FM and Web Based Solution: A Novel Approach to Monitor and Control Home Appliances using Mobile

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Abstract - The capacity of controlling various electrical and electronics devices in a wireless and remote fashion has provided a great convenience to many people in life. Through a wireless distant control system, people can do remote operation without directly accessing the host of home appliances like fan, lamp, TV, washing machines and others. Pocket switch is one of these types of system which we can use to control home appliances smartly from anywhere. The main objective of this work is to make such a system which controls the home appliances remotely using Web service and FM technology from a mobile phone. This paper discusses two methods of controlling home appliances. The first one is web service based where server will generate a command to the controller computer and the second one is FM network based where server will synthesize the SMS in to speech.

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GJCST-E Classification : C.2.m

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FM and Web Based Solution: A Novel Approach to Monitor and Control Home Appliances using Mobile

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Abstract - The capacity of controlling various electrical and electronics devices in a wireless and remote fashion has provided a great convenience to many people in life. Through a wireless distant control system, people can do remote operation without directly accessing the host of home appliances like fan, lamp, TV, washing machines and others. Pocket switch is one of these types of system which we can use to control home appliances smartly from anywhere. The main objective of this work is to make such a system which controls the home appliances remotely using Web service and FM technology from a mobile phone. This paper discusses two methods of controlling home appliances. The first one is web service based where server will generate a command to the controller computer and the second one is FM network based where server will synthesize the SMS in to speech.

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I. Introduction

Use of long range wireless control system is not a new concept in today's world; it is used to provide expediency for user to remotely control the home appliances with a better use of electricity. Sometimes it is not feasible to be physically near to the home whereas it is very important to control the appliances for many purposes such as electrical short circuit, fire burning, electrical explosion etc. These types of situation may cause loss of wealth and life. By controlling the system from distant place, we can save the unexpected waste of wealth and loss of life.

There exists a number of available media for remote communication. Internet is a good example of this type of remote communication. Internet places virtually no bounds on geographical placement and is thus considered "enough" remote by our definition. But the Internet is a place crowded with various types of traffics, often hostile to each other. Security vulnerability is the most striking alert point of the Internet. Whenever a web based application goes live, a lot of efforts have to take place before it can be said to be secured, if at all. When we say remote control, we want to make sure no malicious party ever gains control and abolishes everything. Also to use web, it requires resources like flawless internet connections and hosting servers, which may not always fit to the concept of remote control-ling [1].

Mobile Phone is another example of remote communication which has become one of the most popular communication devices amongst the people all over the world with wide range of communication services like voice and data transfer through SMS and other enhanced data transfer protocols like GPRS, EDGE etc. Research shows that, at the present with the world population of around 6.7 billion peoples, 60% of the world population uses mobile phones which are about 4.1 billion mobile phone users. Since the GSM network started its operation in 1991, the SMS became popular as it provides cheap and convenient method of communication. SMS users are able to message over 160 (7 bit) word characters including the space using cellular network to almost anywhere in the world within seconds [2]. Unlike the Internet, the SMS is safe from network security threats and can be operational from anywhere in the world where there is a mobile network.

Numerous techniques have been proposed to address the challenging issues associated with the control of home appliances remotely. Wireless technologies are very attractive where infrared, or radio link technologies (e.g. IEEE802.11b) are most frequently utilized. For example Sachin Sharma et al [1] has proposed a system that control home appliances through infra-red remote controller and power line communication by developing a JAVA (Android platform) based module in cell phone at the Transmitting end that gives instructions and commands to Receiving Unit via GPRS network that will control the Infrared control devices. Nevertheless, with the availability of complex controllers and processors at lower costs, technologies that are well established for common PCs are being revisited for numerous embedded devices. It is not unusual therefore, that simple computer systems are being used to bridge devices interconnection gap, having the cheap PC act as a home/ambient controller. On top of PC-based architectures, user interfacing is often provided by a simple web server, when PC is exposed to the global network and can be accessed from any internet hot spot [3, 4, 7].

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Also, GSM or GPRS networks can be used with a standard mobile provider, to allow control of the system via short message service (SMS) or a phone call. PC based software packages that provide management of supported devices with the goal of home automation are scarce, at least when it comes to providing ambient intelligence and awareness. Dedicated home automation controllers are also deprived of high level ambient functions [5, 6, 8].

In this paper we present a novel method to control the electronic devices using a mobile phone through FM system. In case of absence of internet service mobile user will send the SMS to the server computer. The server computer will work as a service provider. The server computer will receive the SMS and synthesize it to the speech. The speech will be transmitted through the FM system. The remote controller computer will receive the signal by recognizing the command and act on that. Clients can also control the electronic devices over internet. Mobile and controller computer will be connected with the internet. The mobile will send service request to the server. The server will generate a command to the controller computer. The controller computer will control the device on the basis of service request.

II. System Architecture

a) Method 1

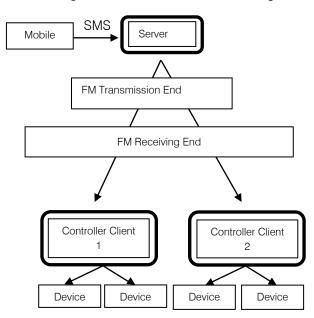The block diagram of this method is shown in Fig. 1.

Figure 1 : Block Diagram of the Web Service based Method

i. *Server*

There exists one server listening to the COM port with a GSM receiver for command SMS to come from GSM network. This server is also connected with an FM transmitter, which is used for transmitting command signal with a specific frequency (MHz) E.g: 95.6 MHz.

ii. *Controller Client*

It is device controller that is connected with an FM receiver listening to the frequency that server will transmit. Multiple devices e.g: "Generator", "Automatic door lock" etc. are connected with this client.

iii. *User Client*

It is any kind of cell phone that has SMS sending capability.

The mobile client will send the command SMS to the server. The server will work as a service provider.

Valid SMS format: "*Controller Client ID: Command*"
Valid SMS example: "*Industry client: turn off generator*"

Server will receive the SMS and verify the valid client from database using the cell phone number. If the client is valid, it reads and passes the SMS and find if there is any controller client with this ID number under SMS sender client. Then, existing command will be synthesized into speech and will be transmitted through FM network with a specific frequency for specific client to receive.

Valid transmission format: "*client name followed by the command*".
Valid transmission example: "*Industry client turn off generator*".

All controller clients connected with FM network and listening to the frequency of that server used for transmitting the command signal will receive the signal and try to recognize the command. Only valid controller client will recognize the command. For example: if valid transmission is "Industry client turn off generator" only client that has name "Industry client" will be able to recognize the command. If received command is, "turn off generator", it will turn off the generator.

iv. *Security*

While sending an SMS to the server, server will analyze the mobile number. Any unauthorized SIM number will not be able to control the server. Thus there is no chance of misuse of control.

b) Method 2

In this method, there exists one server with one web service and multiple device controller clients connected with it over TCP. The block diagram of this method is shown in Fig. 2.

i. *Server*

When TCP server first starts, it listens on two ports, one for web service and another for multiple device controller clients.

ii. *Controller Client*

Device controller client is a computer which is equipped with an application which is built using C-Sharp programming language. Device controller client has the servers IP address and Listening port. When it

first starts, it sends a formatted request to the server containing its unique identification, that is; its device identification number and electronic/electrical devices that are connected with it or it can control.

a. *Format of Request*

"*Device unique identification: name of electrical/electronic devices separated by comma: Owners ID*".

Format of request example: "Controller client 78941256: generator, door, main power switch: 12345".
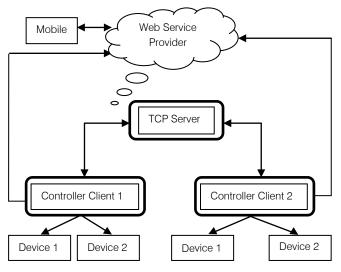

Figure 2 : Block Diagram of the Web Service based Method

SQLite database is provided with the TCP server. When server receives this message, it will first check if the client is in database, if so it will update the information and its active status to up. If client is not in the database, it will insert it to the database with a unique ID and send the ID back to the client with same socket.

Format of the database:

Unique ID	Own ID	Device to be controlled	Owners ID

By this time, server saves this socket information to an active client list for further use. When client gets this ID, it will start its functionality with that ID.

iii. *Mobile Client*

A J2ME based application is equipped with the client mobile phone. Mobile client sends a request to the web service to control his electrical or electronic device using mobile application. Web service will add it to the queue if another request is in process. Web service will then send the client request to the TCP server using servers IP and listening port over socket and wait for a specific time to get acknowledgement form distant client.

Message format (Mobile Client to web service): "*Encrypted command [Device unique identification]: encrypted command [on off status/operation status]:*

encrypted command [name of electrical/electronic devices]: session ID".

When server gets the web client request from web service it will first decrypt the Device Unique Identification and check to the active socket client list. If it exists, then it will send the encrypted command to the matching distant client over existing socket as shown below.

"*Encrypted command [on off status/operation status]: Encrypted command [name of electrical/electronic devices]: session ID*".

After getting the message, device controller client will decrypt it and perform the desired operation and send the ACK with the session ID to the web service. After getting the ACK from distant client with appropriate session ID web service returns the status message to the calling Mobile client.

c) *PC Interfacing System*

In controller client end, computer is used as controller client. In this paper, the PC parallel port is used for the purpose of interfacing with the real time control applications. The parallel port pins are TTL levels output. This means that they put output 0 to 0.8 dc volts to logically 0 and 2.4 to 5 dc volt to logically 1. An optocoupler is connected with parallel port which controls the relay. External devices are connected with that relay. When command signal reaches the device controller, it triggers the optocoupler, which operates the relay. Fig. 3 shows the Block diagram of PC interfacing system.
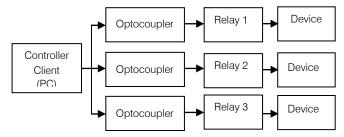

Figure 3 : Block diagram of PC interfacing system

III. Advantage of the System

The system offers some attractive features like:

1. SMS technology is easy to use and learn and can be accessed easily when needed.
2. In case there is any suspension of internet connectivity this system provides backup control and monitoring using FM technology.
3. This system saves time as the user does not require making a dedicated connection to the computer to be controlled.
4. SMS services are very cheap and most service providers do not charge users for receiving SMS.
5. It is very cost effective and very easy to implement.
6. The industrial management could minimize the loss of life and wealth in accidental circumstances.

IV. Conclusion

Now a day, human beings are so much busy in their daily life. Accidents may occur anytime due to their unconsciousness about various sort of life e.g. electricity mismanagement. Solution is required in a simple way. This paper presents the novel design of a remotely controlled electrical apparatus via FM and web service. Both the proposed models are very effective and efficient in appropriate circumstances to control electric or electronic devices in a less complex manner that is highly required for the busy people. Again, mobile phone and computers are very common and less costly. So we think this project will be successfully deployed in real life situation to change the world.

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