Proc. Annual Symposium on Research & Industrial Training, 01(2014) 145-150
Department of Electronics – Wayamba University of Sri Lanka

RELAY BASED BACKUP SYSTEM FOR THE VOICE COMMUNICATION CONTROL SYSTEM

S.P.A.U.K.Samarakoon*, W.A.S.Wijesinghe

Department of Electronics, Wayamba University of Sri Lanka, Kuliyapitiya, Sri Lanka
*samarakoon.upeka@yahoo.com**

ABSTRACT

Voice communication is an essential part in Air Traffic Management. A Voice Communication Control System (VCCS) handles both air to ground and ground to ground communication. Airport & Aviation Services Sri Lanka (AASL) Limited uses an expensive VCCS system (GAREX220) which is older than a decade. Sometimes this system fails to work due to certain problems and AASL has no backup system. In this study we develop a low-cost VCCS that can be used as a backup system by AASL when the expensive system fails to work.

Keywords: *Voice Communication Control Systems, Push to Talk system (PTT), Audio amplifiers, microphone pre-amplifiers*

1.0 INTRODUCTION

Voice communications is a fundamental part of providing air traffic control services. Both air-to-ground and ground-to-ground voice communications are essential for the en route, flight service and terminal domains of aircraft flights to provide safe, orderly and efficient flow of air traffic. In Sri Lanka also there exists a voice communication control system (VCCS) which can control any air crafts throughout the Sri Lankan Flight Information Region (FIR).

Airport Aviation Services (Sri Lanka) Ltd (AASL) had awarded a contract to Park Air Systems for a Garex 220 voice and communications control system. In 2001 it was installed at the Ratmalana Area Control Centre (ACC). Garex 220 consists of a touchable voice communication switch which allows the operator to communicate over air-to-ground over radio channels and over ground-to-ground line-based circuits i.e. a combined voice and data switch providing integrated voice communications for radio, telephone and

intercom in one unique system, with unlimited conferencing capabilities. The Garex VCCS will provide an integrated airspace communication system, with the ability to speak with any aircraft throughout the Colombo FIR and to communicate with other ground facilities both in Sri Lanka and at other regional centres. The system consists of 50 external communications channels for radio, telephone and intercom connectivity, with 12 user positions featuring touch screen panel interfaces.

1.1 Garex 220

Telephone, radio and intercom functionality recommended by (International Civil Aviation Organization) ICAO; IFATCA, ATCA, IFATSEA, EUROCONTROL as well as additional features to meet national and local requirements are implemented in the open system hierarchical structure of the GAREX 220 VCCS[1].

The radio subsystem ensures routing the communication between controllers and pilots. The actual transmission and reception of radio signal are provided by transmitters and receivers located on different locations.

The telephone part provides voice connections between sites within the ANS. Connection with the adjacent air traffic control centers is realized through leased fixed circuits[2].

The GAREX 220 Compact VCCS offers all the functionality and connectivity required for Air Traffic Control (ATC)communications at installations with up to 36 Controller Working Positions.Controller Working Positions are equipped with one Touch Screen Panel, one loudspeaker and a single two-plug panel for connecting two positions instruments such as microphones, headsets or handsets. The Controller Working Positions are delivered in 6U high 19" frames for mounting in consoles, desktops or racks[3].

In this study, it was attempted to design a backup system for existing VCCS in case of any error occurs in it since the existing system is about 13 years old. VCCS is essential in air traffic management, and since it is a centralized system any failure in the system will affectto lose the communication both air-ground & ground-ground. AASL hopes to use the existing system for another few years ahead, and designing a backup system which is totally independent of the existing one, is better.

Therefore a simple and cost effective system was designed using basic electronics. A circuit was designed usingrelay based switching system, basically for 4 channels. It is a simple, cost effective and totally independent of the existing system.

2.0 EXPERIMENTAL PROCEDURE

According to objectives a relay based switching system for 4 essential communication channels was constructed. It consistsof microphone preamplifier, power amplifiers, series of relays, a microphone and two speakers; one for master and other for mixer. Microphone preamplifier is used to amplify the audio signals come from the microphone since its signals are often too weak to be transmitted[4]. Power amplifiers or audio amplifiers are electronic amplifiers those amplify low-power audio signals to a level suitable for driving loudspeaker and are the final stage in a typical audio playback chain[5].For microphone preamplifier, a 741 op-amp and LM 1456 were usedand for power amplifiers LM 380 ICs were used. For the conversion of audio signal into current and vise versa, 600 ohms audio transformers were used. Also eight 4 pole double throw relays were used, a pair for representationof each channel with a common ground. A relay consists of a coil, armature and two contacts which one contact is normally open and other is normally closed. In a 4 pole double throw relay there are 4 sets of contacts pair. The microphone preamplifier and also the power amplifiersfor master and mixer were connected to each channel. Channel switching was done by using a selector switch which its common pin was connected to +24V. PTTtechnique was used in the system to talk on half duplex communication lines. Channel indicator LEDswere there to indicate which channel is selected at the moment. From the block diagram in Fig.1, the whole design is described.

To drive relays, 24V supply is needed but to drive some ICs and to activate some parts of the circuit 12V supply and 6V supply are needed respectively. For that I used 7812 regulator and 7806 regulator. The common circuit diagram for them is shown in Fig.2.

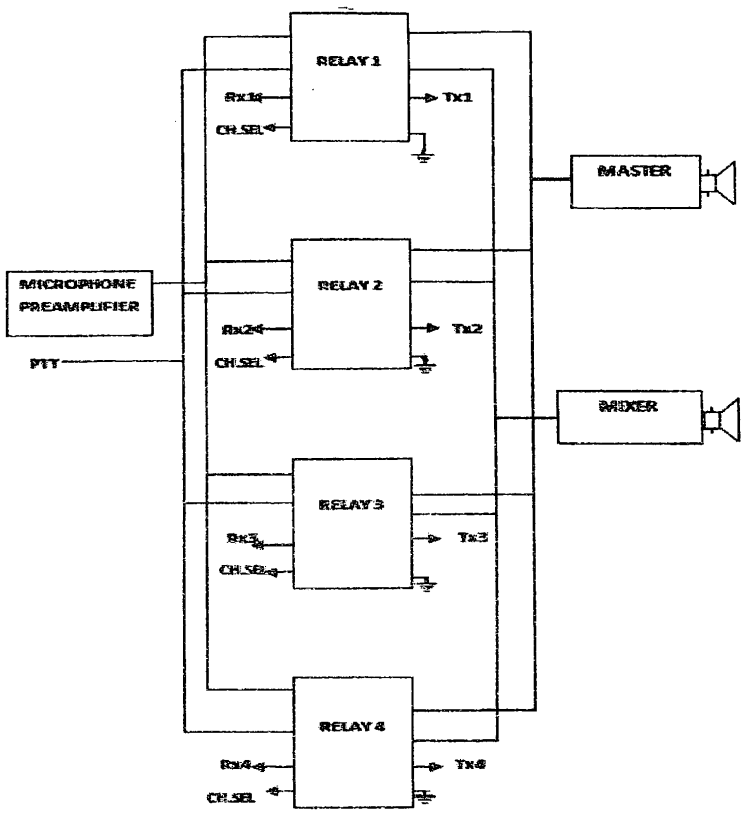

Figure.1: Block diagram of the designed system

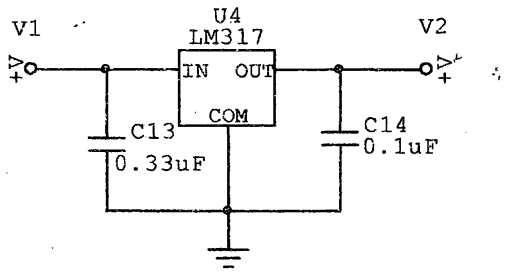

Figure 2: Voltage regulator circuit diagram

For generating of 12V, 7812 regulator is used for U4 and for V1 end 24V supply was connected. Then from V2 end I got 12V output. For generating of 6V, 7806 regulator is used as U4 and 12V for V1 end was connected and from V2 end I got 6V supply as wished.

3.0 RESULTS AND DISCUSSION

When the system is powered with 24V, the whole circuit is powered except relaysand audio signals come from all receivers is heard through the mixer speaker. When one channelis selected by rotating the selector switch to necessary position, the relays pair relevantto that channel is powered and all lines of that relay are activated and able to communicate with the transmitters & receivers, connected to that channel. When relevant

relays pair is activated, relay armatures touch Normally Open head from Normally Closed head. Then the voice signals coming from the receiver which is connected to that relays pair was heard through the MASTER speaker. To transmit voice signals we have to push the PTT button and then we can talk to the microphone. Then that voice signals transmit through the transmitter which is connected to that channel.

Theexisting VCCS provides communication facilities for about 50 external communication channels at the same time. Also it provides external telephone facilities. In this design It is accommodated only for four communication channels and do not provide telephone facilities. Other thing is the existing system is more reliable and accurate than this design.It has designed by Park Air Systems according to recommendations of the (International Civil Aviation Organization) ICAO. And it is a flexible system with many additional features suchas enablingchanges inScenariostobe controlledmanually, automaticallyat a set time,or undercontrol of the airspace management system androles andscenarioscan be createdand modified while the system is operational. But according to company's necessity this system is madewith basic electronics and it can be used as a successful backup whenever AASL needs it in a twinkle.

4.0 CONCLUSION

Since air-ground communication is essential in the Air Traffic Control. AASL depends on an old Voice Communication Control System (VCCS) and exists no backup system. We attempted to develop a low-cost VCCS that can be used as backup system for the existing expensive, old VCCS.The proposed system can connect any four transmitters and their receivers which they mostly needed. It is totally independent of the existing system and easy to handle. The maintaining cost of the new system is very low compared to the old system. Moreover, the new system is simple and need no expert knowledge to use maintain and repair it.

ACKNOWLEDGEMENT

I offer my heartily gratitude to all who have helped in numerous ways to make this study a success.

REFERENCES

[1]. http://www.deltronic.be/index_bestanden/Page674.htm (visited on 07th March 2014)

[2]. http://www.rlp.cz/generate_page.php?page_id=629(visited on 07th March 2014)

[3].www.indracompany.com/sites/default/files/garex_data_sheets.pdf (visited on 08th March 2014)

[4]. Park Air transmitter type 1500 technical hand book

[5]. Park Air 1201 series VHF receiver Technical hand book