

VIDEO IMAGE PROCESSING AND DATABASE FOR TRAFFIC ACCIDENT RECORDING SYSTEM

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ABSTRACT

This paper describes the outline of Video Image Processing and Database System (VIDS) developed as a support system of TAAMS* to analyze the image information and the image processing technology which is adopted to TAAMS. VIDS is composed of two main functions, one is a function to save a picture of the videocassette tape with huge information on the laser video disc** with a good cost performance and to search, other is an Analyse-Supporting-Function to construct the database which supported the analyses such as the speed of the vehicle, the collision sounds, and the view obstruction events for instance. In a word, VIDS enables to process the image data of a lot of accidents and the near miss cases, etc. collected by TAAMS with low-cost, in a short time and a large amount of it. Moreover, the constructed data base is used for the research of the occurrence mechanism of the traffic accident, the accident prevention measures or the driver education etc.. In addition, VIDS is evaluated as one tool which practicably uses a lot of video pictures to which it is forecast to be going to increase more and more in the future. In this paper, some of the middle result of the database and the subject in the future constructed with VIDS are considered.

INTRODUCTION

TAAMS records not only accident but also near miss cases by detecting the brake sound and the horn

to avoid the danger. The horn is not necessarily used under the dangerous state which becomes tense. It is used as a method of transmitting communications when urging or warning the other party to behave in case of no particular state. Therefore, the state to use the horn suggests potential danger, and those pictures are necessary to research the mechanism of the occurring accident.

The medium, videocassette tape usually used TAAMS, is good performance and has extremely large capacity. However, It is remarkably difficult to analyze and process actually, because of abundant amounts of information a voluntary comparison of the picture (similarity and difference). In addition, a video picture is sequential data, and has a definite difficulty in a random search. Moreover, video-tape has the problem of preservation for long time so that the picture quality deteriorates from passing year, and actually, most of valuable image data collected is not used effectively. To analyze the video image data of TAAMS, we developed VIDS as a support system to construct the database, which was able to search a video image at random and efficiently.

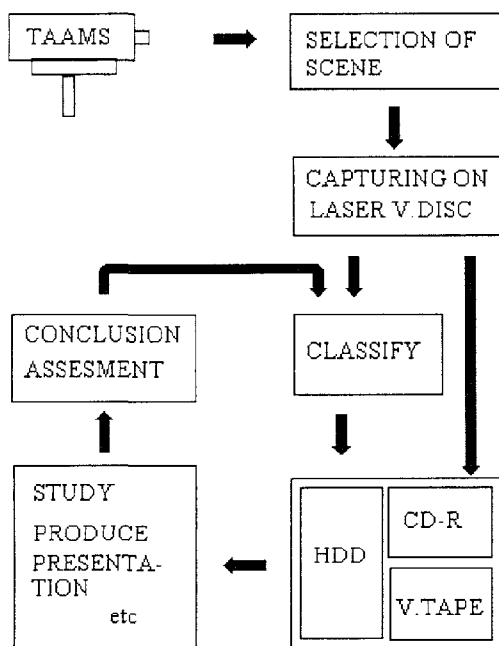
It is being proven that VIDS is not only a tool which give a time shortening (favor) for research the traffic accident mechanism from the picture of TAAMS, but also a support system offers us a profitable new hint. The later is more important aspect VIDS.

*Footnote is explained at the last page.

Video Image Processing and Database System

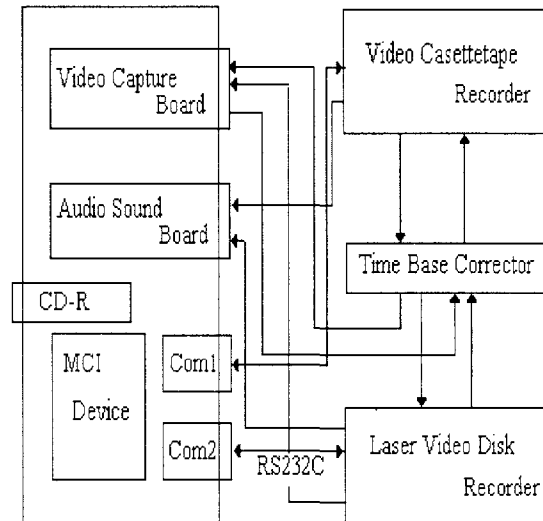
Outline-Figure 1 illustrates a basic flow chart of VIDS which constructs the image database by selecting, preserving, analyzing, and classifying the picture of TAAMS. The procedure of the VIDS is as follows; First of all, the pictures from the videocassette tape is displayed by VIDS in real time, and captured the picture elected to the laser video disc. The captured picture data is observed more in detail and classified. The in-depth analysis, for example, the speed of the vehicle, the collision sound, the brake sound and traffic, etc. are performed with other analytical application software linked with VIDS and these topic informations and analytical results are arranged by VIDS, and saved in the character database on the hard disk. Because the analyzing picture is displayed from the laser video disc directly by the function of VIDS, an observation and an analytical operation can be done, smoothly. This character data base links with the picture data on the laser disk, and both of them are composed the image database. If these results is suggested the proposal of a new classification, the classified items are added into the image database, and the data is updated to be available as basic data for the study.

Figure 1



The basic composition chart of VIDS is illustrated in Figure 2. It is composed of a personal computer (CPU: Pentium II, 266 MHz), a videocassette recorder (Mitu-bishi BV-2000R with RS232C Interface), a laser videodisc recorder (Sony LVR-3000AN with RS232C Interface), and various devices in the personal computer. The development language is Visual Basic 5.0.

Figure 2



Record Medium- we examined the hard disk and the laser disk where three conditions (passing year's deterioration, a large capacity, and the random access) were satisfied when the medium of the image database was selected. Table 1 shows the comparison of the performances of the both. The difference is hardly seen as a random access by the both. But, the laser disk is selected for the reasons why are a good cost performance and safety to protect for data trouble. However, the fault breaks out in the capture operation to the laser videodisk. This fault derives from the system it by which the picture frame controls on the laser disk device. Generally, it is necessary to stand by which the number of capturing frames of original picture is allocated in the blank area on the laser video disc so that the user may record the picture on the laser video disc.

Because of the allocation in the blank area procedure, the work that the user counts the number of frames beforehand is a very annoying and not a little in the case of wrong specification. Executing the procedure, the user will consume man-and-hours considerably.

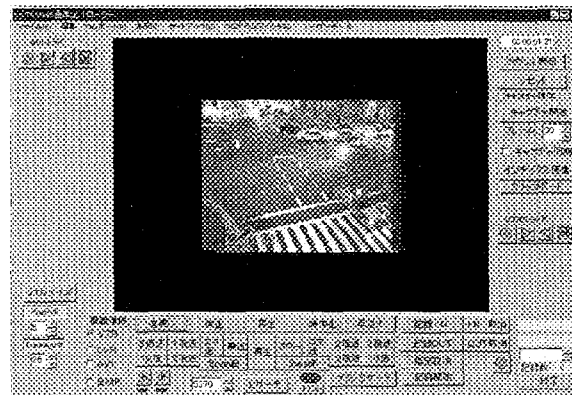
Table 1

Performance comparisons of record media		
	HDD	LVD
Access speed	Excellent	9600bps
Quality	Less excellent	Excellent
Capacity	13GB/48min.	1/48min.
Amount/year	65GB	5
Procedure	Easy	Difficult
Data Security	Danger	Safty

Automatic capture function- Because VIDS had added the automatic capture function to cancel the complexity when capturing on the laser video disk, the load of the user was extremely reduced. Figure 3 shows a main screen of VIDS. The user can do all work by clicking the mouse on this screen. The user reads the picture from the videocassette tape displayed on the screen, and specifies the IN and the OUT point of the capture which wants to be made surely. The following task automatically capture specified area as VIDS controls the videocassette recorder and the laser recorder, and records the captured address and other information in the user data area of the laser video disc simultaneously.

When capturing, the most important algorithm is method of the search for the IN point of the video cassette tape and a synchronization between the video cassette tape-recorder and the laser video disc recorder. A synchronous error are ± 5 frames or less. The margin of 10 frames is set beforehand when capturing.

Figure 3



File Capture Function- VIDS can be captured to the file type of AVI and BMP. Because the synchronization between image devices is made even when capturing as AVI file, we can get a clear file without uselessness of the top and bottom in the file. The performance of capturing depends on the performance of the capturing driver used, and the routine uses the component which is called "OCX".

To analyze the speed of the car, the image resolution 640×480 pixels and 30 frames per second are required.

Troubleshooting-The following two points are described as a main troubleshooting. The first is the control trouble of the recorder device concerning the lack on the image signal of the videocassette tape, and the second is a trouble of the computer crash concerning the operating system.

The trouble of the recorder device control is as follows; VIDS regularly confirms the address on the tape by generating the timer event while searching for the IN point. The case where there is abnormal signal on the videocassette tape when confirming the address, is often happened. In this case, the videocassette tape-recorder might fall on the uncontrolled state with disregarding the command, stopping or rewinding.

The reason for the cause which enters such a state is that the gap is occasionally caused in the commissure of the scene and the scene when the image that TAAMS is saved in DRAM is recorded on the videocassette tape.

Only if the image is displayed, it is not a trouble which becomes a problem. However, when the capture is done in each frame by the computer, it becomes a serious trouble. Then, VIDS provides the routine of an emergency procedure, and recovery from the uncontrolled state automatically (or semi-automatically).

Next is about a computer crash which is occurred to our regret daily. As the solution, IN and OUT point of capturing which the user specified, the state of capturing progress and user's areas are always checked, and written in the log file by VIDS. Therefore, only the user orders the processing of the remainder to VIDS by reset the computer even if the computer stops abnormally during capturing, the task is promoted automatically, and there is no damage by an abnormal stop. If we had selected the hard disk as a picture record medium, VIDS will have been a fatal system.

DISCUSSION

Relation picture data selection function of TAAMS and VIDS

TAAMS was developed as a device which selectively collected the accident and the near miss picture. However, it was clarified that extremely sharpening the detected function of TAAMS caused the obstacle to the collection of an important picture by the field test. Therefore, it is necessary to collect to some degree a lot of data, and select efficiently data needed from them. VIDS was developed as a support system for the efficiently selecting, and VIDS enabled to capture the data collected by TAAMS easily comparatively and to construct the image data base with the development.

On the other hand, from the different views, the VIDS suggested that is being included very important informations in the picture which related to the sounds collected by TAAMS (device selected according to the sound). For instance, the situation of a very light horn etc. is data which shows daily behavior of drivers as a scene of the conversation of the car and the car though it is not a state of the near miss.

Moreover, TAAMS does not overlook a natural phenomenon that is the groan sound of the electric wire by the storm and the lump fall sound of the snow etc. also, it is natural, and record the work situation of the road construction. These picture data has the possibility to use widely as basic data which investigates the change in traffic under broken situation.

Paraphrasing the function of such TAAMS, it is a picture diary by which affecting suitable of a social and a natural phenomenon and traffic situation is expressed (record), and a machine which measures citizens' traffic manners. When the traffic safety is educated, a real colliding scene by TAAMS will show a superior persuasive power to a lot of character information. Importance is to be able to classify and to analyze the huge image data collected in relation to the sound of these TAAMS systematically by developing VIDS.

Subject in the future

Efficiency of analysis-At first, we attempted the development of the data base including the technology which made the computer recognize the image and the voice, too. For examples, the object of recognition is the shape of the car, the direction, the type of collision, the brake and a collision sounds and a horn, etc.. Studying will have advanced remarkably if succeeding in the practical use of this technology. However, the theme of the shape of the image and the audio recognition have too a lot of obstacles, our development is not advanced.

Delivery of image-We recognized the complexity of the mechanism of the traffic accident occurrence again while investigating the accumulating image. The reason is to be gradually clarified about the doubt of a local rule of the driver not publicly admitted, or a fact to look for the correlation to the occurrence frequency and the traffic of the accident and the near miss, or a reality which measures of suggested anti-collision did not effect of expecting, by the process of studying. The more this kind of finding will increase though the advance by studying, but it is likely to become a result that only the theme is left behind.

About the future of the database of TAAMS, strongly, we feel the development of the data delivery system by an appropriate form to researchers in all fields, administrative organizations, and operation managers of vehicles, etc..

Three-Dimensional Image-The image of TAAMS is a fact, and a shocking collision scene gives people a strong impression. However, because the story is a short time at before and after the collision, and a camera position is located for an objective expression, the effect of production that people makes a hero of the collision scene is thin, also has the fault to make the strength of the image forgotten at once. Therefore, we think that the development of the three-dimensional picture processing technology is necessary as an analytical technique which clarifies the fact obtained from the traffic circumstances which is behind a short scene or the driver's view-point. If the technique is used, the persuasive power to people will rise further, and keep the scene in the mind for a long time.

CONCLUSION

VIDS was developed as an analytical support system of the TAAMS image data. VIDS is composed of a function to capture the picture of the videocassette tape to the laser video disc easily and a function to construct the image data base at the same time.

It is evaluated as a useful tool for an efficient analysis and a classification while flexibly updating the image data with a large amount of information.

*TAAMS is a system which senses the sound, and records the image data saved in DRAM till then by CCD camera on the videocassette tape by the NTSC procedure. One scene is composed between 260 and 300 frames, and the scene is not recorded in case of the sound which does not reach at a constant level so that the sound entering from the sensor may pass various filters.

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** Laser video disc: A metallic powder of Sb, Se, Bi, and Te are spread on the polycarbonate base, and these metals melt by the heat of the irradiated laser beam and they become an alloy. When playing on the display, the difference of reflectivity in alloy part and non-alloy part is read by the own device. Non-contact laser picking up. Analog record method. 87,000 frames/both sides. User data area of 128KB. Diameter 12 inches, protected with the cartridge.