Remote Monitoring System using Raspberry-pi

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ABSTRACT: In this busy world one cannot give his full time to observe the single activity so it is essentially needed that we can do our different routine work and with use of modern technology we can monitor various activities from different places without being actually present there. This project deals with the design and implementation of Smart monitoring system using Raspberry pi and sensors such as soil moisture sensor, camera module, motion detectors, temperature and humidity sensor for wide variety of applications ranging from security to event control. There are various surveillance systems such as camera, CCTV etc. In such systems, the person who is stationary and located in that particular area can only view what is happening in that place , but here even if the user is moving from one place to another, he can know what is happening in that particular place. This review paper provides a description of raspberry pi along with other technologies such as Arduino, Beaglebone and Pcduino and their comparison is summarized in a tabular form.

 KEYWORDS: raspberry pi, soil moisture sensor, remote access, temperature and humidity sensor (DHT22), data monitoring system, raspbian, LAMP server, remote pc.

I. INTRODUCTION

 With day to day improvement in new technologies the daily events are becoming easy for us. Automation is the use of control systems and information technologies to improve the production of goods and services by reducing the need for human work. The system has raspberry pi with camera module and sensors such as temperature and humidity sensor, soil moisture sensor, for the purpose of remote monitoring using a web server. Along with these sensors PIR sensor can also be interfaced to increase the scope for the project and taking snapshots we can use a Pi camera, for temperature readings DHT22 sensor can be used.

The proposed home security system captures information and sends to a server where we can see this information remotely. Raspberry pi operates and controls sensors and video cameras for remote data viewing and surveillance, streams live video and stores data for future analysis. Also another advantage is that it offers privacy on both sides since it is being viewed by only one person .Other advantage is that it is a simple circuit and the system uses raspbian OS operating system. For transmitting image to the smartphone raspbian needs to be installed.

Raspberry pi: The raspberry pi is a very powerful, minicomputer with the dimensions of credit card which wasdesigned with the hope for learners to be creative. This computer uses ARM (advanced RISC machine) processor, the processor at the heart of raspberry pi. All the Storage is provided from a SD card. We can connect this to our network with an Ethernet Cable.

The SoC (system on chip) includes a CPU, a video controller which has hardware MP4 encoder/decoder,Ethernet controller and USB controller. The Revision A boards had 256M of RAM and Revision B boards have 512M RAM. The Pi has SD card slot for storage purpose. Mostly people run a version of Linux (e.g., Raspbian) on the boards. One can either log in remotely to program on the device itself, we can also plug a USB keyboard and mouse to it and use it like a computer as HDMI port allows it to be connected to a TV or Monitor. The device consumes 3.5W of power and has 8 GPIO pins, UART,SPI, I2C, and I2S for programmable I/O.

Processor ARM1176JZF-S 700 MHz is known as brain of pi .It has graphics and a HDMI output. We can plug in a keyboard and monitor, load with Linux, and this small technically device might have no clue how tiny the machine driving everything really is. The device is an incredibly powerful platform in a very small size package, it has size of credit card and perfect for embedded systems, and good for projects which need more interactivity and processing power.

Figure 1. (Raspberry pi)

II.   LITERATURE SURVEY

As technology is growing day by day there are many devices available for performing the same task. Before finalizing the raspberry pi for this project we have gone through many other technologies for surveillance and studied various other techniques few of them are here.

[1] Remote home monitoring system using zigbee .Various nodes are used for the purpose of data gathering of different forms such as ambient temperature, motion etc. These parameter measurements are gathered and processed using digital signal processing. In digital signal processing, the analog signals generated from the sensor nodes are converted into digital signals. Again the digital signals are converted into analog signal. The analog signals from various sensor nodes are transmitted to the local home monitoring server using zigbee. From the local server the data has been sent to the remote view through the network interface.

[2] The core of the monitoring system consists of two main hardware components: the PC home server and the Arduino Unomicrocontroller. The data is collected using various nodes in the desired area and this data is analyzed in arduino only, then this data is sent to a personal computer using LAN cable and then with the use of Ethernet this data is sent to remote smartphone where it can be conveniently monitored. As arduino does not has any provision for Ethernet as it is a type of microcontroller this makes difficult for users to send data remotely also Arduino supports limited number of programming language support.

[3] Sometimes Bluetooth technologies are also used for their simplicity in monitoring systems. This project dealt with remote monitoring by using a bluetooth and a smart phone. Data collected using various nodes is sent to a smartphone using Bluetooth where this data can be further analyzed and processed. But in this system the inability of Bluetooth to send data over long distances limits its functionality. Thus to achieve monitoring this data has to be sent to a personal computer and then can be viewed remotely which becomes a tedious process.

[4]Some popular home monitoring systems and appliance control systems use GSM technology. GSM is a protocol which is used to send SMSs regarding various situations in automation or monitoring system. For this purpose a GSM module has been used generally SIM900 Quad-band/SIM900A Dual-band GSM/GPRS module are used .But using a GSM module limits the functionality of monitoring system as a GSM module will only be able to send messages regarding various situations that arise in the workplace, it will not be able to send real time footage and pictures that a Raspberry-Pi can send although it can be used along with the Raspberry-Pi.

[5]During our survey we also found that for some sophisticated and hard real time monitoring environments other System on Chip such as Beaglebone can be which has all the functionalities of a computer as well as Raspberry-Pi but at the same time it is quite costly and impractical for mid-level projects, where Raspberry-Pi is able to provide more than satisfactory results.

By the survey we understood that arduino is just a microcontroller and it cannot have an operating system so we cannot write program directly, here we have to write codes in computer then transfer it via USB. Beaglebone and pcduino are turns out to be the better alternative for raspberry pi as theyboth are more powerful than raspberry pi but they appears to be more costly. So final decision is to reach raspberry pi is according to achieve specific project application

requirement with minimum ofinvestment. For this various technologies been compared on the basis of their technical specification and are summarized in a table after a detailed explanation of some other technology.

III.   PROPOSED WORK

We can understand the proposed system with concept of two premises out of which one is plant premises and other is office premises. In plant premises all hardware setup is being installed, there are various sensors like soil moisture sensor, temperature and humiditysensor. The many other sensor like camera module and motion detector can also be attach in plant premises so all this sensors sense the environment and sends the information to raspberry pi. Raspberry pi is a minicomputer which contains ARM processor which process the data and stores it memory of pi. In office premises user can log in to account with the IP address of raspberry pi and can check all parameters within single window using GUI and database system user can also set limit range of parameter and if parameter goes beyond that value it give notification signal and according to the reading obtained by sensor user can switch on/off the device. In this way we can keep a place completely under monitoring system. With the use of soil moisture sensor the problem of over irrigation can be solved. The scenario can be understood exactly by block diagram.
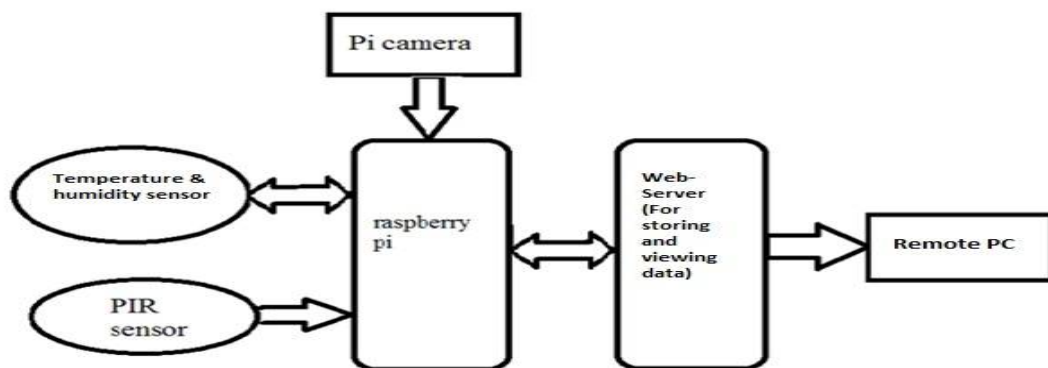

Figure2. (Block Diagram)

IV.   CURRENT THEORY

An Arduino is a micro-controller board has 8-bit AtmelAVR micro-controller. It has between 32K and 512K of on-board flashable memory, run at clock speeds of 8-84MHz and run off voltages of 2.7-12V.The RAM is 2K and it takes about 7 seconds to boot. It is programmed using a special subset of C and has no operating system. The program is first written on a computer and uploading the compiled code over a USB cable. Depending on various model they have 9 and 54 digital I/O pins and 6-12 analog input. Power consumption is < 0.5W.

The Arduino is simply perfect for electronics projects and prototyping. We can easy connect some LED's, sensors, motors directly into the board with their user friendly board it becomes too easy. To program the Arduino we need their software. Basically with that software we can upload our source code directly into our Arduino through USB.After we upload the Arduino code we need to unplug the USB cable attach a battery to our Arduino Board and it will run our program forever.The heart of the Arduino is ATMega3280P microcontroller. ArduinoUNO is the most common board.

Fig 3.0 (Arduino)

BeagleBone Black: Thedevice is more similar to the Raspberry Pi but it's more powerful and it is based on the TI Sitara AM335x, which is an application processor SoC containing an ARM Cortex-A8 core. This device has more pins to control. BeagleBoard community is perfect for developers and hobbyists.

Among other differences, it has RAM of 512 MB, the processor clock to 1 GHz, and it has HDMI and 2 GB of eMMC flash memory. The BeagleBone Black also ships with Linux kernel 3.8 which is upgraded from the original Beagle Bone's Linux kernel 3.2, so that advantage of Direct Rendering Manager (DRM) is taken up by BeagleBone Black.

The new BeagleBone Black Revision C (released in 2014) increased the flash memory sizeup to 4 GB due to which it can ship with Debian GNU/Linux installed. The BeagleBoard community is perfect for developers and hobbyists.

Fig 4- (Beaglebone)

PCDuino = "PC + Arduino": This device board is similar to the Raspberry Pi, now a day it becomes an alternative and better choice of developers. The device hasall the features of the Raspberry Pi and even it's more powerful so its cost become much higher. It has a flash memory of 2 GB and that can be increase up to 32GB by adding a SD card which is a really advantage over the Raspberry pi.

PcDuino provides a platform where one can run the operating systems like Ubuntu and Android ICS. It outputs screen to HDMI, alsoit has hardware headers interface compatible withArduino.
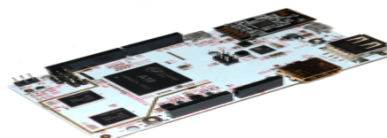
Fig5- (pcduino)

Comparison Table

feature	Raspberry pi	Arduino	Beaglebone	PCDuino
Processor	ARM 11	ATMEL AVR	ARM CORTEX A8	ARM CORTEX A8
Clock speed	700 MHZ	16MHZ	1 GHZ	1GHZ
Operating system	Raspbian	None	Linux kernel 3.8	Ubuntu
Memory	512 Mb	0.002 Mb	512 Mb	1 Gb
Input voltage	5v	7–12 v	5 v DC, 1A	5v, 2A
Flash	SD Card (2 to 16 Gb)	32 Kb	4 Gb	4Gb (expandable upto32Gb)
USB	Two, peripheral	One, input only	One	One
Cost	2600Rs	1600Rs	4500Rs	8300Rs

V. CONCLUSION

All technologies are good; their usage depends more on specific application according to cost consideration. Arduino is suited more for simple pure hardware projects wherever Raspberry pi is better for software applications like in embedded system and hold good with complex networks. Beaglebone black and PCduino are similar to Raspberry pi and even more powerful and can be used as replacement for Raspberry pi but cost plays an important role here as they are much expensive. It means we had to decide carefully by looking at our requirement and cost. Thus raspberry pi suits best for the project of remote monitoring system.

This system is capable of recording/capturing video/image, raw data, and transmitting to a personal computer for analysis and monitoring purpose. It has advantage of offering reliability and privacy on both sides as it does authentication and encryption on the receiverside; hence it allows only the person concerned to view the details.

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