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Plant Growth and Moisture Content Monitering Device

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ABSTRACT: Plant monitoring is seen as one of the most important tasks in any farming or agriculture-based environment. With the inception of Ambient Intelligent systems, there have been a rise in ambient intelligent based devices-Smart Homes. With the increasing population the demand of agricultural development has also been hiked up. Starting from the nourishment in the field to cultivation and supply. The demand and supply chain is increasing rapidly with passing year. Requiring focus to be made on the cultivation part. If plant growth cycle could be measured precisely, a detailed plant growth model can be prepared. Hence the production of the plant can be predicted and controlled accurately depending on the environmental changes. The proposed system in the further report deals with two crucial aspects of the plant growth which is the height of the plant and the moisture content of the soil near the roots. The system described is programmed in such a way that it is able to determine the height of the plant after every successive growth stage. The system also determine the moisture value of the soil which could be altered during different hours of the day. Data for the study can be achieved by continuous monitoring and understanding the plant growth.

I. INTRODUCTION

Agriculture is the backbone of human existence on earth. For any civilization to prosper, agriculture has to be healthy and sustainable. Agriculture provides nourishment to the world population and holds the badge of being the source of income for India and other developing nations. Also the demand for food is expected to continue to grow as a result both of population growth and rising incomes.

It results in great pressure on agriculture industry to secure the growing demands for the food. If plant growth per growth cycle can be measured precisely, a detail plant growth model can be prepared and at the same time production of plants can be predicted and controlled accurately depending on environmental changes.

Data for the study can be achieved by continuous monitoring and understanding the plants growth. The proposed system measures dimensions of the plant by using an ultrasonic sensor, and generates maximum height and gives an idea about the soil content of the plant which would further be helpful to calculate if the plantation would be suitable.A **microcontroller** is embedded inside of a system to control a singular function in a device. It does this by interpreting data it receives from its I/O peripherals using its central processor. The temporary information that the microcontroller receives is stored in its data memory, where the processor accesses it and uses instructions stored in its program memory to decipher and apply the incoming data. It then uses its I/O peripherals to communicate and enact the appropriate action.Microcontrollers are used in a wide array of systems and devices. Devices often utilize multiple microcontrollers that work together within the device to handle their respective tasks.Microcontrollers are used in multiple industries and applications, including in the home and enterprise, building automation, manufacturing, robotics, automotive, lighting, smart energy, industrial automation, communications and internet of things (IoT) deployments.One very specific application of a microcontroller is its use as a digital signal processor. Frequently, incoming analog signals come with a certain level of noise. Noise in this context means ambiguous values that cannot be readily translated into standard digital values. A microcontroller can use its ADC and DAC to convert the incoming noisy analog signal into an even outgoing digital signal.

II. DESIGN PROCEDURE

The design includes four major modules, (i) Ultrasonic sensor (ii) Moisture sensor (iii) 4×4 Matrix keypad (iv) 16×2 LCD display. The Microcontroller (8085) being the heart of the system controllers other four modules. The schematic of the design and the description of the modules given below.

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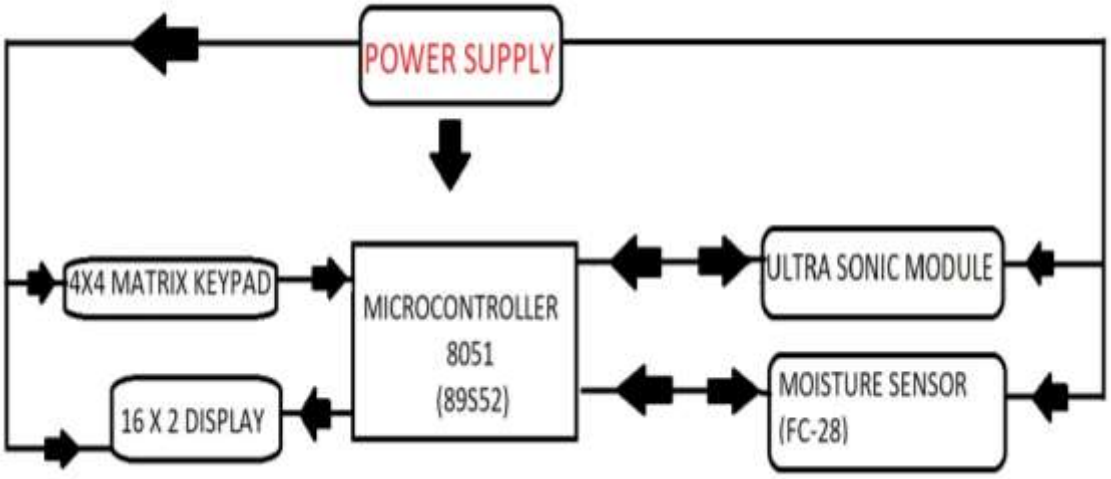
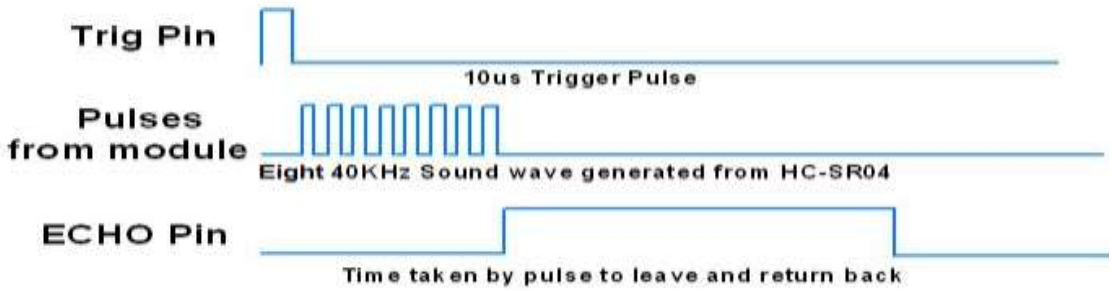


Schematic of the device design

The **ultrasonic sensor (HC-SR04)** works on the principle of SONAR and RADAR system which is used to determine the distance to an object.An ultrasonic sensor generates the high-frequency sound (ultrasound) waves. When this ultrasound hits the object, it reflects as echo which is sensed by the receiver as shown in below figure. HC-SR-04 has an ultrasonic transmitter, receiver and control circuit. In ultrasonic module HCSR04, we have to give trigger pulse, so that itwill generate ultrasound frequency 40 kHz. After generating ultrasound i.e. 8 pulses of 40 kHz, it makes echo pin high. Echo pin remains high until it does not get the echo sound back. So the width of echo pin will be the time for sound to travel to the object and return back. Once we get the time we can calculate distance, as we know the speed of sound. HC-SR04 can measure up to range from 2 cm - 400 cm.
Distance = Speed x Time
The speed of sound waves is 343 m/s.
Total distance = 343 × time of height

$$\frac{}{2}$$



Moisture Sensor (FC-28): The soil moisture sensor consists of two probes that are used to measure the volumetric content of water. The two probes allow the current to pass through the soil, which gives the resistance value to measure the moisture value.When there is water, the soil will conduct more electricity, which means that there will be less resistance. Dry soil conducts electricity poorly, so when there is less water, then the soil will conduct less electricity, which means that there will be more resistance. This sensor can be connected in analog and digital modes.

Analog Mode: To connect the sensor in the analog mode, we will need to use the analog output of the sensor. When taking the analog output from the soil moisture sensor FC-28, the sensor gives us a value from 0 to 1023. The moisture is measured in percentages, so we will map these values from 0 to 100, and then show them on the serial monitor. You can set different ranges of the moisture values and turn the water pump on or off according to it.

Digital Mode: To connect the soil moisture sensor FC-28 in the digital mode, we will connect the

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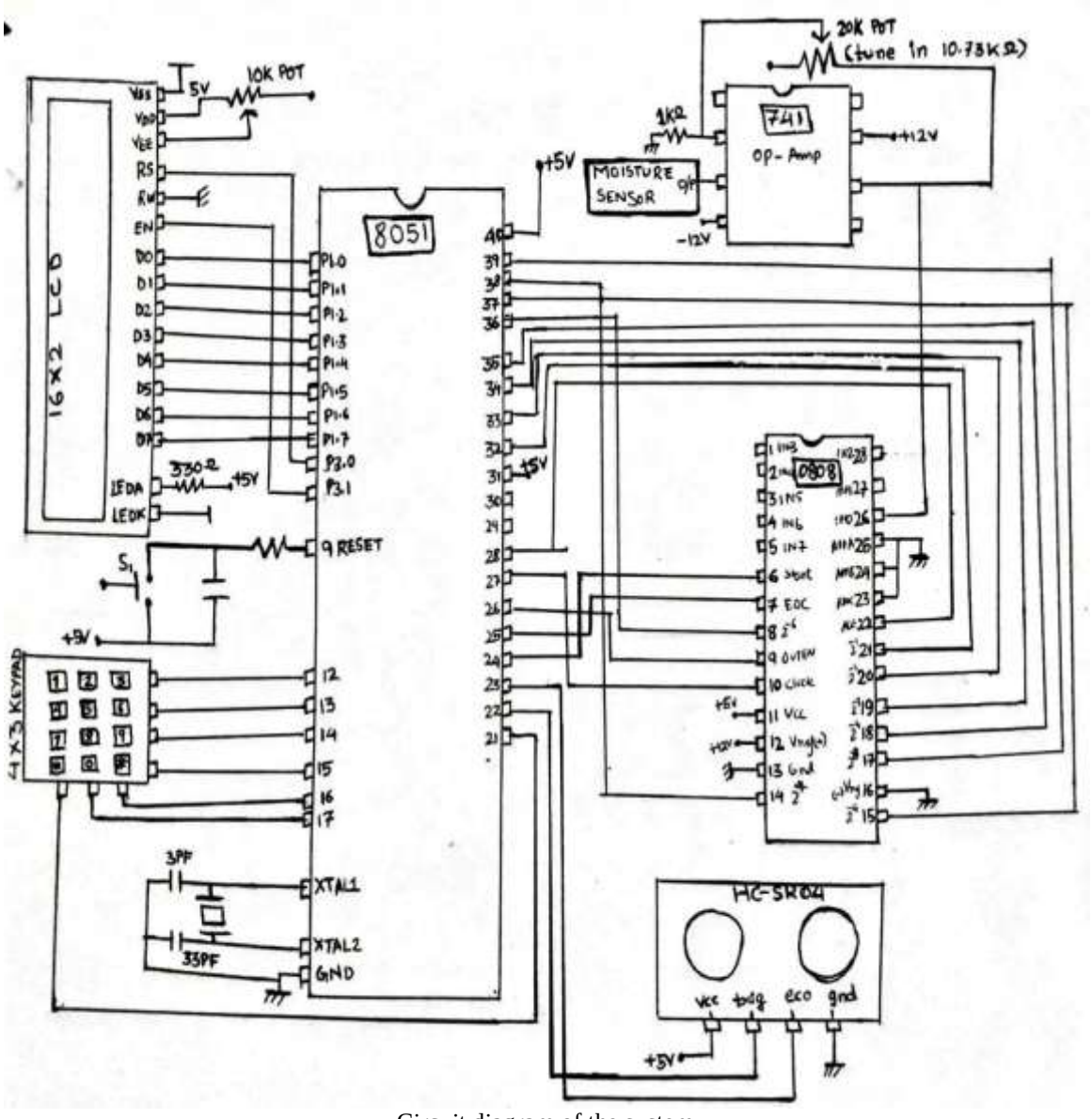
digital output of the sensor to the digital pin of the Arduino. The sensor module contains a potentiometer, which is used to set the threshold value. The threshold value is then compared with the sensor output value using the LM393 comparator, which is placed on the sensor module. The LM393 comparator compares the sensor output value and the threshold value, and then gives us the output through the digital pin. When the sensor value is greater than the threshold value, the digital pin will give us 5V, and the LED on the sensor will light up. When the sensor value will be less than this threshold value, the digital pin will give us 0V and the light will go down.

16X2 LCD Display: An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

III. DESIGN IMPLEMENTATION



Circuit diagram of the system

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- Port 1 is assigned as output port and connected with data line of the 16x2 display.
- P3.0 and P3.1 are assigned as control line of the 16x2 display.
- P3.2 to P3.7 & P2.0 are assigned as input port and connected with a 3x4 matrix keypad.
- Port 0 is assigned as input port and connected with data line of the ADC-0808.
- P2.7 is connected with ALE Pin (22) of 0808.
- P2.6 is connected with clock Pin (10) of 0808. It will give a certain frequency clock pulse to the 0808.
- P2.5 is assigned as input pin and connected with Enable output Pin (9) of 0808.
- P2.4 is assigned as input port and connected with End of Conversion Pin (7) of 0808.
- P2.3 is assigned as output port and connected with start Conversion Pin (6) of 0808.
- P2.2 is assigned as output port and connected with trigger pin of Ultrasonic module (HC-SR04).
- P2.2 is assigned as input port and connected with echo pin of Ultrasonic module (HC-SR04).
- Pin no 9 of 8051 is rest pin and connected a rest circuit.
- A clock circuit is connected between pin no18 and 19 of 8051.

HC-SR04 Implementation in the project

- First, LCD has to clear.
- Then we have to give three types of input to the microcontroller. These inputs are:

1. Standard range of height
2. Minimum height
3. Highest length of a particular plant

- Controller needs to know the height at which it will going to be place to measure the height of the plant. To do that we have to place the HC-SR04 module at that height and have to give the instruction to the controller to measure the total height.
- After measure it we have to place the ultrasonic module top of the plant and let it measure the distance between the top most surface of the tree and the ultrasonic module. Working of this ultrasonic module is described briefly in earlier chapter.
- After doing that, this distance has to be subtracted by the total distance and this would be the actual height of the tree.

FC-28 Implementation in the project

- Now the moisture sensor is also there to measure the moisture content in the soil. We use the analog output of this FC-28 moisture sensor.
- Output terminal of FC-28 is connected with a non-inverting negative feedback op-amp amplifier, with $V_{(out)}/V_{(in)} = 12$.
- The output of the amplifier is feed to the 1st input pin (pin no.-26) of 0808 ADC.
- This ADC has total seven input terminal. To select the first input, select lines of ADC are connected with ground.
- Two reference voltages are given as V_{max}=12V and V_{min}=0V. These will select range of the input.
- After receiving the input micro controller will send a logic "1" signal to the ADC to start the conversion.
- After doing whole calculation ADC will send a logic "1" to the through the EOC pin of ADC.
- Then the eight bit data is received and converted in to percentage value.
- Throughout the operation ALE pin of ADC goes low.
- After doing all this things all the out puts will show by the 16x2 LCD display.

IV. OBSERVATIONS FROM THE TESTS CONDUCTED

The system was tested on three different plants whose respective height and their moisture content of the soil during different interval of growths has been recorded in the following tables listed below.

Experiment: 1

- NAME OF PLANT : **Marigold plant**
- STANDARD HEIGHT RANGE : 15cm to 90cm

RECORDED DATA	COMPARISON	REMARK
12cm (End of 2nd week)	12cm < 15cm (smaller than range)	Plant growth is low
40 cm (End of 4th week)	15cm < 40cm < 90cm (in the range)	Plant growth is moderate

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101 cm (End of 8th week)	101cm > 90cm (beyond the range)	Plant growth is high

Record of height table by the system for Exp: 1

NO. WEEK	RECORDED PERCENTAGE
End of 2nd week	65%
End of 4th week	54%
End of 8th week	68%

Record of Moisture content percentage of marigold plant

Experiment: 2

- NAME OF PLANT : **Sunflower plant**
- STANDARD HEIGHT RANGE : 20cm to 200cm

RECORDED DATA	COMPARISON	REMARK
15cm (End of 2nd week)	15cm < 20cm (smaller than range)	Plant growth is low
40cm (End of 4th week)	20cm < 40cm < 200cm (in the range)	Plant growth is moderate
244 cm (End of 8th week)	244cm > 200cm (beyond the range)	Plant growth is high

Record of height table by the system for Exp: 2

NO. WEEK	RECORDED PERCENTAGE
End of 2nd week	71%
End of 4th week	69%
End of 8th week	76%

Record of Moisture content percentage of Sunflower plant

V.CONCLUSION

The device has been tested upon three plants namely marigold, sunflower and rose and the results has been recorded in the above section, the functioning of the device (i.e. the working of the sensors) was almost accurate. Although the plant height may differ if the plants were grown under different environmental condition. Also the remarks about the height could be altered with respect to respect to the range (i.e. the lower range and the higher range) provided as the input.

Different plant require different growth environment and the water requirements are also different in each experiment and hence the moisture content of the soil also differs. The plants considered in the experiments has been studies thoroughly before proving the ranges as the input. The experiments conducted in three stages where the growth period has been divided into three different experimental stages. That is data has been recorded after every significant week or twice. The soil moisture content has been recorded almost after 2-3 hours after watering the plants.

The system devised gives the accurate height of the plant and moisture percentage of the soil depending on the ranges provided.

REFERENCES

[1]. Automatic plant monitoring system (Published by: IEEE), Author: K. Krishna Kishore; M.H. Sai Kumar; M. B. S. Murthy
[2]. A Plant monitoring and smart gardening system using IoT (Researchgate.net)
[3]. All in One Plant Monitoring System (Hackster.io/Siddhant Poojary)
[4]. Process monitoring using ultrasonic sensor systems (sciencedirect.com)
[5]. Smart Plant Monitoring System (Research gate.net)