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Development of a GSM based Control System for Electrical Appliances

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ABSTRACT

This paper presents the development and implementation of a Global System for Mobile Communication (GSM) based control system for electrical appliances that enables the complete control of the interface on which it is based. GSM module was used for receiving short message service (SMS) from user's mobile phone that automatically enable the controller to take further action like switching ON and OFF electrical appliances such as fan, air- conditioner, light etc. The system was integrated with microcontroller and GSM network interface using C language. MPLAB software was utilized to accomplish the integration. The system is activated when user sends the SMS to the controller at home (regarded as Smart Home). Upon receiving the SMS command, the microcontroller unit then automatically controls the electrical appliances by switching ON or OFF the device according to the user's order. In other word, it reads message from the mobile phone and respond to control the devices according to the received message.

Keywords: *GSM, Microcontroller, Smart Home, Electrical appliances, MPLAB software and Switch.*

1. INTRODUCTION

The new age of technology has redefined communication. Most people nowadays have access to mobile phones and thus the world indeed has become a global village. At any given moment, any particular individual can be contacted with the mobile phone (Gwenael, 2005), but the application of mobile phone cannot just be restricted to SMS (Short Message Service) which is a service available on most digital mobile phones that permit the sending of short messages also known as text messaging service. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as Infra-red, Bluetooth to mention a few, have been developed in recent years to show the very fact that improvements are in fact possible and these improvement have eased our life and the standard of living.

GSM based remote management control is a subject of growing interest which has found application in different areas. Tan, Lee, and Mok, 2007 developed an automatic power meter reading system using GSM network. It utilizes the GSM network to send power usage reading to authorize office to generate the billing cost and send back the cost to the respective consumer through SMS. Lock, 2004 developed a remote and security control system via SMS to control the switch for lamp, door and alarm system using Visual Basic 6.0 software. Elia et al, 2008 presented the design of Vehicle Speed Detection using SMS. Furthermore, Mohd, 2008 developed a system for Acquiring Water Level and Temperature Status via SMS by utilizing PIC 16F877 and MPLAB IDE software for programming. He also suggested a system triggered by SMS to a home to notify the owner of any incident happening around the house such as robbery or fire.

Sending text messages is very popular among mobile phone users (Mouly, 2002). Instant messaging, as it is also known, allows quick transmission of short messages that allow an individual to share ideas, opinions and other relevant information. Hence, the development of information technology has led to the rapid change in human lifestyle. The use of electricity is also very important as one of the main sources of energy that is vital in today modern life. Presently, electrical energy is often used as one of the main source of power to operate any electrical device or appliance. Erratic supply of electricity leads to forgetfulness on the part of users to switch off home appliances; this could lead to energy wastage when the light is turned on continuously. Mechanism of information technology management could be used to reduce wastage in electricity usage. Thus a prototype based on a microcontroller device using SMS was developed which automatically control any electrical equipment at home remotely both for long and short distances using mobile phone. Hence daily electrical energy savings is made more efficient and effective.

2. SYSTEM DESIGN

The System was designed with Fig 1 as the block diagram, the first Mobile station is used as a transmitting section from which the subscriber sends text messages that contain commands and instructions to the second mobile station which is based on a specific area where our control system is located. The mobile phone as indicated in the block diagram is a Nokia 6100 mobile set. Nokia

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6100 was preferred as a result of its reliability. It can pick signal in the worst places and the battery is durable. It is also easy to use and navigate; and the keypad is very easy for texting.

The received SMS message is stored in the SIM memory of the phone and then extracted by the microcontroller and processed accordingly to carry out specific operations. The relay driver (BUFFER ULN2003) is used to drive the relay circuits which switches the different appliances connected to the interface. The LED is used to indicate the status of the operation performed by the microcontroller and also its inclusion makes the overall system user-friendly. Fig 2 shows the system flow diagram for this work. The SMS from the user cell phone was transmitted through the GSM chip to the microcontroller and the microcontroller finally performed the required instructions as stated by the user.

Assuming that the control unit is powered and operating properly, the process of controlling a device connected to the interface will proceed through the following steps;

- The remote user sends text messages including commands to the receiver.
- GSM receiver receives messages sent from the user cell phone.
- GSM receiver decodes the sent message and sends the commands to the microcontroller.
- Microcontroller issues commands to the appliances and the devices connected will switch ON/OFF

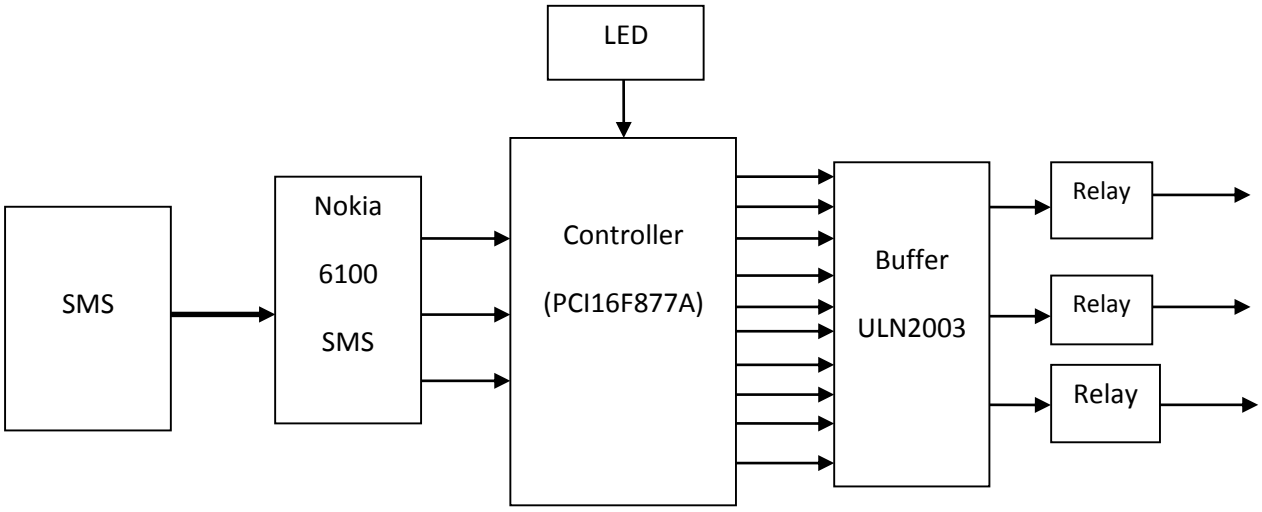

Fig 1: System Block Diagram

3. SOFTWARE DEVELOPMENT

The software was developed using a simple high level language tool in C. The software extracts the sent message from the SIM location at a regular interval and processes it to control the different appliances connected within the interface. Nokia F-Bus protocol was used to communicate with the mobile phone set. Most Nokia phones have F-Bus and M-Bus connections that can be used to connect a phone to a PC or in this case a microcontroller. The connection can be used for controlling just about all functions of the phone, as well as uploading new firmware. This bus allows SMS messages to be sent and received

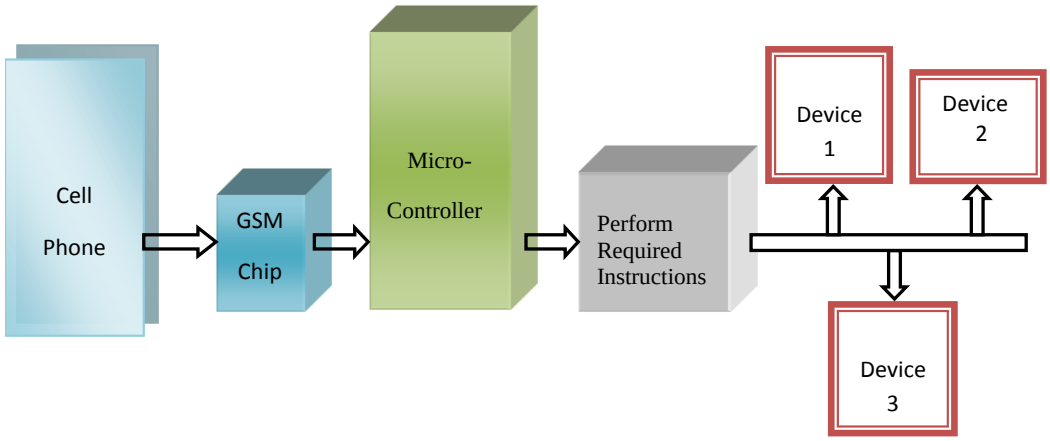

Fig 2: System operation flow diagram

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All the peripherals used in the program were first initialized. In the coding, ASCII code was used in declaring the coding for received and read SMS message. A declare delete SMS coding is used to avoid the SMS interrupt with the previous message. It occurs when the microcontroller has carried out the instruction, the message is being deleted. The circuit diagram of the control system is as shown in Fig. 3.

3.1 Algorithm

Step 1: Start

Step 2: Phone initialization

Step 3: Get Hardware Software

Step 4: Poll SMS from mobile phone

Step 5: If new SMS received go to step3 else, go to step1

Step 6: Receive SMS

Step 7: Check SMS pattern

Step 8: Control the device based on status

Step 9: Notify end user

Step 10: Go to step1

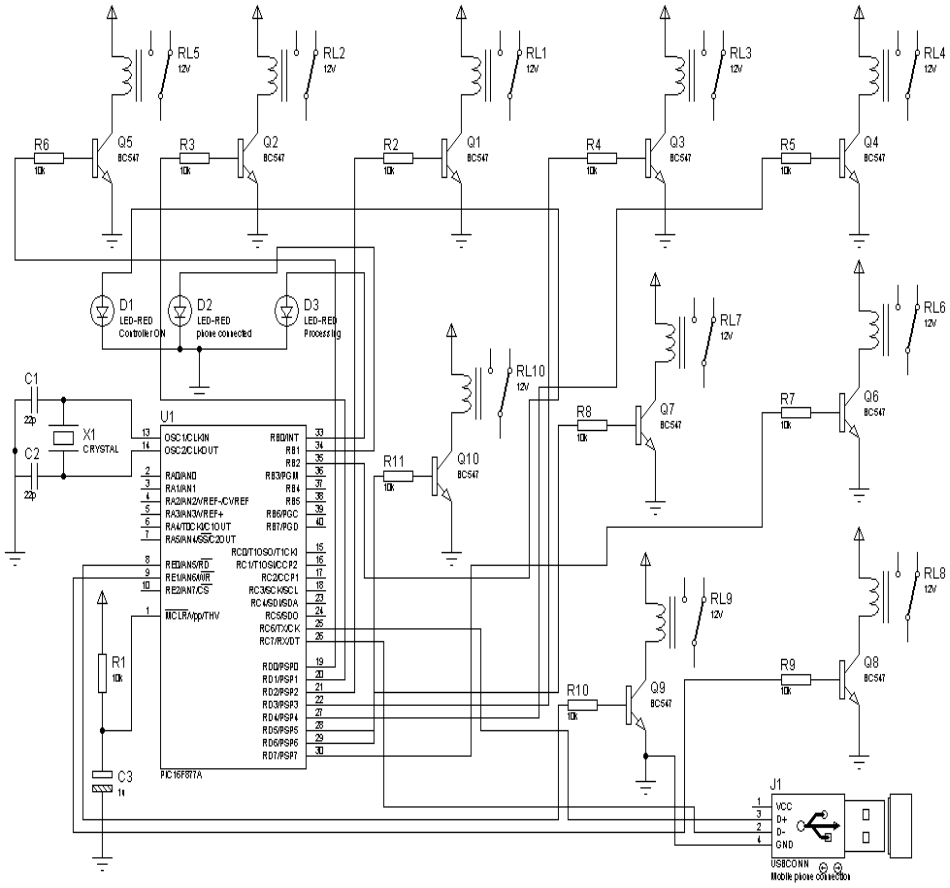

Fig 3: Circuit Diagram of the Control System

4. RESULT AND DISCUSSION

This section describes the output of the implemented system. Several testing were performed to ensure proper execution and production of the intended result. The system was designed to receive SMS from user mobile phone to the mobile phone connected to the PIC16F877A circuit that acts as a GSM modem. This can be performed by dialling the mobile phone number which has been set in the PIC16F877A. The incoming message was deleted by the microcontroller upon completion of the requested process and the message is erased in the connected mobile phone which acts as GSM modem.

The system then replies by sending a message to user mobile phone reporting the status of the devices (turned ON or turned OFF). The status message is to remind the

user regarding the current state of the appliances. Fig 4 shows the sy activation when power was supplied.

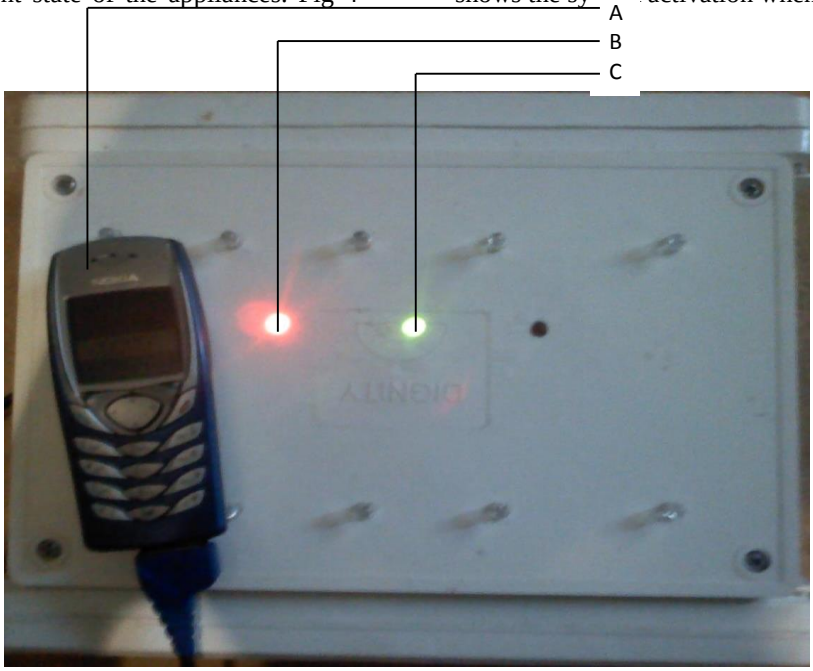

Fig 4: System Activation

A - Mobile phone, B - Red light indicating microcontroller initialization, C - Green light indicating mobile phone initialization

Table 1 shows the numbering representations for each device; 0 represent device 1, 1 represent device 2 and so on. Also Table 2 shows the summary of the various commands that can be sent by the users and the corresponding responses by the control system. When a command like ha.0*1.4*1.9*1.end*0# is issued, the devices corresponding to the numbers indicated in the command come up as show in Fig 5. In the commands in Table 2, the last 1 or 0 before # represent REPLY or NO REPLY respectively and the 1 or 0 after * (after each device number, starting from the left) represent ON or OFF.

Table 1: Numbering Representation for Devices

Numbers	Devices Represented
0	Device 1
1	Device 2
2	Device 3
3	Device 4
4	Device 5
5	Device 6
6	Device 7
7	Device 8
8	Device 9
9	Device 10

Table 2: List of Commands

Commands From User Mobile Phone	Actions Carried out by the Microcontroller	Status Report to User Mobile Phone
ha.0*1.3*1.end*0#	Device 1 and 4 are ON	NO REPLY
ha.0*1.3*1.end*1#	Device 1 and 4 are ON	Device 1 and 4 status are ON
ha.1*1. 2*1.4*1.end*0#	Device 2, 3 and 5 are ON	NO REPLY
ha.1*1. 2*1.4*1.end*1#	Device 2, 3 and 5 are ON	Device 2, 3 and 5 status are ON
ha.0*0.3*1.5*1.7*1.8*1. End*0#	Device 1 is OFF, device 4, 6, 8 and 9 are ON	NO REPLY
ha.0*0.3*1.5*1.7*1.8*1. End*1#	Device 1 is OFF, device 4, 6, 8 and 9 are ON	Device 1 status is OFF, device 4, 6, 8 and 9 status are ON
ha.6*1.8*1.9*1.end*0#	Device 7, 9 and 10 are ON	NO REPLY
ha.6*1.8*1.9*1.end*1#	Device 7, 9 and 10 are ON	Device 7, 9 and 10 status are ON

Fig 5 shows that device 1, device 6 and device 10 are switched ON as indicated by the LED with red light based on the message received by the mobile phone connected to the control system. Fig 6 shows the SMS sent by the user to the mobile phone connected to the control system, Fig 7 shows the action carried out by the control system and Fig 8 shows the reply sent to the user's mobile phone reporting the status of the devices.

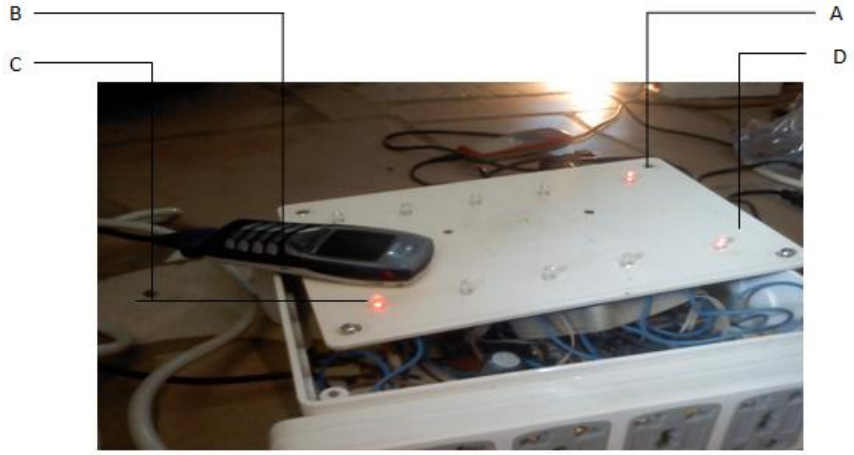

Fig 5: The status of devices 1, 6 and 10

A - LED indicator for device 1, B - Mobile phone that receives the text message, C - LED indicator for device 6, D - LED indicator for device 10.

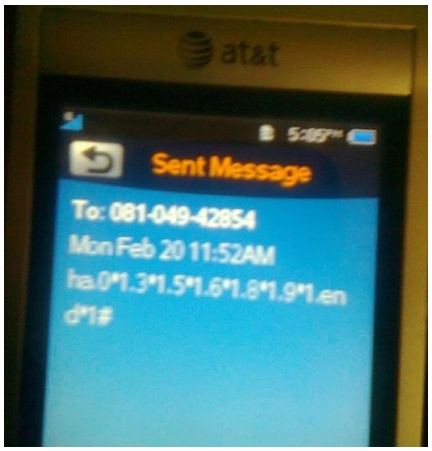

Fig 6: Shows the SMS sent by the user to the control system

Fig 7: Shows the action carried out by the microcontroller

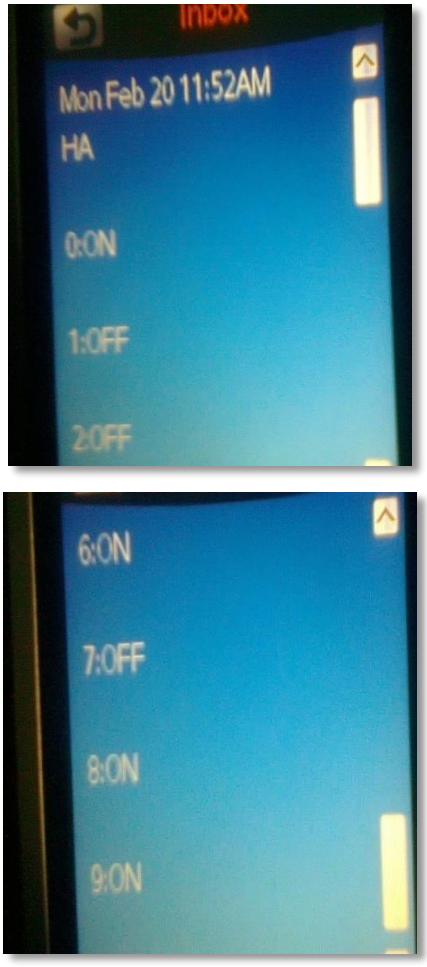

Fig 8: Shows the cross section of the replied SMS to the user by the system mobile phone

5. CONCLUSION

The project which is development of a GSM based control system for electrical appliances was designed considering some factors such as economic application, design economy, availability of components and research materials, efficiency, compatibility portability and durability. The performance of the project after test met design specifications. However, the general operation of the project and performance is dependent on the user who is prone to human error such as entering wrong timing.

Also the operation is dependent on how well the soldering is done, and the positioning of the components on the Vero-board. If poor soldering lead is used, the circuit might form dry joint early and in that case the project might fail. Furthermore, if logic elements are soldered near components that radiate heat, overheating might occur and affect the performance of the entire system. Other factors that might affect performance include transportation, packaging, ventilation, quality of components, handling and usage.

REFERENCES

[1] Abd Wahab, M.H., Mohd, S.Z. and Fazliza M.N. (2007). Integrated Billing System through GSM Network. In Proceeding of third International Conference on Robotics, Vision, Information and Signal Processing.

[2] Abdullah, M.B. (2008). Acquiring Water Level and Temperature Status via SMS.

[3] Gwenael, L. Bodic (2005). Mobile Messaging: SMS, EMS, and MMS.

[4] Lock K.A. (2004). Remote and Security Control via SMS.

[5] Mazidi, M. Ali, (2007). The 8051 Microcontroller and embedded System, Second Edition Prentice Hall. India, New Delhi

[6] Mouly, Michel, Pautet, M. Bernadette (2002). The GSM System for Mobile Communications. Telecom Publishing, ISBN:0945592159

[7] Sabudin, E.N., Zarina, M., Mohd, M.M., Abd Wahab, H., Johari, A. and Ghani, N.B. (2008). GSM based Notification speed Detection for Monitoring purposes. Proceeding of IEEE International Symposium of Information Technology.

[8] Suhaimi, M.M. (2008). Home Security with Messaging System.

[9] Tan, H.G.R, Lee, C.H, and Mok, V.H.(2007). Automatic Power Meter Reading System using GSM Network. In: 8th International Power Engineering Conference (IPEC), Singapore.

[10] Vasillis, S. (2003). SMS Remote Control for Ericsson T10 GSM Mobile Phone.