IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 04, Issue 12 (December 2014), ||V2|| PP 49-53

GSM Based Remote Control Design for LCD Publicity Display

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Abstract: *The paper deals with the design of remote control system based on Short Message Service (SMS) for displaying publicity on Liquid Crystal Display (LCD's). The control center is supplied with Global System for Mobile communications (GSM) for SMS transmission and reception. The GSM receiver is connected to a microcontroller which decodes the messages and accordingly sends commands. The microcontroller issues orders to display advertisements as required by the message.*
The control system includes two separate units; the control center and the control unit. Therefore there are two operating environments. The control center operates indoors whereas the control unit operates outdoors .The indoors electronic devices are within the temperature and humidity limits for proper operation of the hardware. The outdoor units must be fully enclosed and protected from the climate changes for the safety of the hardware.
Keywords: *microcontroller, LCD, GSM, SMS, publicity, Control center, Control unit.*

I. 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. But the application of mobile phone cannot just be restricted to sending SMS or starting conversations. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as infra-red, Bluetooth, etc which has developed in recent years goes to show the very fact that improvements have eased our life and the way we live. Remote management of several electrical and electronic devices (such as home appliances, office appliances, and even what this paper want to deal with "control of LCD publicity" is a subject of growing interest and in recent years we have seen many systems providing such control.

II. Methodology

This paper uses descriptive and applied methodology. The block diagram of the system is shown in figure (1).

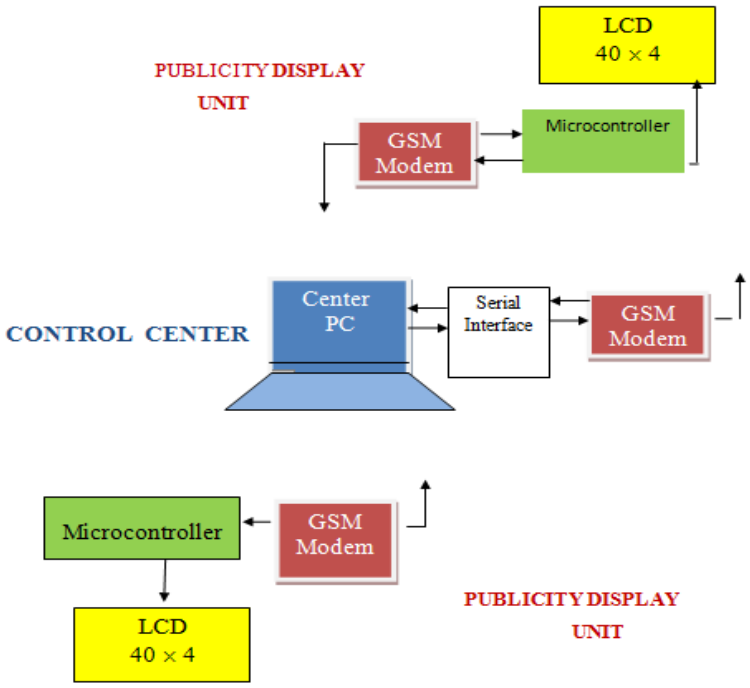

Figure (1) Block Diagram of the System

Figure (1) shows the block diagram for the system. It is an illustration of how to implement the design and the various parts involved in it. The control center is used as a transmitting section from which the advertising services provider sends text messages that contain commands and instructions to the other stations which are located on specific areas. The received SMS messages are stored in the Subscriber Identity Module (SIM) memory of the GSM module and then extended to the microcontroller and processed accordingly to carry out specific operations. A relay driver is used to drive the relay circuit which switches the power of the screen. The LCD is used to display the advertising messages.

III. Hardware Components

The main hardware components in the design are:

1. Microcontroller (Atmega32) :

Atmega 32 is a microcontroller from Atmel 8-bit family with 32KB flash memory is used. Figure (2) shows the pins description of the microcontroller (Atmega-32).

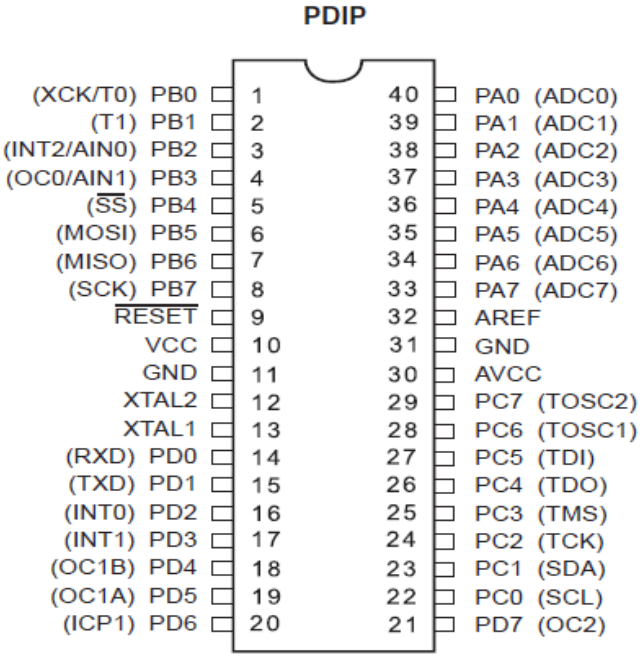

Figure (2) Atmega32 microcontroller pins

2. SIM 900 GSM

GSM Modem is built with SIMCOM Make SIM900 Quad-band. GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed to interface PC Serial port through max circuit .The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud mode. It is suitable for SMS as well as DATA transfer application in M2M interface. The modem needed only 3 wires (Tx , Rx and GND) except Power supply to interface with microcontroller/Host PC. Using this modem, allows sending & Reading SMS through simple AT commands.

3. LCD 40x4

The LCD 40x4 is used in the system design. Table (1) shows the terminal functions of LCD 40x4.

Table (1) the terminal functions of 40x4 LCD

Descriptions	Name	Pin
Ground	VSS	1
Positive power supply	VDD	2
LCD contrast reference supply	Vo	3
Register Select RS = High: Transferring Display Data RS = Low: Transferring Instruction Data	RS	4
Read/Write control Bus R/W = High: Read mode selected	R/W	5

R/w = Low: Write mode selected		
Data Enable	E1	6
Data Enable	E2	7
Bi- directional Tri- state Data Bus	DB)	8
	. .	. .
	DB7	15
No connection	NC	16
LED Backlight Positive Power supply	BLA	17
LED Backlight Negative Power supplies	BLK	18

IV. Circuit Operation

The proposed hardware includes one control center and five display units. A message format of twelve digits is assumed to be send from the control center to any one of the destination publicity display units. A message send from the GMS module to the display units will be recognized by its SIM card number attached to the GSM modem in each display unit. The message format contains twelve digits .The meaning of each digit in the message is as follows:

First digit => Number of publicity to be displayed in the specified display unit.

Second digit => The time duration to display the publicity in the specified display unit. (the unity time base programmed = 2 seconds).

The same procedure of display for the other four programmed display advertisements is followed in the destination display unit. . The meaning of the eleventh and twelfth digit in the message is as follows :

Eleventh digit => Number of repetitions of the five publicities to be displayed in the specified display unit.

Twelfth digit => To indicate the status of the specified display unit. (0 = OFF mode, 1 = READY mode).

For example if the message sent from the control unit is "213142532121". The microcontroller initially checks the readiness of the destination display unit (digit twelve)..Since digit twelve in the message is equal (1) , it means that the destination display unit is in the ready mode. The first ten digits in the message means that the LCD in the destination display unit will display the five programmed advertisements. The duration of display for each advertisement is specified in the message .The process of display of the five advertisements will be repeated twice as indicated by digit number (11) in the message format.

V . Software Design

Programming language is a set of commands and rules written in specific way to build a program. The microcontroller executes the program instructions one by one till the end of the program..

Compiler is a program used in the computer to compile the program and transfer it into the machine language (0, 1). The programmer is a device used to download the hex files from the computer to the flash memory in the microcontroller.

The program used is BASCOM language. Any program in this language will be saved with an extension (.bas). The compilation performs the following two steps:

- Convert (.bas) extension file to assembly codes.
- The compiler automatically converts the assembly codes to executable (.hex) file that can be downloaded into the microcontroller.

Pony Prog program is used to download the (.hex) file program into the flash memory of the microcontroller.

VI. Algorithm

The microcontroller program in any of the five display units deals with a fixed length SMS format for displaying the publicities .The format of the first ten digits in the SMS message is shown in equation (1):

(SMS)publicities =[(d1,d2) 1^{st} publicity + (d3,d4) 2^{nd} publicity + (d5,d6) 3^{rd} publicity +(d7,d8) 4^{th} publicity + (d9,d10) 5^{th} publicity] …….. (1)

The remaining digits in the SMS message are digit eleven (d11) and digit twelve (d12) . These two digits are shown in equation (2) .

(SMS)b11,b12 = (d11)times of repetitions + (d12)mode of display unit …….. (2)

The total length of the SMS message is twelve digits (d1 – d12).The following assumptions are considered in the BASCOM program and downloaded in the microcontroller.

Maximum number of publicities displayed in the display unit = 5. (odd numbers in the SMS message).

Maximum number of time durations for each publicity = 5. (even numbers in the SMS message).

Maximum number of repetitions for displaying the publicities = 5. (digit eleven).

Readiness of any of the display units can be (0 = OFF or 1 = Ready). (digit twelve).
The assumed SMS message format is shown in table (2);

Table (2) The assumed SMS message format

d1	**d2**	**d3**	**d4**	**d5**	**d6**	d7	**d8**	**d9**	**d10**	**d11**	**d12**
Pub. No.	**Display duration**	**Pub. No.**	**Display duration**	**Pub. bitNo.**	**Display duration**	Pub. No.	**Display duration**	**Pub. No.**	**Display duration**	**Rep. No.**	**Ready Mode**
2	**1**	**3**	**1**	**4**	**2**	5	**3**	**2**	**1**	**2**	**1**

POINTER

The algorithm contains the main program and three subroutines .Following is the algorithm for the system.

Start
INITIALIZATION:
. Start modem.
. Declare TXT SMS
. Delete previous SMS.
Declarations:
SMS message pointer (POINTER =1).
SMS digit eleven (REPEAT =0).
SMS digit twelve (MODE=0).
Wait for an input SMS from the control center.

SMS reception:
If SMS is received
Call check display unit readiness Subroutine.
Call Display publicity subroutine.
Else go to SMS reception.
End

Display unit readiness:
If [digit twelve (MODE) = 0] then put the display unit in ready mode .
Else go to display unit readiness.
Return

Display publicity subroutine :
Publicity number:
If (digit = 1) then display publicity-1 and go to check digit (POINTER + 1).
If (digit = 2) then display publicity-2 and go to check digit (POINTER + 1).
If (digit = 3) then display publicity-3 and go to check digit (POINTER + 1).
If (digit = 4) then display publicity-4 and go to check digit (POINTER + 1).
If (digit = 5) then display publicity-5 and go to check digit (POINTER + 1).
If (digit > 5) then call SMS error subroutine.

Check digit (POINTER + 1) :
POINTER =POINTER +1.
If (digit = 1) then display publicity duration (T = 2 s.) and go to check POINTER.
If (digit = 2) then display publicity duration (T = 4 s.) and go to check POINTER.
If (digit = 3) then display publicity duration (T = 6 s.) and go to check POINTER.
If (digit = 4) then display publicity duration (T = 8 s.) and go to check POINTER.
If (digit = 5) then display publicity duration (T = 10 s.) and go to check POINTER.
If (digit > 5) then call SMS error subroutine .

Check POINTYER:
POINTER = POINTER + 1.
If (POINTER > 10) then go to check digit eleven (REPEAT).
Go to Publicity number.
Check digit eleven(REPEAT):

If (digit = 1) then go to end of subroutine.
If (digit = 2) then go to repeat publicities two times.
If (digit = 3) then go to repeat publicities three times.
If (digit = 4) then go to repeat publicities four times.
If (digit = 5) then go to repeat publicities five times.
If (digit > 5) then call SMS error subroutine .
Return.

SMS error:
Send an error SMS to the control unit.
Go to declarations.
Return

VII. Results

Many SMS messages have been send from the control center to the display units in the system. Table (3) shows the results while sending SMS message from the control center to a display unit attached to GSM with SIM phone number (0964184329).

Table (3) Results of SMS message send to display unit attached to GSM with SIM phone number (0964184329)

Status of Display unit	Repeat publicities (times)	Time duration of show (s.)	Advertises order	Message code format	SMS No.
OFF	**1**	**2.s. for all**	**1, 2, 3, 4, 5**	**112131415110**	**1**

VIII. Conclusion

This paper adopts a concept to design a system that acts as a platform to receive messages, which in fact are commands sent to control display units connected to the platform. The control system is based on the GSM technology that effectively allows control from remote area to the desired technological world. The design allows a greater degree of freedom for control and monitoring of far distance work. The system design eliminates the need to be physically present in order to control the publicity in far locations.
The model is build with a GSM based control center (computer + GSM module) and two display units (microcontrollers + LCDs + GSM modem).
The system design is expandable . A PC or a simple phone can control and monitor the system operation. The system is made user friendly.

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