EVIDENCE COLLECTION SYSTEM FROM EVENT DATA RECORDER FOR CAR CRASH ANALYSIS

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ABSTRACT
This paper describes the effective way of retrieving data collected by event data recorder whenever accident occurred or crash detected. The Event Data Recorder (EDR) is one of the favorable solution for public safety. This event data recorder is composed of various sensors which are interfaced with processor for collecting vehicle status. This evidence collection system is nothing but the software based system which will collect data from EDR, process it and show the exact cause of accident. Graphical user interface (GUI) is constructed using Visual basic VB. NET software which shows readings of all sensors at the time of accident. This helps to design safer vehicles, driver behavior system, clear technical faults, issuing driving license, etc. This system can be implemented into any vehicle all over the world.
KEYWORDS: Event Data Recorder, Vehicle Monitoring, Evidence Collection system, crash analysis, police verification.

INTRODUCTION
Currently traditional method of crash analysis is being used in which cops need to visit accident site and check for signs of accident**.** Then they need to check for evidences like skid marks, degree of damage, collision part, eye witness etc. Often, there is situation of insufficient evidences. Sometimes it may also possible that some clues got missed by police. This is very time consuming and complex process. By using this evidence collection system we could perform analysis of accident cases just from police station. This reduces manpower, time and complexity over traditional system. Results obtained from analysis may also useful in driver training purpose, safety purpose, insurance issuing process etc. An Event Data Recorder is a device installed in vehicles to record information related to vehicle conditions crashes or accidents. Event Data Recorder is also commonly known as the "Black-Box". In recent time vehicles like trucks, cars etc. Black boxes are activated or triggered by the problems sensed by the electronic components like sensors. These problems also known as the electronically sensed Problems. Black Box preparedness to collect the statistically applicable crash information to enhance the safety of the vehicles. This collected information is stored micro SD memory card. This memory card is that much capable to store all data.

This system satisfies objectives which are, To build such an Evidence collection system which could construct clear picture of an accident, To design an Evidence collection system which will reduce time and complexity in police verification and accident analysis process, To provide sufficient memory space to store event data in form of micro SD memory storage card, To prevent falsification of data stored in memory card. There could be cases of data forgery or data modification and To construct such Evidence Collection System which helps in insurance cases.

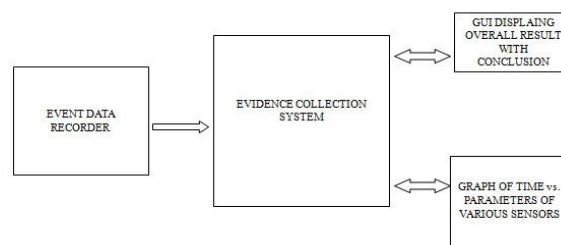## SYSTEM ARCHITECTURE
BLOCK DIAGRAM

Figure 1. Block Diagram of Evidence Collection System

As shown by block diagram, this system collects data from event data recorder and shows results using GUI. It's no more complexity. Just simple and convenient design is this.

DATE	TIME	TEMPERATURE	DISTANCE	LONGITUDE	LATTITUDE	SEAT BELT WORE	SPEED
10-12-2014	10:10	37	1	37.764	78.897	YES	78 kmph
10-12-2014	10:13	34	0.75	36.543	79.765	YES	112kmph
10-12-2014	10:16	32	0.75	34.543	77.765	YES	111kmph
10-12-2014	10:19	45	0.75	35.543	77.765	YES	102kmph
10-12-2014	10:21	32	0.75	45.678	78.565	YES	90kmph
10-12-2014	10:24	46	1	89.543	89.67	YES	88kmph
10-12-2014	10:27	76	0.75	56.678	90.657	YES	92kmph
10-12-2014	10:30	54	1	78.543	78.859	YES	45kmph
10-12-2014	10:33	67	1	67.762	90.09	YES	29kmph
10-12-2014	10:36	43	1	65.667	44.689	YES	65kmph
10-12-2014	10:39	32	0.75	89.776	90.758	YES	92kmph
10-12-2014	10:42	45	1	90.876	78.97	YES	93kmph
10-12-2014	10:45	78	0.75	12.456	67.987	YES	72kmph
10-12-2014	10:48	65	1	34.567	78.565	YES	52kmph

Figure 2. Input data to be process by system

The above figure shows data stored in micro SD memory card. Parameters in this data are temperature, distance till front vehicle, latitude, longitude, seat belt status, speed of vehicle etc. Like this excel file is used to save whatever data collected by sensors.

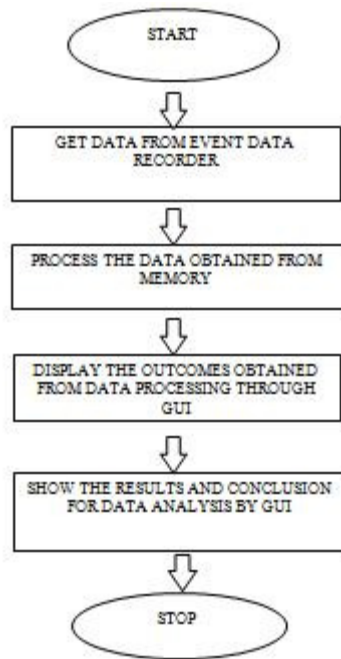### B. FLOW CHART

Figure 3. Flow Chart of Evidence Collection System

As from block diagram, this system first fetches data from EDR. This is nothing but the recordings of various sensors while vehicle is running. Then Evidence Collection System processes this data. This data is organized in tabular form. Then we get outcomes such that comparison of Time Vs Speed, Time Vs steering angle, Time Vs

Temperature etc. After all this data processing, system tells exact cause/causes of accident. For that system checks threshold value of individual sensor. If a particular sensor has crossed threshold value, it's a cause of accident.

This system depends on continuously recording based EDR. This may need large amount of memory to store data. But, by using excel files this problem is solved. Then also we are using micro SD memory card of largest storage capacity to store this data. Data retrieval and analysis of recorded data is done through GUI which is prepared from Microsoft Visual Basic .Net (VB .NET). All information collected by sensors is shown by this GUI. This ECS system works at three interdependent levels.
Data Collection Level: At this level, data from different sensors are collected and stored in SD card. For this ARM processor is interfaced with al sensors. Data Processing Level: This is the main level where data from SD card is retrieved and processed. Various information required for post crash analysis is obtained here.
Human interference window: At this stage all processed data is made available for manual analysis. A separate GUI is constructed for this.

C. BREADTH FIRST SEARCH -TECHNIQUE

Now there is have huge data collected by all sensors. There must be a data mining algorithm which could handle this all data very effectively. That's why Breadth First Search technique is used here. This is most reliable search technique than any other.

$$A = \begin{pmatrix} A_{1,1} & \cdots & A_{1,p_c} \\ \vdots & \ddots & \vdots \\ A_{p_r,1} & \cdots & A_{p_r,p_c} \end{pmatrix}$$

Figure 3. Data mining in Breadth First Search

As shown in figure, this technique maps data by row and column. Initially it selects first row. Then data on all columns of first row are mapped into system. Then again same technique for second row. Likewise all data of micro SD memory card is fetched into system. By this speed of system increases and dependability of system on external devices is reduced.

SOFTWARE DESCRIPTION

A] MICROSOFT VISUAL BASIC:

VISUAL BASIC also known as VB is a high level programming language. It is evolved from the earlier programming language in the DOS version called as the BASIC. BASIC is the abbreviation for Beginner's All-purpose Symbolic Instruction Code. The Visual Basic programming codes resembles the English language. Different software companies generate the different versions of BASIC like Microsoft GWBASIC, QBASIC, QUICKBASIC, IBM BASICA and many more. It is easy programming language to learn and for anybody interested in programming but have a less knowledge of professional training in software engineering.

RESULTS

Results obtained are shown below using snapshots. This GUI contains two main windows.

Figure 4. Home page of GUI

This is first page when GUI opens. Again it contains different sub-links connected. File option allows to select excel file from SD card. After selection of excel file from SD card, all data is mapped into new window of GUI. By this option we can select any file for analysis.

Figure . Data mapped from SD card.

This comparison option allows to compare sensor parameters with respect to time. Last cause of accident option gives exact cause of crash. There may be one or more causes for an accident. This system will tell each cause.

APPLICATIONS

These analysis results are useful in various cases.
A. POLICE VERIFICATION
Results obtained are important in case of police verification. Cops can use these results as evidences and solve accident cases very effectively. This gives justice to victims.
B. DRIVING LICENSE ISSUEING
Driving license issuing authorities can check performance of driver using this system. If certain driver has poor performance regarding to driving, particular action can be taken by authorities. This helps to award license for skilled drivers only and to minimize road accidents.
C. DRIVER BEHAVIOR MODEL.
A car owner or transportation company owner can check how his driver used to drive vehicle. Comparison analysis can show fluctuations in speed, temperature, steering angle etc. This helps owner in diver behavior analysis model.

CONCLUSION

"Evidence Collection System from Event Data Recorder for Car Crash Analysis", paper deals with results obtained from advanced Event Data Recorder for fault protection in vehicle to get data recorded. Also this paper aims to provide the actual cause of the accident or crash of the vehicle by retrieving the data from the EDR. Graphical comparison of various parameters such as speed, temperature, wheel rotations etc. with respect to time is also done. Time wise analysis of particular sensor is much easier due to these results.
These results are also helpful in cases like Driver training program, Insurance cases, Police verification etc.

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