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Home Plant Management System

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Abstract:- The goal of this project was to create an automatic irrigation system for plants. Plants are beneficial to have indoors. In addition to their air-purifying properties, they have been shown to increase employee productivity and decrease sick leave at workplaces. This paper deals with an automatic irrigation system which automatically senses the moisture content of soil and decides whether irrigation is needed or not and how much water is needed for soil. We used a UV sensor for the proper amount of sunlight and a PH sensor for maintaining the Ph value for homegrown plants. The final design consisted of a microcontroller (Arduino UNO) which controlled the system, moisture sensor, temperature sensor, UV sensor and PH sensor. The project resulted in a system that managed to keep the plant alive. Instead of batteries, solar cells could be used to meet the system's energy needs. The Automated Plant Irrigation system represents our most basic step towards automated farming drought and loss due to irrigation issues.

Keywords:- *Arduino, Irrigation System, Moisture, Plant, Sensors*

I. INTRODUCTION

Most people are unaware of some important aspects of home gardening, such as the amount of water, sunlight, and PH required for plant health. This frequently results in plants drying out or being flooded with water. There is also a link between the number of plants in close proximity to a person and their healthy lifestyle. One issue is that the plants must be kept alive in order for them to benefit the person's health. A self-watering system would drastically reduce the amount of time required to keep plants alive, allowing people to have a large number of plants without sacrificing time for care.

The system should be able to measure and control the moisture level of a plant's soil. A moisture sensor was used because it's proven to be an efficient way of determining when a plant needs more water. We used a UV sensor for the proper amount of sunlight and a PH sensor for maintaining the PH value for homegrown plants. The Arduino was linked to a water pump, which transported water from the reservoir to the plant via tubes. The system was evaluated based on how well the soil's moisture level was kept stable and whether it was able to keep the plant healthy. All the sensors are controlled by a microcontroller.

II. LITERATURE REVIEW

On a larger scale, having an automatic irrigation system can reduce water usage by 73 percent when compared to traditional watering [1]. Automatic plant watering system, which is regarded as one of the most widely used and beneficial automated systems today, assisting people in their daily activities by reducing or completely replacing their effort. This system employs sensor technology, as well as microcontroller and other electronics in order to behave like a switching system that detects soil moisture levels and, if necessary, irrigates the plant [2]. Clay soil is a better choice for home plants because it has a higher water-holding capacity and a good ability to transport water from deeper layers via capillary action [3]. Companies that do not have plants in their offices are expected to have a higher rate of health and discomfort issues among their employees than companies that do have a lot of plants in their buildings. Plants in offices have been shown to improve both air quality and employee health. Twelve symptoms were measured on staff members, including headaches, coughing, dry throat, and dizziness other things showed a decrease by 21% when introducing plants to their work environment [4]. We can also operate our system with the help of the solar energy. Solar panel absorb sunlight and convert into electrical energy with the help the photovoltaic effect. The process only works when the solar panels are illuminated. The energy can be stored and used when needed by using batteries. The best solar cells on the market can generate up to 150 W per square meter in an instant, depending on the system [5]. Wireless sensor network technology has the potential to reveal fine-grained, dynamic changes in an outdoor landscape's monitored variables. However, significant challenges must be overcome before this vision can be realised in operational systems. The soil moisture level sensor was used in this project. The sensor consists of two probes that are embedded in the soil and measure the resistance between them. Our solution's reactivity to soil is a novel feature: when soil water content increases, soil moisture changes rapidly, and measurements are collected frequently; when soil water content decreases, measurements are collected less frequently. We set the threshold value of the soil water content, when the sensor detects a soil water content below the threshold value the irrigation sequence should be initiated [6]. Ultraviolet (UV) sensors have gotten a lot of attention in the last decade because of their wide range of applications in both civil and military settings. UV light can be detected effectively by wide bandgap semiconductor-based UV detectors, and nanowire structures can greatly improve sensor sensitivity. In this study, we can use a UV

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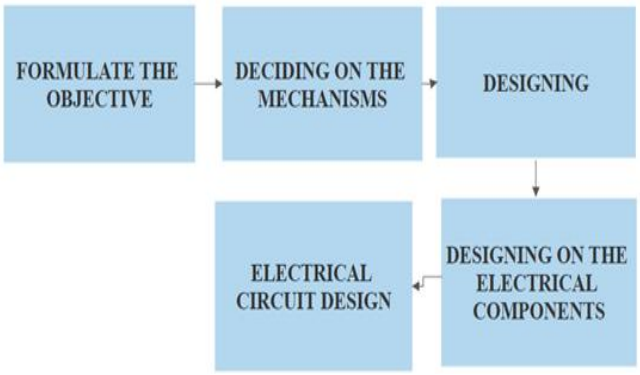
sensor to detect the amount of sunlight required for plant growth [7]. A PH sensor is also used in our research to keep the Ph value of homegrown plants stable. The intelligent pH sensor consists of three modules: light detection, signal processing, and intelligent calibration. To obtain the pH signal, the light detection module employs fluorescent absorption methods. The optical fibre has been chosen as the transmission medium. pH signals are processed by the signal processing module [8]. A Bluetooth module can be used for wireless system implementation and control. Connecting one to an Arduino is a common method of allowing your Android phone to control the device. There are numerous small modules that can be used for this purpose; they are inexpensive and as small as a coin. They appear to be the same, but their outputs and inputs differ. They have a range of 10 m and can be connected to an Arduino via the 3.3 V port. There is one significant distinction between them. The HC-05 can function as both a slave and a master, which means it can receive and transmit data, whereas the HC-06 can only function as a slave, which means it can only receive data and cannot initiate a connection on its own [9].

OBJECTIVE

The objective of our project is to design a smart home plant management system using ph sensor, moisture sensor, temperature sensor and UV sensor.

WORKFLOW



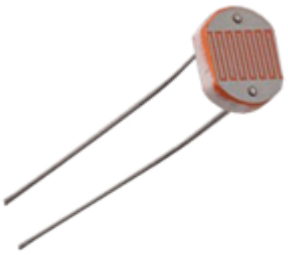
III. TECHNICAL SPECIFICATIONS

Humidity Sensor: Soil Moisture Sensor is a simple breakout for measuring the moisture in soil and similar materials. The two large exposed pads function as probes for the sensor, together acting as a variable resistor. The more water that is in the soil means the better the conductivity between the pads will be and will result in a lower resistance, and a higher SIG out.

Temperature Sensor (Thermistor) : A thermistor is a special type of resistor which changes its physical resistance when exposed to changes in temperature.

Thermistors are generally made from ceramic materials such as oxides of nickel, manganese or cobalt coated in glass which makes them easily damaged. Their main advantage over snap-action types is their speed of response to any changes in temperature, accuracy and repeatability.

LDR Sensor: LDR are light sensitive devices most often used to indicate the presence or absence of light or to measure the light intensity. An LDR can be applied in light-sensitive detector circuits and light-activated and dark-activated switching circuits.



pH Sensor: A pH sensor helps to measure the acidity or alkalinity of the water with a value between 0-14. When the pH value dips below seven, the water starts to become more acidic. Any number above seven equates to more alkaline. Each type of pH sensor works differently to measure the quality of the water. The pH of water can help determine the quality of water. Measuring the pH can also provide indications of pipe corrosion, solids accumulation, and other harmful byproducts.

DC pump motor: DC motor to make water pump. DC motor has two leads one is positive and another one is negative. If we connect them directly to the Arduino board then it will damage the board. To overcome this problem, NPN transistor is used to control the switching activity of the motor according to the code.

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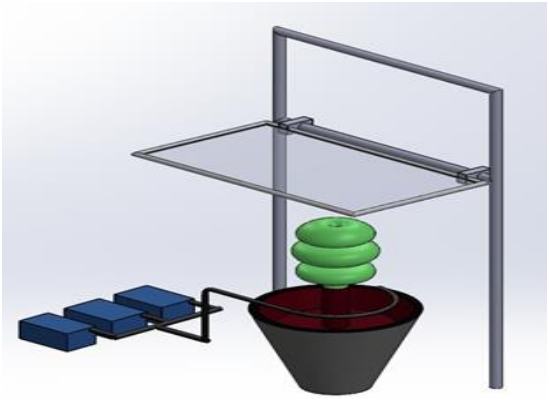
Arduino Uno: Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

IV. DESIGN AND WORKING PROCEDURE

The working principle is very simple, the soil sensor measures the moisture content present in the soil and LDR measures the light intensity falling on the plant. Both the data are read by the Arduino and appropriate command is executed whenever a read request is arrived.



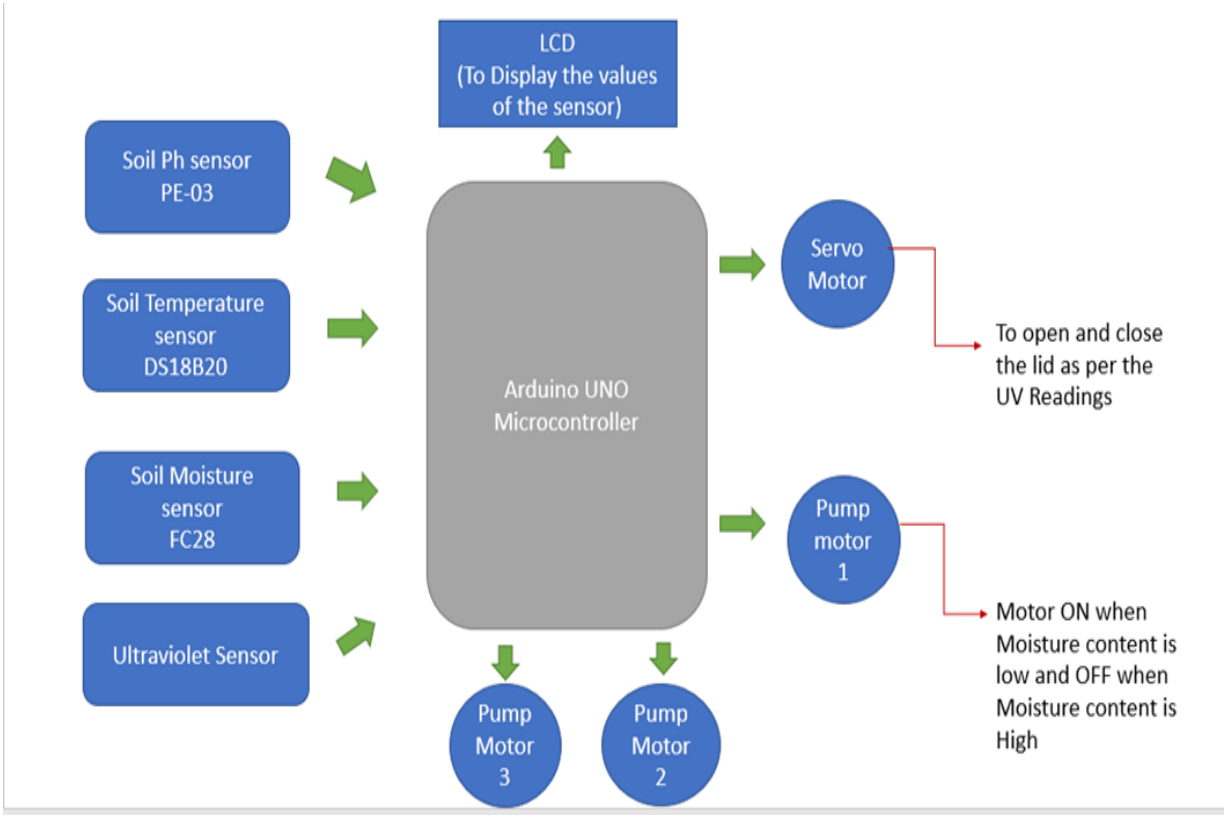
In the case of a soil sensor if the moisture content is less than the threshold value (set by the user), the output of the sensor is LOW, otherwise it is HIGH.

In case of LDR analog data is read and if the value is greater than threshold then the motor is actuated to open the shed above the plant.

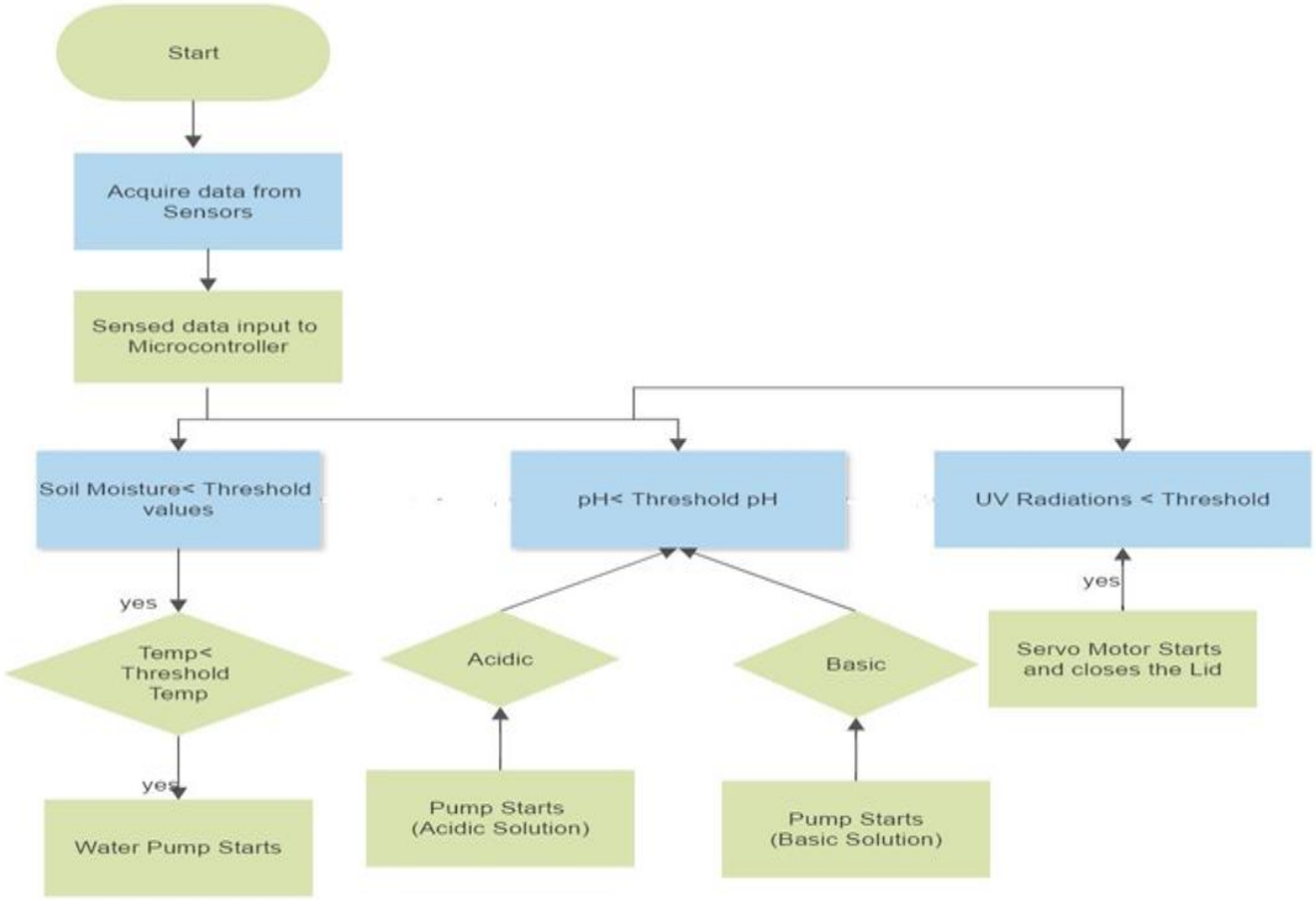
In case of pH sensor if the pH content is Acidic (it will vary with respect to every plant conditions) then Basic solution will be given through pumps, and in case of Basic pH then Acidic solution will be provided till the pH is maintained.

A motor is also present to move the glass panel if the UV radiations are high enough and hinder the growth of the plant. The panel is made of saturable absorber glass which reflects the light after reaching its threshold value.

BLOCK DIAGRAM



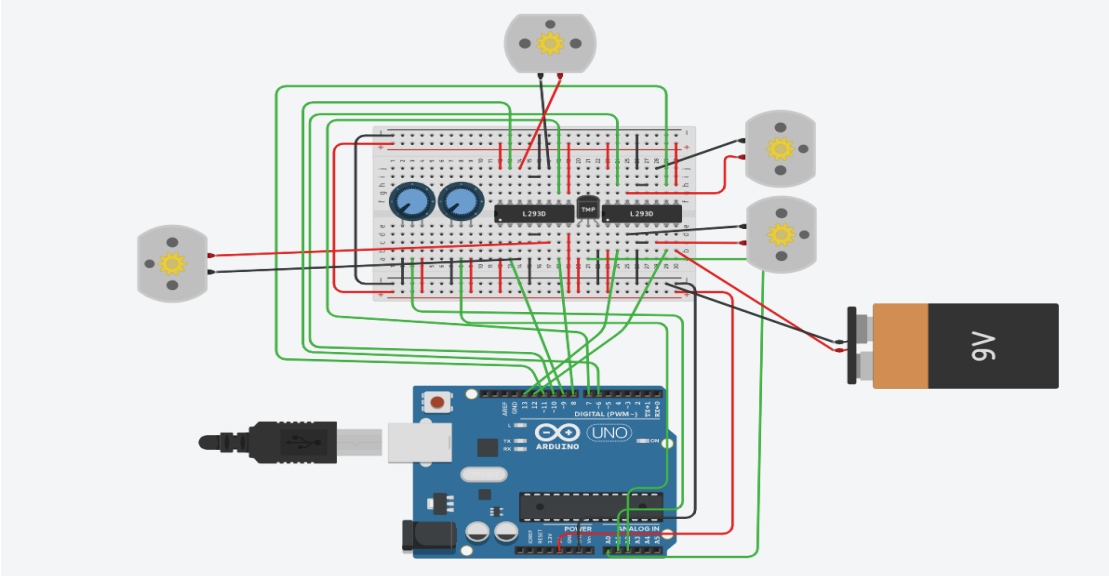
ALGORITHM



CIRCUIT DESIGN

COMPONENTS USED

1. BREADBOARD
2.ARDUINO UNO
3.L239D MOTOR DRIVERS
4.3 PUMP MOTORS AND 1 DC MOTOR
5.9V BATTERY
6.TEMPERATURE SENSOR
7.POTENTIOMETER AS UV SENSOR
8.POTENTIOMETER AS pH SENSOR



V. CONCLUSION

A home plant management system was mechanically designed and a circuit was also built, using UV sensor, pH sensor, temperature and humidity sensor. The design involves drip irrigation, pH balancing of the soil and filtering only the required amount of sunlight to the plant. Installing a display that shows the current moisture level would be an easy enhancement in the future. It would make the product more appealing to some people, and you would be able to keep track of what was going on.

REFERENCES

[1]. Michael D. Dukes, Rafael Munos-Carpena, Herbert Bryan, Waldemar Klassen" Automatic soil moisture-Based drip irrigation for improving tomato production" University of Florida , 116:80-85, 2003.

[2].TY - JOUR AU - Đuzić, Nermin AU - Đumić, Dalibor PY - 2017/06/17 SP - 169 EP - 172 T1 - Automatic Plant Watering System via Soil Moisture Sensing by means of Suitable Electronics and its Applications for Anthropological and Medical Purposes VL - 41 JO - Collegium Antropologicum ER

[3]."Characteristics of different soil types" Vaderstad, Available: https://www.vaderstad.com/en/know-how/basic-agronomy/ soil-basics/characteristics-of-different-soil-types/. [Accessed: 13 February 2019]

[4]. Tove Fjeld, Bo Veiersted, Leiv Sandvike, Geir Riise. Finn Levy "The Effect of Indoor Foliage Plants on Health and Discomfort Symptoms among Office Workers"Agricultural University of Norway, 7:204–209, 1998.

[5]. "Solenergi" Svensk solenergi, Available: https://www.svensksolenergi.se/fakta-om-solenergi. [Accessed: 1 april 2019]

[6]. Mark Kranz, Keith Smettem, , Kevin MayerFirst Published March 1, 2005 Research Article https://doi.org/10.1080/15501320590966422 Zou, Yanan; Zhang, Yue; Hu, [7]Yongming; Gu, Haoshuang. 2018. "Ultraviolet Detectors Based on Wide Bandgap Semiconductor Nanowire: A Review" Sensors 18, no. 7: 2072. https://doi.org/10.3390/s18072072

[8]. Yaoguang Wei, Xuelun Hu, Dong An, Design of An intelligent pH sensor based on IEEE1451.2, IFAC-PapersOnLine,

[9]. "HC Serial Bluetooth Products, User Instructional Manual" Elektrokit,
https://www.electrokit.com/uploads/productfile/41015/hc hc-05-userinstructions-bluetooth.pdf