Public Area Large Transport Flip through Security by Information and Intimation System (PALT SIIS)

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Abstract-- *PALT SIIS is an abbreviation for Public Area Large Transport Flip through Security by Information and Intimation System. The basic concept behind PALT SIIS is a rotational and orientation sensor based application which helps to prevent accidental flips of vehicles like buses, trucks, cars etc. This project includes a sensor and global network (GPRS/GSM/GPS) based device that is to be installed inside the vehicles, running in hilly/plane areas on road. So that if any accidental flip occurs, the control room will be informed immediately by the signals of the sensor based device of vehicle. It is an effective and sensitive intimation in real time system. It will provide redundancy of network service providers to empower the robustness of the system. Android is used for making this sensor based application. Android is a mobile operating system that is based on a modified on Linux kernel. The main advantage of adopting Android is that it offers a unified approach to application development. Developers need only develop for Android, and their applications should be able to run on numerous different devices, as long as the devices are powered using Android. The environment used in this is Eclipse.*

I. INTRODUCTION

This project includes a sensor and global network based device that is to be installed inside the vehicles, running in hilly/plane areas on road. The work done includes developing an Android based sensor application that will detect or sense the value of orientation as it changes. The logic behind this includes that whenever the degree of orientation reaches at 45 or above it, which means that the vehicle is about to flip, then immediately the message will be send to the specified number, including the proper location of accident along with latitude and longitude.

Along with this it will also generate high alert alarms to acknowledge the nearby people, so that immediate action can be taken. Whenever the degree of orientation reaches at 15 or below 45, it will also generate two different low pitch alert to driver so that he could control his driving speed and prevent such type of flips.

II. ANALYSIS AND REVIEW

A. ANALYSIS:

The problem of accident is a very acute in highway transportation due to complex flow pattern of vehicular traffic, presence of mixed traffic along with pedestrians. Traffic accident leads to loss of life and property. Thus the traffic engineers have to undertake a big responsibility of providing safe traffic movements to the road users and ensure their safety. Road accidents cannot be totally prevented but by suitable traffic engineering and management the accident rate can be reduced to a certain extent. Most prominent and tourist places are situated in hilly areas and large number of people visits there. Driving in complex and hill areas in day/night is quite tough and risky task in comparison of plain areas. The constant twists and turns of the roads along with a steady incline or descent can test your driving skills to the hilt. Most of the road accidents that occur every year are said to occur in mountainous regions. They also tend to be the worst kind with victims having the bleakest chances of survival as vehicles can go plummeting into a deep ravine or gorge killing instantly.

Research and product review says, various causes of road accidents are:

Road Users - Excessive speed and rash driving, violation of traffic rules, failure to perceive traffic situation or sign or signal in adequate time, carelessness, fatigue, alcohol, sleep etc.

Vehicle - Defects such as failure of brakes, steering system or tube/tyre burst and lack of proper lighting system.

Road Condition - Skidding road surface, pot holes, ruts.[15]

Road design - Defective geometric design like inadequate sight distance, inadequate width of shoulders, improper curve design, and improper traffic control devices and improper lighting.

Environmental factors -unfavorable weather conditions like mist, snow, smoke and heavy rainfall, which restrict normal visibility, and makes driving unsafe.
Other causes -improper location of advertisement boards, gate of level crossing not closed when required etc.[15]

B. REVIEW:

Abdelhamid, Sherin; Hassanein, Hossam S. & Takahara, Glen says in paper entitled Vehicle as a Mobile Sensor that automotive manufacturers are currently giving much interest to in-vehicle sensors and their relevant \{ITS\} applications. The number of in-vehicle sensors is in continuously increasing because of their proved benefits represented in avoided accidents, higher driving efficiencies, and ubiquitous sensing-based services. These benefits are not limited to only the vehicle's driver, but also to other vehicles and third parties. In this paper, they introduced Vehicle as a Mobile Sensor (VaaMS), a concept that shows how sensor-equipped vehicles can be considered a pivotal, mobile resource of sensory data and sensor-related applications/services. In addition, they present a new categorization of in-vehicle sensors along with a discussion of some representative sensors and several supported \{ITS\} applications. Besides, they elaborate on some communication technologies that support VaaMS [1] .
Behzad, M.; Sana, A.; Khan, M.A.; Walayat, Z.; Qasim, U.; Khan, Z.A. & Javaid, N. says in paper entitled Design and Development of a Low Cost Ubiquitous Tracking System, design and development of a ubiquitous tracking system is proposed, in which vehicles are tracked and controlled using the prevailing cellular technologies. The system contains a \{GPS\} receiver and a \{GSM\} modem interfaced with a microcontroller. To track any vehicle, the vehicle's owner has to send a \{SMS\} to the tracking system installed inside the vehicle. Upon receiving the SMS, the microcontroller takes the current location's longitude and latitude coordinates from \{GPS\} receiver, packs it into a \{SMS\} and sends it to the owner and on a web server using \{GSM\} modem. When the web server receives the \{SMS\} containing vehicles coordinates, it will show location of the vehicle on Google Maps. For android users, the location is also displayed on an android application. In case of vehicle theft, the owner is able to turn off the main ignition switch, check status and speed of the vehicle simply by sending an SMS. The system is also equipped with a special security button for parked vehicles. By turning the button ON, the system will come in \{ACTIVE\} mode and will keep a special check on the vehicle's movement meanwhile performing the normal tasks. If the system senses any movement of vehicle during the \{ACTIVE\} mode, it will turn the main ignition \{OFF\} and will inform the owner immediately be sending 5 SMSs. Record of the vehicle's movement will be continuously managed on the web server where each owner will have vehicle's account. They have used a wide number of technologies including, but not limited to, Global Positioning System (GPS), Global System for Mobile Communication (GSM) and Microcontroller [3].
Cachulo, LuÃs; RabadÃ£o, Carlos; Fernandes, Telmo; Perdigoto, Filipe & Faria, SÃ©rgio says in paper entitled Real-Time Information System for Small and Medium Bus Operators . The public-transportation sector is in constant development, yet the operating companies need to improve the quality of service they provide to passengers. In order to achieve this goal, they have to increase passenger security, comfort, information access, the destinations offered and extended service schedules. These improvements are very expensive to any public-transportation operator; the companiesâ€™ sustainability will be compromised. This paper describes an Intelligent Transportation System (ITS) that allows public-transportation companies to implement Real-Time Information to Passenger System (RTPI), that also provides monitoring and management tools to optimize service management and administration. The \{SITREPA\} System includes a hardware and software combined system that acquires data from vehicles and provides information to the needs of different actors in the public-transportation environment. We have designed a system that with low complexity and with an affordable cost, adequate for most small and medium passenger operator enterprises. The result of the implemented prototype in test scenarios showed that this system can be an important tool to passengers and can improve public-transportation management services [5]. EL-Zaher, Madeleine; Dafflon, Baudouin; Gechter, Franck & Contet, Jean-Michel says in paper entitled "Vehicle Platoon Control with Multi-configuration Ability" defines that vehicle platoon approaches found in literature deal generally with column formations adapted to urban or highway transportation systems. This paper presents an approach in which each platoon vehicle follows a virtual vehicle, in order to cope with issues such as different platoon geometries. Those different types of formations can be encountered in a wide range of field such as the military or agriculture. A platoon formation is composed of a vehicle which assumes the platoon leader role (generally human driven) and other vehicles which play the follower role. A follower vehicle assigns a local leader role to one of the vehicles it perceives. The approach presented here based on a predefined translation of position, by a follower vehicle, calculated from the perceived position of its local leader vehicle. This translation depends on the desired platoon geometry, expressed in terms of a predefined longitudinal and lateral distance of a follower vehicle relatively to its local leader position. Each vehicle is implemented as an agent

which makes decisions depending only on its own perception [7].

Khan, Rafiullah; Khan, Sarmad Ullah; Khan, Shahid & Khan, Mohammad Usman Ali evaluate in paper entitled "Localization Performance Evaluation of Extended Kalman Filter in Wireless Sensors Network" says that the positioning and tracking performance of Extended Kalman Filter (EKF) in wireless sensors network. The \{EKF\} is a linear approximation of statistical Kalman Filter (KF) and has the capability to work efficiently in non- linear systems. The \{EKF\} is based on an iterative process of estimating current state information from the previously estimated state. Its working is based on the linearization of observation model around the mean of current state information. The \{EKF\} has small computation complexity and requires low memory compared to other Bayesian algorithms which makes it very suitable for low powered mobile devices. This paper evaluates the localization and tracking performance of \{EKF\} for (i) Position (P) model, (ii) Position-Velocity (PV) model and (iii) Position-Velocity-Acceleration (PVA) model. The \{EKF\} processes distance measurements from cricket sensors that are acquired through time difference of arrival between ultrasound and Radio Frequency (RF) signals. Further, localization performance under varying number of beacons/sensors is also evaluated in this paper [8].

III. METHODOLOGY

The most important module of PALT SIIS is the Android device. This module is defined as the basic working unit i.e. a cell. It will be installed in the vehicle traveling in hilly/plane areas in such a way that it cannot be harmed and misused by common public. Now, the location of this vehicle will be tracked by the control room through the signals of the service provider. It is:

- Information Based.
- Message Based.
- Network Based.
- GPS Based.
- Centralized System.
- Internet Based.
- Mobile Service Based.
- ANDROID Based.

In this study, a Sensor Based system for Smart Devices will be designed and developed. The system is split up into the following modules – Client, Server, and Communication.

Client Module will be having 3 sub modules:

A. ***Display:***-At Client side, will give continuously audio and video alert to Driver for Critical Inclinations.

B. ***Processing:***- It will use and collect data from orientation , rotational and GPS Sensor and process proper calibration and calculation will be meet at this step.

C. ***Communication:***-Communication module will use SMS , GPRS and HTTP,HTTPs, TCP/IP based communication establishment and information transfer at any critical event happened.

Server Module will be having 3 sub modules:

A. ***Display:***-At Server side, will receive continuously audio and video alert from client at central control room. In Graphical and tabular form, any critical position will be communicated by audio, visual and communicational alert.

B. ***Processing:***- Process and calibrate incoming information from server to make next step communication . Recording and Storing complete information in Database through Database Server.

C. ***Communication:***-Communication module will make communication with sensor device of vehicles and informing and intimating other systems for rescue operations.

Following flow chart (Fig 3.1) shows the complete logic for PALTSIIS.

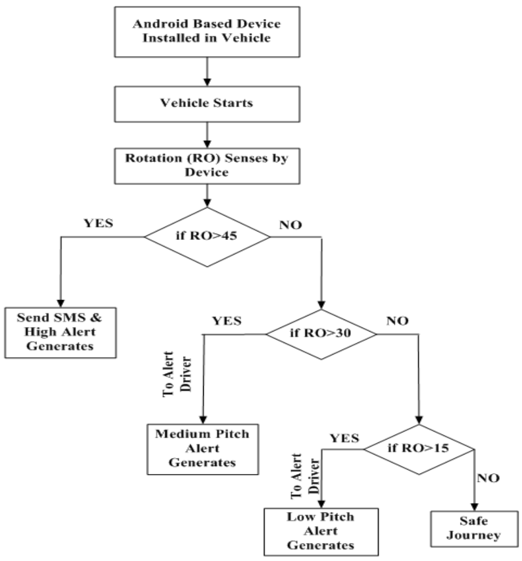

Fig: 3.1

IV. CODING

4.1 To Send SMS:

SmsManager: Class that manages Android SMS operations such as sending data, text. We need to create object by calling the static method SmsManager.getDefault().

SmsManager.getDefault () - will get default instance of SmsManager

Using this instance we need to call sendTextMessage(String destinationAddress, String scAddress, String text, PendingIntent sentIntent, PendingIntent deliveryIntent)

srcAddress - This is used to specify the SMS service center to use. If you enter null, the default service center for the device carrier will be used.
destinationAddress - is the target phone number you wish to text
Text Message - message to be send
SmsManager smsManager = SmsManager.getDefault();
smsManager.sendTextMessage("Phone No", "Message Center No", "Text Message", null, null);
Permission: Another critical part is to update Androidmanifest.xml, by adding this code to it.
<uses-permission android:name="android.permission.SEND_SMS" />

4.2 To Design Graphics :
a) Canvas:
The Canvas class holds the "draw" calls.
Methods used:

- drawLine(float startX, float startY, float stopX, float stopY, Paint paint)

Draw a line segment with the specified start and stop x,y coordinates, using the specified paint.

- drawPoint(float x, float y, Paint paint)

Helper for drawPoints() for drawing a single point.

- drawText(String text, float x, float y, Paint paint)

Draw the text, with origin at (x,y), using the specified paint.
b) Paint:
The Paint class holds the style and color information about how to draw geometries, text and bitmaps.
Methods used:

- setColor(int color)

Set the paint's color.

- setStrokeWidth(float width)

Set the width for stroking. Pass 0 to stroke in hairline mode.

4.3 SensorManager:
SensorManager class provides various methods for accessing and listing sensors, registering and unregistering sensor event listeners, and acquiring orientation information.
SensorManager sm = (SensorManager) getSystemService(SENSOR_SERVICE);

4.4 SensorListener:
Once you acquired a sensor, you can register a SensorEventListener object on it. This listener will get informed, if the sensor data changes.
To avoid the unnecessary usage of battery power, you can register your listener in the onResume() method and de-register it in the onPause() method.
sm.register Listener(g, Sensor Manager. SENSOR_ORIENTATION);
Method used:

- onSensorChanged(SensorEvent event)

Called when sensor values have changed.

4.5 GeoCoder:
Geocoding is the process of transforming a street address or other description of a location into a (latitude, longitude) coordinate.
Method used:

- List<Address>getFromLocation(double latitude, double longitude, int maxResults)

Returns an array of addresses that are known to describe the area immediately surrounding the given latitude and longitude.

4.6 LocationManager:
This class provides access to the system location services. The LocationListener is used for receiving notifications from the LocationManager when the location has changed
Methods used:

- requestLocationUpdates(String provider, long minTime, float minDistance, LocationListener listener):

Register for location updates using the named provider, and a pending intent.

- removeUpdates(LocationListener listener):

Removes all location updates for the specified LocationListener.

- getBestProvider(Criteria criteria, boolean enabledOnly):

Returns the name of the provider that best meets the given criteria.

- getLastKnownLocation(String provider):

Returns a Location indicating the data from the last known location fix obtained from the given provider.

4.7 TimeStamp:
The Timestamp class consists of a regular date/time value, where only the integral seconds value is stored, plus a nanoseconds value where the fractional seconds are stored.
SimpleDateFormat: The most useful non-localized pattern is "yyyy-MM-dd HH:mm:ss.SSSZ", which corresponds to the ISO 8601 international standard date format.

4.8 Media Player:
To create the Mediaplayer object we call some methods to start or stop the music.
Method Used:

- Start()

Music will start playing from the beginning.

- pause()

Music would start playing from where it is left and not from the beginning.

4.9 AssetFileDescriptor:
File descriptor of an entry in the AssetManager. This provides your own opened FileDescriptor that can be used to read the data, as well as the offset and length of that entry's data in the file.
Method Used:

- getFileDescriptor()

Returns the FileDescriptor that can be used to read the data in the file.

- getStartOffset()

Returns the byte offset where this asset entry's data starts.

- getLength()

Returns the total number of bytes of this asset entry's data.

Permission: Another critical part is to update Androidmanifest.xml, by adding this code to it.
<uses-permission android:name="android.permission.INTERNET" />

V. REALISATION

After development of this application this will be upload to play store so that it can be installed in any android device. After installing this application it can be attached in vehicles travelling in risky areas. A proper place should be provided to this device in the vehicle so that it can not be harm by anyone. There should be availability of socket, to charge it all time and dual sim must be provided for reliability of network. i.e. if any of the networks fails then other can work at particular place.
Government should maintain device by providing SMS Pack Facility and efficient balance in it so that the application will play its role effectively and it does not get any hurdle in its working.
Proper training should be provided to drivers about the application that how it works, so that they could understand its indication easily and work accordingly. After fulfilling all these requirement, this application will be implemented successfully in the realization. The complete process and realization suggested model is shown in Fig 5.1

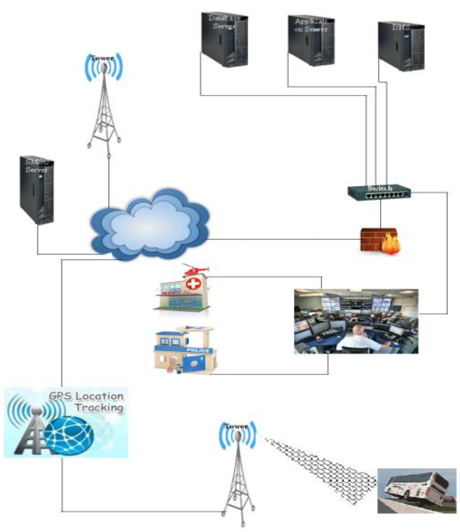

Fig 5.1

VI. TESTING AND RESULTS

A. *Test Cases:*

S.NO	Test Case	Result
1.	Angle of Rotation=0	No Action
2.	Angle of Rotation<15	No Action
3.	Angle of Rotation between 15 and 30	Low Pitch Alert Generates
4.	Angle of Rotation between 30 and 45	Medium Pitch Alert Generates
5.	Angle of Rotation between>45	High Pitch Alert Generates and SMS Send
6.	If Network is available for both sims.	SMS will be sent by both sims.
7.	If Network is available for only one sim.	SMS will be sent by one of the sim whose network is available.

B. *Graphs and Pie Charts:*

(a). Graph for Applied Angle and Measured Angle.

Applied Angle	10	30	50	70	90	100	110	120	130
Measured Angle	10	30	50	70	90	90	90	90	90

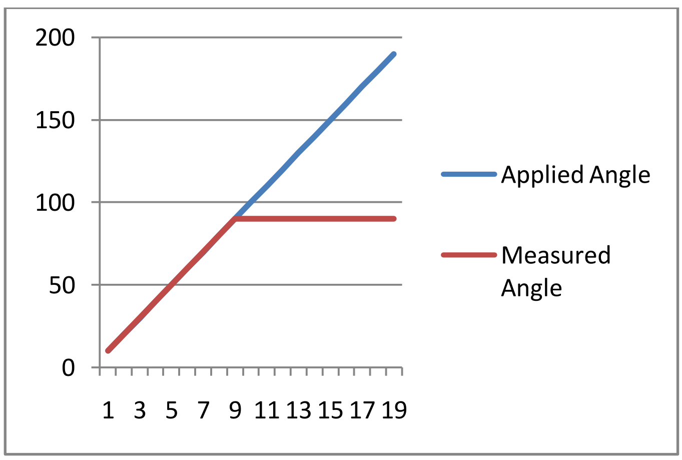

Fig 6.2.1

In Fig 6.2.1 , applied angle and measured angle shows that if applied angle will be greater than 90 then measured angle will remain 90 in all cases i.e. constant.

(b). Pie Chart for angle of Rotation and their effects respectively as shown in Fig 5.

Rotation	0-15	15-30	30-45	45-180
Effects	No Effect	Low Pitch Alert	Medium Pitch Alert	High Pitch Alert & SMS Send

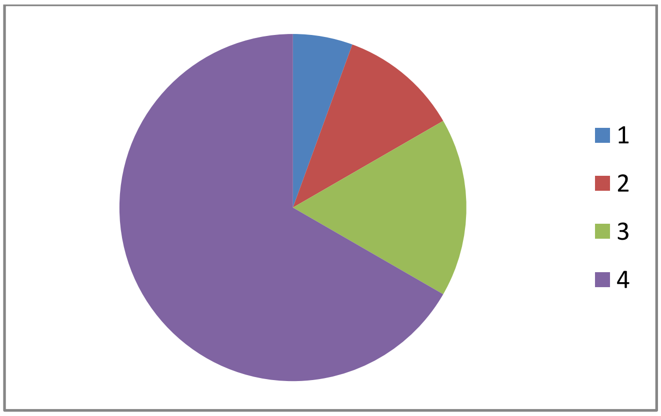

Fig 6.2.2

In Fig 6.2.2 ,Intervals of rotation angle is defined by different colors in the pie chart.Here ,
1:- Refers to the interval (0-15) of rotation angle.
2:- Refers to the interval (15-30) of rotation angle.
3:- Refers to the interval (30-45) of rotation angle.
4:- Refers to the interval (above 45) of rotation angle.

(c). Graph between time of SMS Send and Receive.

SMS Send	1	2.2	3.5	5.8	6.6	8.9	9.6	12
SMS Receive	1.5	2.4	3.9	6	6.9	9.5	9.8	12.4

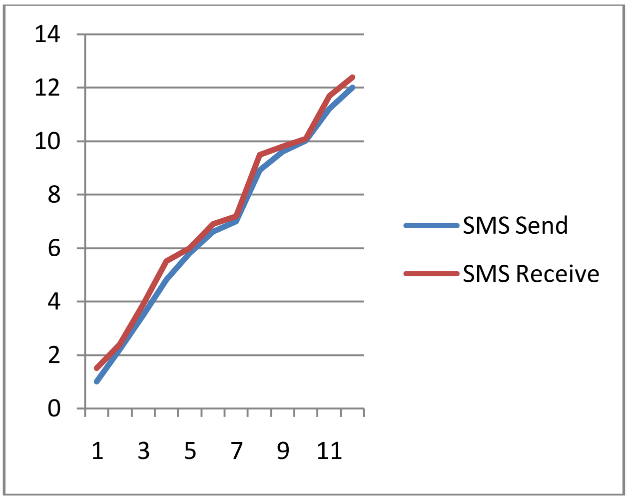

Fig 6.2.3

The plotted figure 6.2.3 shows the time taken by the SMS to be arrived i.e. when SMS send by android device and SMS received.

C. Results:

(a).When the angle is between 0 and 15:-

When the rotation angle is between 0 and 15 as shown in above figures, means that driver is safely driving the vehicle so, no action will be performed .

(b).When the angle is between 15 and 30:-

When the rotation angle is between 15 and 30 as shown in above figures, means that driver is somehow not safely driving so, in order to alert the driver a low Pitch Alert Generates .

(c).When the angle is between 30 and 45:-

When the angle is between 30 and 45 as shown in above figures, means that the driver is not driving safely so in order to prevent accidental flip a medium Pitch Alert Generates ,to alert the driver.

(d).When the angle is greater than 45:-

When the rotation is more than 45 as shown in above figures, it means that the accidental flip has occurred, so now SMS will be send and high pitch alert will be generated .

SMS will be received as shown in below figure 6.3:

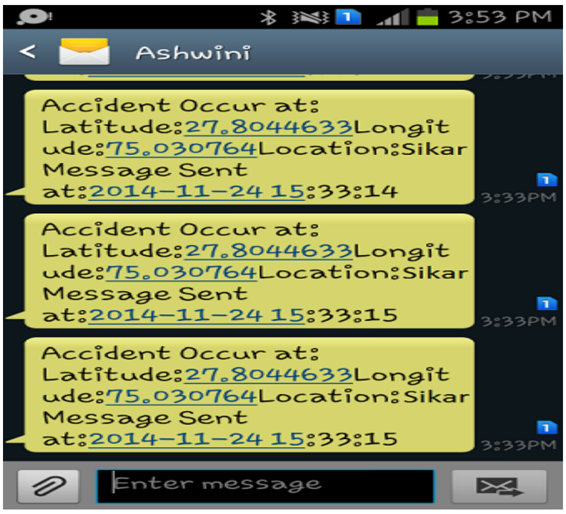

Fig: 6.3

VII. ADVANTAGES AND DISADVANTAGES

A. Advantages:

- Fast rescue operation as after knowing the accidental location appropriate action can be taken as soon as possible.
- Under the limit of government policy doctors can be informed immediately in order to treat the patients and save their life.
- To study the causes of accidents and suggest corrective measures at potential location.
- It could solely perform the security activities at the public places
- It is easy to use, modify and customized and expanded as per the requirements.
- Suspected Vehicle could be traced and exact location and time can be found.
- It could be gradually implemented at global level to reduce loss of life and property.
- Preflip Indications and Measures.
- Robustness of Connectivity by the redundancy of channels.
- Fast information and Intimation to appropriate authority servers and displays.

B. Disadvantages:

- Installation cost will be expensive due to device installation in vehicle.
- Cost increases battery charging facility and SMS Pack and required balance in sims.
- Android requires an active internet connection. At least there should be a GPRS internet connection so that this application can be installed from play store.
- Android more wasteful than any other operating system, because this operating system is a lot of "process" in the background that lead to the battery quickly drains.
- Applications can contain virus so that it can also be affected.
- Sometimes location may not be displayed but it can be easily calculated on the basis of longitude and latitude provided in the SMS.

VIII. CONCLUSIONS

The outcome of PALT SIIS System is to provide such an ANDROID device and server based Application that would be ready to lend a hand in reducing the effect of disastrous accidents taken place in hilly areas.

Since Government is answerable every time if proper actions in time are not taken. If this System is implemented properly, it will be very beneficial and gratifying for the common public and Government.

As per our observations, Government should allow such system to be installed in Government/public/private vehicles those are running in intricate and perilous regions.

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