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Automatic Irrigation and Green House Environment Controlling Robotic System

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Abstract:- Centuries ago the Romans have created the first greenhouses to develop the "modern lifestyle" and where irrespective of season we can have fresh vegetables. Seeking a solution to the unavailability of fresh vegetables in every season, they started to grow plants indoors and thus invented the first greenhouses. The last century has seen many technological advances that have been used to construct more efficient and cheaper greenhouses, which in turn has made them available to the ordinary gardeners. Because of the invention of large sheets of polyethylene, the greenhouse construction has been revolutionized and today the percentage of greenhouses built using poly sheet are almost more than 90%. During the same time Aluminum and plastic hoops were invented made up of galvanized steel tubing, aluminum extrusions were an easy and cheapest way to construct a greenhouse.

Nowadays greenhouses are becoming automated, because of which people can save time on activities like watering. Automated greenhouses are equipped with automatic watering system including providing water and fertilizers to the plants whenever needed, monitoring of temperature and humidity and controlling with the help of automatic vents that opens and closes based on the temperature, automatic fans and heaters. In order to make greenhouses more efficient and cheaper many new materials are also used like fiberglass, polycarbonate and acrylic panels. Though there has been tremendous change in greenhouse construction, Only the passion for gardening has not Changed through centuries. Because of many technology advances now gardeners or farmers can spend their time taking care of the plants instead of spending more efforts on watering or maintaining the required environment in greenhouses.

Keywords:- *PIC controller, Temperature and soil moisture sensor, LCD, DC motor, DC pump, L293D, DC brushless fan.*

I. INTRODUCTION

Water must be properly utilized as it is a very precious natural resource. Agriculture sector utilize a lot of water. Sometimes more than the actual need of plants. Watering must be done on a timely basis and its time consuming process. So here in this project our aim is to develop an automatic irrigation system which measures the soil moisture and temperature of green house and automatically turns on and off the water supply system and fan system. After installment of this project it requires less human intervention. The circuit is based on PIC controller, a temperature sensor and a soil moisture sensor. The designed system can be used in turf grass or with small garden plants. PIC 18F4520 is the main processing IC. Greenhouses Environment Control System form an important part of the agriculture in our country as they can be used to grow plants under controlled climatic conditions for optimum produce.

II. PURPOSE

- The main purpose of this project is increasing crop yields as appropriate environmental conditions are necessary for optimum plant growth.
- Making the data acquisition process automatic to collect the information related to different greenhouse parameters like soil moisture content, temperature with more efficiency and less human intervention.
- Increases farmer's profit as it helps to reduces water wastage, fertilizer cost.

III. ELECTRONIC AND HARDWARE DESIGN ASPECTS

A. PIC CONTROLLER

PIC18F4520 is a high-speed 8-bit Microcontroller unit. Which comes with the 40 pins out of which 36 pins can be used as I/O pins. It has Power-on-Reset (POR), the Extended Watchdog Timer (WDT) circuitry, which can be programmed for 4ms to 131s.

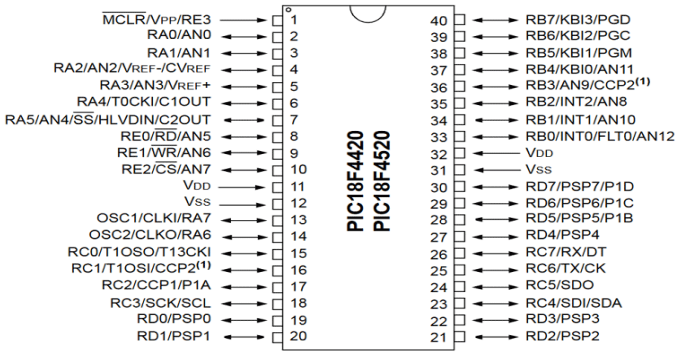

Fig. 1: PIC18F4520 controller

It has inbuilt ADC which is used to convert various analog inputs into digital form for further data processing.

Specifications :-
- 40-pin Microcontroller
- Flash Program Memory: 32 Kbytes
- Data Memory (EEPROM): 256 bytes
- Data Memory (SRAM): 1536 bytes
- 36 I/O Pins

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- One 8-bit timer / Three 16-Bit timers
- 10-bit 13 Channels A/D Converter
- PWM: 10-bit Two Modules
- up to 40MHz External Oscillator
- 8MHz Internal Oscillator

A. Temperature sensor

LM35 is a temperature measuring device. It has an analog output voltage which is proportional to the temperature. It does not require any external calibration circuitry. The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases.

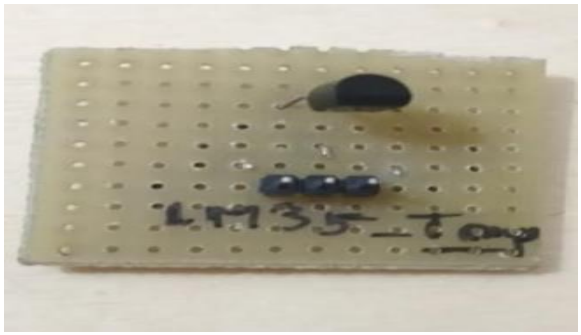

Fig. 2: LM35 temperature sensor

It is used to sense the temperature of greenhouse and according to that PIC controller will turn on the fan when the temperature exceeds the given limit.

B. Soil moisture sensor

This is a digital soil moisture sensor. By inserting the sensor in the soil we can measure moisture content in soil. It gives a digital output where 0V represents low moisture level and 5V represents high moisture contents.

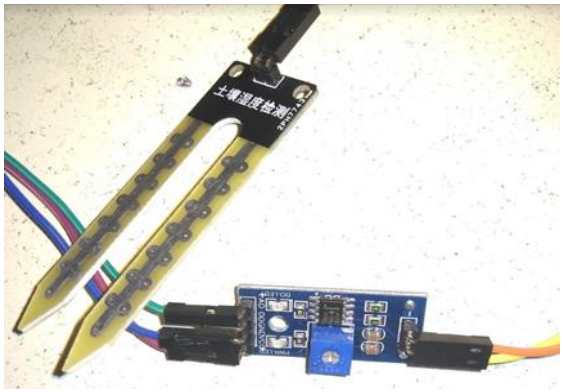

Fig. 3: Soil moisture sensor

Specifications :-

- Operating voltage: 3.3V~5V
- Dual output mode both digital and analog output, analog output is more accurate
- Easy to install
- Consisting power indicator and switching digital output indicator, red and green respectively
- Having LM393 comparator chip, stable
- Digital (DO) and analog(AO) output interface

C. LCD Display

Liquid crystal display(LCD) is a 16*2 display. It is an electronic display module. It uses liquid crystal to produce a visible image.

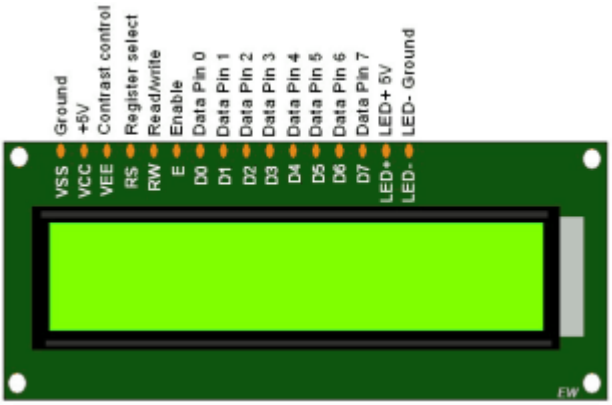

Fig. 4: LCD Display

It is used for displaying the temperature and moisture values sensed in the greenhouse environment.

A Liquid Crystal Display (LCD) is a thin, flat display device made up of a number of color of monochrome pixel arrayed in front of light source or reflector. It is often utilized in battery-power electronic device because it uses very small amount of electric power.

D. DC motor

A DC motor converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation. DC Motor is generally a simple DC motor with a gearbox attached to it. This can be used in variety of robotic applications.

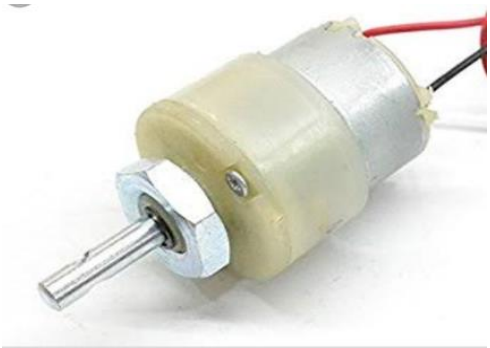

Fig. 5: DC motor

It is used for the movement of the robot.

Specifications :-

- 30- RPM
- Operating Voltage: 12Volt DC
- Attached plastic gearbox
- Torque: 2 kg-cm
- No-load current = 60 mA(Max)
- Load current = 300 mA(Max).

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E. DC brushless fan

This Brushless DC Cooling Fans are operating at 24V with a dimension of 80x80mm. This Cooling fans helps your electrical products cool, extend the life of the system, and perform better.

Fig. 5: DC brushless fan

The fan will be turned on when the temperature exceeds the given limit.

Specifications :-
- Dimensions: 80 x 80 x 10mm
- Voltage: 24V
- Speed: 2700-3000 rpm
- Cable length: 30cm
- Bearing Type: Bushing / Ball

F. DC pump

This is a low cost, small size Submersible Pump which can be operated from a 3 ~ 6V power supply. It sprinkles the water when the moisture content of the soil goes below the given limit.

- **Irrigation unit:** When the moisture content of the soil goes below the predefined limit the irrigation unit sprinkles the water with the help of DC pump.

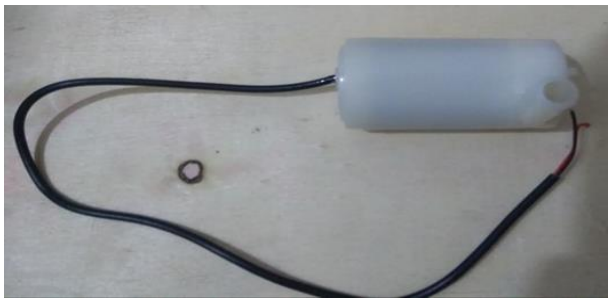

Fig. 7: DC pump

Specifications:-
- Operating Voltage: 3 ~ 6V
- Operating Current: 130 ~ 220mA
- Flow Rate: 80 ~ 120 L/H
- Maximum Lift: 40 ~ 110 mm
- Driving Mode: DC, Magnetic Driving
- Diameter of outside outlet: 7.5 mm
- Diameter of inside outlet: 5 mm

G. LED and Buzzer

A Light Emitting Diode (LED) is a semiconductor device. LED is an indicating device which emits light when an electric current passes through it.

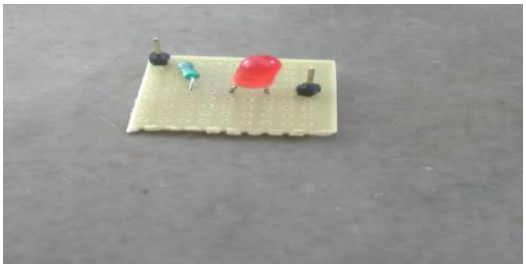

Fig. 8: LED

The buzzer is a sounding device used for signaling purpose that can convert audio signals into sound signals. It is usually powered by DC voltage.

Fig. 9: Buzzer

LED and buzzer will be turned on if the temperature exceeds the given limit and the moisture content goes below the predefined value.

H. L293D

The L293 and L293D are quadruple high-current half-H drivers. The L293D is an upgraded version of L293. The L293D provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Designed to drive inductive loads and also other high-current/high-voltage loads in positive-supply applications.

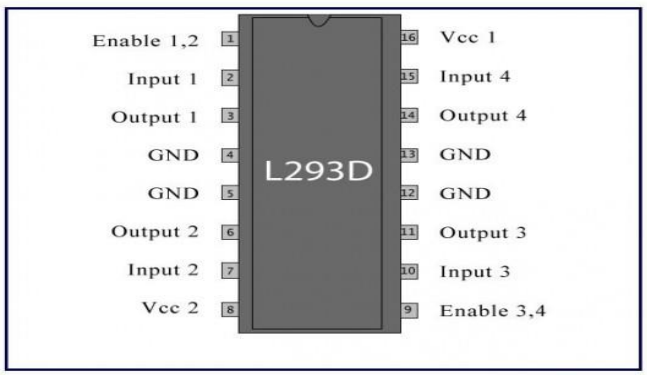

Fig. 10: L293D

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Between controller and motor L293D driver IC acts as a bridge. Single L293D is capable of handling two DC motors simultaneously. as it is comparing to two H-bridge circuits inside. The L293D is compact in size.

IV. PROPOSED SYSTEM

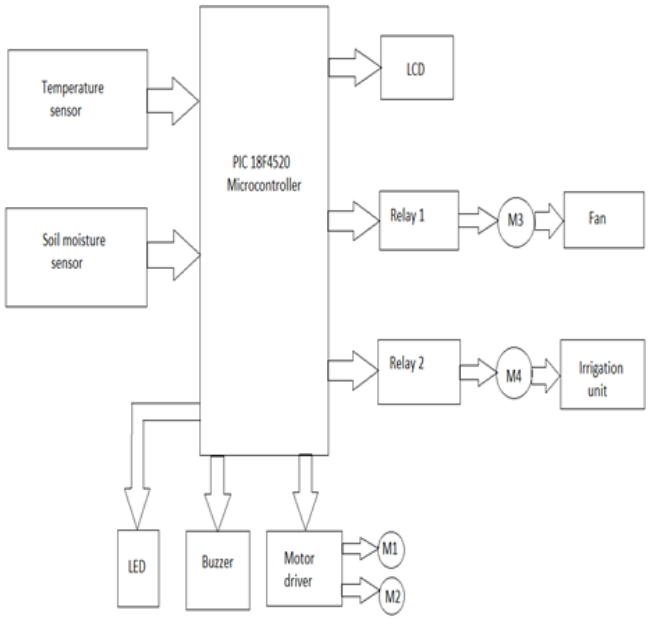

Fig. 11: Block Diagram

This project consists of temperature sensor, soil moisture sensor for monitoring and controlling temperature and humidity in greenhouses. This unit is installed on a robot that moves through the greenhouse. This project consist of two main modules, first is "Parameters monitoring" then "Parameters controlling" which will be achieved by automatic movement of robot.

Temperature and soil moisture content will be displayed by display unit. Parameter controlling module is used to control the parameters like temperature and moisture. This system is useful, as manually monitoring and controlling all these parameters is not possible and this system is more accurate. Lesser labor requirement as robot will move automatically throughout the greenhouse.

V. SIMULATION RESULTS

A. *Moisture < 30 % then buzzer and irrigation unit will turn on*

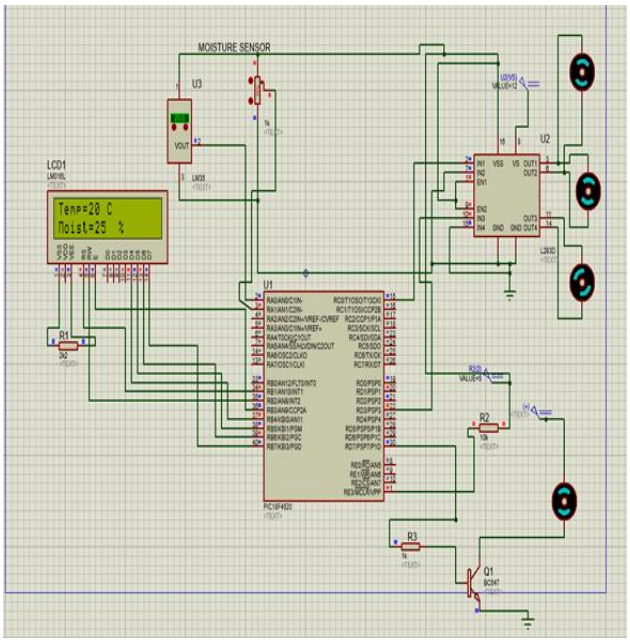

Fig. 12: Moisture < 30 % then buzzer and irrigation unit will turn on

B. *Temp > 40°C then buzzer and fan will turn on*

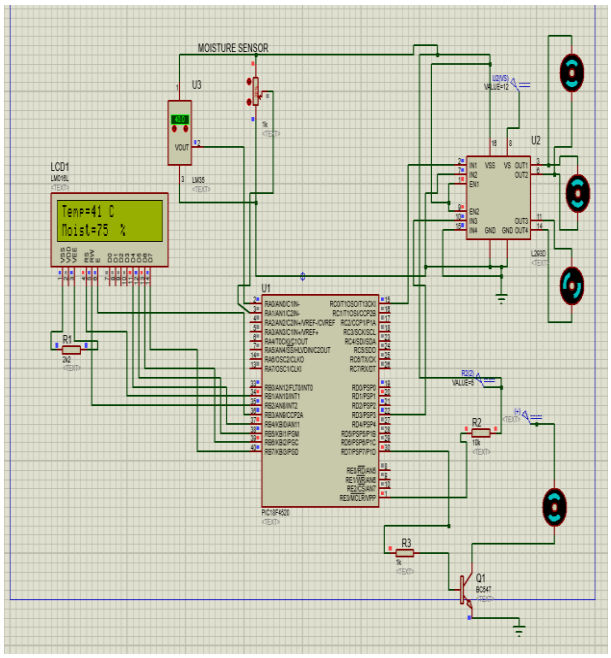

Fig. 13: Temp > 40°C then buzzer and fan will turn on

C. Temp > 40°C then buzzer and fan will turn on

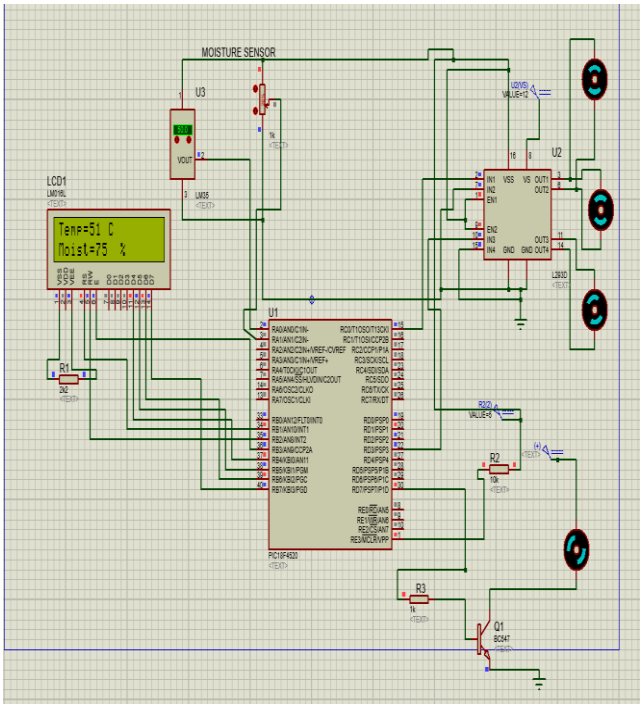

Fig. 14: Temp > 40°C then buzzer and fan will turn on

VI. RESULTS

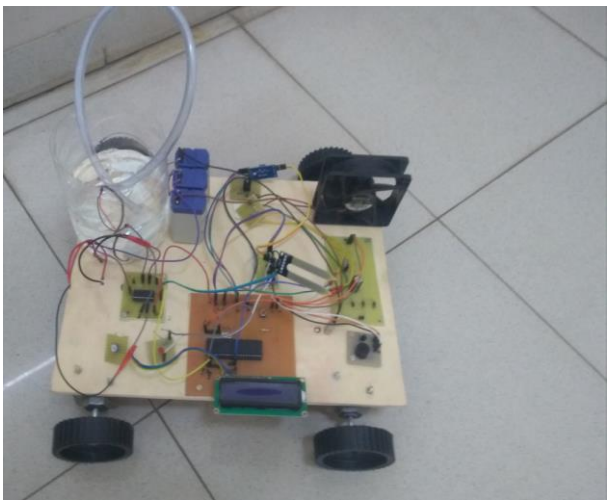

Fig. 15: Experimental Setup of automatic irrigation system

VII. SCOPE OF PROJECT

- Humidity sensor, temperature sensor is embedded in the system and with the help of the collected data irrigation system can be able to control irrigation without human intervention.
- further advancement can be done by making the data available related to other climatic parameters governing plant growth on a mobile phone from where greenhouse can be controlled.

VIII. CONCLUSION

The microcontroller based robotic irrigation is a real time feedback system which monitors and controls the activities of greenhouse such as temperature and humidity, soil moisture effectively. The present proposal is a model to modernize the agriculture industries.

Using this system, one can save man power, water to improve production and ultimately profit. In this project we designed a system which monitors various parameters of greenhouse such as temperature and moisture content of soil without any human intervention.

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