iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VIII **Month of publication:** August 2022

DOI: https://doi.org/10.22214/ijraset.2022.46428

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VIII Aug 2022- Available at www.ijraset.com

Modern IoT Based Gardening System

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Abstract: This paper aims at developing an auto irrigation/gardening system with raspberry pi. This system is easy to manage as allusers are able to login by Smartphone and access the condition of garden. These features sense that, user can access the parameters of the land such as moisture, temperature etc. and also water flow can be controlled, as well as supplies the water when required. To implement this system soil moisture, temperature, humidity and sunlight are fed into microcontroller. Web server running on raspberry pi receives this data and can transit to the mobile phones or any other device, which requests the data. Based on the obtained data, end-user can then control the system remotely. The special feature of the model is that, the user will ensure if his/her need of the plants, herbs are served based on the right need and there is over/under usage of the water. A Web server along with a web page will help in user being notified about the requirements of the water when required.
Keywords: Raspberry Pi, Microcontroller, Web-Server

I. INTRODUCTION

The large portions of the land is used by the farmers to grow different types of crops keeping a constant eye on an irrigation/garden land. Sometimes a small portion of land receives excessive amount of water, leads to water logging [1]. In this case, the crops or may be some plants in the land get damaged and farmers may suffer heavy loss.

To overcome this problem, we have proposed an “Advanced IoT (Internet of Things) based irrigation/gardening system using Raspberry Pi”. This work is a really good thing, that allows the user to regulate and monitor his water supply from his current location [2]. This paper discusses the notion of sensors and how they are used in the creation of the Internet of Things (IoT).The physical parameters of soil are determined using temperature, sunlight and moisture sensors. Several analog and digital sensors such as light, temperature& soil moisture are used to collect real-time data. In turn, the sensors will be connected to an Arduino microcontroller. Web server running on raspberry pi receives this data and can transit to the mobile phones or any other device, which requests the data[5]. Based on this obtained data the end-user can then control the system remotely.

II. METHODOLOGY

Fig.1 below shows the block diagram of advanced IoT based gardening system using Raspberry Pi.

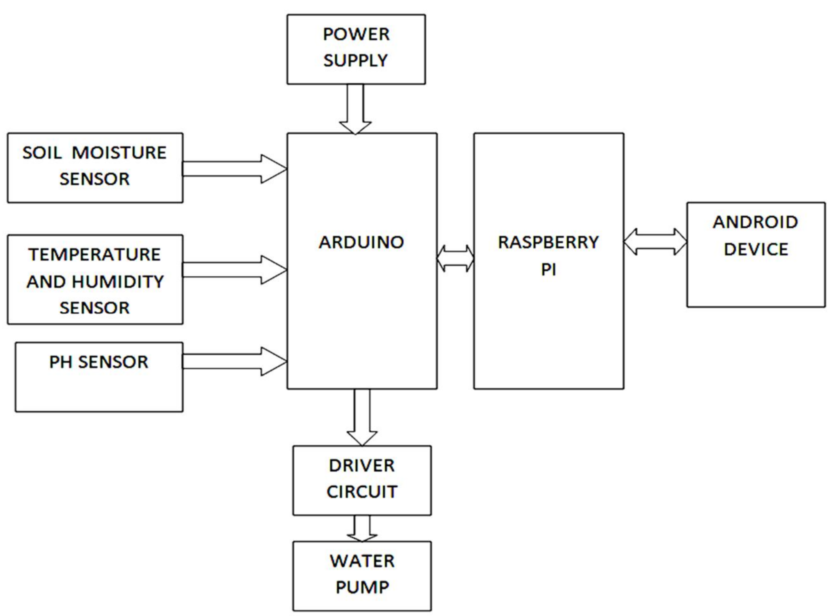

Fig1:Block diagram of Advanced IoT basedgardening system

In the present work, moisture, temperature and Photoresist or sensors are used. All these sensors will be interfaced to Arduino board. Moisture sensor gives the value sof real time moisture level in the soil. The temperature is measured using a temperature sensor. Photoresist or records the intensity of the sunlight. In the system to be implemented, soil moisture, temperature, humidity and sunlight are fed into the microcontroller and the data fed are transferred to raspberry pi through serial communication via USB port. Web server running on raspberry pi receives this data and can transit it to the mobile phones or any device, requesting the data. Based on this obtained data, the end user can then take a decision from the list of queries remotely.

A webserver is created using a flask, a python web-framework and run it on raspberry pi using the static IP address is assigned. It allows us to access the system remotely from any device by keying in that IP address The water pump is used to supply the water to the irrigation land. With this system a farmer can supply water, that is he/she can also control the water pump (can be switched on /off or supply of required amount of water to land) using remote device. This advanced system is also be useful for people who has agricultural land at far distance, while it very hard for an individual person to be present at his/her land all the time. Also, this work can be used to monitor soil moisture and maintain proper water supply to the irrigation/gardening land even from remote devices.

III. COMPONENTS

A. Arduino IDE

Fig.2 below shows Arduino UNO board. Arduino UNO is a microcontroller board based on the ATmega328P (datasheet).
It consists of fourteen digital input/output pins (out of 14,6 can be taken as PWM o/p), six analog i/p’s, a 16 MHz quartz crystal, a USB connector, a power slot, an ICSP header and a reset button. It has a configuration that supports the micro controller [2].
Simply use a USB card to connect with computer. To get started, use an AC→DC adaptor or a battery.

Fig 2: Arduino UNO

User can play with the UNO without being overly concerned about making a mistake, worst case scenario user can exchange the chip for a few rupees and restart it again. This is the most recent model of the Arduino USB board. It connects to the laptop/computer using a USB cable &it has all the requirements that user need to write the code and use this board. A variety of shields are added to it.: custom daughter-boards with specific characteristic. It is similar to the Duemilanove, but it has a different USB-to-serial chip and ATMega8U. It has redesigned labelling to identify inputs and outputs easier.

B. Raspberry PI 3

The Raspberry is a line of single-board computers created in the UK by the Raspberry Pi foundation. The Raspberry Pi hardware has gone under much iteration, each with various memory capacities and peripheral/*interfacing* device support. Fig. 3 below shows the circuit board of Raspberry Pi 3.

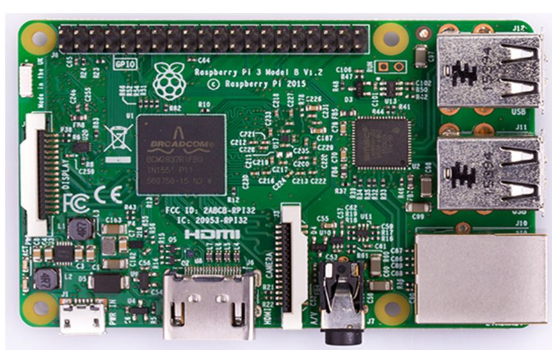

Fig3: Raspberry Pi 3

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In this proposed system, Raspberry **Pi** -3 is used. The Raspberry Pi 3 is the 3rd generation Raspberry Pi. It has been replaced with the Raspberry Pi 2 Model-B in February 2016. It has the following components as shown in table below compared to Raspberry Pi 2.

Table below shows components of raspberry pi2.

Table1: Component in Raspberry Pi 3

1.	**A 1.2GHz 64-bit quad-core**
2.	**ARMv8 CPU**
3.	**802.11n Wireless LAN**
4.	**Bluetooth 4.1**
5.	**Bluetooth Low Energy (BLE)**
6.	**1 GB RAM**
7.	**4 USB ports**
8.	**40 GPIO pins**
9.	**Full HDMI port**
10.	**Ethernet port**
11. **12.**	**Combined 3.5mm audio jack and composite video**
13.	**One Camera interface (CSI)**
14.	**Digital Display interface (DSI)**
15.	**One Micro SD card slot (now push-pull rather than push-push**
16.	**Video Core IV 3D graphics core**

C. Digital Temperature/Humidity Sensor

DHT22 is a low-cost digital temperature and humidity sensor with a basic design. The o/p is calibrated digital signal. It makes use of a unique digital signal collection technique as well as humidity sensor technology. Its technology offers a high level of reliability and long-term stability. Eight-bit single chip computer is connected to the sensing elements. Each sensor of the model is calibrated in accurate calibration chamber and the calibration-coefficient is saved in type of program in OTP memory. When the sensor is detecting, it will cite coefficient from memory. Every sensor is temperature compensated and small in size & low consumption &long transmission distance (20m) enabled. DHT22 is used for all harsh application occasion [4].

D. CdS Photoresistor

A cadmium sulphide (CdS) photo resistor or photo cell changes its resistance depending upon the light intensity. It isvery sensitive and it has been around from decades. It is also called as LDR which is used in street lighting systems and also as an electric eye. In darkness the resistance decreases from millions of Ohms(Ω) and in bright light of about few hundred Ω.

E. VH400 -SOIL Moisture Sensor

VH400 version sensor isused to measure soil water content and its of low cost. It uses Tx(transmission) line techniques to measure dielectric constant of the soil. It is not affected by water salinity and will not corrode over a time as conductivity-based probes does. These probes are tiny, ruggedand low power [1].

F. PH Sensor

The alcoholate/acidity of the water solution can be measure using PH value basedon relative number of hydrogen (H^+)/hydroxyl (OH^-) ions present in it. The pH value < 7 is acidic and >7 is basic. As temperature also changes.

IV. RESULTS

The following tests are done for our work with different parameters. For different types of soil the temperature sensor Humidity sensor and moisture sensor showing the values.

CASES	TEMPERATURE	HUMIDITY	MOISTURE
DRY SOIL	29 C	57%	1023 m^3
WATER	30 C	53%	240 m^3
SAMPLE SOIL 1 (MEDIUM MOIST)	29 C	57%	670-880 m^3
SAMPLE SOIL 1 + WATER	29 C	57%	260-300 m^3
SAMPLE SOIL 2	30 C	53%	850-930 m^3
MOIST SOIL	29 C	57%	250 m^3

A. Snapshots

Based on the experiments conducted using various test scenarios, we have the following outputs in our GUI.

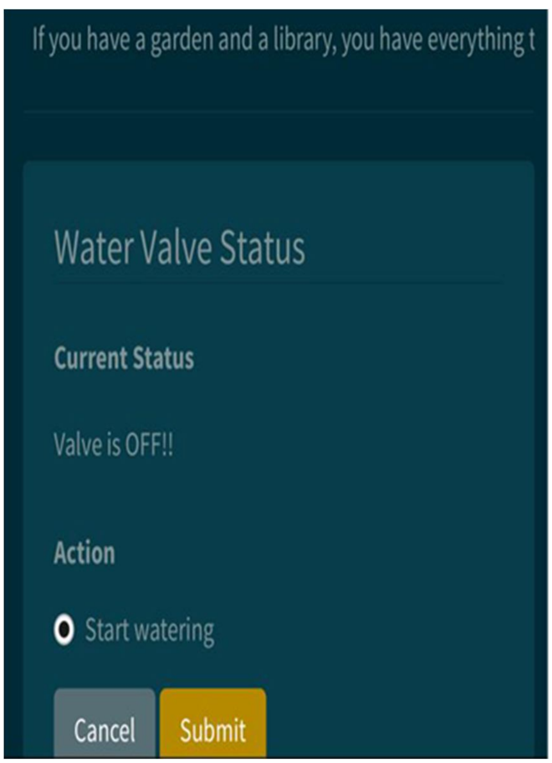

Fig 4a: Initial Window

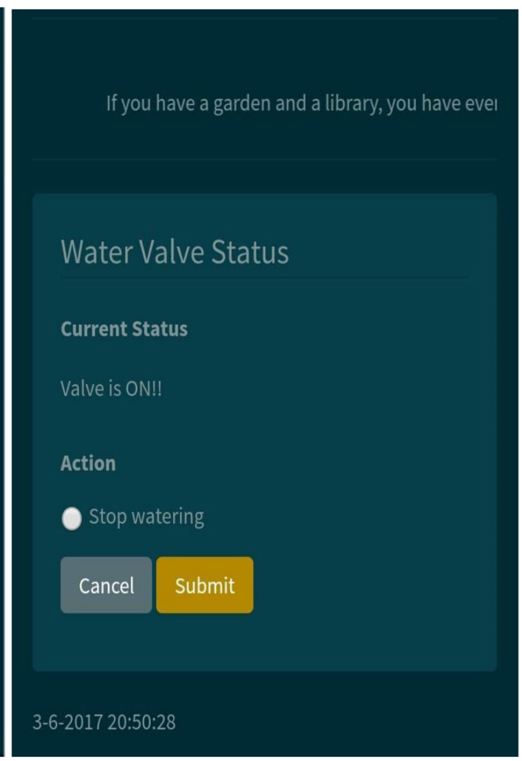

Fig 4b:Window after the valve is turned 'on'

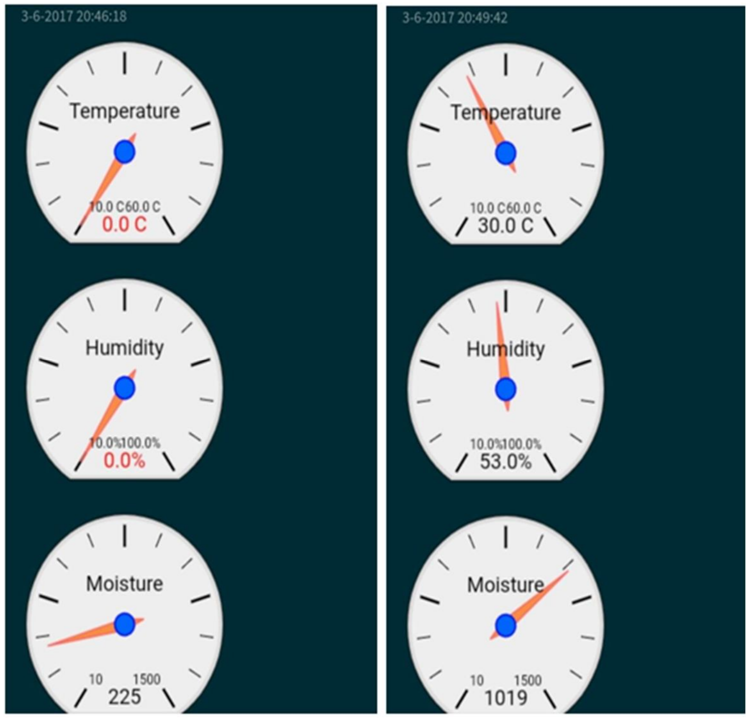

Fig 5: Gauge Readings

V. CONCLUSION

Automated gardening system is a reliable and efficient system for effective monitoring of irrigation/agricultural land parameters. Monitoring the land using wireless technology allows the user to reduce the human power and also allows user to see changes in it.Using a Raspberry pi and other electronic parts allows supportable irrigation land with sensors to check soil moisture, as well as a web scraper to check future weather. It makes use of this details to conserve water by only using what is required.

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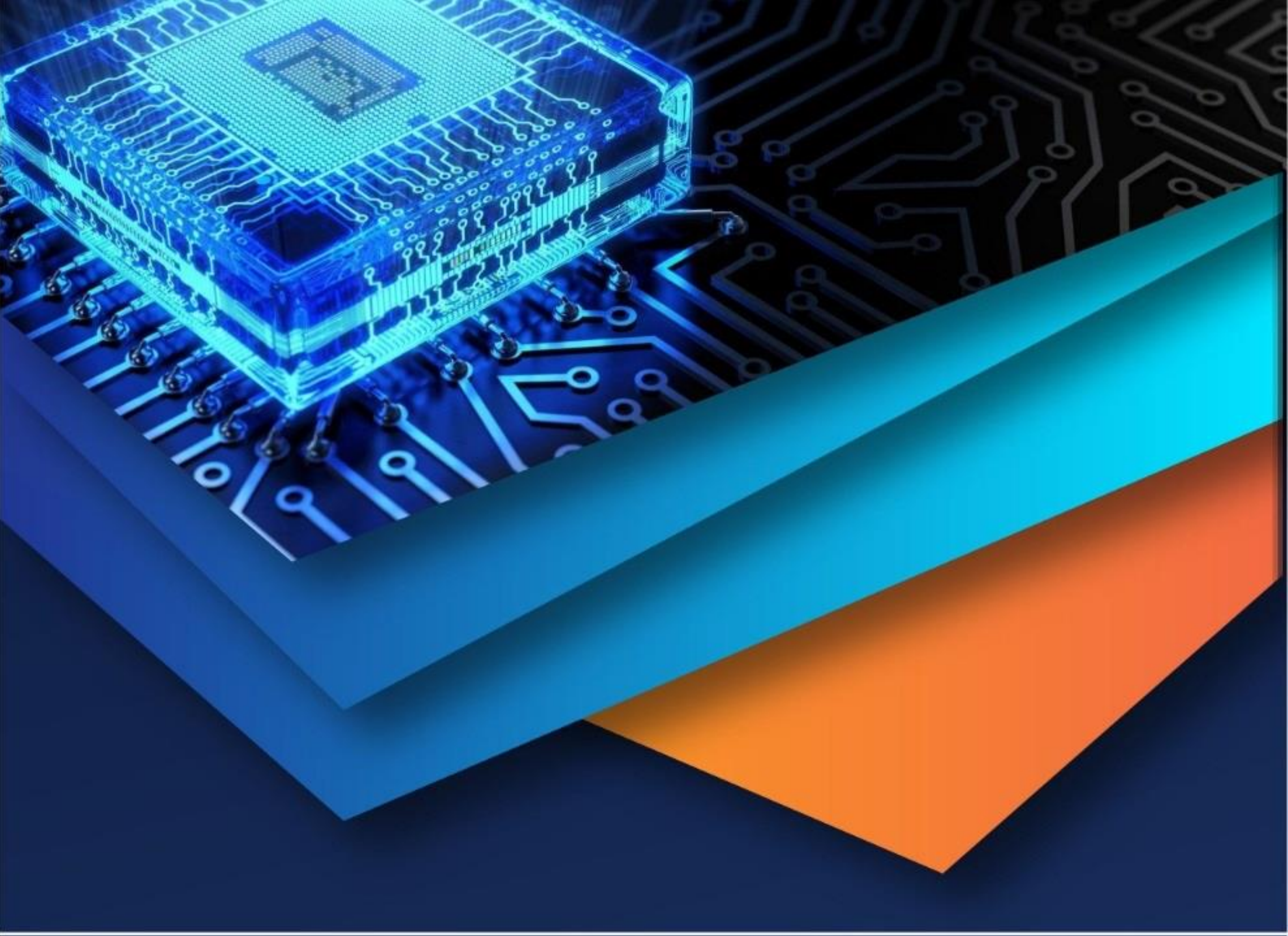

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