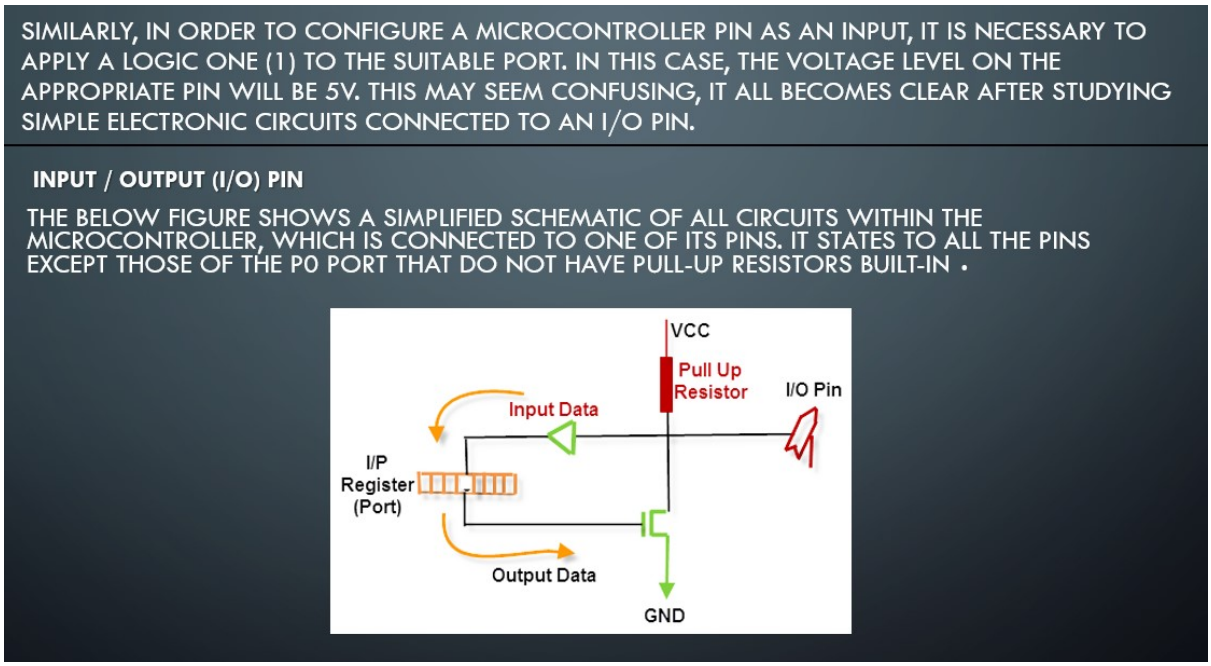
Input unit

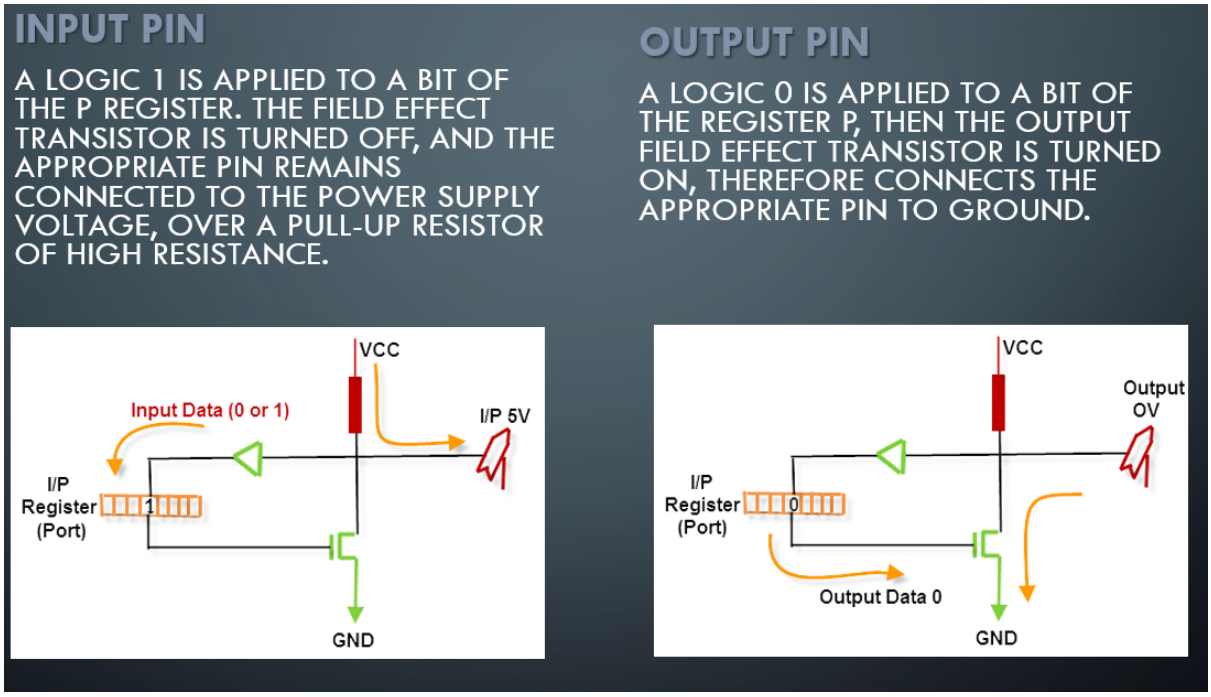
Input unit comprise of operational amplifier working as a comparator, variable resistance (which will manage the

threshold of moisture content), metallic stiffs. The metallic stiffs will be connected to the two terminals of op amp (inverting and non-inverting terminal) which will help comparator in analysing the potential difference created due to moisture content of soil as these stiffs will be dipped into soil.

Processing unit

Our processing unit (micro controller) comprises of 8051 c series IC with pullup resistors, required capacitors, crystal and other required resistors (generally of 1000 ohms). It will accept input from comparator and (port 0, pin 1 will be connected for sensing input), and process this input and give it as output to implementing unit through the port 0, pin 0.



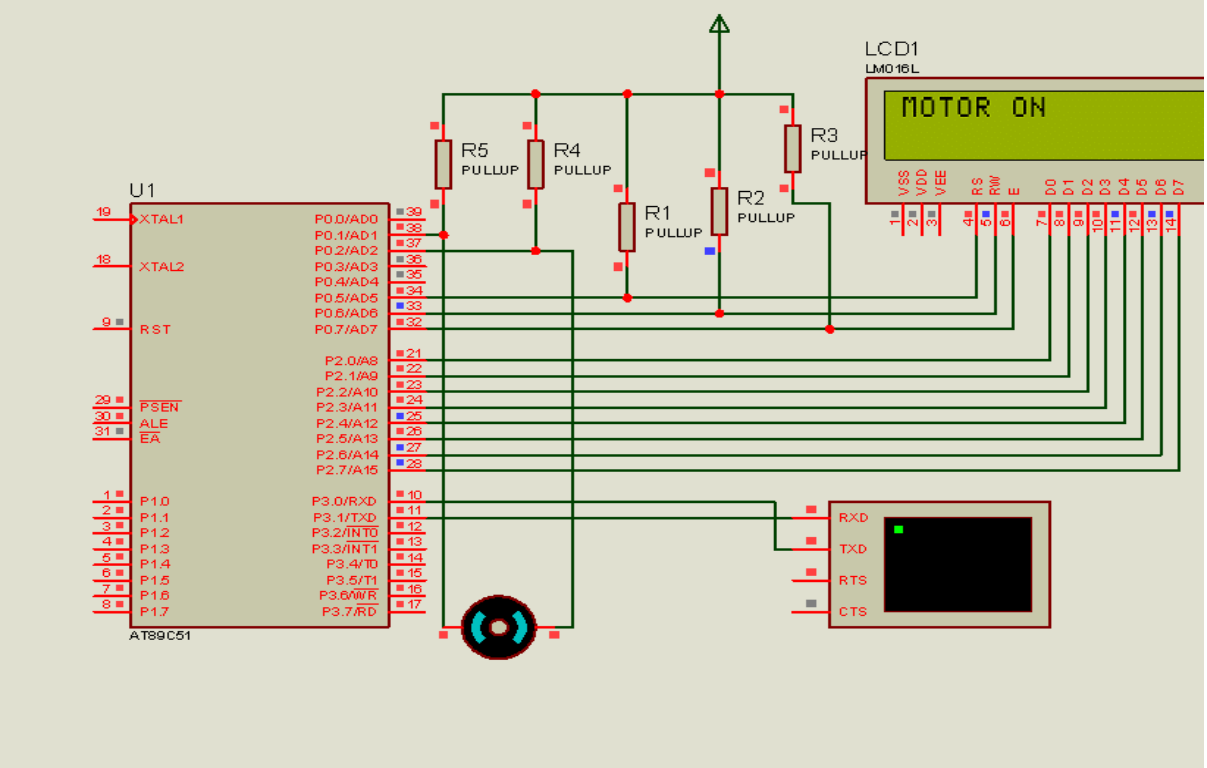


Implementing unit

It consists of relay switch which will analyses the digital output of microcontroller and operate the load as per the logical output.

Interconnections of all these units

5v input will be supplied to microcontroller & comparator, VCC, GND and Port0-P1 will be connected to comparator. Port 0-P0 will be used for output and will be connected to relay along with the VCC, GND coming as output from microcontroller and input to the display. Display will be connected like schematic diagram.



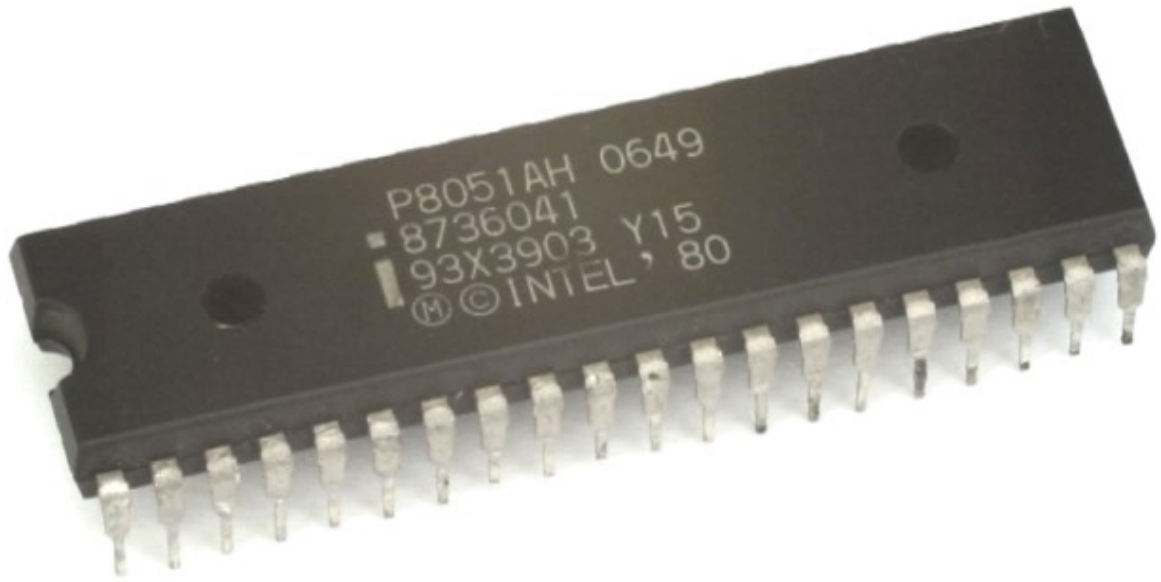
➲ *Focus of our Project:*

8051 Microcontroller

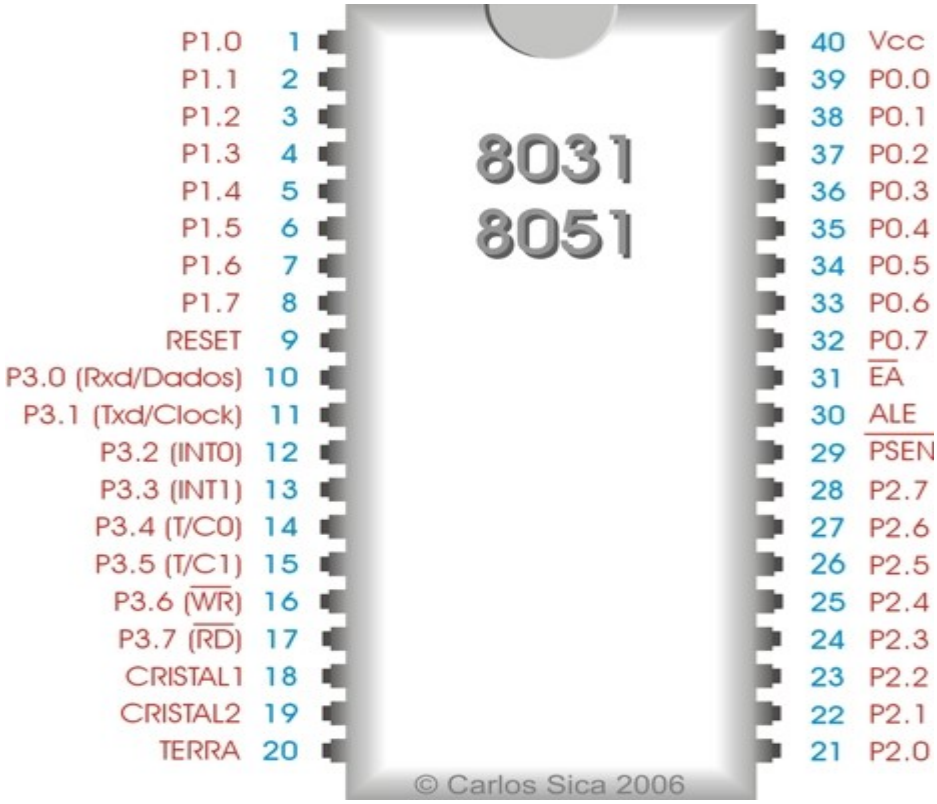
The Intel MCS-51 (commonly termed 8051) is a single chip microcontroller (MCU) series developed by Intel in 1980 for use in embedded systems. The architect of the Intel MCS-51 instruction set was John H. Wharton. Intel's original versions were popular in the 1980s and early 1990s and enhanced binary compatible derivatives remain popular today. It is an example of a complex instruction set computer and has separate memory spaces for program instructions and data.

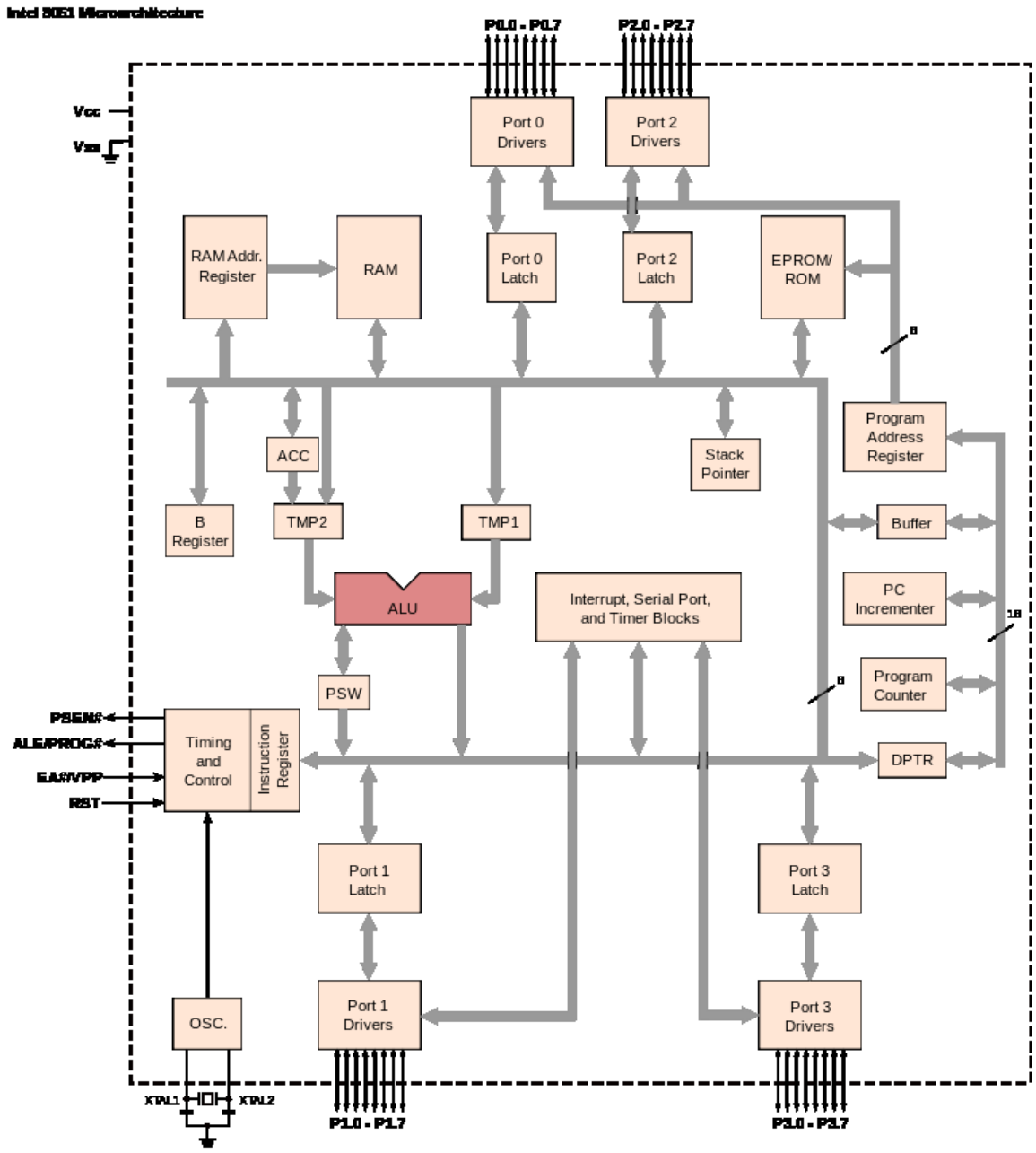
Intel's original MCS-51 family was developed using N-type metal-oxide-semiconductor (NMOS) technology like its predecessor Intel MCS-48, but later versions, identified by a letter C in their name (e.g., 80C51) use complementary metal–oxide–semiconductor (CMOS) technology and consume less power than their NMOS predecessors. This made them more suitable for battery-powered devices.

The family was continued in 1996 with the enhanced 8-bit MCS-151 and the 8/16/32-bit MCS-251 family of binary compatible microcontrollers.[3] While Intel no longer manufactures the MCS-51, MCS-151 and MCS-251 family, enhanced binary compatible derivatives made by numerous vendors remain popular today. Some derivatives integrate a digital signal processor (DSP). Beyond these physical devices, several companies also offer MCS-51 derivatives as IP cores for use in field-programmable gate array (FPGA) or application-specific integrated circuit (ASIC) designs.



8051 is the original name by Intel with 4 KB ROM and 128-byte RAM. Variants starting with 87 have a user programmable EPROM, sometimes UV erasable. Variants with a C as the third character are some kind of CMOS. 8031 and 8032 are ROM-less versions, with 128- & 256-bytes RAM. The last digit can indicate memory size, e.g. 8052 with 8 KB ROM, 87C54 16 KB EPROM, and 87C58 with 32 KB EPROM, all with 256- byte RAM.

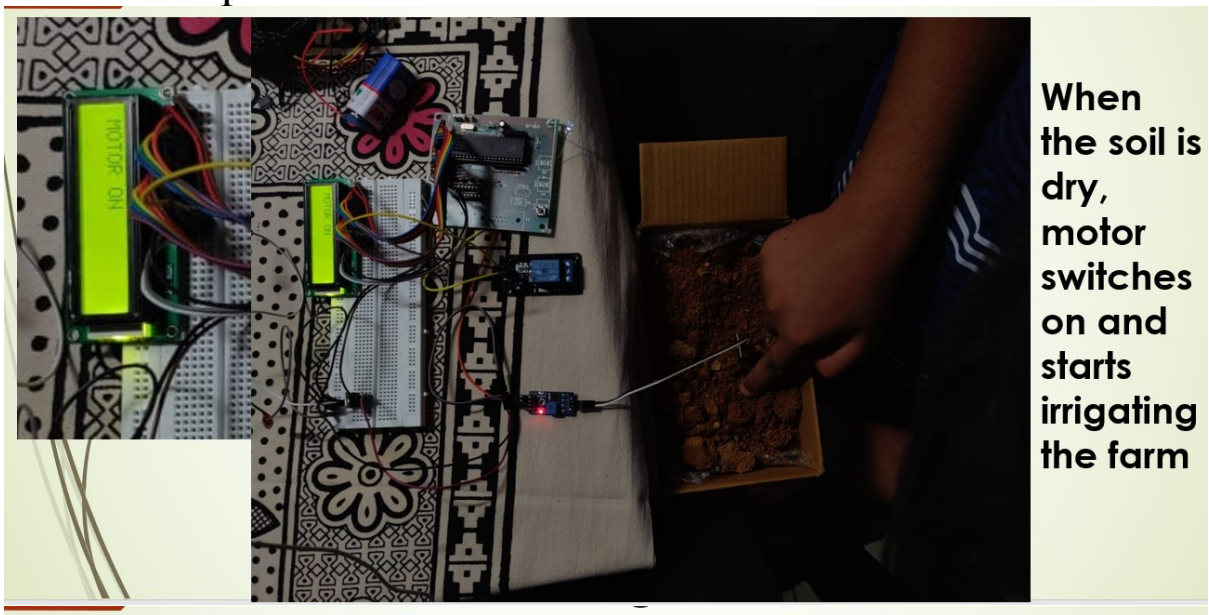



Intel 8051 Microarchitecture
P0.0 - P0.7
P2.0 - P2.7
Vcc
Vss
Port 0 Drivers
Port 2 Drivers
RAM Addr. Register
RAM
Port 0 Latch
Port 2 Latch
EPROM/ ROM
8
Program Address Register
ACC
Stack Pointer
B Register
TMP2
TMP1
Buffer
ALU
Interrupt, Serial Port, and Timer Blocks
PC Incrementer
16
PSW
8
Program Counter
PSEN#
ALE/PROG#
EA#/VPP
RST
Timing and Control
Instruction Register
DPTR
Port 1 Latch
Port 3 Latch
OSC.
Port 1 Drivers
Port 3 Drivers
XTAL1
XTAL2
P1.0 - P1.7
P3.0 - P3.7

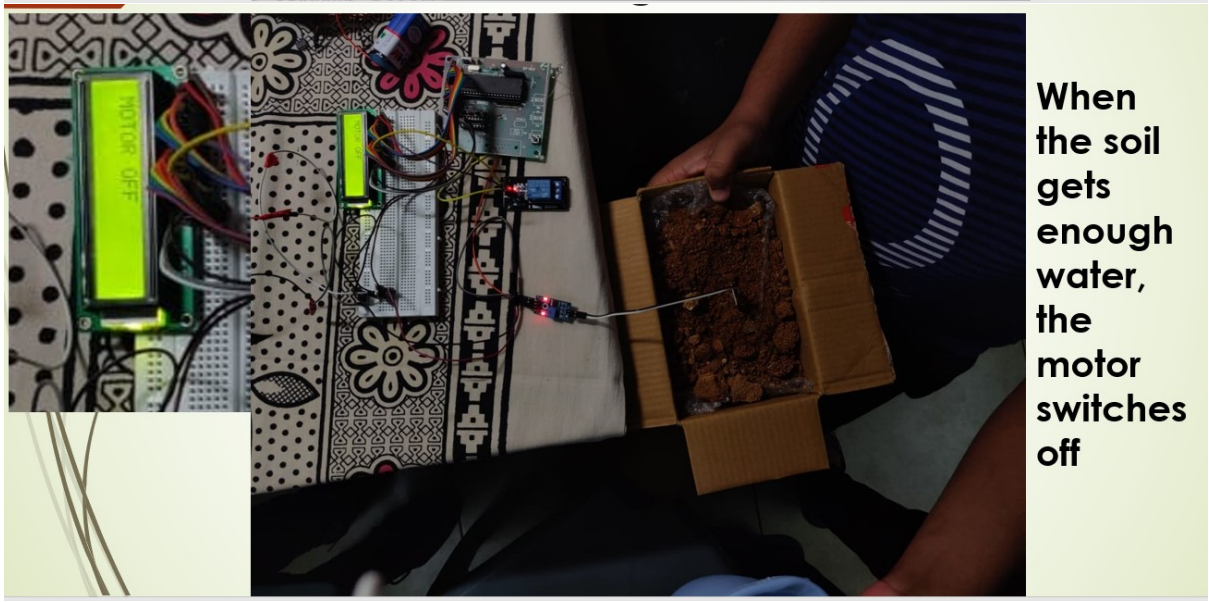
Result

The smart irrigation system is working just fine. It senses the dryness in the soil and once that reaches a threshold value it starts the water pump and the led signal says ‘motor on’ just like in the images below.

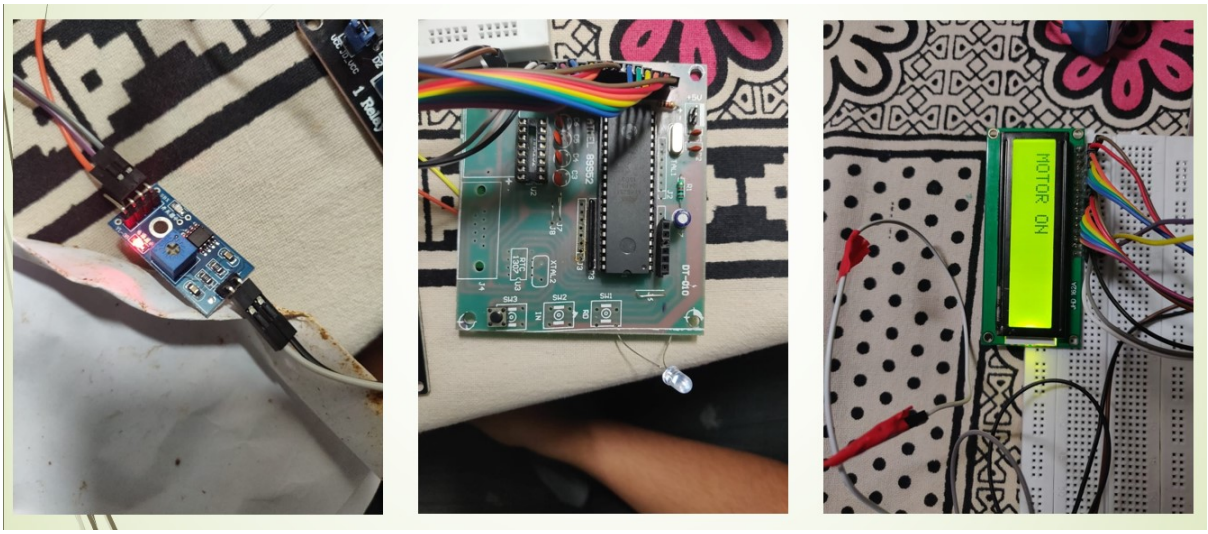
Similarly, when it has watered the soil to an optimum level then the motor switches off and the led says ‘motor off’ as seen in the picture below



When the soil is dry, motor switches on and starts irrigating the farm



When the soil gets enough water, the motor switches off



Future Scope & Modifications

There are a few modifications that we would like to mention as future prospects of this project.
They are as follows:

- We can integrate GSM (Global System for Mobiles) in our system allowing the farmers to remotely monitor the irrigation system.
- We can add other sensors like temperature sensors which will help in better irrigation of the soil.
- Adding a humidity sensor will also help in smart irrigation by avoiding irrigation during times of high humidity and higher probability of rains.
- We can make it transfer relevant data like amount of water used and time required to water the entire fields to database which will then help predict water demand models.
- Other modifications can be done to make the whole system more energy efficient and more affordable.

Conclusion

After Analyzing above result and considering social proofs and surveys, we concluded that, this Implementation can be very useful for the farmers. We would like to justify our points through below snapshot.

References

Following are some of the links we used to learn about the hardware components and research about the project:

- https://www.worldbank.org/en/topic/water-in-agriculture
- https://www.orfonline.org/expert-speak/if-80-water-consumption-in-india-is-for-agriculture-why-is-it-unregulated-and-inefficient/
- https://www.youtube.com/watch?v=k9zQjEaKtfk – about Comparators
- https://www.youtube.com/watch?v=Vs86QPCGfs4 – using relay in a circuit
- https://www.youtube.com/watch?v=I1xMNR1q7Ds – microcontroller programming
- https://www.youtube.com/watch?v=BgLQucEzqHg – making a relay circuit

- https://en.wikipedia.org/wiki/Intel_MCS-51_- about 8051 Microcontroller

- https://www.elprocus.com/embedded-system-programming-using-keil-c-language/ Embedded C programming.

Appendix

Code:

Main code:

```
#include <REGX51.H>
#include<intrins.h>
#include "serial.c"
#include "lcd.c"

sbit motor = P0^0;
sbit moist= P0^1;

void intro()
{
 cmdwrt_lcd(0x80);
        display_lcd("Smart Irrigation");
        cmdwrt_lcd(0xc0);
        display_lcd("   system   ");
        delay(65000);delay(65000);delay(65000);
}

void main()
{
        unsigned char a;
        motor = 0;

        serial_init();
        lcd_init();
        intro();

        cmdwrt_lcd(0x01);
        cmdwrt_lcd(0x80);
        while(1)
        {

                if(!moist==0)
                {
                        cmdwrt_lcd(0x80);
                        display_lcd("MOTOR ON     ");motor= 1;
                }
                else
                {
                        cmdwrt_lcd(0x80);
                        display_lcd("MOTOR OFF    ");motor = 0;
                }
```

```
        }}
```

Lcd code:

```
sbit rs = P0^5;
sbit rw = P0^6;
sbit en = P0^7;
void delay(unsigned int s)
{
        while(--s);
}

//void delay3(unsigned int dela)
//  {
//  unsigned int i;
//  for(i=0;i<dela;i++);
//  }
void Epin(void)
{
        en = 1;             // Give a pulse on E pin
        delay(500);     // so that LCD can latch the
        en= 0;              // data from data bus
        delay(500);
}
void cmdwrt_lcd(unsigned char cmd) //function to display lcd commands
        {
        rs=0;
P2&=0x0F;

P2|=( cmd&0xF0);
Epin();
P2&=0x0F;

P2|=(( cmd<<4)&0xF0);
Epin();
}
void datawrt_lcd(unsigned char datas)//function to display lcd data
        {
        rs=1;
P2&=0x0F;

P2|=(datas&0xF0);
Epin();
P2&=0x0F;

P2|=((datas<<4)&0xF0);
Epin();
}
```

```
void display_lcd(unsigned char *lcdstr)//function to display lcd string data
        {
        while (*lcdstr !='\0')
                {
                datawrt_lcd(*lcdstr);
                lcdstr++;
                }
        }

void lcd_init()
        {
        rw=0;
   cmdwrt_lcd(0x38);
   cmdwrt_lcd(0x0c);
        //lcdclr();

delay(50);
P2 &= 0x0F;                     // Make Data pins zero
        P2|= 0x30;                      // Write 0x3 value on data bus
        Epin();             // Give pulse on E pin

 delay(50);

        P2&= 0x0F;                      // Make Data pins zero
        P2 |= 0x30;                     // Write 0x3 value on data bus
        Epin();             // Give pulse on E pin

 delay(50);

        P2 &= 0x0F;                     // Make Data pins zero
        P2 |= 0x30;                     // Write 0x3 value on data bus
        Epin();             // Give pulse on E pin

 delay(50);

        P2 &= 0x0F;                     // Make Data pins zero
        P2 |= 0x20;                     // Write 0x2 value on data bus
        Epin();             // Give pulse on E pin

        delay(50);
 /////////////// Reset Process End ///////////////
cmdwrt_lcd(0x28);   //function set
cmdwrt_lcd(0x0c);   //display on,cursor off,blink off
cmdwrt_lcd(0x01);   //clear display
cmdwrt_lcd(0x06);   //entry mode, set increment
}
```

Serial communication:

```
unsigned char asc,ok[2],r[4],a,i,oxoa,num[15], a,m[20],j,temp[10],temp1[10];
        unsigned char cnt1;
        unsigned char cnt; /*= 0x00*/
        int s=0;
void serial_tx(unsigned char srda);
void serial_init()
        {
        TMOD = 0x29; //settimer for serial commun.
        TH1 = 0xFD;     //set baudrate
        SCON = 0x50; //set serial control register
        TR1 = 1;          //enable transmit interrupt
        }

 void serial_tx(unsigned char srda)
        {
                SBUF = srda;   //tx data to serial buffer register
                while(TI == 0);
                TI = 0;
        }


unsigned char serial_rx(void) //serial  receive
        {
        unsigned char rbuf;
        while(RI == 0);
        RI = 0;
        rbuf = SBUF;
        return rbuf;
        }
void serial_transmit(unsigned char *srstr)    //serial  transmit
        {
//                      cmdwrt_lcd(0x80);
//                              display_lcd("           ");
//              cmdwrt_lcd(0x80);
        while(*srstr != '\0')
                {
                serial_tx(*srstr);
//      datawrt_lcd(*srstr);
                srstr++;
                }
        }
```

Thanks!

MICROPROCESSORS AND INTERFACING

CSE2006

S M A R T IR R IG A T IO N S Y S T E M

ABSTRACT & OBJECTIVE

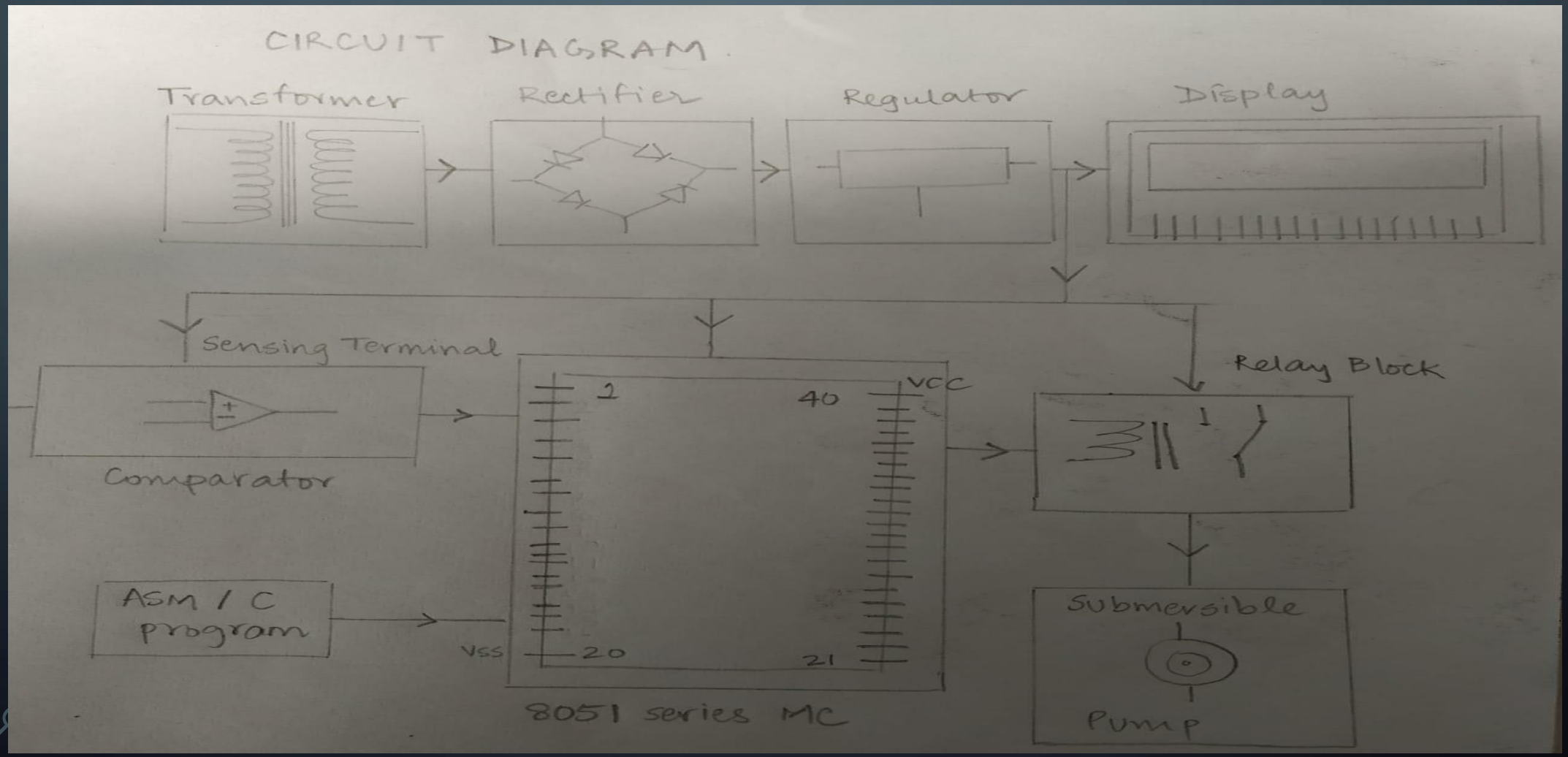
India is an agrarian country, but our farming technology is far outdated. We still use the technology that we were using more than 50 years ago. It was a different age back then and the technology was sufficient at that time.

But now, things are very different. These are very expensive time to live, where there is high demand for food as well as water putting extreme pressure on this sector to produce more food using the least amount of water possible. At the same time, the farmers in India are amongst the poorest of all who cannot afford fancy and expensive technology available to aid them

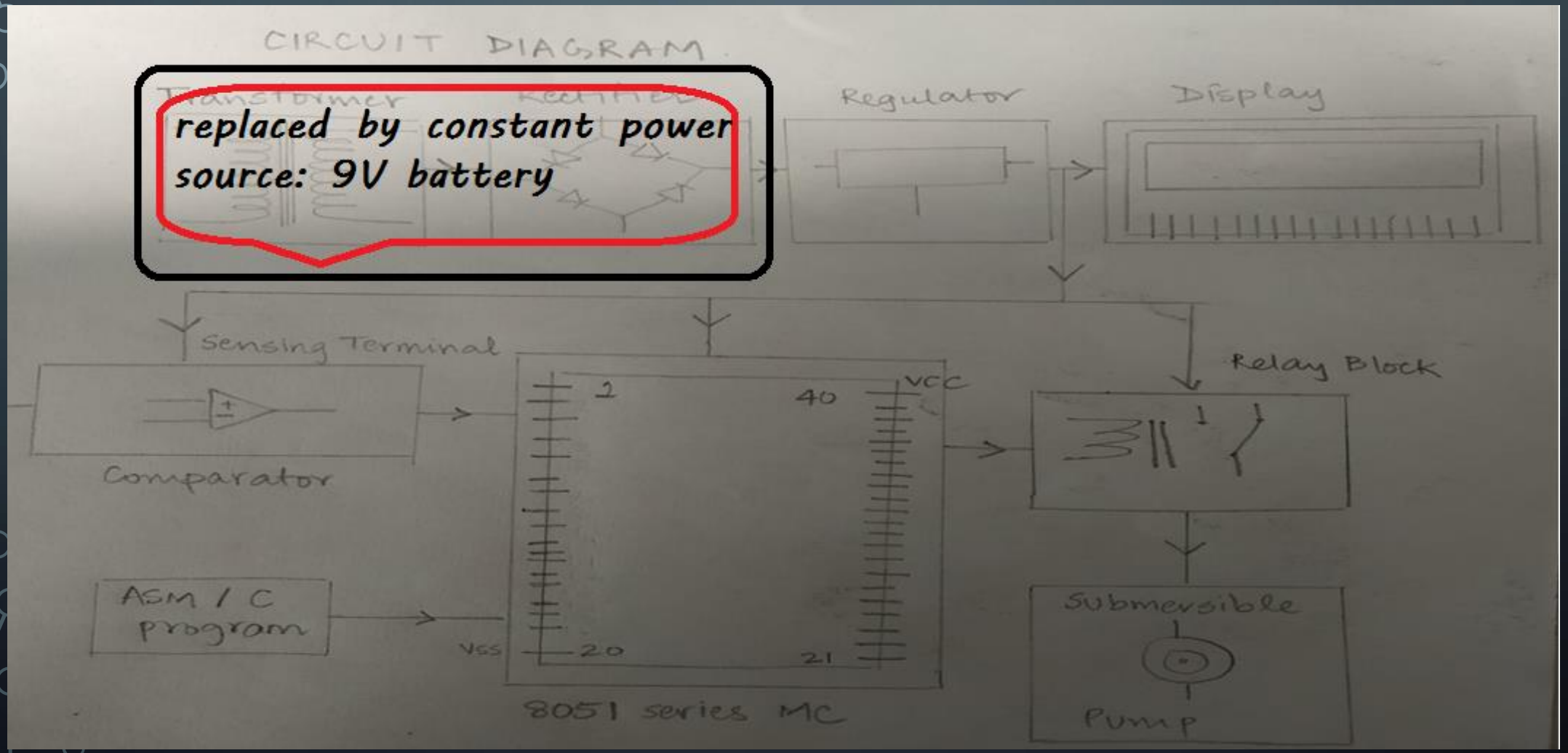
- # An effort towards providing a convenient, worry free, energy & cost efficient irrigation system to the farmers.
- # A promising water conservation technique.

PROPOSED BLOCK DIAGRAM*...

{TENTATIVE}



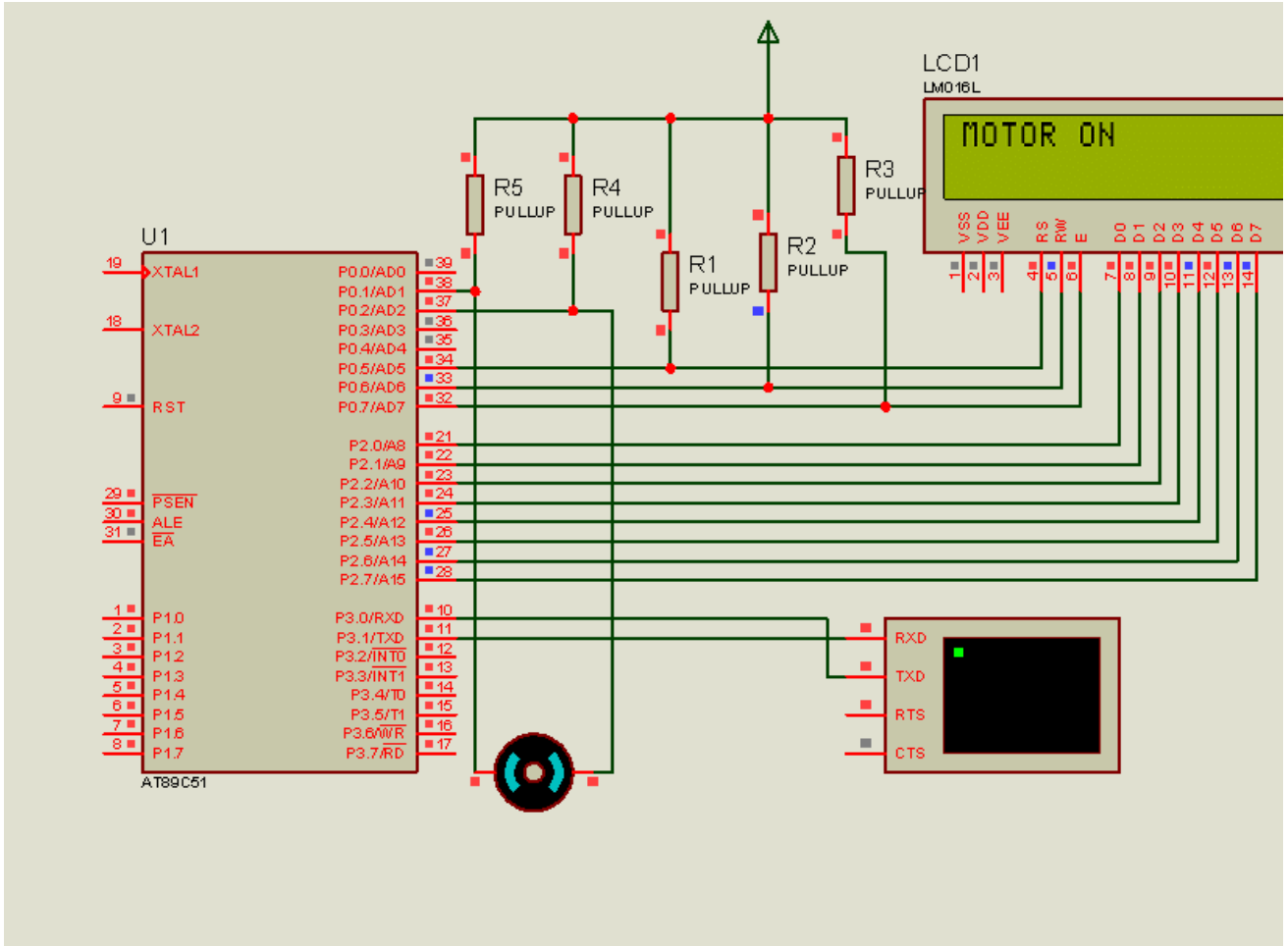
MODIFIED BLOCK DIAGRAM*...



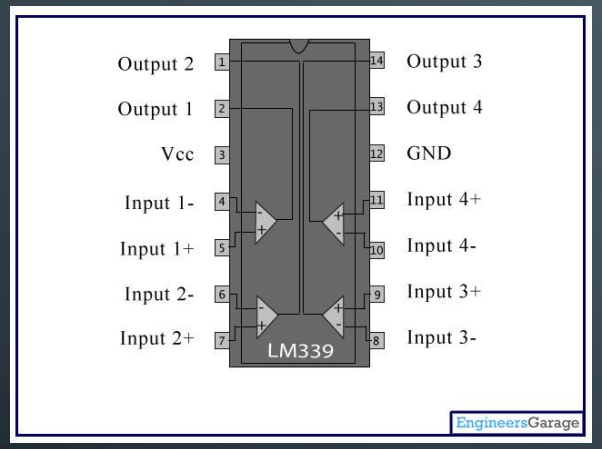
ALGORITHM TO SOLVE THE PROBLEM

- This works on the principal that when the soil is wet, electricity will start flowing through it and thus the potential drop across two points will decrease
- When the soil is dry, there is no electricity flowing through the soil and the potential drop across two points will increase.
- We will be using this increase and decrease in the potential drop to operate our system

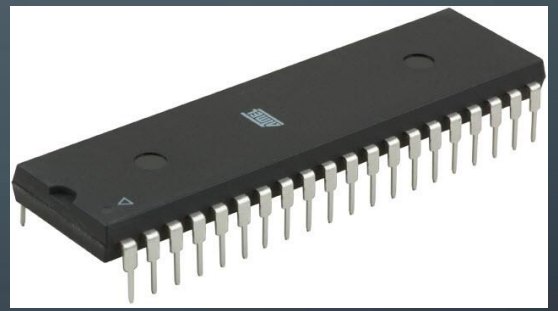
SIMULATION OF CIRCUIT DIAGRAM



WORKING OVERLOOK



- **Input form soil** taken by the operational amplifier acting as a comparator



- **Processing** done by the microcontroller

- **Output** given to pump and LCD screen.

WORKING METHODOLOGY

We are using following components:

- 8051 C-Series MC
- Breadboard
- 2*16 pin LCD
- 1DC motor
- LM 741 op amp
- 7805/7812 Voltage regulator
- 1 k Ω resistors
- 10 k Ω Variable resistor
- Relay, Jumper wires and some other basic components

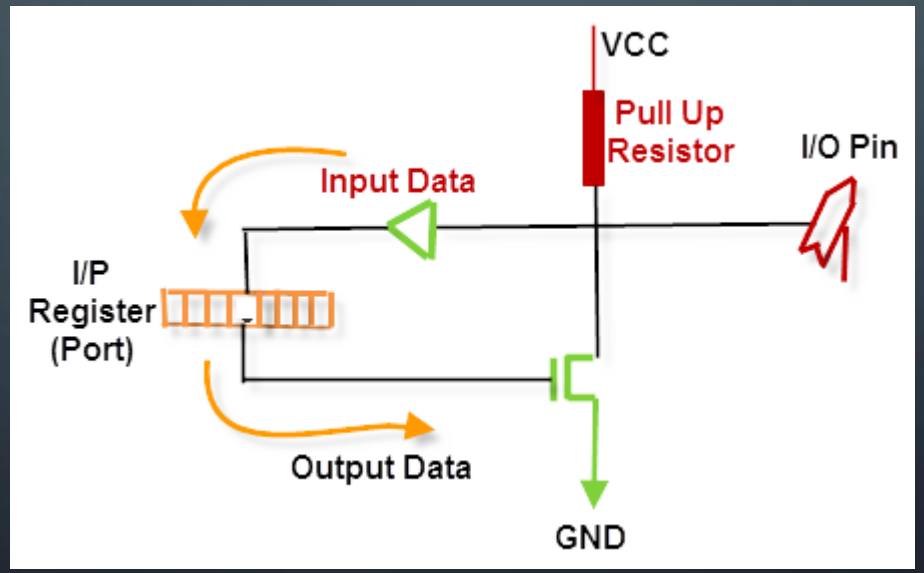
8051 C-SERIES MICROCONTROLLER

- A microcontroller is a small computer on a single IC that integrates all the features that are found in the microprocessor. In order to serve different applications, it has a high concentration of on chip facilities such as RAM, ROM, I/O ports, timers, serial port, clock circuit and interrupts. Microcontrollers are used in various automatically controlled devices such as remote controls, automobile engine control systems, medical devices, power tools, office machines, toys, and other embedded systems.

SIMILARLY, IN ORDER TO CONFIGURE A MICROCONTROLLER PIN AS AN INPUT, IT IS NECESSARY TO APPLY A LOGIC ONE (1) TO THE SUITABLE PORT. IN THIS CASE, THE VOLTAGE LEVEL ON THE APPROPRIATE PIN WILL BE 5V. THIS MAY SEEM CONFUSING, IT ALL BECOMES CLEAR AFTER STUDYING SIMPLE ELECTRONIC CIRCUITS CONNECTED TO AN I/O PIN.

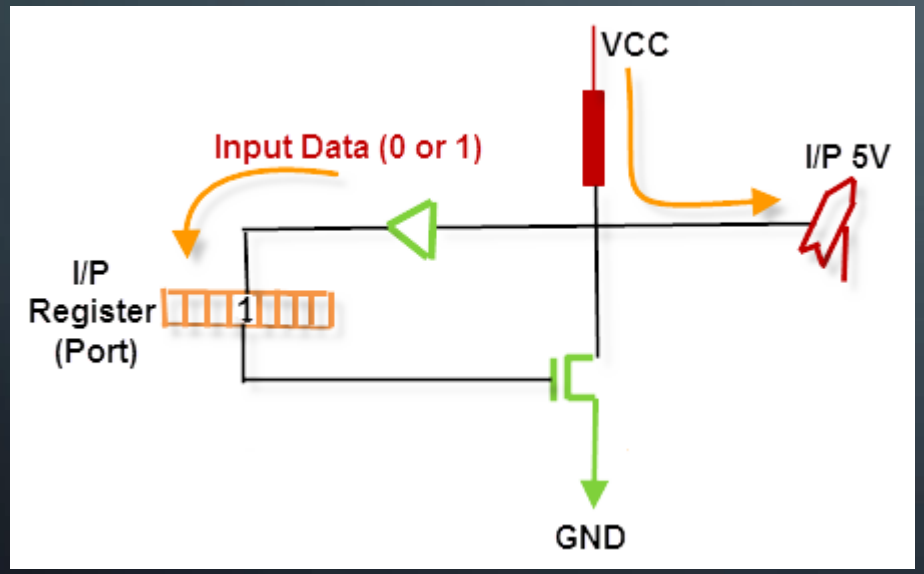
INPUT / OUTPUT (I/O) PIN

THE BELOW FIGURE SHOWS A SIMPLIFIED SCHEMATIC OF ALL CIRCUITS WITHIN THE MICROCONTROLLER, WHICH IS CONNECTED TO ONE OF ITS PINS. IT STATES TO ALL THE PINS EXCEPT THOSE OF THE P0 PORT THAT DO NOT HAVE PULL-UP RESISTORS BUILT-IN .



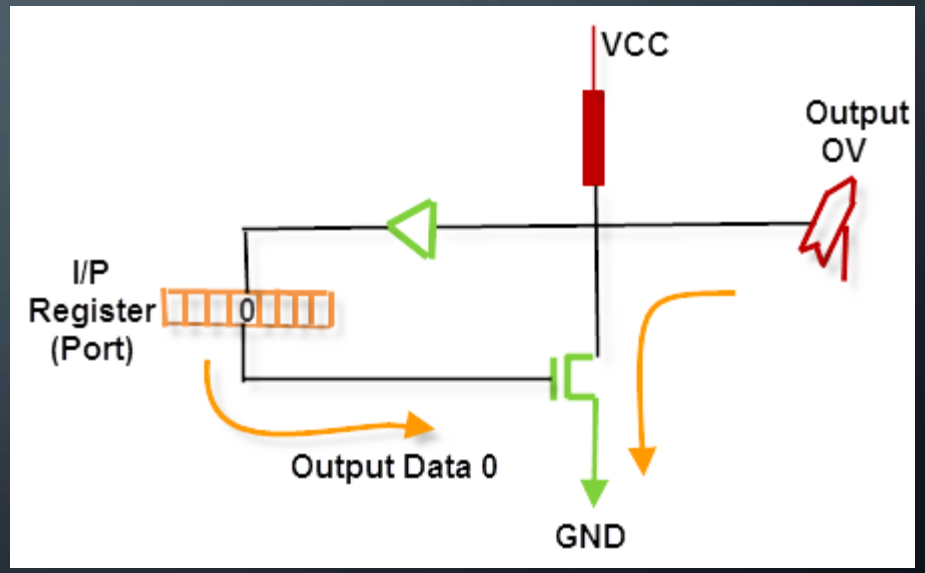
INPUT PIN

A LOGIC 1 IS APPLIED TO A BIT OF THE P REGISTER. THE FIELD EFFECT TRANSISTOR IS TURNED OFF, AND THE APPROPRIATE PIN REMAINS CONNECTED TO THE POWER SUPPLY VOLTAGE, OVER A PULL-UP RESISTOR OF HIGH RESISTANCE.



OUTPUT PIN

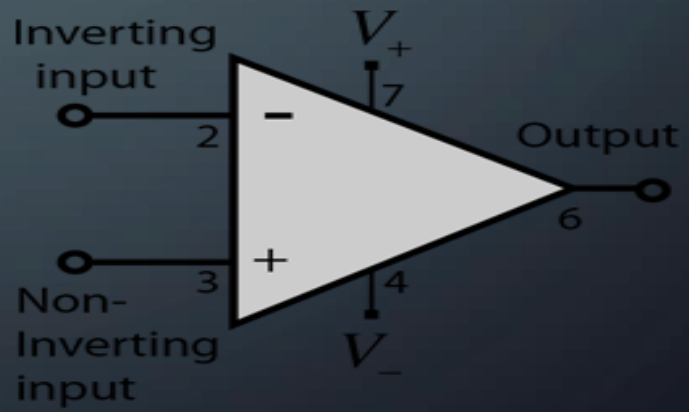
A LOGIC 0 IS APPLIED TO A BIT OF THE REGISTER P, THEN THE OUTPUT FIELD EFFECT TRANSISTOR IS TURNED ON, THEREFORE CONNECTS THE APPROPRIATE PIN TO GROUND.



LM741- OPERATIONAL AMPLIFIER

- AN OPERATIONAL AMPLIFIER IS A DC-COUPLED HIGH-GAIN ELECTRONIC VOLTAGE AMPLIFIER WITH A DIFFERENTIAL INPUT AND, USUALLY, A SINGLE-ENDED OUTPUT. IN THIS CONFIGURATION, AN OP-AMP PRODUCES AN OUTPUT POTENTIAL THAT IS TYPICALLY HUNDREDS OF THOUSANDS OF TIMES LARGER THAN THE POTENTIAL DIFFERENCE BETWEEN ITS INPUT TERMINAL. AND THAT OUTPUT VOLTAGE IS GENERALLY 2-2.5 V LESS THAN THE EXTERNAL OUTPUT VOLTAGE PROVIDED.

- WE ARE USING THIS AMPLIFIER AS A MOISTURE SENSOR IN OUR CIRCUIT. TECHNICALLY IT IS NOT A DEVICE WHICH IS USED AS A SENSOR.



- 7805/78012 VOLTAGE REGULATOR

  We are using it to convert 9V power supply to 5V.

- 10 k VARIABLE RESISTER

  It will be used before relay channel or any place where it will be needed.

- RELAY CHANNEL

  It will be used as a switch to turn motor on or off.

INDIVIDUAL'S CONTRIBUTION….

Member's name		Contribution
18BCE0101	ANIKET KUMAR	Research, Marketing, Assembling, Coding, Presentation
18BCE0125	Krishna Nand Dwivedi	Coding, Presentation, Assembling ,Research
18BCE2279	Ashutosh Singh	Coding, Marketing, Research, Assembling

REFERENCES

- Following are some of the links we used to learn about the hardware components and research about the project:
- • https://www.worldbank.org/en/topic/water-in-agriculture
- • https://www.orfonline.org/expert-speak/if-80-water-consumption-in-india-is-for-agriculture-why-is-it-unregulated-and-inefficient/
- • https://www.youtube.com/watch?v=k9zQjEaKtfk – about Comparators
- • https://www.youtube.com/watch?v=Vs86QPCGfs4 – using relay in a circuit
- • https://www.youtube.com/watch?v=I1xMNR1q7Ds – microcontroller programming
- • https://www.youtube.com/watch?v=BgLQucEzqHg – making a relay circuit
- • https://en.wikipedia.org/wiki/Intel_MCS-51 - about 8051 Microcontroller
- • https://www.elprocus.com/embedded-system-programming-using-keil-c-language/ Embedded C programming.

SMART IRRIGATION SYSTEM

KRISHNA NAND DWIVEDI,ANIKET KUMAR,ASHUTOSH SINGH | BHULAKSHMI BONTHU| SCOPE

Introduction

Our solution is to build a smart irrigation system. It detects the moisture content of the soil based on which it turns the system on/off. This works on the principle that when the soil is wet, electricity will start flowing through it and thus the potential drop across two points (sensing terminals) will decrease When the soil is dry, there is no electricity flowing through the soil and the potential drop across two points will increase. We will be using this increase and decrease in the potential drop to operate our system.

Motivation

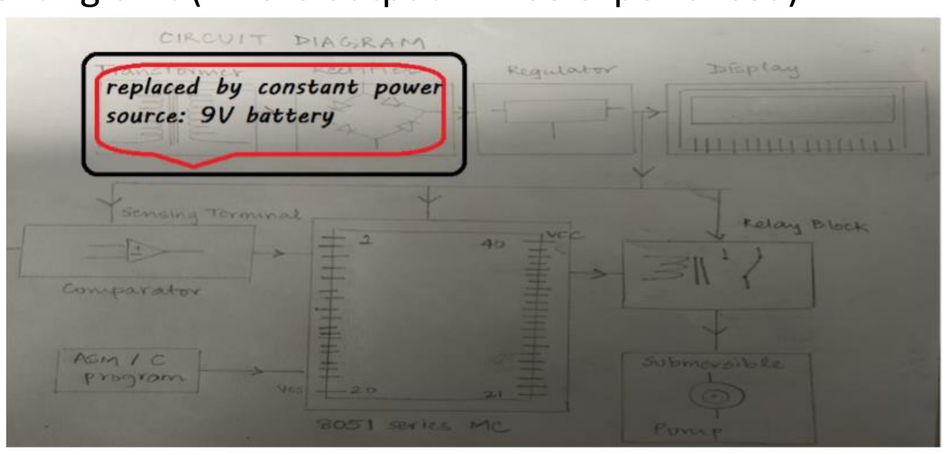
During the 2011 census, India entered the league of water deficient nations. As per the Central Water Commission, 85.3% of the total water consumed was for agriculture in the year 2000. This is likely to decrease to 83.3% by 2025. Smart Irrigation System As the name suggests, it will automatically water the plants when there is insufficient water for the crops.

SCOPE of the Project

> We can integrate GSM (Global System for Mobiles) in our system allowing the farmers to remotely monitor the irrigation system.
> We can add other sensors like temperature sensors which will help in better irrigation of the soil.
>Adding a humidity sensor will also help in smart irrigation by avoiding irrigation during times of high humidity and higher probability of rains.
> We can make it transfer relevant data like amount of water used and time required to water the entire fields to database which will then help predict water demand models.

Methodology

Our project comprises of mainly four units.
1.Power supply unit
2.Input unit (sensing part)
3.Processing unit (logical analysis)
4.Implementing unit (where output will be experienced).



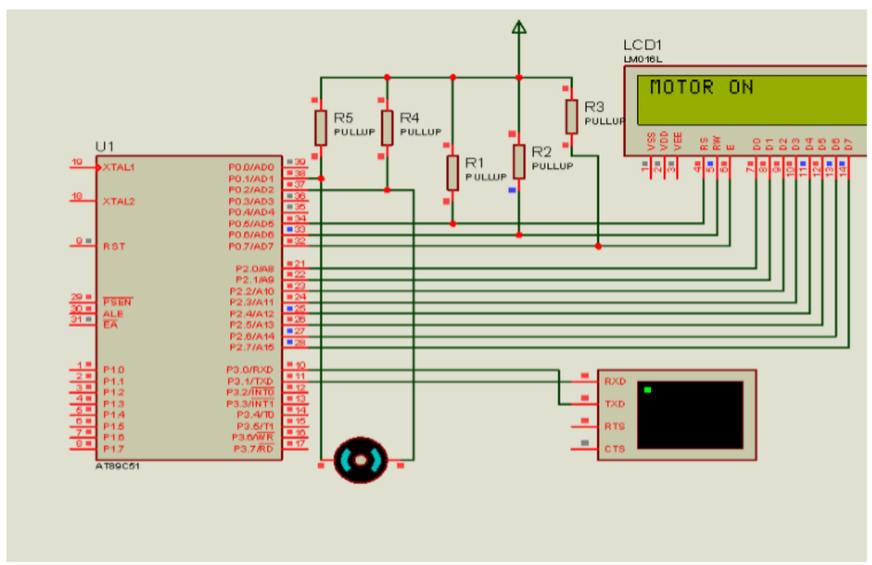
Power supply unit>> It consists of 9v batteries and voltage regulator (to convert 9v to 5v).

Processing unit>> Our processing unit (micro controller) comprises of 8051 c series IC with pullup resistors, required capacitors, crystal and other required resistors (generally of 1000 ohms).

Implementing unit >>It consists of relay switch which will analyses the digital output of microcontroller and operate the load as per the logical output.

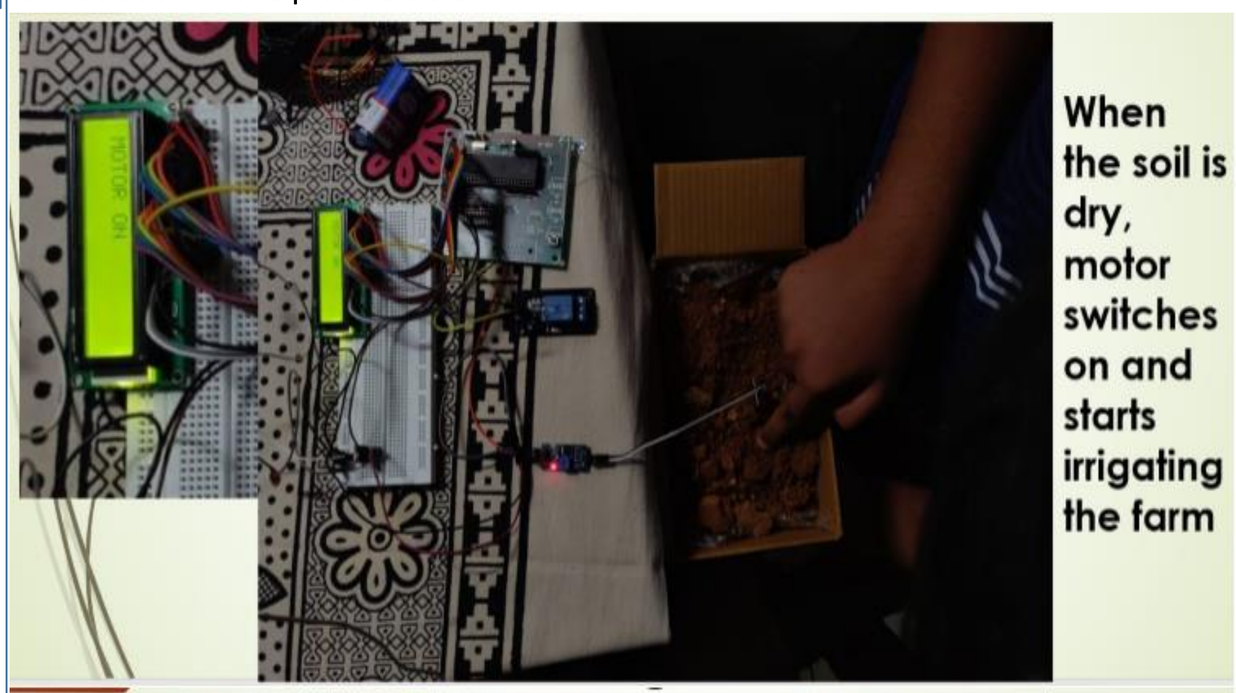
Interconnections of all these units—

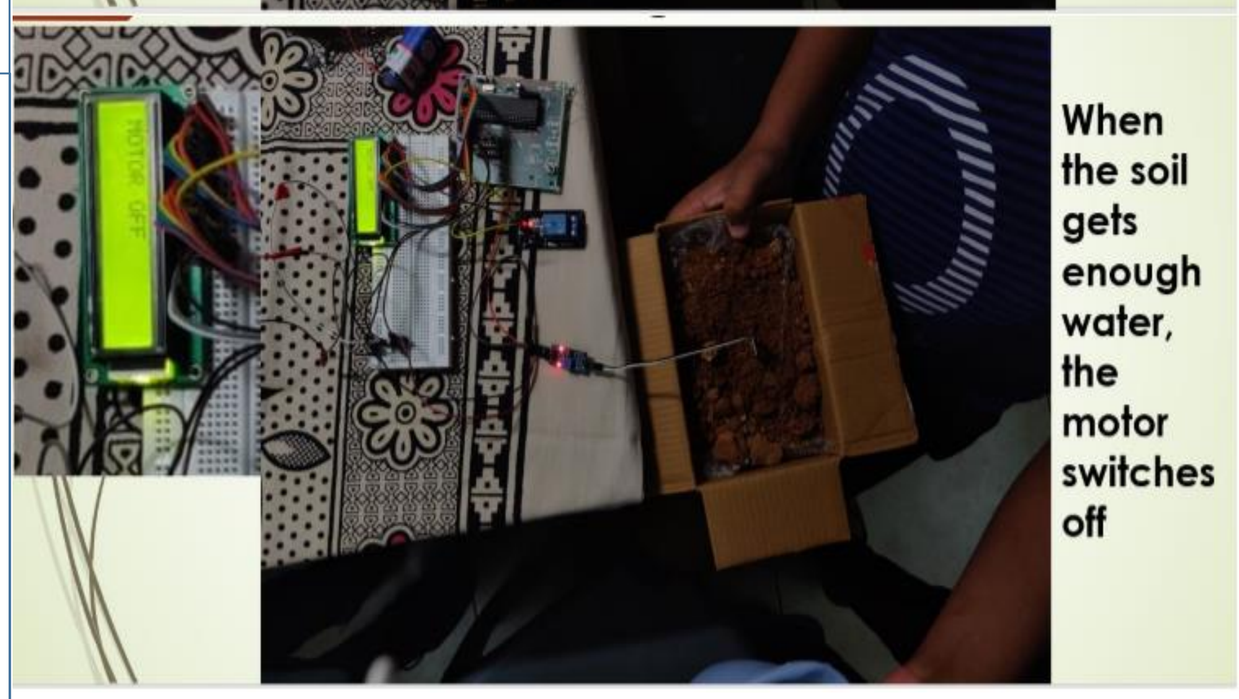
5v input will be supplied to microcontroller & comparator, VCC, GND and Port0-P1 will be connected to comparator. Port 0-P0 will be used for output and will be connected to relay along with the VCC, GND coming as output from microcontroller and input to the display. Display will be connected like schematic diagram.

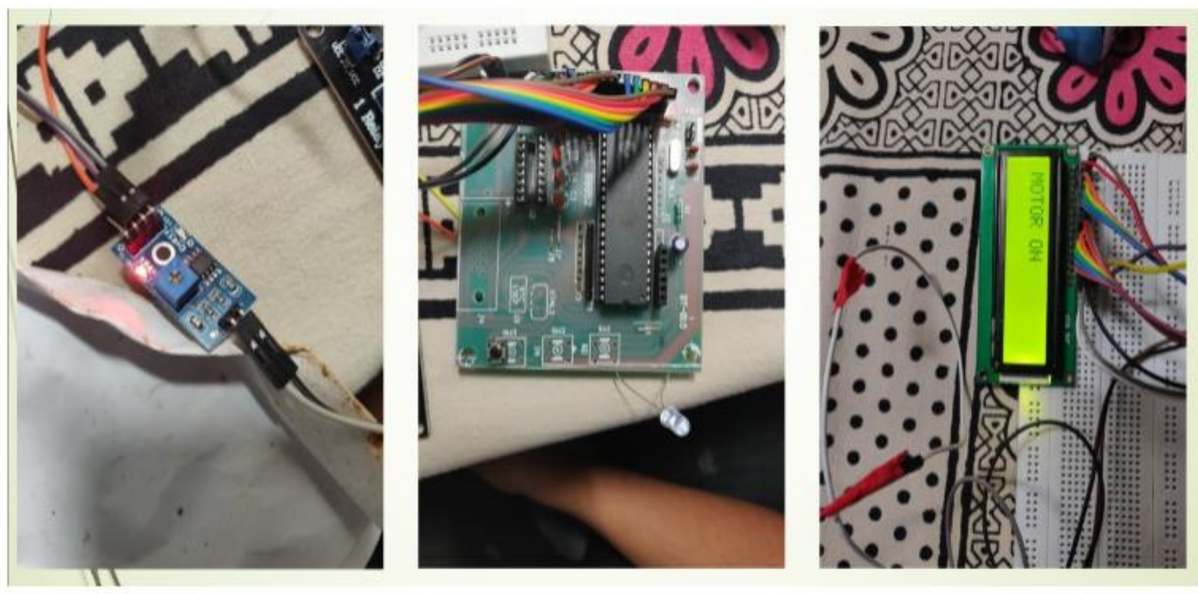


Results

The smart irrigation system is working just fine. It senses the dryness in the soil and once that reaches a threshold value it starts the water pump and the led signal says ‘motor on’ just like in the images below. Similarly, when it has watered the soil to an optimum level then the motor switches off and the led says ‘motor off’ as seen in the picture below







Conclusion

We would like to justify our points through below snapshot.

References

>https://www.worldbank.org/en/topic/water-in-agriculture
>https://www.orfonline.org/expert-speak/if-80-water-consumption-in-india-is-foragriculture-why-is-it-unregulated-and-inefficient/
➢ https://www.youtube.com/watch?v=k9zQjEaKtfk –
> https://www.youtube.com/watch?v=Vs86QPCGfs4 –