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A Study of Event Based Audio and Video Recording System

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Abstract: This system is well suited for vehicle in order to monitor status of vehicle. This system is able to track vehicle and if any fatal condition or any unusual event occur, this system is able to track that event. Mainly used in car or trucks. This entire system is mounted on vehicle. System is composed of the hardware required to capture video stream. Two video cameras are used in this system for front and rear video capturing. Both cameras are mounted either at 120 or 180 degrees of each other. The recorded video files are store on SD card based on an event trigger. When this system enters into Wi-Fi zone, system uploads all recorded files on server. Along with two video cameras, system is capable of record some sensor data. System comprises of sensors like Audio, Accelerometer, Magnetometer, Gyroscope, GPS, Light sensor, Pressure sensor all these sensors data can also be recorded along with video. All these sensors along with two cameras are mounded on board in order to track location and if any fatal event occurs then system is able to generate that event and video is uploaded on server. The cameras also include a microphone to capture audio inside and outside the vehicle. Though the cameras are continuously recording, the system is set to save video clips only when triggered by an event. Event is triggered when gravitational forces (g-forces) on the vehicle that exceed a predetermined level. These movements are measured by an accelerometer that triggers the camera system when typical vehicle movements occur, such as sudden braking or acceleration, sharp turns. The camera system automatically saves video footage from before and after the incident. In addition, Driver can press a button to manually trigger a clip to be saved.

Keywords: Software, Firmware, Hardware, Micro Controller, SD card, Wi-Fi, GPS, Accelerometer, Magnetometer, Gyroscope, Light sensor, Pressure sensor, IR LED, Temperature sensor , Latitude, Longitude, Microphone, gravitational forces.

OBJECTIVE AND SCOPE OF PROJECT

This system is well suited for vehicle in order to monitor status of vehicle. This system is able to track vehicle and if any fatal condition or any unusual event occur this system is able to track that event. Mainly used in car or trucks. This entire system is mounted on vehicle.

Abbreviations:

MCU	Micro Controller Unit
SD card	Secure Digital Card
Wi-Fi	Wireless Fidelity
GPS	Global Positioning System
IR	Infrared
LED	Light Emitting Diode
RGB	Red Green Blue
GPIO	General Purpose Input/output
SSID	Service Set Identifier
FPS	Frame per Second
dB	Decibel
OS	Operating System
GB	Giga Byte

I. INTRODUCTION

Starting in 2000 a number of public transit agencies in the United States started a new form of video recorder technology. These new video recorder systems were designed to improve safety by monitoring driving habits to identify risky behaviors and train operators to avoid them before they led to a collision. Rather than simply saving a continuous loop of video feed, the systems capture a short video clip only when triggered by a unusual driving event, such as hard braking, a sharp turn or impact with an object. This system consists of a small, video camera that is mounted on the vehicle windshield, usually behind the interior review mirror of the car. The cameras also include a microphone to capture audio inside and outside the vehicle. Though the cameras are continuously recording, the system is set to save video clips only when triggered by gravitational forces (g-forces) on the vehicle that exceed a predetermined level.

These movements are measured by an accelerometer that triggers the camera system when atypical vehicle movements occur, such as sudden braking or acceleration, sharp turns. The camera system automatically saves video from before and after the incident. In addition, the operator can press a button to manually trigger a clip to be saved if there is a particular event he or she wants recorded. When system is triggered by an event then blue LED glows, a solid green light on the equipment that indicates the system is uploading its data on server

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software. Red light on equipment indicates that device is not ready or not functioned properly. This provides the driver with immediate feedbacks and awareness that an action he or she took activated the recorder. This is intended to encourage self-evaluation and can signal behaviors that the driver should work to avoid, even before formal review and coaching takes place. [1]

The rest of the paper is organized as follows. Section 2 explains basic building blocks of firmware. Section 3 explains software requirements and server software design. Section 4 gives an idea about hardware used to build this system. Section 6 draws conclusion and comparison. Section 7 shows experimental results in various testing scenarios. Entire system comprise of three building blocks, Firmware, Software and Hardware.

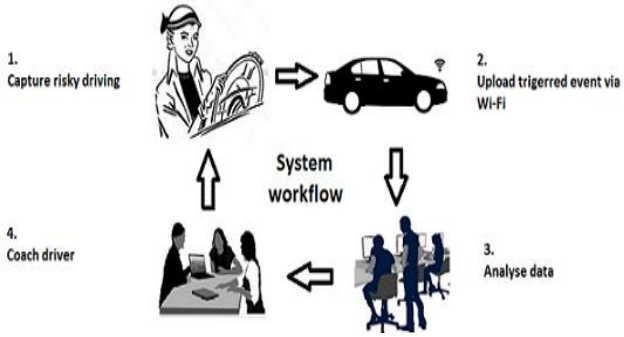

Fig.1.System Workflow

II. FIRMWARE

Firmware is the heart of any embedded system. Firmware consists of various blocks. Major firmware building blocks of this system are,

SD storage manager

System needs continuously maintain enough free space available on storage media SD card to record and store new video and event files. Video storage management module will handle this functionality for system. This module will continuously monitor free space available on SD Card. If enough space is not available to store new video then it will delete oldest video first. It will continue deleting oldest video file till enough space is not available.

Microcontroller unit communication

MCU Communication is at the heart of System. It is multithreaded application which is responsible for getting all peripheral sensors data. It is also responsible for controlling IR LEDs, RGB LEDs and GPIOs. MCU communication stores all these sensors data in the predefined shared memory region.

Event Manager

Event Manager is a very much important feature of the system. It is responsible for storing recorded video/Audio files on SD Card based on generated events for total event duration.

III. SOFTWARE

In order to view events, system need to upload all video files along with all event details on server software. For that first step is to register a device on server software in order to upload events. Only authorized user can access this server software. Server software will provide information about triggered event, Interior and exterior camera's video, Vehicle identification number, Sensor Data, GPS Data, etc. It consists of several modules such as event viewer, Dashboard, Device Vehicle management, System configuration, Firmware upgrade, Reports etc. Dashboard will show list of not viewed Events. Alerts/Warning at the very top, different statistical graphs based on event, vehicle etc. List of filter parameters will be on top right Advanced Search. Right Panel of dashboard will display list of connected/transmitting and disconnected devices. System configuration is used to set configuration file on device. Configuration file consist of threshold limit for acceleration, Speed, Pre time and Post time for event, Wi-Fi SSID Password,, etc. Firmware upgrade is used to upload the firmware package on the server and set the Firmware version on the device. Event viewer is used to display event data consist of acceleration and speed graph, Interior and exterior video, Map, Event details such as current event and sensor data such as acceleration and speed values, Key event etc. Device vehicle management is used to register a device, to delete a device and to update a device. User can generate reports also for particular event containing all details of that event.

TABLE.1.Software requirement

Software	OS	Windows7,Windows8, Windows10
	Development code	C, JAVA

IV. HARDWARE

Hardware required for this system

TABLE.2. Hardware requirement

Hardware	Microcontroller STM32f
	Video processor DM385
	Cameras(Front and Rear view)
	Image sensors
	Microphone
	GPS
	XMG sensor LSMD 935
	Temperature sensor
	IR sensor
	Wi-Fi
	SD card

V. CONCLUSION AND COMPARISION

This paper has proposed a system that is able to record continuous loop of audio and video but it save that video only when triggered by an event such as acceleration, high speed or key event. When this device enters into Wi-Fi

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region it uploads all its data on server software. Server software will provide all information about event, and interior and exterior videos. This system can be useful in order to observe behavior of a driver who is driving a car and by observing video we can educate him/her accordingly.

TABLE .3.Comparison

	Existing System	Proposed system
Maximum Resolution	1600x500	1280x720
Maximum Frame Rate	5 fps	30 fps
Image Dynamic Range	<70 dB	>115 dB
Max capture time/event	120 sec	30 minutes
Microphone	--	Stereophonic

VI. RESULTS

In this section we demonstrate the experimental results. We test this system in various testing environment by applying hard breaking, by taking sharp turns, by increasing speed and to capture a particular fatal condition we have pressed a key given on board.

TABLE 4. GPS Data

Vehicle Name: Unit_8_Audi				
Threshold Speed	**Speed Value**	**GPS Valid Flag**	**Latitude**	**Longitude**
30	1	1	23.04447	72.518112
30	0.4	1	23.04438	72.518318
30	31.036	1	23.04418	72.519371
30	0.4	1	23.04223	72.524445
30	0.4	1	23.03971	72.527954

TABLE 5 Sensor Data

Vehicle Name: Unit_8_Audi					
Acceleration X	**Acceler ation Y**	**Acceler ation Z**	**Threshold X**	**Threshold Y**	**Threshold Z**
-0.06692	0.05499	0.01525	0.4	0.4	0.5
0.4898	0.12951	-0.22114	0.4	0.4	0.5
0.17285	0.09745	0.00674	0.4	0.4	0.5
0.05649	0.4928	0.23249	0.4	0.4	0.5
0.2496	0.02897	0.5692	0.4	0.4	0.5

TABLE. 6. Event Data

Vehicle Name: Unit_8_Audi				
Event id	**Trigger id**	**Event Type**	**Event Start Time**	**Event Stop Time**
111	1	Key	27/02/16 15:07:10 IST	27/02/16 15:09:30 IST
111	2	Ax	27/02/16 15:07:40 IST	27/02/16 15:08:50 IST
111	3	Speed	27/02/16 15:07:50 IST	27/02/16 15:09:00 IST
111	4	Ay	27/02/16 15:08:20 IST	27/02/16 15:09:30 IST
111	5	Az	27/02/16 15:09:40 IST	27/02/16 15:10:50 IST

Fig.2 GPS Data

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Fig.3.Interior and Exterior view

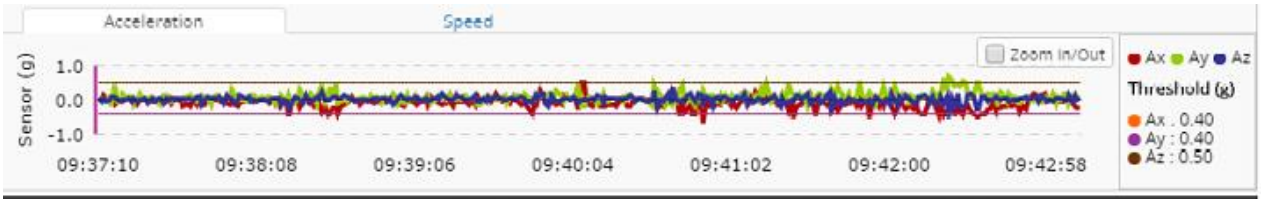

Fig.4.Accleration Graph

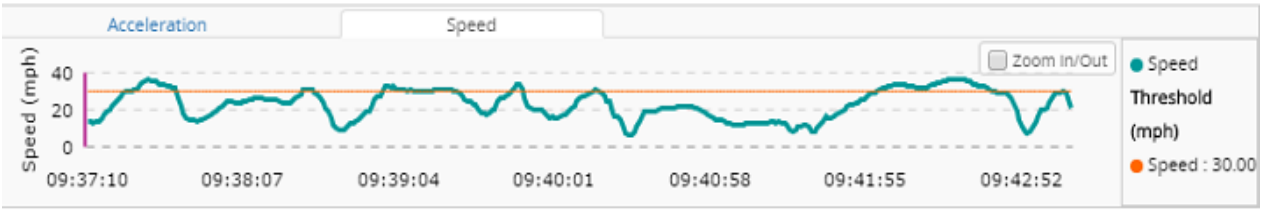

Fig.5.Speed Graph

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