DESIGN & IMPLEMENTATION OF VEHICLE BLACK BOX FOR DRIVER ASSISTANCE AND ALERT IN VANET

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ABSTRACT

In this paper we proposed the GPS (Global Positioning System)/GSM (Global System For Mobile Communication) for driver assistance and car surveillance. Wireless black box using MEMS accelerometer and GPS tracking system is developed for monitor the accident. The system consists of cooperative components GPS device and GSM module. In the event of accident, if any injury happened to the car driver or passengers so may be there will be loss of lives due to delay in medical help. Keeping this idea in our mind, we are proposing a system where car itself intimates the concern emergency service for immediate reaction in case of accident or any emergency situation. After the accident, this wireless device will send mobile phone short massage indicating the position of vehicle by GPS system to family members, nearest police station and hospitals. The emergency medical service (EMS) is provided to the driver. The threshold algorithm is used to determine speed of motorcycle and fall or accident in real-time.

Keywords: MEMS accelerometer, emergency medical service (EMS), real-time monitoring.

I. INTRODUCTION

Car stealing is now a day’s common problem. Daily many cars got stolen. Many cars never get recovered and customer gets suffered due to this. Much security system work to keep cars safe from theft. But these options are useless once your car get stolen. No one can detect or recover customer car easily. For this we need to developed and install some system inside car which will tell you the car location after stolen. Keep this in mind we are trying to start one project which can fulfill all our requirements related car security. We are trying to build a project which will help to
keep your car safe even after it get stolen. We also are trying to make car accessible using remote system. After deep discussion and work we complete our problem definition. That is we are developing GSM enabled system which will help customer control his car remotely using just a mobile phone Car security is the major concern now a day’s. Car manufacturers try to modify security system by implementing different technologies. Currently central locking system and also theft detection system is available in the vehicle these can alert car owner for theft detection. But major problem with all these system having a major limitation that it can alert local user only not remote. Consider a condition user is far away from vehicle and theft detection siren start then user can’t listen alert and he can’t take any step. And consider a condition owner wants to control his vehicle remotely using any technology it is not possible at this stage. To overcome this type of problem we are trying to implement a system which can used to interact with the system remotely.

The system consists of cooperative components of an accelerometer, microcontroller unit (MCV), GPS device and GSM module for sending a short massage.

Mobile short massage containing position from GPS (latitude, longitude) will be sent when motorcycle accident is detected.

Wireless black box using MEMS accelerometer and GPS tracking system is developed for accidental monitoring.[1]. A high performance 16 bits MCV is used to process and store real-time signal from the accelerometer. Thus, this device is analogous to a black box in airplane. The police and insurance examiner can obtain accident history to investigate accident situation from data-logger in this device. The device keeps data log of track and acceleration data.

II. PROBLEM DEFINITION

Consider the situation that a car is met with an accident in the middle of highway and there is no immediate assistance from anybody nearby. If any injury happened to the car driver or passengers so may be there will be loss of lives due to delay in medical help. Keeping this idea in our mind, we are proposing a system where car itself intimates the concern emergency service for immediate reaction in case of accident or any emergency situation.

The system we are developing is very useful in case of above mentioned scenario. If a vehicle met with an accident, then the system will automatically activate itself but it will wait for one minute for user response. In case of user is Ok and situation is under control then the user deactivate the system manually. In case of serious problem then the system will send the message to registered mobile numbers along with the geographical position of the incident after one minute. The coordinates send by the system will help to find out the exact position of the vehicle on globe so that the emergency services will track the vehicle and can help with minimum amount of time.
Now consider the one more scenario where we are working in the office at high floor or watching the movie at cinema hall etc. means we are away from the our vehicle and a vehicle thief is trying to thief our car which is already fitted with security system which only prompt with a sound alert which is not possible to hear at long distance. We are trying to develop the system where vehicle automatically inform the user via phone call directly on user’s GSM phone. As soon as the thief tries to thief the vehicle, system will automatically make a phone call on user’s phone. User will then take necessary action to save the vehicle. In this case, other people will not be harassed because of irritating sound created by sound alarm. Another advantage of system is that the user is always reachable by vehicle security system.

III. DESIGN CHALLENGES

The challenge of our Project is to create a Black Box for car which will used to find the exact location of car. Consider the situation that a car is met with an accident in the middle of highway and there is no immediate assistance from anybody nearby. If any injury happened to the car driver or passengers so maybe there will be loss of lives due to delay in medical help. Keeping this idea in our mind, we are proposing a system where car itself intimates the concern emergency service for immediate reaction in case of accident or any emergency situation.

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vehicle automatically inform the user via phone call directly on user’s GSM phone. As soon as the thief tries to steal the vehicle, system will automatically make a phone call on user’s phone. User will then take necessary action to save the vehicle. In this case, other people will not be harassed because of irritating sound created by sound alarm. Another advantage of system is that the user is always reachable by vehicle security system.

IV. PROPOSED WORK

Our proposed work will worked out by creating a black box.

A. Car Location detection system

This is another advantage of the system that we can track the car location just by sending the mobile SMS or making the call to the car. Owner car is less with GPS device so it is possible to locate the car location on Google map is very easy. Here user will send Preformatted SMS to car in response car system will use GPS device and collect the current car longitude and latitude and send back as a reply to the SMS. Now user get the car location as SMS now he can use these details to track the car on Google map using Google earth like software.

B. Car accident surveillance

In day to day life we are facing many problems and many times we are helpless and need someone’s assistance and which is not an accident analysis system based on an in-vehicle complaint EDR that allows the acquisition of multimedia content, considering the three main elements of traffic safety: vehicle, driver, and road[5].

Possible every time. Consider a situation we are going for long drive and suddenly we caught in critical condition it may be accident. If we are ok and can help ourselves then it is ok but what if we can’t. Consider another condition if we found that our car has been stolen we can’t do anything as quick action. We are having so many technologies to overcome such problem and provide
artificial intelligent based system to assist human in such a condition. Consider a car had an accident
the sensor will activated automatic and start it’s surveillance mode. If user is ok and can help himself
then he will stop surveillance mode within given time period else system will consider user need
assistance and start auto contacting with call center and specified person. Once the system started in
assistance mode first of all system will gather the car location using GPS device in the form of

Great-circle algorithm

1. Algorithm is used to calculate the distance and the angle between two Geo point on the earth
2. The degree calculated is called as bearing
3. This can be utilized to get the travelling direction

The great-circle or orthotropic distance is the shortest distance between two points on the
surface of a sphere, measured along the surface of the sphere (as opposed to a straight line through
the sphere’s interior). The distance between two points in Euclidean space is the length of a straight
line between them, but on the sphere there are no straight lines. In non-Euclidean geometry, straight
lines are replaced with geodesics. Geodesics on the sphere are the great circles (circles on the sphere
whose centers coincide with the center of the sphere). Through any two points on a sphere which are
not directly opposite each other, there is a unique great circle. The two points separate the great
circle into two arcs. The length of the shorter arc is the great-circle distance between the points. A
great circle endowed with such a distance is the Riemannian circle. Between two points which are
directly opposite each other, called antipodal points, there are infinitely many great circles, but all
great circle arcs between antipodal points have the same length, i.e. half the circumference of the
circle

Formulas
Let \( \phi_1, \lambda_1 \) and \( \phi_2, \lambda_2 \) be the geographical latitude and longitude of two points 1 and 2,
and \( \Delta \phi, \Delta \lambda \) their absolute differences; then \( \Delta \sigma \), the central angle between them, is given by the
spherical law of cosines:

\[
\Delta \sigma = \cos^{-1} \left( \sin \phi_1 \sin \phi_2 + \cos \phi_1 \cos \phi_2 \cos \Delta \lambda \right).
\]

The distance \( d \), i.e. the arc length, for a sphere of radius \( r \) and \( \Delta \sigma \) given in

\[
d = r \Delta \sigma.
\]
Computational Formulas

On computer systems with low floating-point precision, this formula can have large rounding errors if the distance is small (if the two points are a kilometer apart on the surface of the Earth, the cosine of the central angle comes out 0.99999999). For modern 64-bit floating-point numbers, the spherical law of cosines formula, given above, does not have serious rounding errors for distances larger than a few meters on the surface of the Earth. The haversine formula is numerically better-conditioned for small distances:

\[ \Delta r = 2 \arcsin \left( \sqrt{ \sin^2 \left( \frac{\Delta \phi}{2} \right) + \cos \phi_1 \cos \phi_2 \sin^2 \left( \frac{\Delta \lambda}{2} \right) } \right) \]

Historically, the use of this formula was simplified by the availability of tables for the haversine function: \( \text{hav}(\theta) = \sin^2(\theta/2) \).

Although this formula is accurate for most distances on a sphere, it too suffers from rounding errors for the special (and somewhat unusual) case of antipodal points (on opposite ends of the sphere). A more complicated formula that is accurate for all distances is the following special case (a sphere, which is an ellipsoid with equal major and minor axes) of the Vincenty formula (which more generally is a method to compute distances on ellipsoids):

\[ \Delta r = \arccos \left( \frac{\cos \phi_2 \cos \phi_1 \sin \Delta \lambda + \sin \phi_1 \sin \phi_2} {\sin \phi_1 \sin \phi_2 + \cos \phi_1 \cos \phi_2 \cos \Delta \lambda} \right) \]

When programming a computer, one should use the \text{atan2()} function rather than the ordinary arctangent function (\text{atan()}).

The determination of the great-circle distance is just part of the more general problem of great-circle navigation which computes also the azimuths at the end points and intermediate way-points.

Vector version

Another representation of similar formulas, but using normal vectors instead of latitude/longitude to describe the positions, is found by means of 3D vector algebra, i.e. utilizing the dot product, cross product, or a combination:

\[ \Delta r = \arccos (\mathbf{n}_1 \cdot \mathbf{n}_2) \]
\[ \Delta r = \arcsin (|\mathbf{n}_1 \times \mathbf{n}_2|) \]
\[ \Delta r = \arctan \left( \frac{|\mathbf{n}_1 \times \mathbf{n}_2|}{\mathbf{n}_1 \cdot \mathbf{n}_2} \right) \]

where \( \mathbf{n}_1 \) and \( \mathbf{n}_2 \) are the normals to the ellipsoid at the two positions 1 and 2. Similarly to the equations above based on latitude and longitude, the expression based on arctan is the only one that is well-conditioned for all angles.

From chord length[edit]

A line through three-dimensional space between points of interest on a spherical Earth is the chord of the great circle between the points. The central angle between the two points can be determined from the chord length. The great circle distance is proportional to the central angle.
The great circle chord length, $C_{bh}$, may be calculated as follows for the corresponding unit sphere, by means of Cartesian subtraction:

\[
\begin{align*}
\Delta X &= \cos \phi_2 \cos \lambda_2 - \cos \phi_1 \cos \lambda_1; \\
\Delta Y &= \cos \phi_2 \sin \lambda_2 - \cos \phi_1 \sin \lambda_1; \\
\Delta Z &= \sin \phi_2 - \sin \phi_1; \\
C &= \sqrt{(\Delta X)^2 + (\Delta Y)^2 + (\Delta Z)^2}
\end{align*}
\]

The central angle is:

\[
\Delta \sigma = 2\arcsin \left( \frac{C}{2} \right).
\]

The great circle distance is: 

\[d = r\Delta \sigma.\]

**Radius for spherical Earth**

The shape of the Earth closely resembles a flattened sphere (a spheroid) with equatorial radius $a$ of 6378.137 km; distance $b$ from the center of the spheroid to each pole is 6356.752 km. When calculating the length of a short north-south line at the equator, the circle that best approximates that line has a radius of $b^2/a$ (which equals the meridian's semi-latus rectum), or 6335.439 km, while the spheroid at the poles is best approximated by a sphere of radius $a^2/b$, or 6399.594 km, a 1% difference. So as long as we're assuming a spherical Earth, any single formula for distance on the Earth is only guaranteed correct within 0.5% (though we can do better if our formula is only intended to apply to a limited area). A good choice\(^{[5]}\) for the radius is the mean earth radius,

\[R_1 = \frac{1}{3}(2a + b) \approx 6371 \text{ km}\]

(for the WGS84 ellipsoid); in the limit of small flattening, this choice minimizes the mean square relative error in the estimates for distance.

**V. LITERATURE REVIEW**

N. Watthanawisuth, T. Lomas and A. Tuantranon proposed Wireless black box using MEMS accelerometer and GPS tracking system has been developed for motorcycle accidental monitoring. The system can detect type of accident (linear and nonlinear fall) from accelerometer signal using threshold algorithm, posture after crashing of motorcycle and GPS ground speed. After accident is detected, short alarm massage data (alarm massage and position of accident) will be sent via GSM network.

The Limitation of this paper is as follows: Car security is the major concern now a day’s. Car manufacturers try to modify security system by implementing different technologies. Currently central locking system and also theft detection system is available in the vehicle these can alert car owner for theft detection.

Wireless in-complaint Box For Accident Analysis ,Oscar S. Siordia, Isaac Martin de Diego, Cristina Conde, and Enrique Cabello proposed Murugandan and P.R. Mukesh proposed a web based vehicle tracking system using GPS [7]. This system was used in-vehicle and mobile tracking system.
VI. CONCLUSION

After successful completion of this research the system that we can find the exact location of car and we can assist the driver by sending the mobile SMS or making the call to the family members, nearest police station and hospitals.

VII. REFERENCES

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