



International Journal of Control Theory and Applications

ISSN : 0974-5572

© International Science Press

Volume 10 • Number 18 • 2017

A Novel Approach for Controlling Audio/Video Playback System Using SMS

Vinay Chowdary¹, Vivek Kaundal¹, Arpit Jain¹ and Mukul Gupta¹

¹ Electronics & Communication, University of Petroleum and Energy Studies, Dehradun, India,

Emails: vchowdary@ddn.upes.ac.in, vkaundal@ddn.upes.ac.in, ajain@ddn.upes.ac.in, mkgupta@ddn.upes.ac.in

Abstract: Short Message Service (SMS) is one such data service in mobile communication which became very popular in no time. This service is mainly used for communication by the subscribers by exchanging information in the form of text. In this paper a new approach is presented where the application of SMS service is used for controlling rather than communication, where an audio/video system is controlled/ operated by the use of SMS service. All most all the audio/video systems that are being used today are always controlled by legacy old Infra-Red (IR) based remote controllers, firstly, which not only has a very limited range but also has a problem of line of sight. Secondly, internet based event management programs always need connection to internet. This paper proposes a system that provides solution to the above mentioned problems and uses an ARM controller along with a GSM module using a simple service called SMS (Short Message Service)

Keywords: Short Message Service (SMS), Advanced RISC Machine (ARM), Global System for Mobile communication (GSM).

1. INTRODUCTION

Among the data services provided by the mobile operators, arguably there was an immense increase in the popularity of Short Message Service. According to given data [1] SMS service once dominated the revenue for all the mobile operators. SMS popularity, and ubiquitous availability plus the support which is provided by handsets was one of the encouraging factors why all service providers of mobile company used it as their primary data transport facility so that they can always increase the reach to the customer. As communication through text message became a primary requirement and to provide ease to modern life, cell-phone users relied heavily on this service and used it as instantaneous, very fast and very reliable means of data communication.

Also, SMS is one such service that is considered for mission-critical situations such as emergency alerts, security aids and notification of natural disasters as mentioned in [2] and [3]. Many systems operating on SMS have been proposed which became not only popular but also important in a wide variety of applications, as discussed in,

1. *Short Message Service For Wideband Spread Spectrum Systems*, in which a clear description on SMS protocols, the different layers of SMS architecture viz., teleservices layer, transport layer, relay layer and link layer is given.
2. *SMS Based Wireless Home Appliance Control System*: In this paper it was proved that controlling the home appliances remotely is possible along with an additional advantage of providing security.
3. *SMS-based Remote Computer Supervisory Control System Design*: Author of this has tried to supervise a remote computer by designing a control system based on SMS.
4. *Patients' involvement in e-health services quality assessment: A system for the automatic interpretation of SMS-based patients' feedback*: This paper proves that a system design based on SMS can also be used in the medical field.
5. *User acceptance of SMS-based e-government services: Differences between adopters and non-adopters*: Authors of this paper discuss the role of SMS in e-governance by modelling factors which can influence an individual to use services of e-governance based on SMS.

2. WORKING PRINCIPLE

Controlling the audio/ video playback systems remotely is now quite ubiquitous in the domestic environment. Many of the systems existing are operated by the use of infra-red control based remote controls.

Moreover the coverage range of infra-red remote control devices is only few meters. While these remote controllers are very much suitable in the home based environment, it is not possible to easily extend them to situations for example where spectators in a live event say an entertainment program, would like to play and share a song in sequence or a video with the audience on a giant TV screen which is provided at the venue (Fig.1). Furthermore when these type audio and video playback systems are attached to a CPU/microprocessor/microcontroller development boards and devices with memory so as to implement a store, retrieve and playback system then the overall complexity of hardware increases in proportionate with its cost. Another application that can be envisaged is that of a director of a film sitting in his editing or dubbing room inside a studio and to whom an assistant director from a remote place wishes to convey the visualization of the proposed scene by playing a scene similar one from the available store of files present in the studio. These controls completely rely on line-of-sight communication for the transmission of signals for program select, audio and video parameter and also the volume settings for operating television sets and DVD players.

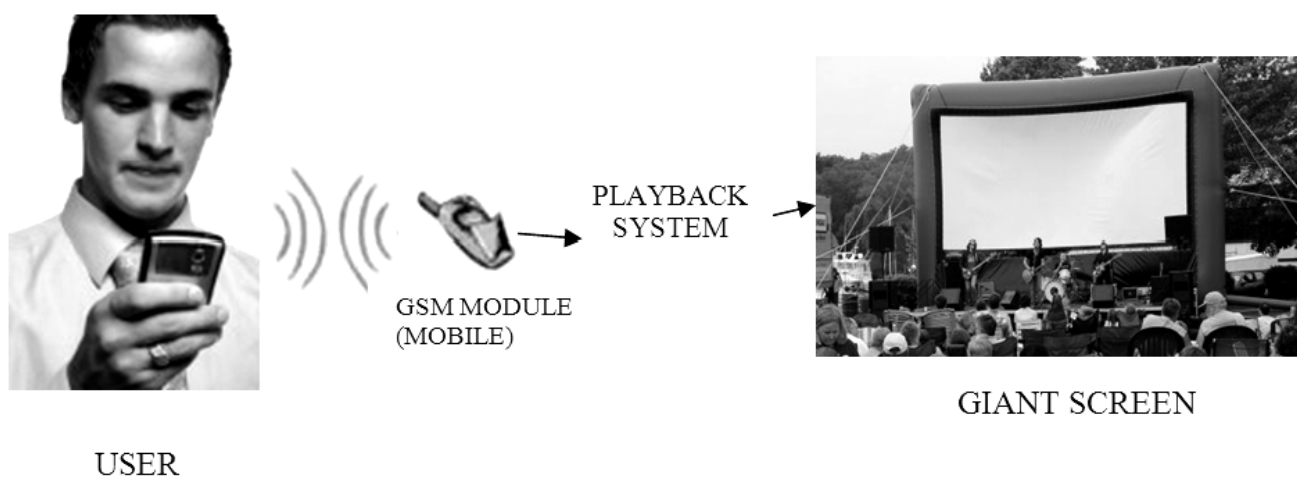


Figure 1: Live event managed by SMS

In this example (Fig.2) an assistant director who wishes to convey the proposed scene visualization an assistant director will simply make a SMS request of the required scene which will then be directly played on the display/LCD screen. The possibilities of application are numerous and the present audio video playback system is intended to demonstrate the feasibility of one such scenario, involving the use of a mobile phone, a GSM modem and an audio/ video storage, retrieval and playback system. This audio video playback system demonstrates an application that combines the reach of a sms message with audio/video storage, retrieval and playback system that will enable an audio or video file to be played at any location around the globe. The application requires a hardware that can receive SMS from a mobile phone in two different cases.

First, it is in the general scenario where it can receive and process the SMS from any mobile number. This normally proves to be a nuisance in some applications as any spectator in the audience in the example 1 cited above will be able to playback a file of his choosing and that may not appeal to the audience. Second, is the scenario where it is programmed to receive SMS only from certain registered mobile numbers and reject SMS from any other mobile number. For example 1, this could mean that only those spectators who have been authorized by the system should therefore have a facility to decode the SMS and compare with entries in an existing table of audio/video files, retrieve that file and playback via the audio system or on the screen depending on the nature of the file (audio or video).

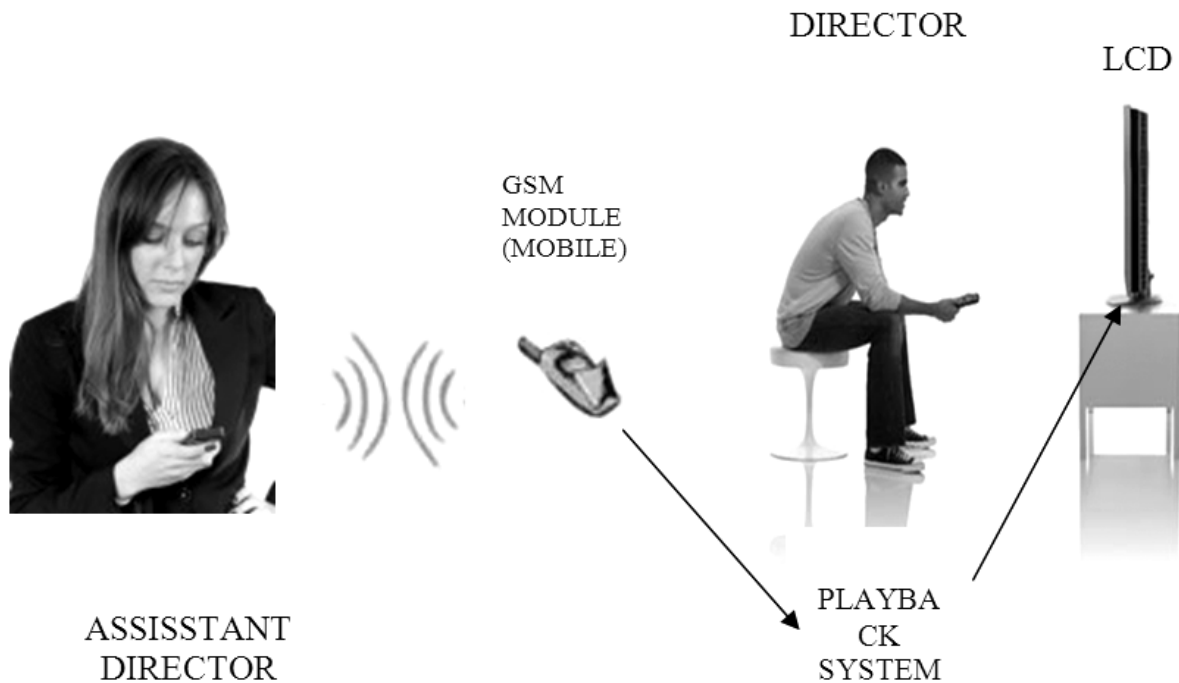


Figure 2: Communication between director and asst. director using SMS system

3. HARDWARE REQUIREMENTS

Considering required computational tasks to be performed which are numerous, it becomes imperative that the system should be designed around a microcontroller or a microprocessor. This not only provides a high degree of flexibility that is required to cater needs to applications that are diverse in nature but also keeps the hardware user-friendly and compact. User-friendliness is one of the key considerations in such type of applications where user demands a high robustness. Also the system should be capable of storing large number of files based with variable size based on customer tastes. For example, a section of music fans that will prefer to quickly locate audio files based on different categories viz., rock, classical, blues and so on. To implement the above mentioned processes, required is a controller/processor of very high speed, low power consumption, which can decode the

SMS in alphanumeric format. As the required hardware for the proposed idea is very complex using a CISC (complex instruction set computer) processor will result in very high complexity and power consumption. Therefore the use of a RISC (Reduced Instruction Set Computer) processor that consumes very less power as compared to its counterpart CISC processor for the given same audio/video playback system will be preferred. The RISC processor that can be used is ARM (Advanced RISC Machine). There are several available versions of ARM such as, ARMv1, ARMv2, ARMv3, ARMv5, ARMv6, ARM7, ARM9 and their variations which are given in below table.

Table 1
ARM architecture Family

<i>Architecture</i>	<i>Family</i>
ARM Version 1	First ARM i.e., ARM1
ARM Version 2	ARM2, ARM3
ARM Version 3	ARM6, ARM7
ARM Version 4	Strong ARM, ARM7TDMI, ARM9TDMI
ARM Version 5	ARM7EJ, ARM9E, ARM10E, XScale
ARM Version 6	ARM11
ARM Version 7	Cortex

As the number of operations to be performed are more in number and also as they should be done in parallel speed of the controller/processor is one of the prime requirements in this system. An ATMEL processors maximum operating frequency is 8MHz which is not sufficient. If an ATmega48P processor that operates at 4MHz is used in this system then it requires a power supply of 5.5V. The same playback system when handled with ARM9 processor, it requires a voltage of 1.2V operating at 300MHz and 1.3V operating at 400MHz.

4. WORKING PRINCIPLE

The idea proposed can be an architecture-system consisting of a GSM modem to send and receive SMS. An ARM microprocessor to decode the SMS received from GSM modem and make subsequent decision.

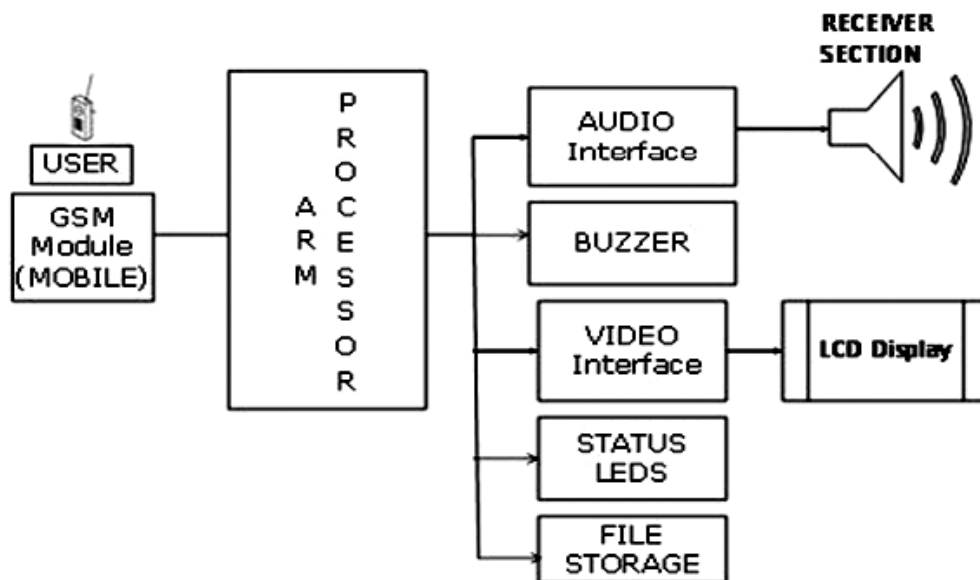


Figure 3: Proposed architecture

A speaker to play the audio file with the help of audio interface, a LCD to play video file with video interface. Additionally a buzzer and LED can be connected which are also operated using SMS. A storage system for files in the form of memory card can be connected to store the audio and video files should also be connected.

4.1. Why GSM?

GSM today is ubiquitous. In today's world presence of GSM is more in countries than the famous brands like McDonalds and Coca-Cola. Users of GSM truly enjoy a global infrastructure (except in Japan as GSM-only phones will not work here). As per ITU (International Telecommunication Union) count of number of GSM users in this present day world has crossed the mark of 10billion.

4.2. Why ARM9?

Proposed system requires a hardware which can receive SMS, decode it and then make suitable decision. Reception of SMS should be possible in the mentioned two cases i.e., one from a registered mobile number and also from any mobile number. The system should be able to provide an audio and video interface for playing audio and video files. Therefore considering the numerous tasks to be performed it's always suggested to use a high speed processor which not only has lightning speed but also be capable of providing the required interface for the proposed system. Samsung's S3C2440 friendly ARM development board is one such single-board computer which can used to implement the proposed idea. Logic behind using the mentioned ARM9 which is a RISC processor ahead of its counterpart CISC processor is explained by taking a practical example. Consider a simple task where a data stored in a processors register has to be multiplied by a constant 15. Performing this task firstly in MC68000 which is 32-bit CISC processor with operating frequency of 20MHz and secondly in ARM9 which is 32-bit RISC with operating frequency of 400MHz processor gave results as summarized in the table

Table 2
Comparison of RISC
and CISC

<i>Parameter/Processor</i>	<i>Memory locations Used</i>	<i>No. of cycles taken</i>	<i>No. of T-sates used</i>	<i>Completion Time (nsec)</i>
MC68000	5	5	22	1100
ARM9	1	1	16	40

4.3. SMS

SMS can be viewed as improved version paging service introduced by GSM, having capability of sending alphanumeric data. Fig. 4 given below gives the architecture of SMS network [8], When a mobile handset of user sends an SMS, it reaches the short message service center (SMSC) from where it will be relayed to the SMS-gatewaymobile switching center (SMS-GMSC). Then from here access to the home location register (HLR) is performed to search and to find or locate the mobile phone address at the destination, and HLR from here will be routed the information to (MSC) i.e., mobile switching center. After this the information from HLR, MSC will decide to which SMSC should be contacted for end point connection and if the calling party is on roaming, then SMS-interworking mobile switching center (SMS-IWMSC) will be next immediate stop for the message[7].

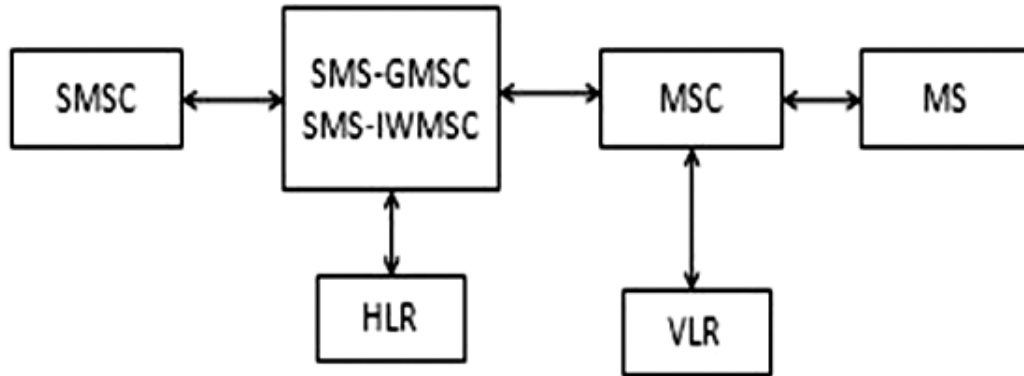


Figure 4: SMS Network Architecture

5. SOFTWARE DESIGN

5.1. Algorithm Description

1. The first step is initialization (system initialization, memory i.e., MMU initialization; system clock initialization); select Nand Flash to load boot-up program; S3C2440's GPIO initialization; selection serial port (COM1); setup baud rate as 115200; data bits 8, stop bits 1, parity none and flow control should be none.
2. Second step is modem initialization.
3. Third setting up hyper terminal.

```
{  
    /* Open modem device for reading and writing.*/  
    char buff[READ_BUFF_MAX];  
    if(modemDev != NULL)  
    {  
        gsmFd = open(modemDev, O_RDWR | O_NOCTTY ,0777);  
        if (gsmFd < 0)  
            errExit(modemDev);  
    }  
    else  
    {  
        gsmFd = open(SMS_OPEN_ZB_DEVICE, O_RDWR | O_NOCTTY ,0777);  
        if (gsmFd < 0)  
            errExit(MODEM_DEVICE);  
    }  
}
```

Figure 5: GSM Modem Initialization Function

4. Fourth switching on S3C2440 board after which a window will appear from which booting option has to be selected. Then type /tty/dev “10 digit mobile number for sending and receiving messages”.

6. CONCLUSION & FUTURE SCOPE

Here in this article analysis of short message service (SMS) which is combined with the embedded technology, GSM technology is done and then a method is proposed to design and implement the short message service system based on ARM9 and GSM. We put forward the system principle block diagram and the functional block diagram of GSM modem. At the same time, we develop the specific algorithm and software process flow, namely, GSM initialization module. This proposed technique is very well suited for numerous applications and has good future prospects. As stated earlier the idea behind the audio video playback system is to operate the whole system remotely and wirelessly by using SMS and the result is shown in the figure below where a video file is played after sending a SMS from the user mobile as shown in Fig. 6. The future application of this system can be in television broadcasting along with control codes which is used for time-shifted viewing of audio/video. This is possible by using the property of control codes as given in [10]. The data rate of a stream of an audio can be adjusted by adjusting the sampling rate as given in [11]. Authors in [12] have given a simulation based model for audio/video feedback system which can be used in medical field. The proposed system can be modified so that it fits into this application.

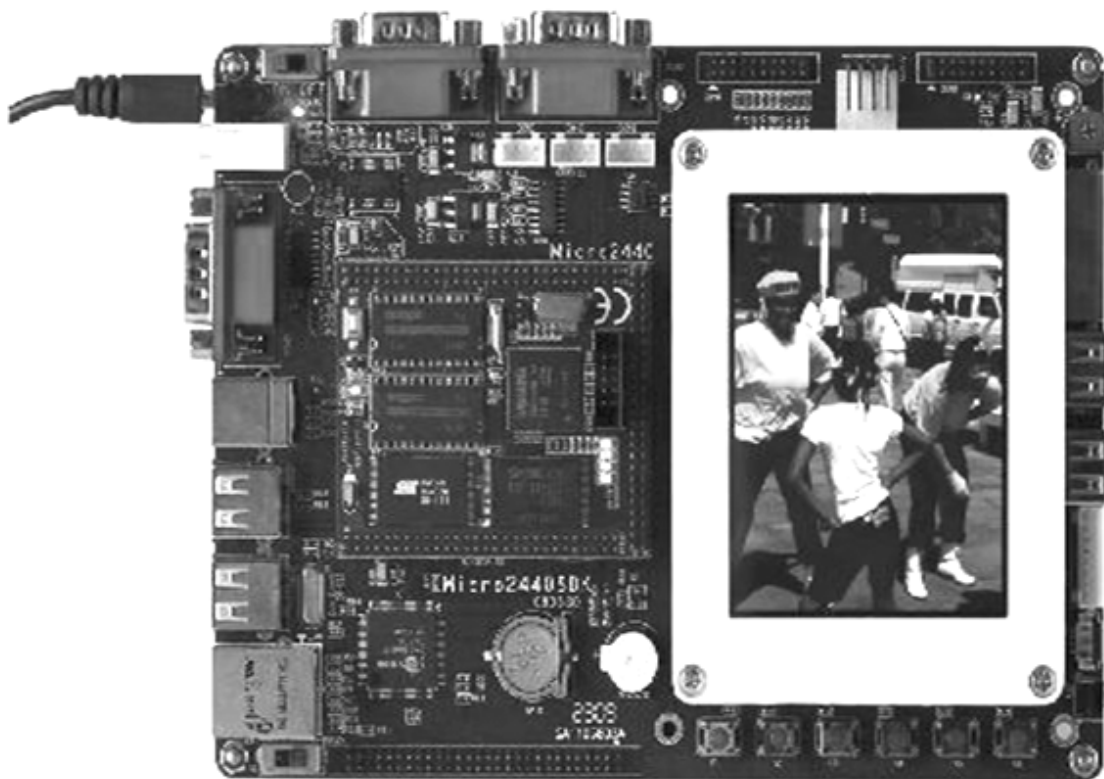


Figure 6: Playing of video file

REFERENCES

- [1] Netsize S.A., “The Netsize guide 2005 Edition - The mobile is open for business,” February 2005.
- [2] Office of the Manager, “SMS over SS7,” Tech. Rep. NCS TID 03-2, National communications system, December 2003.
- [3] H. Rheingold, “SMS disaster warning system,” December 2004.

- [4] Fei Xie et.al, Component-based hardware/software co-verification for building trustworthy embedded systems, The Journal of Systems and Software, 2007.
- [5] Jaewon Kang, Badri Nath, A study on switching voice traffic seamlessly between GSM and GPRS cellular networks, Computer Communications , 2006.
- [6] G. Brasche,B.Walke,Concepts,services and protocols of the new,gsm phase 2C general packet radio service, IEEE Communications, Magazine (1997).
- [7] Chwan-Lu Tseng et.al. Feasibility study on application of GSM– SMS technology to field data acquisition,Computers and Electronics in Agriculture, 2006.
- [8] Peersman,C.,Cvethovic,S.,Griffiths,P.,Spear,H,The global system for mobile communication short message service. 2000.
- [9] Friedhelm Hillebrand. “GSM’sAchievements”, GSM and UMTS, 10/19/2001
- [10] RA Lang, E Walters - US Patent 9,300,902, 2016 - Playback of audio/video content with control codes.
- [11] C Wakeland, W Herz - US Patent 9,286,904, 2016 -Adjusting a data rate of a digital audio stream based on dynamically determined audio playback system capabilities.
- [12] Moritz Mahling, Et. Al,Building an audio/video-feedback system for simulation training in medical education.Bio-Algorithms and Med-Systems.Volume 11, Issue 2 Jun 2015.