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Location-Specific Real Time Monitoring and Controlling Of Irrigation System Using Raspberry Pi.

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ABSTRACT

In the financial nation like India, agribusiness will be the most vital needed one and it is the spine where climatic conditions differ significantly and watering system offices are poor. Keeping in mind the end goal to overcome from that downside, computerization will be the feasible solution. Yet the past computerization was not that much accommodating for the ranchers to attempt it in view of a high cost, execution, troublesome in support. So now is the time to proceed onward to another innovation in view of android application utilizing RaspberryPi. By utilizing this most recent innovation, clients can monitor the field from anyplace around the globe. The reason for this work is to minimize the cost for the ranchers and to utilize the water very efficiently. Here, RaspberryPi is a completely adjustable and programmable little PC which supports for a substantial number of peripherals and it exchanges the gathered sensor information specifically to web without the need of ZigBee and a different PC. In the event that it goes past the particular threshold which is specified by the agriculturist, it permits the water to stream to the specific zone alone. At last it will send notification to the client's mobile app, so that an agriculturist can have the information about his own farming field from anyplace.

Keywords: Computerization, Raspberry Pi, Android applications

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INTRODUCTION

Agriculturists are confronting new difficulties and opportunities consistently to produce more food crops due to increase in global population about 9 billion by 2050. A survey stated that about 14% will be youth and job opportunities will be less. Challenges faced are lack of education, inadequate knowledge about farming, change in climatic conditions, managing water resources and restricted access to lands. In farming field, ecological variables, for example, temperature, mugginess, soil dampness are fundamental requirements which have an impact on the development rate, profit of produce, sugar substance of natural product, acridity and so forth. This work deals with the above-mentioned natural variables effectively, so that to attain enhanced resulting in the farming field environment.

Due to less availability of labor, the percentage of agriculture has been reduced recently. Hence, many cultivated lands are converted into buildings by industry or organization. Various researchers are currently working in computerized agriculture for simplified control over the farm trying to reduce the farmer burden and technically minimize human intervention in the agricultural processes by replacing them with computer programs. Thus the quality of food crops and other factors can be supervised and can also be controlled from remote places using the web. There are hundreds of existing products today that permit control over the devices automatically, either by remote control or even by voice command.

This paper is implemented using Raspberry Pi. Raspberry Pi PC, which was presented in 2012, right now is a standard subsystem that can be utilized as part of farming processes. This analysis has demonstrated that Raspberry Pi is an inexpensive, yet-serviceable PC board having both output and input peripherals. It makes a perfect stage for connection with various gadgets and use in a wide stream of utilizations. Raspberry Pi with Wi-Fi, can convey the message over the remote locality and also can transfer the data directly to the internet without the need of any other PC. It reduces the complexity of the entire system. By this system, the system will be more reliable, very less maintenance and it attains more speed when compared to the previous system. Precisely the system can provide accurate results and increase the productivity in the field.

Related Works

In [2], A Kumar et al., designed a smart irrigation based on X-Bee based communication using PIC microcontroller. Here the sensed data is collected and it is sent to the server through X-Bee. But the drawbacks of this system are no web-based communication, no mobile alerts.

In [5], Xufeng Ding et al., Investigates an environment monitoring based on heterogeneous wireless networks uses GSM, ZigBee technology to gather the real time information and it will notify a farmer to take appropriate action. Here the cost of the system is very high and there is no weather adaptive system.

In [7], Sherine M et al., Proposed a farming solution in Egypt in WSN technology using Mote. Apteen protocol is used here to send the collected data. But the power consumption is high in this system.

In [9], GopalaKrishna Moorthy et al., Proposed a wireless remote monitoring using ZigBee. It continuously collects data from the field side and sends the data to the server using ZigBee and finally it sends to clients mobile. But the processing speed of the system is slow and battery constraint is more.

In [15, 8], K Sriharsa and B Majone et al., Worksby monitoring the field using ZigBee. The drawback of this system is its limited range and man's interruption is necessary. In [10], K Prasad et al., Proposed automatic control irrigation using GSM technology and it uses LPC2129 microcontroller. It is not a completely automatic system; this system waits for the user commands.

In [10], V Divya et al., intended a smart irrigation by vocal commands. By using vocal commands, it simplifies the method of irrigation. In this work GSM modem is used and it is used to receive commands from the specific number. Farmer needs to call to that fixed number. The motor is turned on and off by the received commands. Here the manual command is necessary to control the motor. From the above all systems, getting the required sensor values from different sensors and it is received by the microcontroller and through the ZigBee it passes to the PC which is in control room, from that it transfers the data to the internet and it is

received by the clients mobile. Due to this the power consumption, battery constraint, cost and maintenance are very high and its processing speed is very slow.

In the proposed system, these drawbacks are overcome by using a small credit card sized computer called RaspberryPi. It can be placed directly in the field and it is connected to all the necessary tools and also it is connected to the internet to transfer the sensed data directly from the field itself. So that it can be received by the client's mobile application very easily. And also it eliminates an unnecessary hardware like ZigBee and need of separate PC. By this proposed system we can reduce the cost, less maintenance and water can be used very efficiently and effectively.

System Analysis

Raspberry Pi:

Raspberry Pi is a little PC, at a reasonable cost. This makes it ideal for agribusiness where a little gadget can undoubtedly be set for a situation and mounted inside an electrical box. The Raspberry Pi board contains a processor and design chip, program memory (RAM – Random-Access Memory) and different interfaces and connectors for outer gadgets, however all Raspberry Pi models have the same processor, SoC(System-On-Chip) named BCM28351. It is low-cost, effective and it consumes less power. Raspberry Pi works as a standard PC. Secure Digital (SD) streak memory card is used for the storage purpose. The capacity can be extended, by utilizing an extra hard drive through USB ports. It is likewise critical to note that the Raspberry Pi Model A has 256 MB of RAM while the Models B and B+ have 512 MB. Web integration may be by means of an Ethernet/LAN link through the standard RJ45 Ethernet port. Wi-Fi network through a USB dongle is an option choice. It utilizes OS, which is a Linux based version called Raspbian. The comparison of Raspberry Pi with other platform is described in table 1.

Pushover is a provision to obtain immediate push notifications on client tablet or mobile from a variety of sources. In other words, Pushover is a platform for transferring and getting push notifications. On the server side, we give an HTTP API to queuing messages to convey to gadgets addressable by User or Group Keys. On the gadget side, our iOS, Android, and Desktop customers get those push warnings, reveal to them to the client, and store them for logging off survey. Pushover notifications can be incorporated into the specific application, server process, website, network monitor, or anything else. This application is deliberate to be a complete, end-to-end solution for individuals and organizations demanding to send notifications out, and obtain them on their own devices. Pushover communicates with your device over the Internet.

FEATURES	PIC	AVR	ARDUINO	BEAGLEBONE	UDOO	RASPBERRY PI
RAM	14 KB	1KB-256KB	Upto 512KB	512 MB	1 GB	Upto 1 GB
EXTERNAL MEMORY	N/A	N/A	N/A	64 GB	64 GB	2-64GB
OS	N/A	N/A	N/A	Linux Angstrom	Ubuntu, Android, Arch Linux	Raspbian
USB HOST	N/A	N/A	N/A	1	2	4
NETWORK	N/A	N/A	N/A	10/100/1000 Mbps	10/100Mbps	10/100 Mbps
AUDIO OUTPUT	N/A	N/A	N/A	Analog	HDMI, Audio jack	HDMI, 3.5mm audio jack
CLOCK SPEED	32 MHz	32 MHz	84 MHz	700 MHz	528 MHz	900 MHz
VIDEO OUTPUT	N/A	N/A	N/A	N/A	HDMI	HDMI, Composite
POWER	2.0-5.5V	5V	7-12V	5V	6-15V	5V

Table 1: Comparisons of various platform

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System Description

According to the climatic conditions and to maximize the crop yields to a great extent, a system is designed to provide an optimum distribution of water in the field through motor pump. The proposed system helps the farmer to irrigate the field very efficiently and also they will get notifications about the status of the field regarding any changes happened through an Android mobile app. This section describes how RaspberryPi as a sensor unit as well as the server which passes the information to another device. Here, in the proposed system, there will be the temporary storage tank in which the level of water is continuously monitored and if the water goes below that water level 2, the motor will turned on automatically. After it reaches the water level 1, the motor will be turned off and the notification will be sent to the client's mobile applications.

Field is sub divided into three major target locations. In each location, a soil moisture is deployed and they have been continuously monitored. If it goes beyond the particular level which was set by the farmer, the valve will be released in an automatic manner and it allows the water to flow to the particular zone alone until it reaches the particular level, after that valve will be closed. But in this instead of opening and closing the valve, the motor is turned on/off here. A/D converter (MCP3208/MCP3008) is used in this system to convert the sensed values digitally and it is given to RaspberryPi. RaspberryPi is connected to Wi-Fi so that it can pass the collected data directly to the internet without the need of ZigBee and any other PC which shows in Fig1.

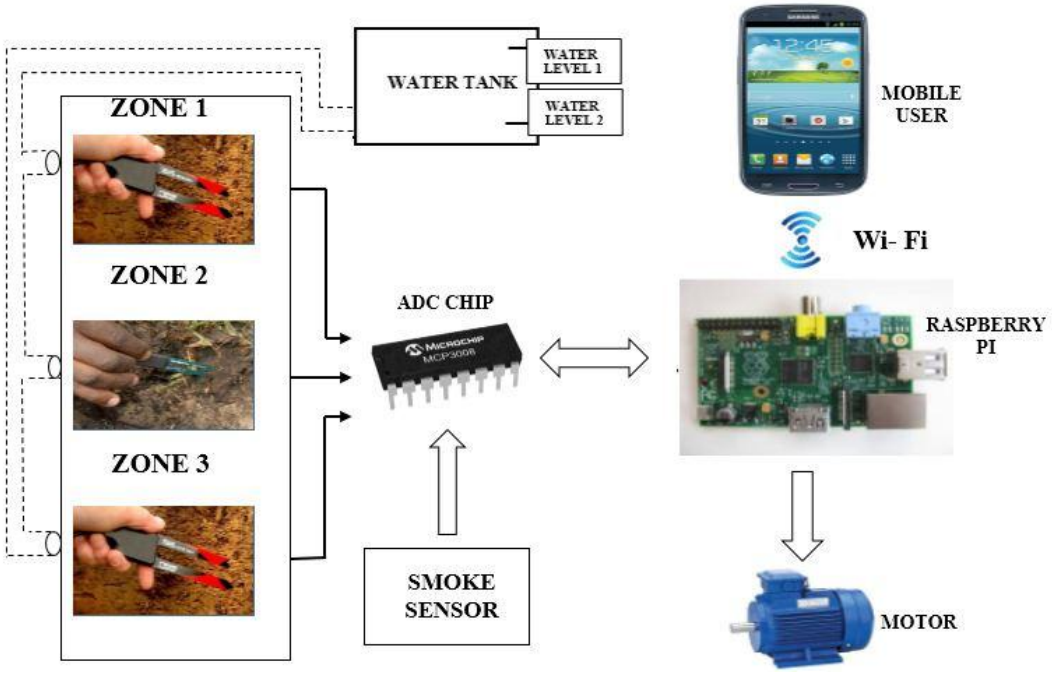

Figure 1: Block diagram of On-Field.

Simultaneously, it will give notification to the farmer about the current status of the field which shows in Fig 1. So that, it will avoid an unnecessary burden to the farmer and the correct water level and soil moisture is maintained and also allows to use the water very effectively and efficiently. Along with this, smoke sensor is also connected. It will detects any unwanted smokes and immediately it gives notification to the Android app. So that any necessary steps can be undertaken at the starting stage itself and preventing it from the damage of crops. Pushover requires a working Wi-Fi or cellular data connection to obtain notifications. When phone doesn't have data connection or if it is in out of range, it will queue up all the incoming notifications. It will receive all notifications once it gets connected.

From this system, the ranchers don't need to travel every time to the field to switch on/off motor and wasting their time unnecessarily. And also they will get the notification even when ranchers are not in the field. Hence, in this work RaspberryPi eliminates many elements considered unnecessary from the design as well as it reduces the overall cost of the system, gains more speed and very less maintenance. The working process of the designed system is depicted in Fig 2.

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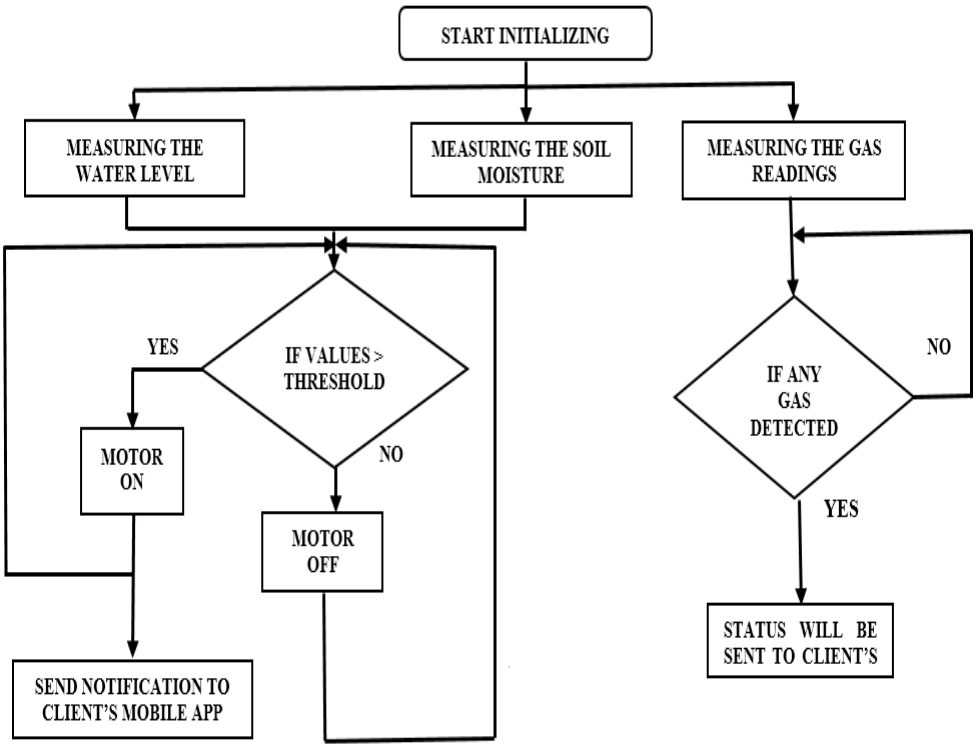

Figure 2: Flowchart of the proposed system

EXPERIMENTATION AND RESULT

The hardware setup of the system is shown in Fig 3. It uses SPI ADC to convert analog to digital and it is connected to SPI pins of RaspberryPi. From ADC chip it is connected to all sensors to get the sensed values. Here transformer is used to run the motor. From Fig 4, all applications that the designed is used are listed in the rancher's mobile application. And the messages can be viewed by clicking on the particular application. The messages will be displayed as shown in the figure 4

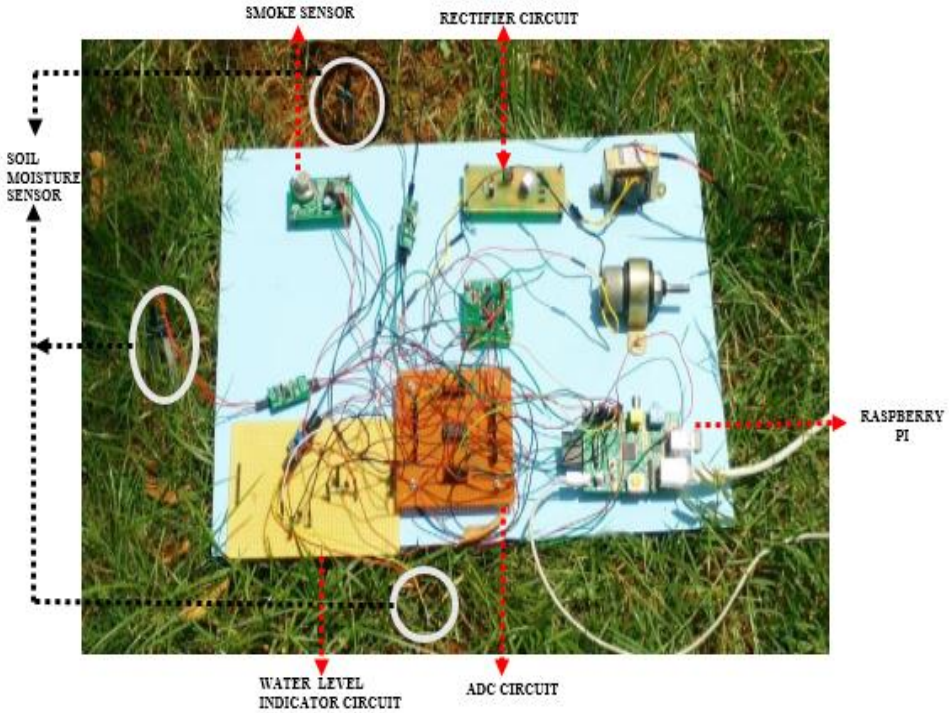

Figure 3: Real time experimental setup of proposed system.

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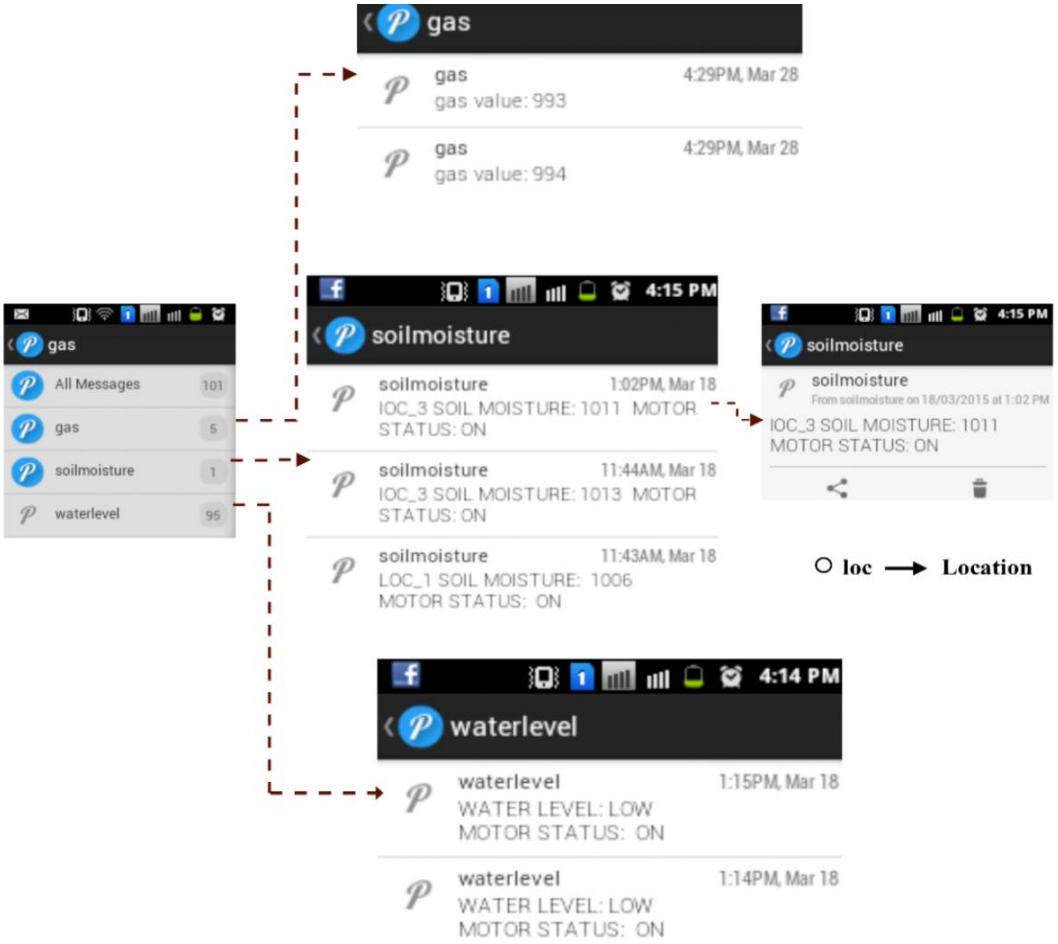

Figure 4: Notification screen shot for the Rancher

CONCLUSION

The proposed system will relieves the burden of the farmer and also able to monitor the field from anywhere around the world. From this system water is used very efficiently as well as effectively. From this system, water can be saved which is used for irrigation that is applied to the particular zone alone when it is needed. And also RaspberryPi eliminates unnecessary elements like ZigBee, need of another PC from the system and reduces the cost for the farmers. Hence it can be concluded by saying that the proposed system is the basic level of agricultural automation and remote monitoring using RaspberryPi which is an inexpensive computer with lot of potential and utilization, not just in agriculture areas but also in other applications.

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