SMART AGRICULTURE MANAGEMENT SYSTEM

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Abstract – *In the present scenario the surroundings and many other technologies are being modernized. Hence but some of the features are still lagging behind with a few drawbacks. In this paper one of the parameter of nature and an important aspect for living which is known as agriculture is being managed in a smart way. This paper illustrates the usage of sensors and updated technology in order to manage agriculture system in a smart way.*

***Keywords*: Smart Agriculture, IOT, RasberryPi, NOOBS (OS), Web Server**

1. INTRODUCTION

Smart environment includes smart energy including renewables,ICTenabled energy grids, metering, pollution control and monitoring, renovation of buildings and amenities, green buildings, green urban planning, as well as resource use efficiency, re-use and resource substitution which serves the above goals. Urban services such as street lighting, waste management drainage systems, and water resource systems that are monitored to evaluate the system, reduce pollution and improve water quality are also good examples. Here the sensors are being used as a medium between the agricultural fields. This feature allows the user to control and monitor the crops and prevents it from being rotten. Main feature of this technology is to reduce manual work and monitor the agricultural system by making it fully computerized.

1.1 SYSTEM OVERVIEW

The Fig shown is a block diagram of smart agricultural management system. It illustrates usage of sensors with the microcontroller which acts as a central node. All these sensors are being accessed with the help of a web application which is being developed with the updated technology and a programming language known as Python. This feature enables the user to control as well as monitor efficiently with a better outcome.

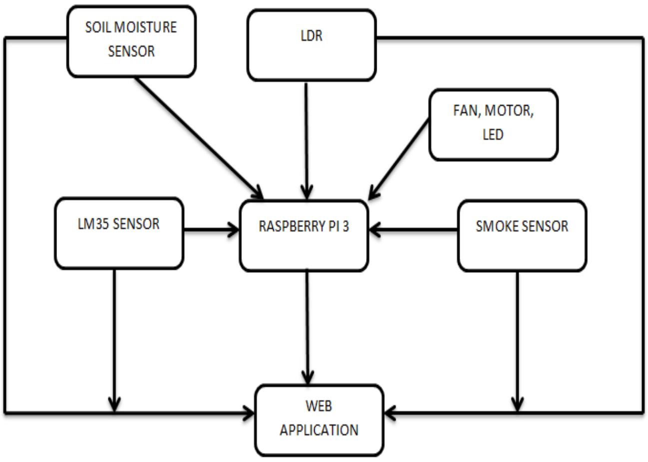

Fig -1: Block Diagram of Smart Agriculture Management System

1.2 LITERATURE SURVEY

In the existing system of agriculture the crops are being monitored with the help of Arduino boards and GSM technology where in Arduino boards acts as a microcontroller but not as a server. Here the set up cost is bit high which may pose problems for the installation.
Hence in order to overcome all these features Arduino boards or renesas microcontrollers are being replaced with the Raspberry Pi 3 which is a latest version and also which acts both as a microcontroller as well as server. Main feature of this methodology is its cheap cost for installation and multiple advantages. Here one can access as well as control the agriculture system in laptop, cell phone or a computer.

2. FEATURES OF RASPBERRY PI 3

Fig -2: Raspberry Pi model 3

[1] CPU: Quad-core 64-bit ARM Cortex A53 clocked at 1.2 GHz

[2] GPU: 400MHz Video Core IV multimedia

[3] Memory: 1GB LPDDR2-900 SDRAM (i.e. 900MHz)

[4] USB ports: 4

[5] Video outputs: HDMI, composite video (PAL and NTSC) via 3.5 mm jack

[6] Network: 10/100Mbps Ethernet and 802.11n Wireless LAN

[7] Peripherals: 17 GPIO plus specific functions, and HAT ID bus

[8] Bluetooth: 4.1

[9] Power source: 5 V via MicroUSB or GPIO header

[10] Size: 85.60mm × 56.5mm

[11] Weight: 45g (1.6 oz)

2.1 HARDWARE SPECIFICATION

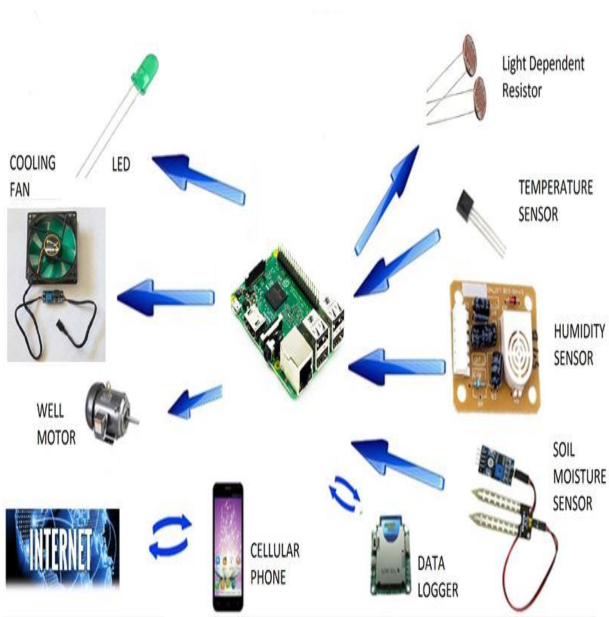

Fig -3: Raspberry Pi model 3

Hardware specification involves usage of LED's, Temperature sensor, light sensor, Humidity sensor, Soil moisture sensor, cellular phone, cooling fan, LDR and a motor.

2.2 PIN DIAGRAM OF RASPBERRY PI MODE

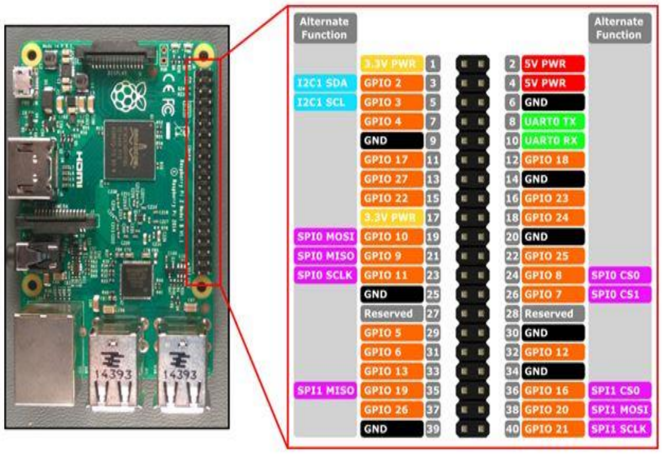

Fig -4: Pin Diagram for Raspberry Pi model 3

Most important characteristic of the Raspberry Pi is the use of GPIO pins along the edge of the board. These pins are a physical interface between the Pi and the outside world. At the simplest level, one can think of them as switches that are used to turn on or off (input) or that the Pi can turn on or off (output). Seventeen of the 26 pins are GPIO pins the others are power or ground pins.
User can program the pins to interact in amazing ways with the real world. Inputs can be from a sensor or a signal from another computer or device, for example output can do anything, from turning on an LED to sending a signal or data to another device. If the Raspberry Pi is on a network, one can control devices that are attached to it from anywhere and those devices can send data back. Connectivity and control of physical devices over the internet is one of the powerful and exciting features and the Raspberry Pi is ideal for this.

A. HARDWARE DESCRIPTION

Fig -5: LM35 Sensor

LM35 is an IC temperature sensor with its output proportional to the temperature. Here the sensor circuit is sealed and is not subjected to oxidation or any other process. Here temperature is measured more efficiently when compared with a thermistor. Even after having its low self-heating it does not cause more than 0.1Oc temperature rise in air. Ceramic materials known as oxides of nickel, manganese or cobalt coated in glass are used to make thermistors and it makes them easily damaged. Their main advantage over snap-action types is their speed of response to any changes in temperature, accuracy and repeatability.

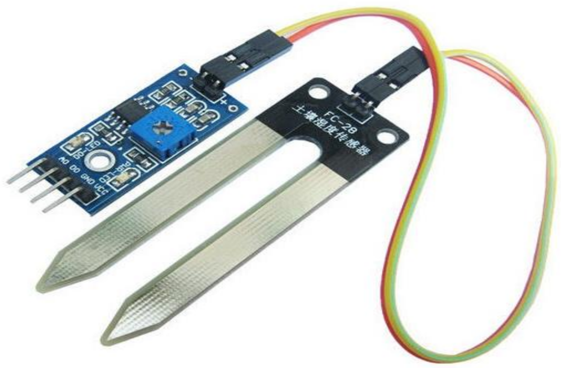

Fig -6: Moisture Sensor

Item	Condition	Min	Max	Unit
Voltage	-	3.3	5	V
Current	-	0	35	mA
Output Value	Sensor in dry soil	1	-	Digital
	Sensor in water	0	-	

Fig -7: Specification of Moisture Sensor

Soil moisture is the most important component in the atmospheric water cycle, both on a small agricultural scale and also in large-scale modelling of land/atmosphere interaction. Vegetation and crops always depend more on the moisture available at root level than on precipitation occurrence. Water budgeting for irrigation planning and actual scheduling of irrigation action, requires a local soil moisture information. Knowledge of the degree of soil wetness helps to forecast the risk of flash floods, or the occurrence of fog. Soil water content can be considered as expression of the mass or volume of water in the soil, while the soil water potential is an expression of the soil water energy status. The relation between content and potential is not universal and depends on the characteristics of the local soil, such as soil density and soil texture. The basic technique for measuring soil water content is the gravimetric method. Because this method is based on direct measurements, it is the standard with which all other methods are compared.

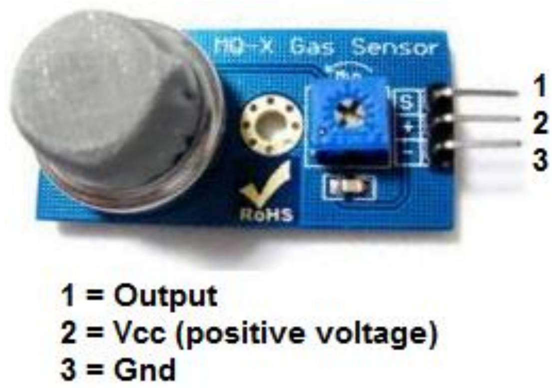

Fig -8: Smoke Sensor

Smoke sensors are used to detect smoke based on the voltage levels. More smoke indicates greater voltage. This sensor has a built-in potentiometer to adjust sensitivity to smoke. Based on the adjustments with the potentiometer, one can change how sensitive it is to smoke. Hence it's a form of calibrating it to adjust how much voltage it will put out in relation to the smoke it is exposed to. As we know Raspberry Pi cannot process analog signals by itself we need an analog to digital converter to convert the analog signals to digital signals, so that raspberry pi can manage it.Hence we need an ADC chip and the one used is MCP3002. With the help of this the Raspberry Pi can interpret analog signals.

Fig -9: LDR Sensor

Item	Condition	Min	Max	Unit
Voltage	-	3.3	5	V
Current	-	0	35	mA
Output Value	Sensor in no light Sensor in light	0 90	90(less light) 255	Analog

Fig -10: Specification of LDR Sensor

A photoresistor is capable of having resistance as high as several mega ohms (MΩ), while in the light a photoresistor can have a resistance as low as a few hundred ohms. When incident light crosses the given range photons are being absorbed by semiconductor which gives bound electrons enough energy to jump into the band. Resulting free electrons conduct electricity, thereby lowering resistance. The resistance range as well as sensitivity of a photoresistor substantially differs among dissimilar devices. However unique photoresistors will react substantially in a different manner to different photons within certain wavelength bands.

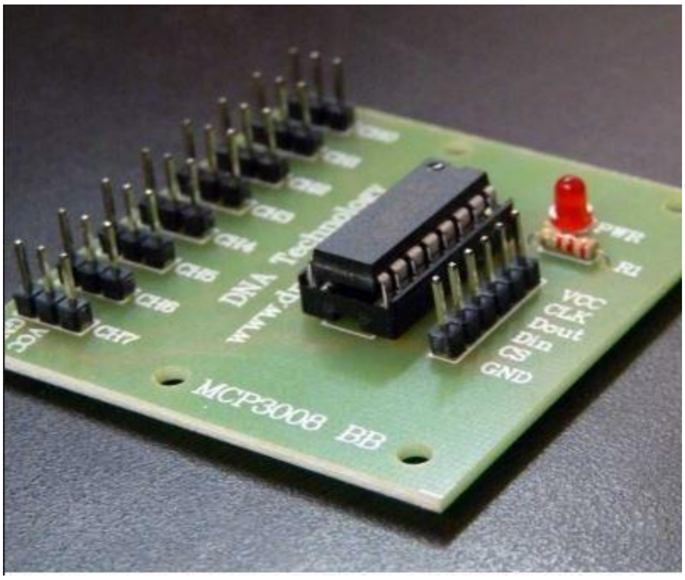

Fig -11: MCP3008

The MCP3008 is nothing but a low cost 8-channel 10-bit analog to digital converter. The precision of this ADC is quite similar to that of an Arduino Uno, with 8 channels one can read quite a few analog signals from the Pi. This chip is a great option if you just need to read simple analog signals, like from a temperature or light sensor. It is used to convert the analog signal from temperature sensor and LDR to its corresponding digital signal so that microcontroller can process it. The MCP3008 is connected to Raspberry Pi with the help of SPI serial connection. One can use either the hardware SPI bus, or any four GPIO pins and software SPI to talk to the MCP3008. Software SPI is quite more flexible since it can work with any pins on the Pi, but hardware SPI is slightly faster and less flexible as it only works with specific pins.

Fig -12: Relay Boards

A relay is an electrically operated switch. Many relays use a single electromagnet to operate a switching mechanism mechanically, but the remaining operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. Relays are being used extensively in telephone exchanges and early computers to perform logical operations

Fig -13: DC Motor

The direct current (DC) motor is the first machines which were devised to convert electrical power into mechanical power. Permanent magnet (PM) direct current converts electrical energy into mechanical energy through the interaction of two magnetic fields. One of the field is produced by a permanent magnet assembly and the other field is produced using electrical current flowing in the motor windings. The two fields result in a torque which tends to rotate the rotor. As the rotor turns, the current in the windings is commutated to produce a continuous torque output Permanent magnet (PM) motors are probably the most commonly used DC motors, but there are many other type of DC motors. DC motors always operates from a direct current power source. Movement of the magnetic field is obtained by switching current between coils within the motor. This action is called "commutation".

B. SOFTWARE DESCRIPTION

In this project raspberry Pi is provided with an operating system known as NOOBS (New Out of the Box Software). Here this operating system unlike UNIX windows helps the user to create web pages and allows to access with the sensors. The main advantage of using python is its low syntax and simpler coding techniques. A microchip slot is being provided to the raspberry pi where in the OS is being installed and fed to the chip. This operating system is available at an open source platform, one can download it easily. Front End to our project is HTML, CSS.These languages allows us to create and design web pages and helps to access the web application. In python a concept known as flask module is being used to create a URL. With the help of this URL one can login and view the current status of sensors and can monitor as well as control using a laptop, cellphone or a computer.

2.3 IMPLEMENTATION

The figure shown illustrates about the usage of sensors and web application in order to control and monitor efficiently.

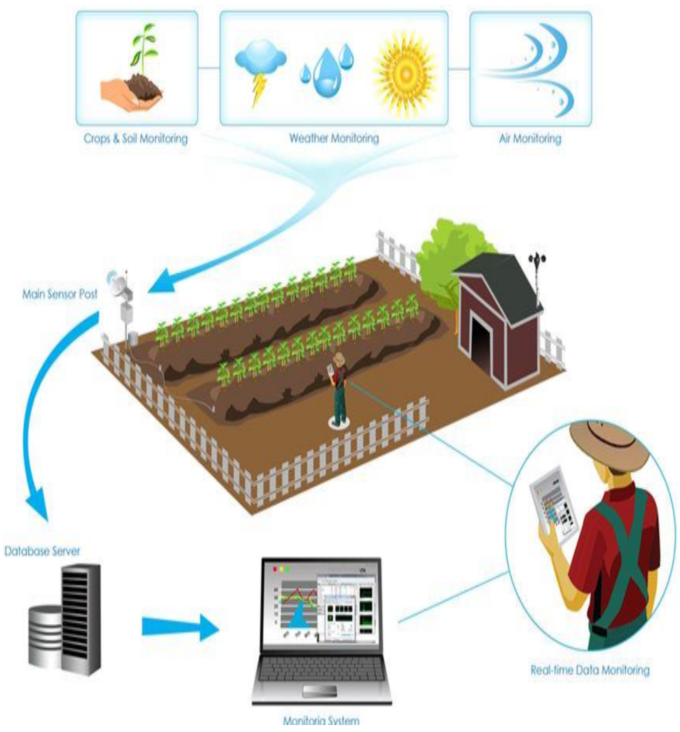

Fig -14: Implementation of Agriculture System

Initially the sensors are installed into the farm land for the monitoring. Then each sensor is being set to a current value or range respectively such as few crops need particular temperature and the range is set by the user using the web app. Light resistor value is being set to 255, If the range decreases the light will automatically switch on. Similarly the two blades of moisture sensor are dipped into the soil in order to check the moisture level. If the land is wet no water is supplied and if the land is dry then the water pump connected with the sensor supplies the water in the field. Also one more sensor is being kept to measure the water level in the particular land, if the land has enough water then the motor can be switched off using the web application via cellphone or a laptop. Similarly in order to save the crops from being rotten in the warehouses temperature sensor is being used which is set to a particular range if the range exceeds fan is switched on automatically which provides a cooling effect. Similarly if any smoke is detected then smoke sensor indicates the user and also the fan is switched on automatically. All these sensors are monitored with the help of a Web Application developed using Python. User will be given a URL wherein he can login with a username and a password and can view the temperatures and also can control the sensors. This feature enables user to get a better yield and a better outcome.

3. CONCLUSIONS

This project helps us to know the significance of using wireless device net in rural areas.
This project sheds the light on the cultivation in India and it shows how the automation of cultivation using wireless device network helps us to resolve a lot of Indian agrarian trouble and recuperate the harvest.

An instance of the greatest significant harvests is designated, which is the vegetable harvest, to training the practice of wireless device system for exactness undeveloped in India.

This project can be implemented with a cheaper cost and can yield a better result.

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BIOGRAPHIES

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