

## IOT based Monitoring and Control System for Appliances

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### Abstract

In present days the use of embedded systems growing rapidly most of the devices in industry and home are associated with Internet of things. With the advancements in internet technologies and Wireless Sensors Networks, such systems monitor the environment parameters such as Temperature, light Intensity, gas levels in greenhouse. Here a system is proposed from the inspiration of the above system to monitor the various parameters in the industry and home automation. This proposed system principally monitors and control some of the environmental parameters such as light intensity by LDR, room temperature and gas levels by MQ2 Sensor. This proposed system also monitor the status of Appliances and send an SMS alert via GSM network automatically to a concerned authority and the status will also update in Embedded Web Server. We can also control the devices i.e ON or OFF the by using web server links. If the conditions get abnormal and find a wide application areas where physical presence is not possible all the time. The Wi-Fi and Raspberry pi are used in the implementation of sensor module. This system offers a complete low cost, powerful and user friendly way of real time monitoring and control of industry or Home.

**Keywords:** Raspberry Pi, LDR, MQ2 Sensor, SMS, GSM, Embedded Web Server.

### I. INTRODUCTION

Monitoring and controlling of appliances is one of the important measures to be closely monitored and used in real-time for safety, security and comfort of people. With the advancements in Internet technologies and Wireless Sensor Networks (WSN), a new trend in the era of ubiquity is being realized. Enormous increase in users of Internet and modifications on the Internet working technologies enable

networking of everyday objects [1]. Web-enabled systems have offered great promise to consumers. Their benefits are well known. Reduction of operating and maintenance costs due to remote monitoring, diagnostics, debugging, and upgrading firmware. Convenience and safety that comes with the ability to monitor the status of a smart house and to control Internet appliances when away from home. Remote monitoring of residential and industrial properties, notification of emergency services in case of fire, theft, and a leak of liquid or gas. Similar types of Internet-based systems, such as those in, are designed to gather a bulk of data before serving them upon request. In these applications, data are compiled in a central server and are then served to the clients via the internet. Interaction with the embedded unit is also an important issue. In, an embedded PC card placed on the Internet allows limited interaction through commands sent through Transmission Control Protocol/Internet protocol (TCP/IP) and User Datagram Protocol (UDP). The paper proposes a Raspberry pi based appliances monitoring and control system through webpage with WI-FI based technology. We have designed and implemented a compact wireless sensor network with internet capability. The system can monitor the status of sensors and send an SMS alert via GSM (Global System for Mobile communications) network automatically to users. The system has the capability to control through internet, when the information update on webserver it is read by the developed algorithm fed into Raspberry pi and then the system responds to the corresponding instruction with high security. The user can directly log in and interact with the embedded device in real time without the need to maintain an additional server. The system is modularly built, allowing different modules to be added. In addition, it is flexible to accommodate a wide range of measurement devices with appropriate interfaces. It has a variety of features such as energy efficient, intelligence, low cost, portability and high performance.

## **II. LITERATURE SURVEY**

WSN has wide spectrum of applications in various sectors. In these applications, it is necessary to monitor & control physical environments remotely with great accuracy & ease [2]. As in [3] a wireless sensor network is a system combination of radio frequency (RF) transceivers, microcontrollers, sensors and power supply source. Wireless sensor networks with self-configuring, self-organizing, self-diagnosing and self-healing capabilities have been developed to omit problems or to enable applications that traditional technologies could not fix. Wireless sensor network consists of various sensors and an RASPBERRI PI controller. Wireless communication is the transfer of information over a distance without the use of electrical conductors or wires. The distances involved may be short (a few meters as in a television remote control) or very long (thousands or even millions of kilometers for radio communications). Wireless communication involves Radio-frequency communication, Microwave communication, Infrared (IR) short-range communication. Applications of this communication may involve point-to-point communication, point-to-multipoint communication, broadcasting, cellular networks and other wireless networks. In the last few years, the wireless communications

industry experienced drastic changes driven by many technology innovations. There are several systems that allow data to be remotely accessed. As a solution to wireless data collection through the Internet, GSM is a popular choice in several applications.

### **III. EXISTING AND PROPOSED SYSTEMS**

In embedded system with the advancement in Internet technologies and Wireless Sensors Networks, such monitor the environment parameters namely ;temperature, CO<sub>2</sub> concentration and light intensity in Greenhouse. In this existing system measures some of the parameters, but I can take various parameters which is important in monitoring system.

The proposed system contains a Raspberry pi based Appliances monitoring system. It can monitor the parameters such as light intensity, room temperature, fire and LPG gas. It also indicates the leakage of LPG gas and also inform the usage of LPG gas when it exceeds beyond certain level to the user or concerned authority. This system can monitor the status of appliances and update in the web server automatically.

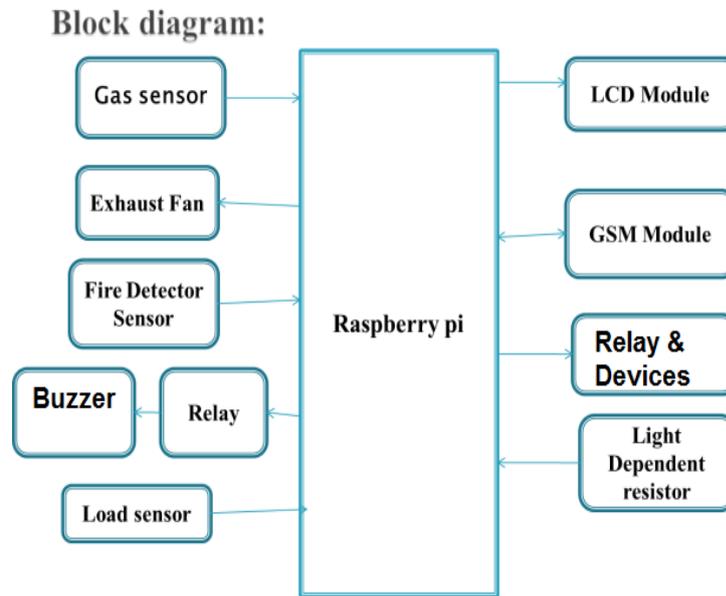
### **IV. OVERVIEW OF SYTEM DESIGNED**

This section presents main features and the design requirements of the system.

The system consists of an embedded web server with Raspberry Pi. This RASPBERRI PI 11 acts as main processor. A wireless sensor network containing the RASPBERRI PI as master controller along with the various sensors such asMQ2 (Gas sensor), LDR (Light Dependent Resistors), Fire Sensor is also used. The RASPBERRI PI hardware is built on single chip module. There are various slots to the RASPBERRI PI11 processor for connecting the various external devices such as GSM modem. A memory card can be inserted into the one of the available slot. A regulated power supply is provided to the overall system as shown in fig.1

All the sensors sense the respective data in the plant and send this data towards the controlling unit such as RASPBERRI PI. Thus all the data is collected by the RASPBERRI PI and is maintained at this location.

Here, the data is stored in the data base. At this stage signal conditioning is done and only required amount of data is sent forward. Thus a successful communication is achieved between a server and client side by using this type of system. Thus personal computer & a Smartphone will continuously monitor all the data from remote processing unit and compare with the value preloaded process structure.



**Fig1:** Block diagram of implemented system

## V. EMBEDDED WEB SERVER

The implementation of embedded internet technology is done with the help of embedded web servers. An embedded web server provides remote access to devices from a web browser. An embedded web server is integral part of embedded network which consists of an RASPBERRI PI processor [4]. RASPBERRI PI processor contains an internet software & application code for monitoring & controlling the systems. Embedded server is a single chip implementation of the Ethernet networking standard. The client computer sends/receives data to/from the Raspberry Pi microcontroller using TCP/IP packets. The client has to enter IP address to access this server. The IP address of embedded devices will be available at client side to directly access the system. By using this IP address people from remote location will access the information on pc as well as on their Smart phones [5]. Booting of the target board is done by using the hyper terminal. After the target is successfully booted with RTOS, it is tested over the network using ping command. Now the embedded web server is responding to the clients. The operating system manages the request of the client and gives to the LAN controller of the client system.

## VI. IMPLEMENTATION OF THE SYSTEM

The design and implementation consists of two sections as

- Hardware tools
- Software tools

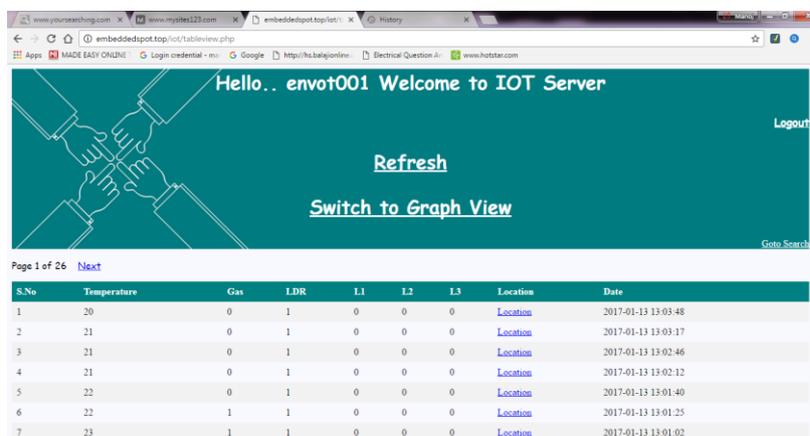
The hardware design consists of various sensors, Raspberry Pi processor package, GSM modem, a far off computer & an android Smartphone. All these hardware's are interfaced with each other. We're developed a coding in Python in IDE of python programming. Additionally we're making use of RTOS to manage the whole project and to provide an outcome in actual time.

**Web Server:**

Web server used to display the temperature sensor value, gas sensor and Light Intensity levels will be displayed. Web server login page and the display on web server page are shown in fig.4 and fig.5 respectively. Along with these it can also displays the status of loads whether in the on state or off state. We can control these devices based on links given.



**Fig4:** web server login page



**Fig5:** Display data on web server via WI-FI in the system

*SOFTWARE TOOLS:**A. Python:*

Python is a widely used general-purpose, high-level programming language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C. Python supports multiple programming paradigms, including object-oriented, imperative and functional programming or procedural styles. It is a scripting Language and it's executing the code line by line.

*B. Raspbian wheezy:*

The Raspbian wheezy is another important software part which deals with the Raspberry Pi. Raspbian wheezy is an unofficial port of Debian Wheezy Raspberry Pi hf with compilation settings adjusted to produce code that uses hardware floating point, the "hard float" ABI and will run on the Raspberry Pi. Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. There are various languages used for web design that have developed over the life time of World Wide Web. Generally web pages are designed using HTML or Hyper Text Markup Language. HTML pages are used for data communication between the client and the server. In the embedded web server, web pages are selected as the media of interaction. Here we are developed a PHP page. The PHP Hypertext Pre-processor (PHP) is a programming language that allows web developers to create dynamic content that interacts with databases.

**VII. RESULTS & DISCUSSIONS**

In the proposed system, Industry and home appliances parameters such as gas leakage, fire, light intensity and LPG gas weight age can be monitored and also controlled by the modules such as when gas will be detected exhausted fan ON automatically to send gas outside of the space and also when fire will be detected. AC motor will be ON to sprinkle the water to remove the fire. This all information will be sent to the concerned authority via GSM and also Email.



**Fig6:** Total system response of the proposed system

## VIII. CONCLUSION

The design and the development of an interactive Industry and home appliances monitoring system with the GSM, WI-FI communication and Web-based measurement and control systems. The Web based monitor and automatic control of equipment is forming an automation field. Replacing PC with low-cost single chip processor can make administrators to get parameters of different remote sensor and send control information to Industry and home appliances parameters at any time through Internet.

The GSM is an excellent choice for this due to its extensive coverage of the all parameters. Since SMS is a text based protocol, even the most basic GSM systems make changes on these states. The complete system is secured through a login to web server and Webpage password based authentication. The design is completely integrated and wireless with the software to form a low cost, reliability and easily operable system. WI-FI communication makes the system to install easily. The GSM and Web based communication system provides a decision making device concept for adaptation to several appliances control.

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