TIME SYNCHRONIZED VIDEO SYSTEMS

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Abstract

The idea of synchronizing multiple video recordings to some type of 'range' time has been tried to varying degrees of success in the past. Combining this requirement with existing time code standards (SMPTE) and the new innovations in desktop multi-media however, have afforded an opportunity to increase the flexibility and usefulness of such efforts without adding costs over the traditional data recording and reduction systems. The concept described can use IRIG, GPS or a battery backed internal clock as the master time source. By converting that time source to Vertical Interval Time Code or Longitudinal Time Code, both in accordance with the SMPTE standards, the user will obtain a tape that contains machine/computer readable time code suitable for use with editing equipment that is available off-the-shelf. Accuracy on playback is then determined by the playback system chosen by the user. Accuracies of ± 2 frames are common among inexpensive systems and complete frame accuracy is more a matter of the users' budget than the capability of the recording system.

INTRODUCTION

The use of video in monitoring various types of testing has become common place: Flight testing and ground battle simulations are just two examples of situations that require multiple views of the events under evaluation. The added flexibility of being able to review each of these views in sync with each other has not been practical for most facilities in the past due to the incompatibility of existing timing systems and available video playback equipment capable of this type of high accuracy playback. With the merging of computer and video technologies in the form of multi-media, many products have been introduced that are lower in cost and more easily adapted to precise command and control. Once precise control over these lower cost playback machines was available the matter of synchronizing them to a "range" time became a simple process of finding the most usable common time format. Once that format was determined, reader cards could be used to read the time from the tape and make that time available to control software. The software can then give the user the option of searching all playbacks to any point on the tape and provide synchronized playback from that point. Using current systems up to seven video tapes may be synchronized. Future systems are expected to offer control of up to 30 playbacks with additional types of playback decks being available choices.

SYSTEM DESCRIPTION

Note: The system described used assumptions not necessarily applicable to the reader. Wherever applicable, time sources, video sources, or video recorders may be substituted without effect on the overall system assuming accuracy is not compromised. That is to say that GPS may be used instead of IRIG, for example.

A typical application uses multiple video sources, such as a HUD camera, an over the shoulder camera and a DDI or heads down display (could include FLIR). These signals may all be recorded on a Hi–8mm triple deck recorder available from TEAC. Most test vehicles receive IRIG–B for synchronization of various test data. Video tape has often had this 1 kHz IRIG–B recorded on an available audio track. This method does not lend itself to recording on single audio channel recorders or playback on stereo recorders that mix the audio tracks (most do). A method was required that would allow recording time in a machine readable fashion that would not interfere with the audio or video. Video time insertion did not meet this requirement. The use of Vertical Interval Time Code (VITC) was selected for this use since it was widely accepted as a standard method of recording time on a tape for editing purposes.

The IRIG to VITC converter was developed with the addition of a feature to allow the user to identify the vehicle and video source. The SMPTE VITC standard allows for three user defined bits to be imbedded in the data inserted on lines 16 & 18 of the video signal. These unique user bits allow the user 999 different tape codes to help identify a specific tape with a specific vehicle, perspective, and event. This combines with the Julian date and time to make each tape immediately traceable in the event mislabeling.

Once the recording of the test is complete, playback becomes the primary concern. The video tapes are played on a video playback deck that can be controlled via computer. The Sony V–deck was chosen for this application, but many interfaces exist for other types of playback decks. The video is routed through the PC card to detect the time information on the video. Although this is commonly referred to as 'stripping off' the time code, the time code information remains in the vertical interval so that any duplicates made will contain the exact same time information and remain frame accurate.

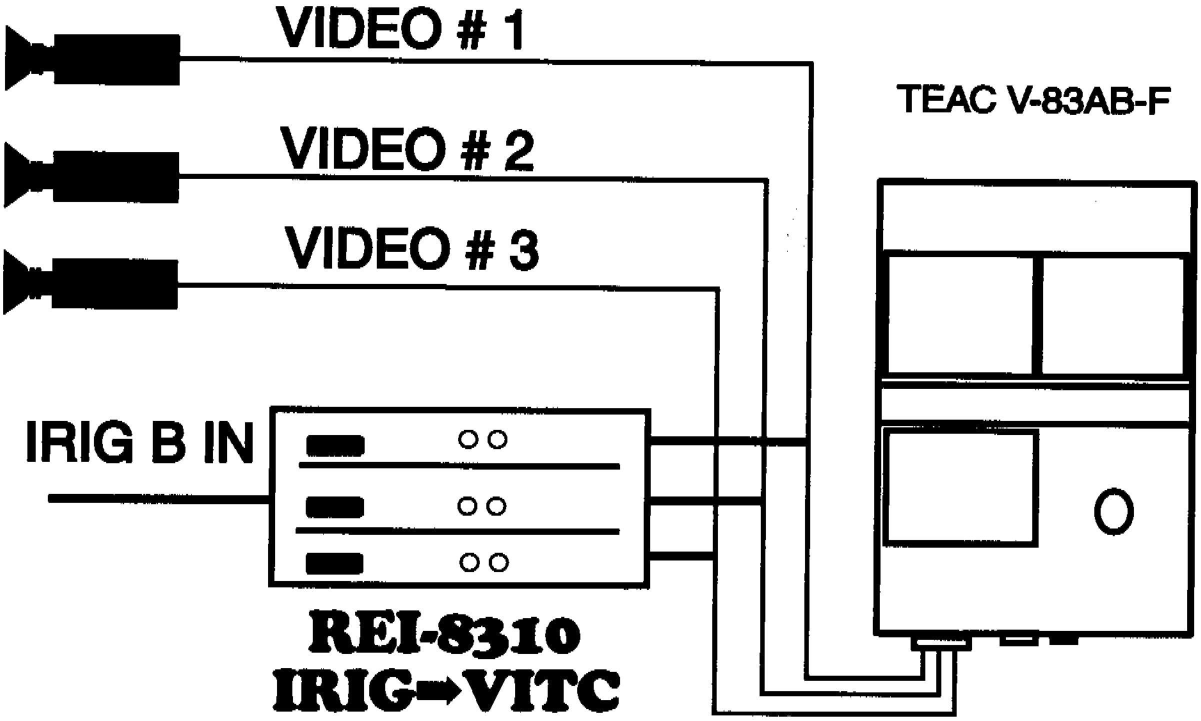
The time information is read into the PC memory by the card for use by the software. Although the software used was created for PC Based Editing, a "Sync Roll" feature has been added to the program. The tapes may be searched to any point in time on the tape, placed in pause and then commanded to play using the Multi–source command. The playback decks are commanded to play on a given clock cycle, which allows the use of a serial command interface. Most decks have identical times from pause to play, but provisions exist in the software to compensate for inconsistencies in response times between decks.

The result is a system that will play tapes at normal, slow, and fast speeds in sync (± 2 frames). Other system enhancements include a VITC to IRIG converter for returning the original IRIG information, and an IRIG display with user ID selection for displaying time and ID.

As indicated in the beginning of this section, one may substitute components for a variety of purposes. If, for example, superior editing capability is required, a high end editing playback deck with Time Base Corrector may be used. These decks are equipped with external sync and precise servo systems. The result would be a completely frame accurate system, that would add $15–20K to the price of a system. Also GPS can very easily be used as a time source without adding significant cost. The real key to the system is acquiring real time as the video is acquired and storing it in a manner that does not interfere with the video and that is machine/computer readable.

CONCLUSION

The system above may be used in a variety of environments from testing to training. Multiple video images from an entire squadron may be reviewed in sync to access any aspect of training and readiness. The cost of such systems has been reduced to a level that is normally associated with high quality playback systems with no special features. A typical playback system of three video monitors, playback decks and timing card sells for under $10K. The rugged three channel inserter is available for approximately $2.5K. Most standard PC clones (486 recommended) running Windows will accommodate the control over the playback system. This system is currently in use at Pt. Mugu, Naval Air Warfare Center.



RECORDING SYSTEM DIAGRAM

TSVS SYSTEM DIAGRAM