CONTROLLING CABLE TV HEAD ENDS AND GENERATING MESSAGES BY MEANS OF A MICRO COMPUTER

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Abstract:

The purpose of this project was to program an Apple Micro-Computer to perform the following functions in Omega's cable system in Brazil, Indiana.

1. Channel Switching
2. Character Generation
3. Perpetual clock and calendar

The clock calendar function and the keyboard command functions interact with the computer to produce output voltages. These voltages switch coaxial switches to perform the above functions. Audio switching is similarly performed with the computer output voltages. The video output of the computer is used as a character generation and is routed to the switcher as an input. Upon command the computer will play messages and/or advertisements which the switcher will route to an output channel. At a cost of less than $3500 complete, the Apple II computer and switcher is an economical controller and character generator.

1.0 Introduction

A modern cable television system has a need to control multiple imputs (normally television signals) into a limited number of cable television channels.

The system needs to control these signals by time of the day, day of the week, and day of the month. For example, in Omega's cable system in Brazil, Indiana, we wished to share our cable T.V. channel 5 among Pay T.V., C-Span, and messages. A further need in our system was to control our time-weather-public service channel among time and weather, public service messages, Pay T.V. previews and advertisements.

Utilizing an Apple II micro computer and custom switcher, the computer will control three audio and video inputs into one output channel and any three audio and video inputs into a second output channel. One of these video imputs can be the video output of the computer which we have utilized as a message and advertising imput to our two channels.

2.0 System Configuration

The Apple II Computer is configured with 32K BYTES of ram memory, "BASIC" language in read only memory, a Mountain Hardware real time clock/calendar, and a single minifloppy disk drive. The operating program, message, and an event file of times of channel changes are stored on the disk and loaded into the computer when needed.

The actual switching of video and audio is accomplished by means of a custom switcher built by David Moffett of the Home Computer Center in Indianapolis. This unit is designed to switch two separate channels, each of which has three possible inputs. The Apple Computer has built into it a four bit parallel output port normally used for game paddles. These four bits are decoded by the switcher box and amplified to drive six double pole, double throw coaxial relays. The data format being used defines the most significant bit as a flag indicating which relay is to be energized on the previously selected channel.

The Double Pull-Double Throw coaxial switch made by Amphenol, is actually two separate SPDT coaxial switches with a common coil. One section is used to switch the selected audio signal to the output and the other section does likewise with the video. Any video signals not currently being used are terminated into 75 OHM resistors mounted on the relays because the outputs of all relays on each channel are wired in parallel. Only one relay on each channel can be energized at any one time.

At this writing, the switcher is controlling our local time/weather channels as channel one, and our premium channel as channel two. The three inputs connected to the time/weather channel are:

1. Weather scan video with local FM audio
2. Premium channel video and audio
3. Computer color video with local FM station audio

The three inputs to the Premium Channels are:

1. Premium channel
2. C-Span
3. Computer video with local FM audio

This is used to present public affairs programming (C-Span) and messages on our

premium channel during the day when the premium channel is not in use.

Any video and audio sources could be s bstituted for those listed above and extra relays could be wired in parallel with the coaxial relays. For example, the computer could energize a remote controlled audio cart player or video player whenever it's video output was selected by the computer. In our Brazil system, we are controlling a Magnavox Scrambler with a parallel relay.

3.0 Program Design

The computer program was written by John Turpin of the Home Computer Center in Indianapolis, consists basically of three parts:

1. A message entry program to input messages and store them on disk.
2. An event entry program to input times and dates of events and store these in chronological order on the disk.
3. An event handling program to compare the time from the real time clock with the times in the event file and carry out the specified events as necessary.

The message entry program is "Menu Driven", that is it presents the inexperienced user with a list of options. This program accepts messages from the keyboard; allows them to be modified if desired; and stores these messages on the disk for future use. Two formats are available - full page message or a single line crawling across the center of the screen.

The event time entry program also is menu driven. It accepts the time and date you wish to change, which relay to energize on the desired channels, and in the case of computer video being used on one of the channels, which message to print and how many times to repeat it. Table I shows part of a time file. Under the column headings Ch. 1 and Ch. 2 imprint three is the computer video message number.

Item	Mo	Day	Hour	Min	Sec	Ch1	MSG	Ch2	MSG
0	4	24	15	0	0	1	0	3	8
1	4	24	15	28	0	2	0	2	0
2	4	24	15	28	30	3	10	3	30

All data entry takes the form of a question and the operator responding with appropriate data.

The event handling program, which runs at all times except when one of the above two programs is in use, constantly checks the time from the Apple clock and compares this with the next time stored in the event file, when these times coincide, the switching information is routed to the output port to turn on or off relays as required. Table 2 shows the computer output video when it is not switching or playing messages.

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Status:
Current:    As of 4/24   15:28:00
  Chan 1    Switch 2
  Chan 2    Switch 2
Next switch at 4/24  15:29:00
  Chan 1    Switch 3
  Chan 2    Switch 2
     Time 4/24  15:28:20
```

Table 2

3.0 Restoration after Power Outage

Upon the restoration of power after a power failure, the computer will reload its program from the disc. The internal clock has a back up power system which will maintain the time for up to 3 days. The computer will compare the time with the last switch time and reset the appropriate relays. Theability to restore and reprogram itself is a unique capability which is not available in most commercial controllers.

4.0 Strengths and Weaknesses of the System

The most important strength of the controller is that the system is "software" controlled rather than "hardware" controlled. Any system changes and additions require only additional programming. The computer's ability to reprogram after a power failure is unique. The system has the ability to play up to 50 messages and switch channels based upon its internal clock to an accurancy of one-tenth of a second.

Among the weaknesses of the system are the limited time file. Although the time file will hold switch information for 20 consecutive days, the number of events able to be specified is only 130 with 32K of memory and 200 with 48K as presently programmed. If the system is utilized to play messages or advertisements on a hourly basis, the number of events for 20 days would exceed the computer's capacity.

The computer is presently being reprogrammed from a calendar date table to a day of the week table. In the new table, the user will program each hour each day of the week by means of a calling up of standard hours and non-standard hours. Standard hours could be programmed for the insertion of ads based upon the time of day and day of the week. The user will input switch changes only as needed to reflect changes in a particular day or in standard or non-standard hours. This change will increase the number of events able to be stored to over 500.

Another weakness of the system is that the system uses the output of the computer as a character generator. The output is legible but is not, as presently programmed, as legible as the output of a commercial character generator. A commercial character generator could be easily interfaced with the Apple Controller.

5.0 Future Design Goals

The head end controller can be utilized for other tasks in the typical cable T.V. head end.

Through the use of telephone interconnections devices (modems), the computer at the head end can be remotely programmed. The cable T.V. office could change the event file without going to the head end. Similarly, any advertizer could access the computer and change his advertisement on a daily or hourly basis.

Head end security and a temperature alarm device can be implemented by a latching relay which would activate an audio switch in the switcher. The audio switch would place a tone on the audio channel of the time-weather channel. A weather alert radio tuned to cable channel frequency would sound the alarm.

A number of manufacturers are building computer output cards that have isolated relay contacts for their outputs instead of voltages. With this card, one could go directly to a Daniels Industries Coaxial switcher. These output cards would extend the number of inputs and outputs which could be controlled by the computer.

6.0 Price vs Performance

The above described Apple II system with 32K RAM memory, disk drive, custom switcher and programming sells for less than $3500. This price compares favorably with a low priced character generator without any controls functions. The price also compares favorably with a head end controller without any character generation functions.

7.0 Summary

The Apple II Computer and custom switcher provides an economical and practical means to switch channels and insert advertisements and messages based upon an internal clock. Because the computer is "software" controlled, the system can be expanded and modified to suit the needs and desires of individual cable systems.

8.0 Acknowledgements

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