ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 4, Issue 6, June 2015

Remote Access of Domestic Resources in Residential Houses using Smart Phones

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***Abstract*— Energy saving importance is increasing from past half century; many studies about the communication technology and energy savings information have been presented. By providing residents about the energy consumption can promote energy savings in domestic sector. Also it has become need to perpetuate gas, water and its wastages. For safety purpose it is necessary to check usage of domestic cooking gas and its leakage detection. Here we propose a spanking home management system, which supervises all devices from any remote place and at anytime, this system allows the house owner to control and monitor his electrical devices, gas valve and water outlets via his mobile phone. Along with this temperature and humidity sensors are also added to monitor electrical stuffs like fan, AC, light, etc. by its intensity. An Android application is proposed for controlling the devices remotely. In real time, the status of switches is simultaneity in the entire control system. It is easily possible to preserve domestic energy, giving rise to a entire home automation system with mainly two objectives, first is conservation and second is safety purpose.**

***Index Terms*— Android application, gas leakage detection, home automation, sensors, smart phone**

I. INTRODUCTION

Prior, we imagined the future when we use to talk about automated devices, which could do any action with the help of a controller, but today scenario has changed and our imagination has turned into a reality and part of day to day life. A robotized device can substitute good amount of man power, humans are more likely prone to errors and in extreme conditions the error probability increases. A robotized device can work with versatility, diligence, and with almost no error.

Home automation can be convenient for those who need to operate home devices while they are not at home and can astonishingly improve the lives of the disabled. The available home automation systems can be categorized as: remotely controlled systems and locally controlled systems. Globally-controlled systems are those systems that use cloud computing. These type of systems can be controlled through cell phones, laptops, personal computer etc. Locally controlled systems use an in-house controlling unit for home automation. Through these systems the user can control his home devices within the home through a wireless interface stationary or. The difficulty of home automation system using GPRS, RFID and Bluetooth, they require a independent software and hardware environment to be installed in each house. These systems provide the user with specific access as the area is restricted only within a limited range. Mobile devices and cloud network discard the need to installation and running of application on the user computers. This paper consolidates the locally and remotely controlled systems with the use of the cloud network. Cloud Computing provides an access on demand to the resources online, which requires less effort and can be easily indulged. This allows the system to operate without any dependence of a mobile provider, it allows the system to be used on various smart phones, and when computer or phone access is unavailable, it allows the system to operate locally.

II. LITERATURE SURVEY

As the wireless technology is emerging nowadays, several different connections are introduced such as Bluetooth, WIFI, ZIGBEE and GSM. Each of these connections has their unique specifications. Among the above mentioned wireless connections, Bluetooth is chosen with its suitable capabilities for designing this HAS project. Bluetooth can provide connectivity up to 100 meters at the speed of 3Mbps with globally available frequencies of 2400Hz [1]. Based on the study of different HAS projects done by developers, [2] microcontroller is implemented in wireless HAS. For creating wireless connection, the system implemented a RF transmitter and receiver for establishing RF connection [3]. The other system implemented Internet, voice wireless HAS and GSM, [3]. The GSM system [3] cost is low but the GSM mode is not considered. By consider all these systems we came to a conclusion that Bluetooth is considered the best for implementing this HAS as Android device consists of Bluetooth by default.

Energy monitoring system using WSN in Residential Houses [4], aggregates the energy consumption data of home appliances and visualizes it into comprehensible forms. Visualizing the fine-grained data enables residents to understand the details of their energy usage and use behavior.

NAWMS: Non-intrusive Autonomous Water Monitoring System [5] propose a scalable water monitoring system capable of estimating water flow rate using wireless sensor network technology. It uses inexpensive vibration sensors attached externally to the pipes. This reduces both cost and effort of installation of system.

A household safety can be intended by detecting gas leakage and monitoring it. For this design can be divided into two modules: the receiving module and the detection and transmission module. The gas concentration is detected by gas sensor and a system is built to send a signal to receiving module. [6]

Home Automation system can be built by integrating smart phones, cloud networking and wireless communication. Here users are allowed to control home appliances remotely through cloud network. [7] For a flexible and low cost monitoring system protocol used for communication is Wi-Fi, it does not require any stand-alone system for installation. If a Wi-Fi connection is not available 3G and 4G mobile cellular networks can be used to access the system. [8]

Home automation is not just limited to monitoring of electrical appliances. Conservation of energy is a necessary along with necessity to conserve domestic water and gas. At present conservation of gas and water has not taken into consideration by other systems referred above. But these resources also play a crucial role in our daily life. So by combining ideas of all above paper we propose a system which will monitor resources of our residential houses. The parameters that system will monitor are: Energy, water, gas, intruder etc. This system will monitor as well as control these parameters using an Android Smartphone for its conservation and safety the house.

III. System Architecture

Home automation is a field within building automation, specializing in the specific automation requirements of private homes and in the application of automation techniques for the comfort and security of its residents. Although many techniques used in building automation such as control of doors and window shutters, light and climate control, security and surveillance systems, etc. are also used in home automation, additional functions in home automation can include automatic plant watering and pet feeding, the control of multi-media home entertainment systems, automatic scenes for dinners and parties, and a more user-friendly control interface.

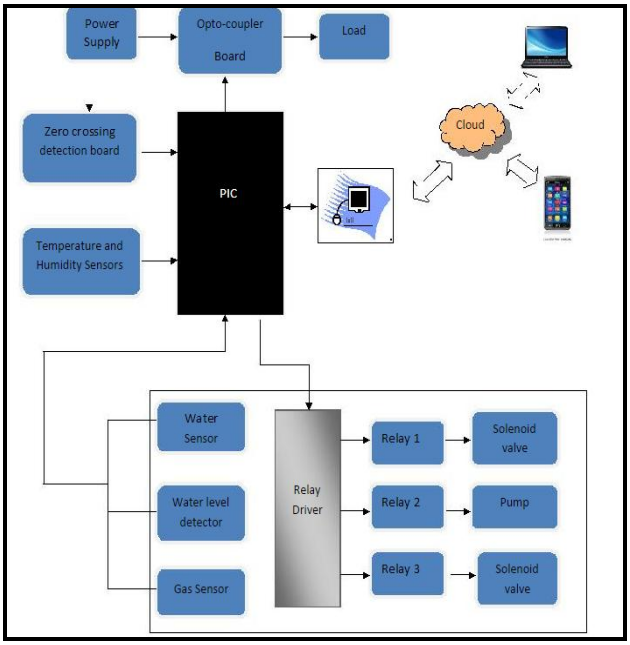

Fig. 1 System block diagram

Figure 1 shows the block diagram of the Android application based HAS i.e., control working of the system. The framework is directly connected to the electrical and electronic devices present in the home such as fan, light, etc. For monitoring and controlling purpose there will be a local server PC which will be connected to microcontroller (PIC) via serial communication RS232. Now this PC will act as a local server from where controlling of appliances will be possible through a GUI which will be developed on this PC. This is the locally controlled system.

For the remote control of these appliances here we have developed an Android application through which status of the appliances along with its switching is made possible. The android phone will be linked to a local server PC through a cloud where the request for switching appliances will be put forward to microcontroller. This communication network created for monitoring and controlling of electronic appliances.

The humidity and temperature level can be measured using the sensors that are linked to the main control board. The indication from the sensors reminds the user to turn on/off the fan or air conditioner in the house. The on/off status of home appliances, temperature and humidity readings are synchronized with the Android application present in the Android device. The monitoring of switch status and sensor reading is done in real-time; any changes in the switch status or sensor readings will be transmitted to the Android application present in Android device.

Along with electrical appliances other domestic resources that here we concentrating are water and gas. This system will be a complete automatic system that will control the gas and water parameters. A gas sensor, water sensor and water level detector are used as inputs for monitoring the above parameters. A solenoid valve for controlling flow of domestic gas and water and submersible water pump are connected to relays through a relay driver. A mechanism is provided to take preventive actions in case of gas leakage and water flow. It will detect gas leakage and give alert regarding same on your Smartphone. After detecting gas leakage automatically the main flow of gas will turned OFF so prevent situation from any Hazard. Same will be with water also.

IV. Design Implementation

The proposed system consists of hardware and software architecture. For this design implementation is divided into hardware implementation and software implementation.

A. Hardware Implementation

In this section we discuss about the hardware construction of the main control board. Figure 2 shows the hardware blocks present in main control board. PIC Microcontroller is considered for designing of this hardware. The main control board is connected to a PC via RS-232 serial communication which will act as a local server. To this local server Android phone can be connected using Wi-Fi easily. Extra cost of installation is reduced. As we know, the temperature and humidity sensors are considered for getting the temperature and humidity levels in the room. The electrical current is directly connected to the main control board. The voltage regulator is constructed by Zero Crossing detection and Opto Coupler circuit which consists of transformer, rectifier and regulator. 3.3V to 5V DC output is needed for the specific components in the main control board.

The system designed is directly installed beside the electrical switches on the wall. The installation of these systems does not need any wiring reinstallation and wiring on the wall, but the existing switches are directly connected to the Opto- Copular circuit inside the main control board. Depending on the requirement, multiple control boards can be installed in home. With these low cost components, the main control board is

constructed in small size but still performs the strong functions of the system.

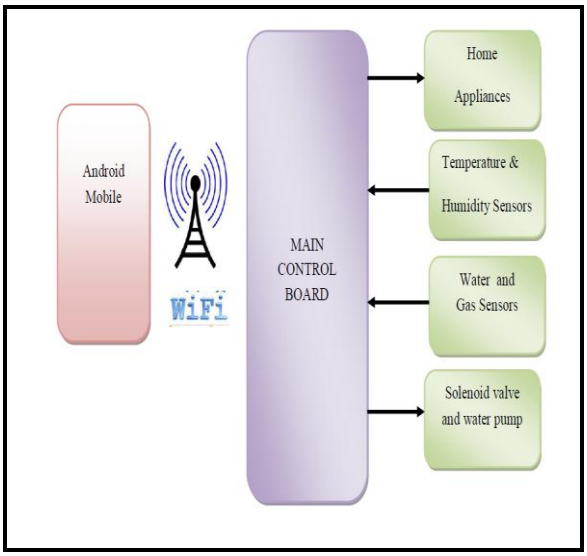

Fig. 2 Hardware implementation of system

The water sensor, water level detector and gas sensor, MQ6 is connected to main control board. If the reference value exceeds the controller will activate relay and solenoid valves that are used for water and gas respectively will be closed and water pump will be off. To drive the relays, a relay driver IC is used ULN2803 is used.

B. Software Implementation

The coding for slave unit is done using following algorithm, shown in Figure 3.

The programming for controller is done using embedded development platform called Keil µVision. For coding we use C language using same software.

Figure 3 illustrates the control flow in PIC microcontroller. The input to the main control board is detected by PIC microcontroller. Any input to PIC microcontroller will cause an interrupt to the main function loop of PIC. This will cause a change in the output peripherals connected to main control board.

Our goal is to build an Automated Home System which can be accessed or used using an android mobile device. This will help us to control our Home Appliances using simple mobile devices. The flowchart for developing an android application is shown in fig. 4. This application detects inputs through PIC micro-controller; if the input is valid then it activates or detects the home appliances, water level and leakage of gas/water. If water level has been exceeding then switch off the pump relay through Relay 2, if not exceeding then again detects the water level. If it has been detecting leakage of gas/water then close the solenoid valve through relay 1 and 3. After checking home appliances, water level and leakage of gas/water system will automatically stops.

The application is unfussy to use, user can turn on and off the appliances that are connected to main control board by simply touching the icons existing on an application.

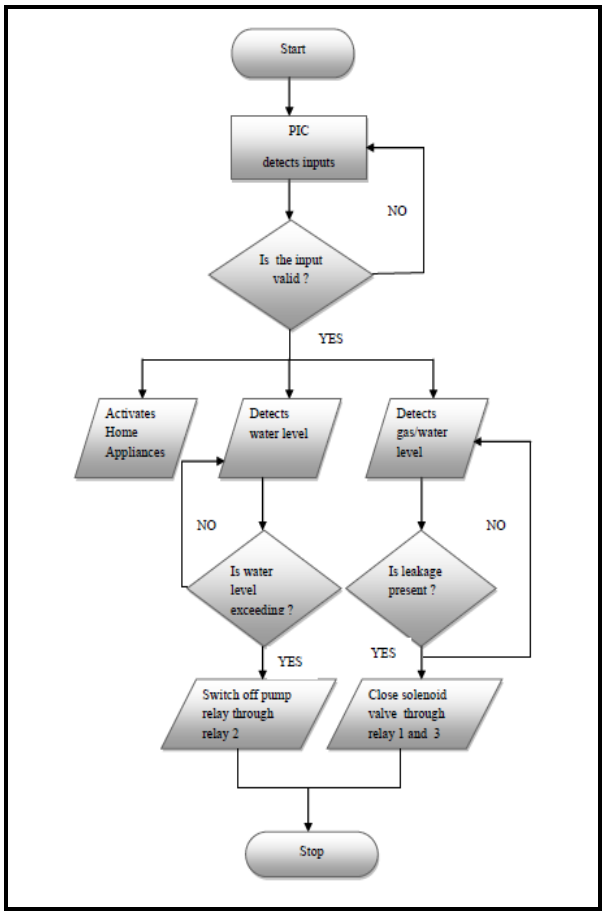

Fig. 3 Software implementation of system

V. RESULTS

Android Application is developed using Eclipse, platform for developing JAVA using Android Development Kit. The result shows user interface screen using Android application shown in figure 4.

Here as a prototype we have used only two electrical appliances i.e. light and fan whose status can be displayed on screen. With the help of temperature and humidity sensor intensity of light and speed of fan can be varied. Along with this the status of gas leakage and water level is shown on this application so as to take safety and preventive measures regarding the same. With help of this application all domestic resources can accessed remotely as we have used communication protocol Wi-Fi.

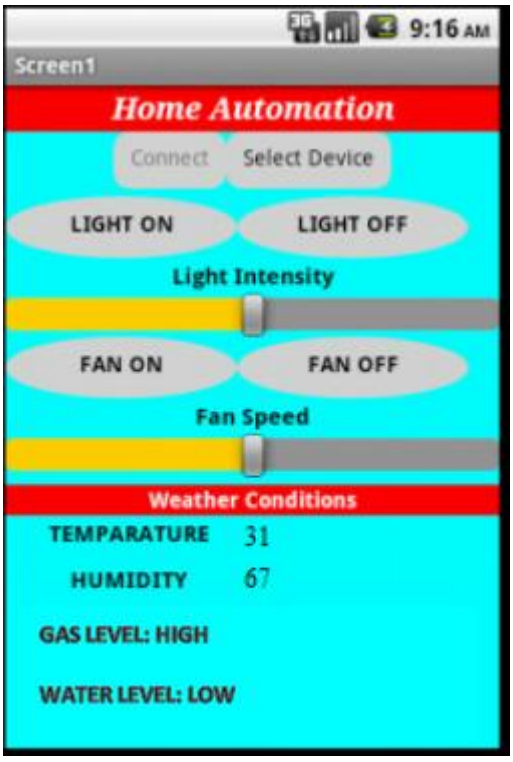

Fig. 4 Developed Android Application

VI. CONCLUSION

In the home automation system, by integrating cloud networking, multi-touch mobile devices, wireless communication, and power-line communication, we will be easily depict and constitute a fully serviceable home automation system. From this following conclusions are drawn:

It will enable the customer to control various appliances and lights within their home and from any remote place through cloud network using

1) PCs,

2) Mobile devices, or

3) In-home graphics user interface (GUI) on their home servers.

With the use of cloud computing concept, the information of devices is stored in cloud so that it can be accessed remotely for monitoring and controlling of devices.

In our future work, we will introduce our system into residential homes and confirm the effectiveness of our system with respect to energy savings.

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