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Raspberry Pi Based Smart Irrigation System Using IOT

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Abstract

Agriculture plays vital role in the development of agricultural country. In India about 70% of population depends upon farming and one third of the nation's capital comes from farming. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. Hence the project aims at making agriculture smart using automation and IoT technologies. The highlighting features of this project includes smart GPS based remote controlled robot to perform tasks like weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance, etc. Secondly it includes smart irrigation with smart control and intelligent decision making based on accurate real time field data. Thirdly, smart warehouse management which includes temperature maintenance, humidity maintenance and theft detection in the warehouse. Controlling of all these operations will be through any remote smart device or computer connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with micro-controller and raspberry pi.

*Keywords—****Internet of Things (IOT), Soil moisture sensor, Humidity and Temperature sensor, water pump.***

I. INTRODUCTION

India is one among the biggest water users within the world, and our country uses great deal of water than alternative country. There's an out sized quantity of water employed in agriculture field instead of domestic and industrial sector. Sixty-fifth of total water is contributes as a groundwater. Nowadays water has become one among the necessary supply on the planet and most of employed in the agriculture field. As the soil-moisture sensor and temperature sensor are placed in the root zone of the plants, the system can distributed this information through the wireless network. The Raspberry Pi is that the heart of the system and is interfaced with via Wi-Fi Module. Python programming language is employed for automation purpose.The system is a network of wireless sensors and a wireless base station which can be used to provide the sensors data to automate the irrigation system. The system is used the sensors such as soil moisture sensor and soil temperature sensor. The Raspberry Pi model is programmed such that if the either soil moisture or temperature parameters cross a predefined threshold level, the irrigation system is automated, i.e. the relay connected to the raspberry pi can activate or OFF the motor. This paper presents economical, fairly low cost and straight forward machine-controlled irrigation system. This technique once installed it has less maintenance cost and is easy to use. Using the android application on mobile phone it is easily online monitoring the actual

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situation of the field and sensors such as soil moisture and temperature are used to provide the knowledge concerning changes happens within the field. It is additional advantageous than the traditional agriculture techniques.

II.LITERATURE REVIEW

The new state of affairs of decreasing water, desiccation of rivers and tanks, unpredictable surroundings, present an urgent need of proper utilization of water. To cope up with this use of temperature and wet, sensors area unit placed at appropriate locations for observation the crops. Once analysis within the agricultural field, researchers found that the yield of agriculture is decreasing day by day use of technology within the field of agriculture plays a vital role in increasing the assembly additionally as in reducing the man power. The cloud computing devices create a whole computing system from sensors to tools that observe data from agricultural field and accurately feed the data into the repositories. This concept proposes a completely unique methodology for sensible farming by linking the sensing system and smart irrigation system through wireless communication technology. It proposes an occasional value and economical wireless sensing element network technique to accumulate the soil wet ,Humidity , temperature from numerous locations of field and as per the requirement of crop water motor is enabled .It proposes a plan regarding however machine-driven irrigation system was developed to optimize water use for agricultural functions.

B.Prabhu et.al buildwireless sensor network system which is reducing the evaporation of water by drip irrigation. In this system, collect information from sensor and send it to the base station. Now when sensor send data to base station as packet so to reduce impact a packet author set a sensor in bulk mode. Now if plant need water so base system start watering that plant using drip irrigation, these will save water as well reduce evaporation of water. [1]

M.Ryu et.al build a system to make a smart farming by connecting farms based on Internet of Things (IoT). In this they are using various sensors like temperature sensor, humidity sensors and CO2 sensors. Now they are using REST APIs to transfer data, Mobius which is IoT supporting platform and Cube which is a middleware between physical devices i.e. sensor and Mobius. Data which is collected from sensors sends to Mobius using cube and end user send a request for particular farm using REST APIs to Mobius. End user can see result of request can see on Mobile Application. [2]

In Zulkifli, C. Z. and Noor'smade a system with wireless sensor network using RFID. In this system, author put soil moisture on different location in the field i.e. farm or it can be a farm and each sensor has its unique ID. Now sensor sends a data to ZigBee at 2.45 GHz. Now sensor sends that data to base station and if soil is dry then pump station will start sprinkling water only on that portion of the field. [3]

R.K.Kodali et.al made a smart irrigation system based MQTT protocol. They are using Esp8266 NodeMCU-12E, soil moisture sensor and water pump. In this system Message Queue Telemetry Transport Protocol (MQTT) is used for transfer the data between Esp8266 NodeMCU12E and the sensor. Soil moisture sends data to Esp8266 NodeMCU-12E, if soil is dry then Esp8266 NodeMCU-12E send instruction to water pump and waterpump will start and after moisture goes up by some value it will off the water pump. They are used LCD to display the current state of soil and water pump. [4]

L.Bhaskaret.al builds a system to improve the quality of food and improve the productivity. This system measures various factors like temperature, humidity and also water level of soil and notify on LCD. To monitor the data they used monitor and send a message to the farmer to inform about current status about farm via SIM900 module on farmer's register mobile number. They are using sensors like Soil Moisture sensor, Temperature Sensor. This system is useful to that farmer who has a power failure and non-uniform distribution of water due to power failure. [5]

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III.METHODOLOGY

This section within the paper explains the methodology analysis of smart irrigation system using IOT.Here this system uses various sensors for considering small portion of the land and analyzing its various parameters like moisture and humidity through the respective sensors and according to the requirement of the land. According to the data which is to be obtained from the various soil parameters. This knowledge is transferred to the mobile application exploitation web of factor (IOT).
A sensor is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. In short sensors are the device which converts the physical parameter into the electric signal. A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes.

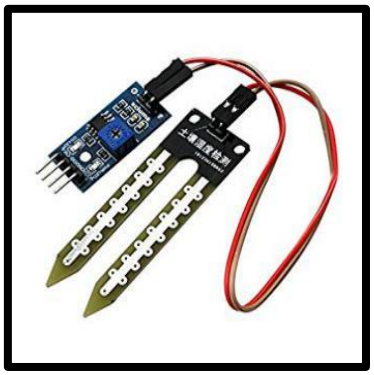

Fig.1Soil moisture sensor

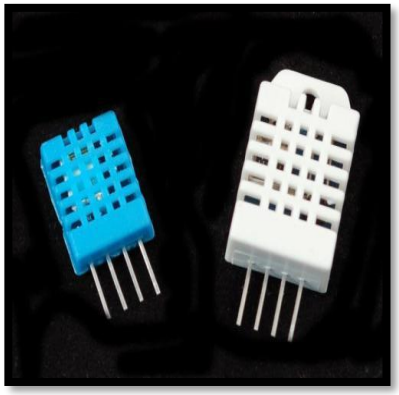

Fig.2 DHT11 sensor

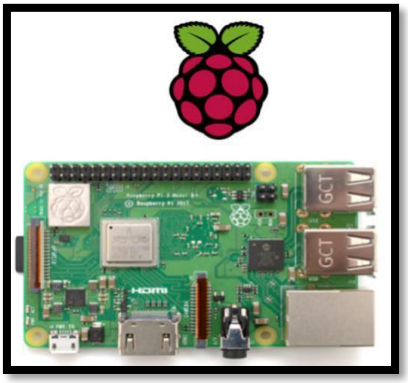

Fig.1 Raspberry Pi 3 model

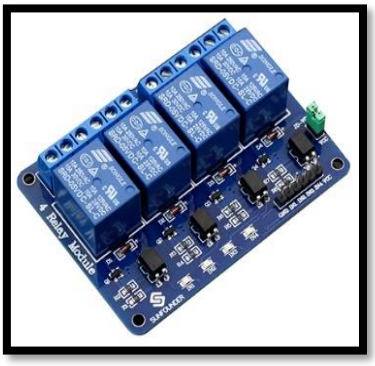

Fig.4 Relay

Fig.5 Motor

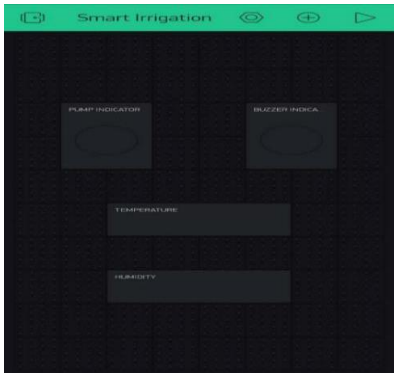

Fig.6Blynk app

Fig.1Soil moisture sensor
The soil moisture sensor is used to measure the moisture content present in the soil. Once the soil wet worth scan by the sensing element is above threshold value, low level (0V) are the digital output and if it's below the threshold level, high level (5V) are the digital output. The digital pin is used to

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directly read current soil moisture value to see if it is above threshold or not. The threshold voltage can be regulated with help of potentiometer.

Fig.2 DHT11 sensor

The DHT11 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old.

Fig.2 Raspberry Pi 3 model

The Raspberry Pi is a small, powerful and lightweight ARM based computer which can do many of the things a desktop PC can do. The powerful graphics capabilities and HDMI video output make it ideal for multimedia applications such as media centres and narrowcasting solutions. The Raspberry Pi is based on a Broadcom BCM2835 chip. It does not feature a built-in hard disk or solid-state drive, instead relying on an SD card for booting and long-term storage.

Fig.4 Relay

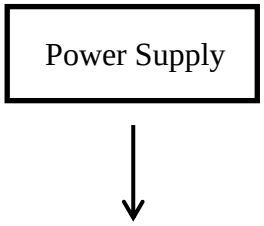
A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a separate low-power signal. A relay with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload. As shown in fig.4 raspberry pi is connected to the devices via relay. Here relay can be operated as switch to on or off the devices.

Fig.5 Motor

To run the motor the current capacity of the controller is insufficient so to drive the motor the motor driver is used .The motor is an electrical machine that converts electrical energy into mechanical energy. The working of motor is based on the principle that when a current carrying conductor is placed in a magnetic field, it experiences a mechanical force.

Fig.6Blynk app

The Blynk app is intended for IoT. The app will remotely management hardware and conjointly shows device data. This app also helps to visualize and store data. It has a similar API and UI for supported hardware and devices. With the use of virtual pins of this app, it is easy to add functionalities and integrate. It is used to connect Wi-Fi, Bluetooth, GSM, and USB to the server. By using various widgets amazing interfaces for the projects can be created. By the use of a bridge widget, it is possible to have the device to device communication.



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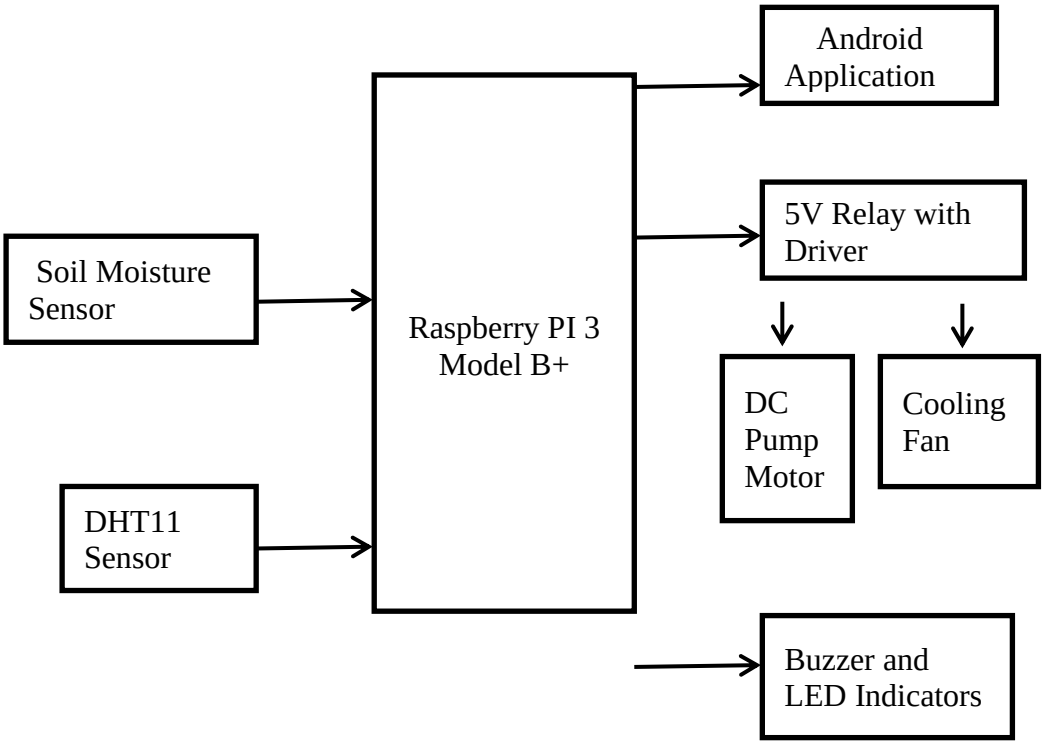
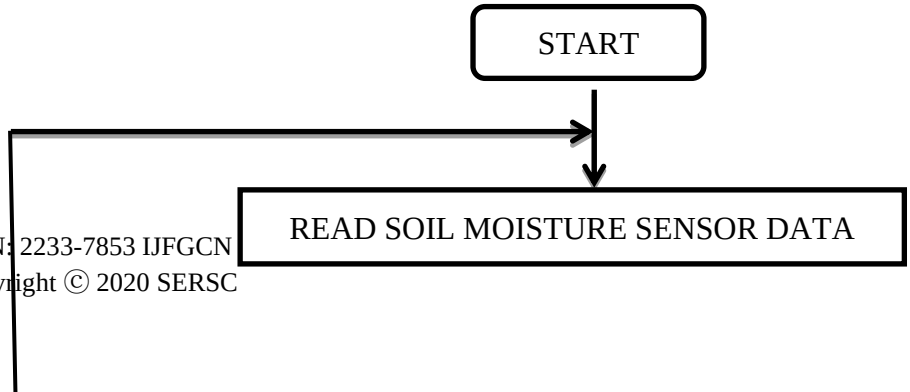


Fig.7 Block diagram of smart irrigation system

This system is used to implement the smart irrigation technique. It is start on the Raspberry Pi. The sensors are connected to the Raspberry Pi. The soil moisture sensor is going to check the moisture of soil & the DHT11 sensor is checked the moisture, humidity of the surrounding. All data of these sensors are displayed on the blynk application. It is helpful to check the level of moisture, temperature & humidity. Whenever soil gets become dry it gives intimation in blynk app. Then the LED become turn ON at the same time DC pump motor turn ON and gives water to the soil.

IV. EXPERIMENTATION

In this paper, system is going to initialize on Raspberry Pi. The soil moisture sensor is used to check the soil moisture level constantly and the DHT11 sensor checks the surrounding temperature and humidity. The sensor constantly senses the temperature and humidity of the field and updates the data in the Android app.



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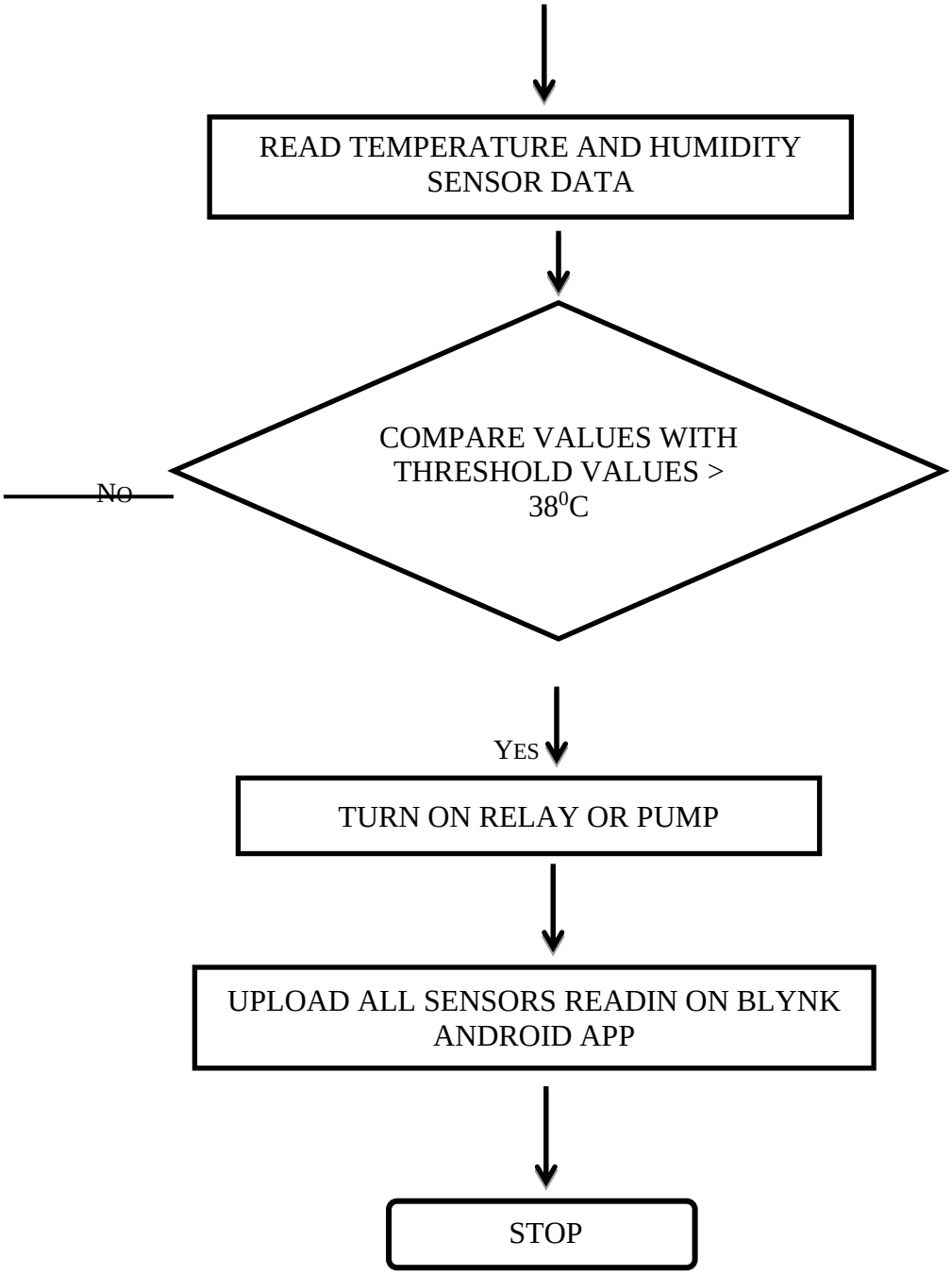

If the permissible level of sensors is reduced, then the relay which is connected to the Raspberry Pi turn ON the motor. Similarly, if the soil becomes dry, the motor which is connected to the relay going to be turned ON to wet the field. It is again going to check the moisture level & surrounding humidity and temperature repeatedly.

V.RESULT AND DISCUSSION

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This paper consists of DHT11 module which is connected to GPIO4 pin of raspberry pi gives temperature and humidity of atmosphere around plants. As temp and humidity is essential parameters for growth of plants, our system always monitors these parameters over IOT and readings broadcasts on Blynk app in farmer's android mobile. Wen temperature value goes beyond 38 degree Celsius then CPU fan which is connected to GPIO12 pin of raspberry pi and led which is connected to GPIO26 pin of raspberry pi should be turn on. Below 38 degree celcius, fan and led should be turn off.

Similarly another parameter we are going to monitor in this project that is soil moisture level. As we know soil and water are very essential parts for any plant to live. We are continuously monitors soils moisture using soil moisture sensor which is connected to GPIO18 pin of raspberry pi. Its output is digital like 1 and 0. When module gives 0 output that means soil is well moisture and no need to turn on pump motor. when soil moisture sensor's output goes high (1), then pump motor which is connected on GPIO24 pin of raspberry pi will be turn on at the same time buzzer which is connected on GPIO5 pin of raspberry pi will be turn on, otherwise fan and buzzer should be remains off.

All these data and status of motor and led buzzer can be seen on blynk app on farmer's android mobile by using IOT technology. For this, raspberry pi has inbuilt WIFI module to connect to the blynk app wirelessly.By developing a Smart Wireless Sensor like humidity and temperature and by using IOT techniques a farmer can increase his profit by solving different problems that are faced by the farmer in his routine life from anywhere using mobile application with the help of raspberry Pi and internet.

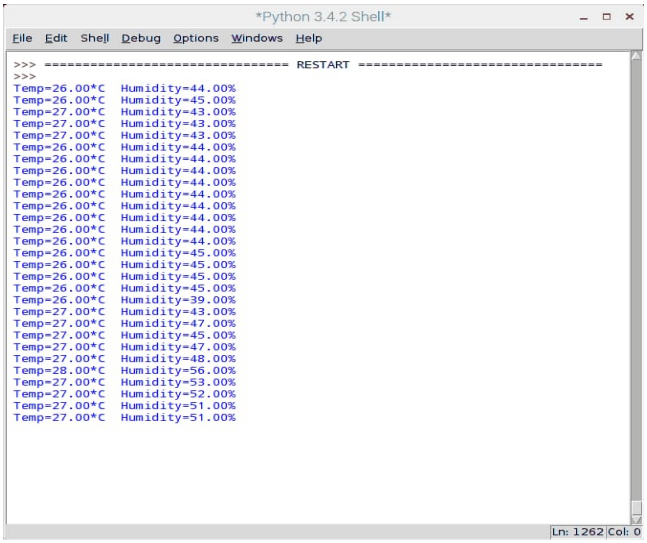

Fig.5.1DHT11 sensor output

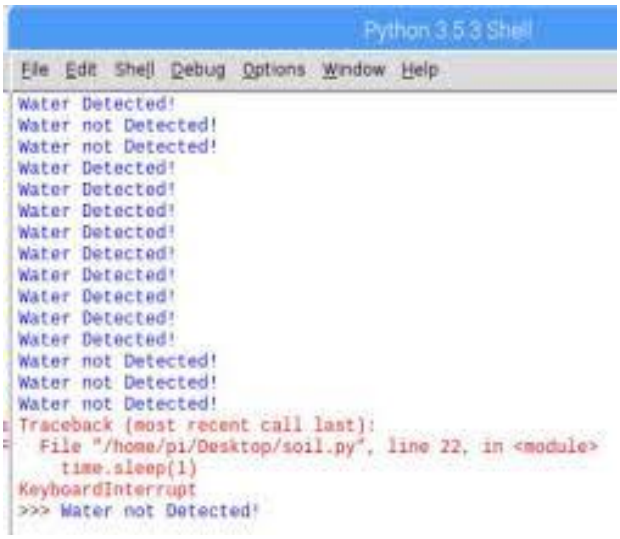

Fig.5.2 Soil moisture sensoroutput

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Fig.5.3 DHT11 sensor and Soil moisture sensor blynk app output

VI. CONCLUSION

The automated irrigation system has been designed and implemented in this paper. The system developed is beneficial and works in cost effective manner. It reduces the water consumption to a greater extent. It needs minimal maintenance the power consumption has been reduced very much. The System is very useful in areas where water scarcity is a major problem. The crop productivity increases and the wastage of water very much reduced using this irrigation system. The developed system is more helpful and gives more feasible results. By developing a Smart Wireless Sensor like humidity and temperature and by using IoT techniques a farmer can increase his profit by solving different problems that are faced by the farmer in his routine life from anywhere using mobile application with the help of raspberry Pi and internet.

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