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A Trenchant Tracking in Car with Smart Emergency Lifesaving System

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Abstract: Internet of things is an emerging technology having the ability to change the way we live.. Immediately after an accident or an emergency, the system either starts automatically or may be triggered manually. Depending upon type of emergency it initiates communication and shares information e.g. location information, a set of relevant images taken from prefixed angles etc. with appropriate authority. The system prototype has been designed with Raspberry Pi 3 Model B. IOT with enable of GPS, can able to track any location or any emergency and more over with camera and object detect sensor, If the object is detected the end result will be the accident and if the object is not detected the end result will be no accident, If the result is accident the camera will capture images and sends the result to the rescue center using Harveshine Algorithm
Keywords: Internet of things (IoT), Global System for Mobile (GSM), Raspberry pi 3 Model B, Global Positioning System (GPS), Harveshine Algorithm

I. INTRODUCTION

A study says that in India 141,526 people were killed on road in 2014 by different types of road accidents [7]. Most of them were killed due to late arrival of rescue teams to the accident location. So it is obvious that if the accident information can be sent to the respective authorities immediately after a situation has occurred some of the lives could be saved. So this proposed system will be enable to avoid the losses of lives.

A. Necessity of Vehicular Emergency System

In the Thompson book of safety it have discussed about the impact of intelligent transportation system (ITS). It introduces a system that detect an accident by smart phone receiving message. The system must be fully integrated to the vehicle. There are many sensors connected to the vehicle like accelerometer sensor and IR sensor [4]. Most of the modern cars must be equipped with safety parameters in order to provide security to their lives and also avoid loss of lives while travelling when a person meets with an accident. [3] Safety and security is one of the most important criteria of a vehicle.

These kinds of modern safety systems are very much useful and reliable for car drivers as well as passengers on road [3]. But those safety system have one major limitation. These systems can only be used to avoid crashes. But unfortunately, if the system fails to avoid an accident or there is any other emergency situations other than accident, those system have no provision to deal with them. In 2005, Vehicle crashes were leading cause of injury and death for children over the age of one. 510 children three years or younger were killed in a highway accidents in 2005 [6].

More recently developers to begin using sensors and gps to provide feedback to the driver. Yet another critical component of safe driving is the human vehicle interface (HVI) very similar to the human computer interaction (HCI). [1] HVI is used to produce sounds, visual aids and other forms of feedback such as the haptic steering wheel to alert the vehicle operator of the roadway conditions. Moreover HVI produces output in visual form and mostly depends on mechanical parts of the vehicle [1].

II. RELATED WORKS

A. Vibration Sensor Analysis

The DSM represents a powerful matrix method for the calculation of natural nodes. For a uniform element there will be no axial distractions occurs but in other case for anon-uniform element there will be axial distractions. To find axial distractions the threshold will be set for certain for 2 Hz. The algorithm used is ellipsoid and differential evolution was proposed by Chang Liu, Guofeng Wang and Yanchao Zhang.

B. Accident Detection based on Sensors

In the Thompson book of safety have discussed the impact of Intelligent Transportation System (ITS) for future intelligent vehicles [3]. Chris, et al. have introduced a system that can detect an accident by a smart phone's sensors, e.g. accelerometer sensor etc. and the phone uses its 3G connection to transmit accident information. But the system is not integrated into the vehicle and also not fully

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automated and sometime needs third party reporter to send complete emergency report by Third party user [8]. The algorithm is will be object detecting and differential evolution [3]. In this it can depict the decision boundary of objects.

C. Usage Of Accelerometer Sensor Networks

FORD introduced Accelerometer senor system that can automatically detect an accident and report it. They have used image processing approach to detect a vehicular crash from CC Camera videos. But the main problem of this kind of system is the accidents can't be detected in absence of a camera [1]. Most of these kinds of systems are dependent on the users' smart phones and are not always automated. Some of them are entirely proprietary product for their own cars and on emergency; they can connect to their call centers only [1]. There is no provision for those solutions to contact nearest police or hospitals directly for emergencies that causes delay in rescue mission. OnStar from General Motors provides smart assistance to their vehicles by providing driving assistance, route direction, and navigation service to its customers. It also provides emergency communication services through its always connected 4G connection. But with OnStar, the user can only contact the vehicle's manufacturer or emergency numbers (e.g. 911) and not to the local emergency rescue centers that can cause a delay in rescue. Review was carried out throughout the whole project to gain. The algorithm used in common will be FACLT algorithm [10]. It has two base stations a macro base station as well as femto base station. These two stations will be using distance to distance calculation as well as the particle weight and the sample density of the signals emitting from the mobile station to the receiving station [7].

D. Usage of GPS System and its Implementation

The information from the GPS receiver is sent in the form of SMS to the user with the help of GSM [6]. Once this SMS is received from the user, a response type of message is sent to the owner of the vehicle through the GSM modem [6].The algorithm used is timer algorithm for tracking efficiently. From the GPS [6] the location is transmitted to monitoring or tracking server. This transmitted information is displayed on the display unit by using the Google Earth to display vehicle location the electronic Google maps. With the help of GSM, the receiver receives the information in the form of SMS to the user with help of GSM [6]. The information can be transformed with the following features like location is obtained after every specific interval of time defines by the user. Then this periodic information will be transmitted to the required source.

E. GSM and GPS based Vehicle Location and Tracking System

The RF transmitter [2] is attached with the vehicle which consists of its own identification. The data which will be continuously transmitting to RF receiver that is connected to micro controller. The GPS [6] will receive the signal like location of the vehicle and will transmit to the microcontroller. Suppose the RF transmitter [2] is not receiving the signal to the microcontroller and from this signal we can identify the theft. If it is identified that the vehicle is theft then it automatically sense the location of the vehicle to its owner of the vehicle. Receives the information in the form of SMS through the GSM modem [6]. This system is much similar and cost effective than the others. The vehicle will be automatically stopped if password like SMS send by the user. This system uses timer algorithm for sending SMS. This system is completely integrated and becomes possible to the user to track the car very easy at any time anywhere. The user will be able to access the position of vehicle at any instant of time. This system is proposed by Pankaj Verma and Hima BindhuYanamadalala "Advanced vehicle tracking system by the development of GPS and GSM. The main parameters in the system will be the location as well as the messages takes advantage of wireless technology in providing powerful management transportation engine.

F. Working flow of System

In this paper, we have introduced an emergency communication and location tracking system for vehicular emergency. This system aims to minimize the damages after a vehicle meets any unfortunate situation like an accident by sending automatic message to the nearest hospital and police station. It is also helpful for other emergency situations such as medical emergency, criminal problem, civil emergency and also for mechanical problem in the car. When a car meets any emergency situation the system starts automatically or manually according to the type of the situation and sends emergency message to the control room with the help of Raspberry pi 3 Model B integrated to the car and the camera fixed at the car at different angles. The control room receives the message like images (current situation of the accident zone) and location (latitude and longitude of the accident zone) with the help of GPS.

From the control room with the help of messages received used to communicate with the rescue center by sending the message. The rescue center in turn search for nearest life saver (Ambulance) to communicate about the emergency type. In car we have raspberry pi 3 Model B is integrated to the system of the car with sensor attached to it after the car meets an accident the sensor starts working

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produce an vibration along the minimum frequency. The accelerometer sensor connected to the raspberry pi will be producing vibration when a car meets an accident moreover the messages from raspberry pi 3 Model B will be sent to the control room.

II. EXISTING SYSTEM

A. Working Flow of Existing System

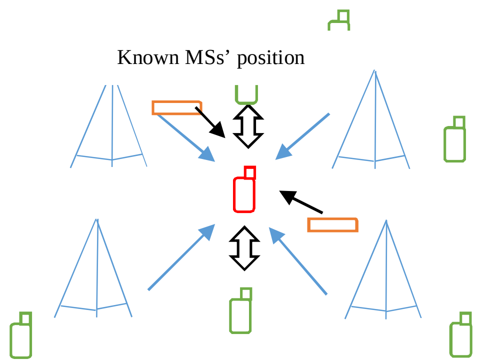


Fig. 1 Cooperative localization in a HetNet

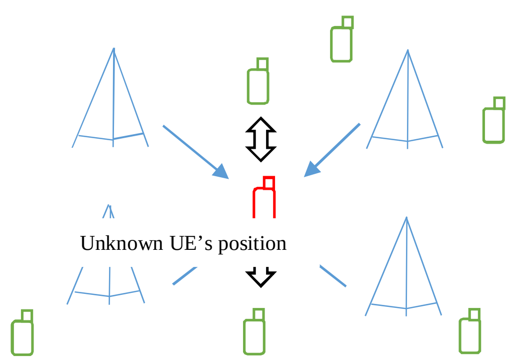
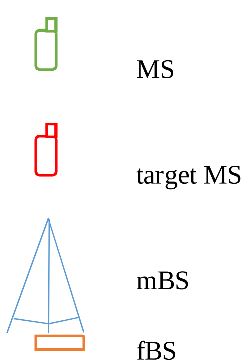


Fig. 2 D2D cooperative localization in a HetNet



B. Contents of Existing System

In dense urban or indoor environments under a weak global positioning system (GPS) signal, the Long-Term Evolution Advanced (LTE-A) system can provide range measurements for location estimation of mobile stations (MSs). Based on the reference signals transmitted from macro base stations (mBSs), femto BS (fBSs), and neighbor MSs in LTE-A heterogeneous networks (HetNets) [7], the femto-aided cooperative location tracking (FACLT) algorithm [9] is proposed to estimate an MS's position. As shown in Fig. 3 fBSs are user-deployed in the residential or business buildings, the locations of fBSs are usually not known exactly. Moreover, an MS can communicate with its neighbor MSs with the support of device-to-device (D2D) communications [8]. To deal with the

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uncertain neighbor MSs' positions as shown in Fig. 4 and the imprecise fBSs' positions, we utilize a Bayesian framework to investigate a distributed co-operative location tracking problem and a particle filter (PF) to develop the FACLT algorithm [9]. Different femto-aided strategies are adopted to deal with the uncertainty of fBS position. The utilization of the PF not only allows the fusion of time difference of arrival (TDOA) and two-way time of arrival (TW-TOA) measurements but enables the line-of-sight (LOS)/non-LOS (NLOS)[10] condition as well, based on the information of the Markov model or indoor map. Performance evaluation is conducted based on the system-level simulation of LTE-A [7] HetNet [7] environments, where the proposed FACLT algorithm [9] using the assistive fBSs and cooperative MSs provides better location tracking of MSs.

With the objective of fulfilling the rising indoor data communication, the architecture of heterogeneous networks is adopted in LTE-A [7] (long term evolution) advanced system to include both macros and femtos base station. Femto can be used in short range calculation whereas macro base station can be used in long distance femto provides very good range of communication along with quality. The device to device communication (D2D) will be useful in calculation of two-way time hetnet measurement is acquired.

Femto can be used in short range calculation whereas macro base station can be used in long distance femto provides very good range of communication along with quality. The device to device communication (D2D) will be useful in calculation of two-way time hetnet measurement is acquired.

C. Calculation of channel state update

A vehicular emergency system is highly necessary and is the mathematical model for measurement update TDOA and TW-TOA [8] are fused in the proposed scheme to release the requirements between the MS and BSs for the TOA measurements [8], there are many types of synchronization. But the clock synchronization between Bss is achieved using GPS to maintain orthogonally in OFDMA system. The D2D measurement between Mss and target is based on femto algorithm for TW-TOA measurement [8]. Since the correlation method has been utilized to detect the arrival timing, the error of distance measurement depends on the link quality, i.e. signal to interference noise ratio (SINR).light interference is considered to be output determination .the relationship between distance and propagation time as detected can be transformed by multiplying the speed of light. For measuring the channel state update ,when MS starts to move the state changes between the LOS and NLOS [10] during tracking period, from the transmitter and receiver for the blocking of direct path from that of NLOS condition. From the condition the Boolean values can be acquired and it can be able to use to find the velocity of both MS and fbs in fast manner. The joint position of two signals as well as channel condition update the factorized to update the position first and then calculate the corresponding channel condition based on the position update.

The difference between the FACLT algorithm [9] and the conventional cooperative localization is that the FBSs does not know exact position. Prior to the target MS location estimation ,the fbs position could be confined in a specific layout ,for receiving signals from mBSs for a longer period femto base station provide more accurate strategy when compared to longer time mobile station. There is a strategy behind the femto signals, in general the FBS has prior knowledge in addition to measurement information the fbs locates at certain address that is known by operator. The operator will have cell id and it will have statistical distribution of FBSs position can be acquired after sequential estimates the fbs position over different time instants. Assuming that the mean and variance of the fBS position $P\,(x^{(F^t)})$ is approximated as circular Gaussian distribution. Given that the prior information of Gaussian values is in general more accurate than the online information can provide there is no need to update the FBS distribution. The FA strategy is adopted for the assistance of the MS location accurate than the online information can provide there is no need to update the FBS distribution. The FA strategy is adopted for the assistance of the MS location estimation to keep the same distribution of fBS every time instant. Faclt algorithm deals with finding the self-belief Information, velocity and angle which in total consists of channel state update. Faclt scheme is used for conventional location in homogenous network. This scheme also combines the signals from mbs and fbs aided location tracking. As D2D location tracking cooperative measurement. This scheme is also available and applied for fbs aided cooperative location tracking. It also able to calculate the weight of the particles and distance between the mobile stations transformed To set up a wide range of maneuvers with the dense urban, we utilize a random-walk mobility model where the velocity and the heading direction changes at different time instants. Three mBSs, four fBSs [6], and ten MSs are included in a dense urban dual-strip model. We provide the estimate of computational complexity regarding big O. A PF consist of n states each with K particles conducting $O\,(K \cdot n^2)$ operations per iteration. The state total number is $n = D + (J + H)$, where D represents the number of position state. J represents the number of measurements between the BSs and the MS. H represents the number of measurements between the other MSs and the MS. On the other hand, EKF technique requires matrix inversion to carry out $O(n^3)$ operations, Moreover, we present the computational complexity analysis of FACLT [9] using the average running time of a PC for each time step, by comparing different numbers of cooperative MSs. We evaluate for the average running time for an MS to perform FACLT [9] and generate the estimated position for one time step. To test the running time using MATLAB, we use an Intel Core i7-3770 CPU with speed of 3.4 GHz.

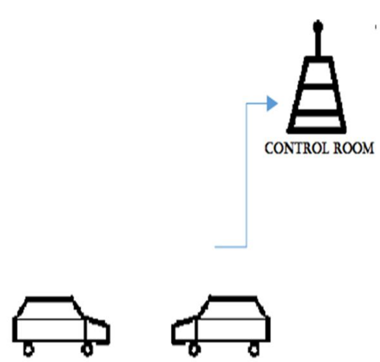
D. Faclt Algorithm

Initial state {[$X_j^{(0)}$], [$C_j^{(0)}$], [$P_j^{(0)}$], [$n_j^{(0)}$]}
For all samples K=1 to K=k
For t=1 to T *do*
State Update:
Broadcast self-belief information {$\alpha_x^{(t-1)}$,$\beta_x^{(t-1)}$}
Inputs mBS measurement m_j^t, fBS measurement f_j^t
Belief information, D2D measurement $d_j^{(t-1)}$ and belief information {$\alpha_x^{(i-1)}$,$\beta_x^{(i-1)}$}
And its velocity {$v_k^{(t-1)}$} and angle {$^{\theta(t-1)}_x$ } □ l € Cooperative set.
Draw sample with importance density:
For k=1 to K do
[$x_j^{(i)}$] k ~ P (x_j^l | [$x_j^{(l-1)}$] k),
[$x_l^{(t)}$] k ~ P (x_l^t | [$x_l^{(t-1)}$] k)
End
Strategy of fBS: [$x_{Fh}^{(i)}$] k, based on FA, [$x_{Fh}^{(i)}$] =$\alpha_{x\ Fh}^{(t)}$
For SFC, [$x_{Fh}^{(i)}$] k ~ P (x_{Fh}^t | [$x_{Fh}^{(l-1)}$] k) for FC
Measurement Update:
Calculate channel state distribution using [$C_j^{(0)}$]
Calculate particle weights using [$P_j^{(0)}$]
Outputs: Estimate [$X_j^{(t)}$]
Resample {[$X_j^{(l)}$]}$K_{k=1}$ to get [$\alpha_{xj}^{(t)}$] and [$\beta_{xj}^{(t)}$]
End

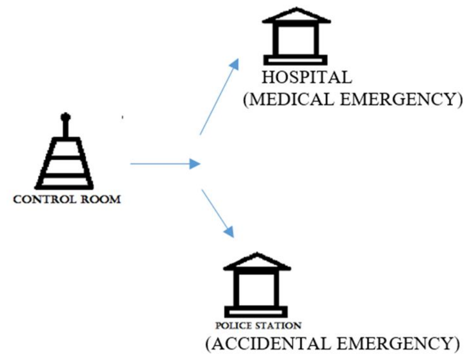
IV. PROPOSED SYSTEM

A. Working Flow of the Proposed System

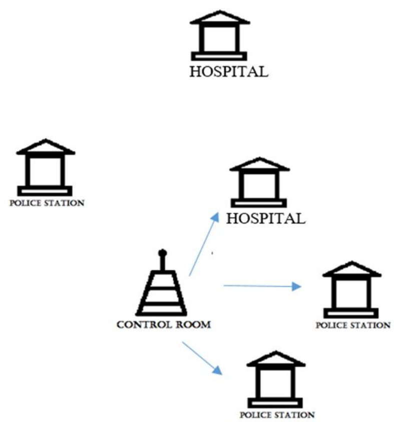
1) *Step 1:* When a car meets an accident it will trigger the message to the control room



2) *Step 2: From the control room the message will sent to the rescue center according to the emergency type*



3) *Step 3: From The Control Room The Message Will Sent To The Nearby Rescue Center*



B. *Contents of Proposed System*

The proposed system is divided in three major parts, an on board embedded device (situation node), emergency control terminal room and rescue center terminal. A vehicular emergency system is highly necessary and is an integral part of any smart city for proper safety, security, and reliability of smart living. Most important feature of this system is when a vehicle meets an accident the system starts automatically and track its location [3] and takes some of its initial photos with the preinstalled cameras and send them immediately to the emergency control room. The control room system automatically finds the nearest hospital and police station and forwards the message to them. Now the hospital and police station authority analyze the situation with the help of initial photos and send rescue teams to the accident location. [3]

Type-1(Accident): This is the most important emergency type for a vehicle on road. When a vehicle crashes or meets any accident the system sends the emergency message [1] to the nearest hospital and police station. Also, the preinstalled cameras activate only for this type of emergency to help the rescue teams to understand the real scenario of the situation from the base station and act accordingly.

Type-2 (Medical): Sometime it happens that a passenger or the driver of a car suddenly becomes sick and is unable to go to the hospital or find any hospital nearby. In that case, they can start the system manually and define the emergency type to medical issue. For this type of emergency the control room sends the message to the 672 nearest hospital as emergency medical situation and the hospital acts accordingly

C. *When a Car meets an Accident*

As soon as the car meets an accident it will be producing vibrations produced from the car to the control room. The vibration [4] will be from the embedded system attached to car and also it will be attached to the preinstalled camera which after vibration starts producing it will be able to start capturing images and it will be able to send the message along with photos. The image will be able to know the current position of the person Raspberry pi 3 model b will consists of 40 input output pins and it will consists of power supply of 5mah and moreover it will be connected to sensors such as accelerometer sensor and IR sensor [4] it will attached to the car and it will be able to produce vibration and moreover it triggers the camera to capture images in the accident spot. Everywhere in the world it is necessary to send the images and information quickly so as to prevent the death loss. But the difficulty is position of embedded kit in the car and even the vibrations must be quickly transmitted in order to send information. The accelerometer sensor [4] will be working in the principle of piezoelectric effect [4] and gravitational forces acted on the sensor.it must be kept on minimum frequency value and after the particular value it will be able to start vibrate. Here the message will be mostly location as well as the type of accident. According to the type of accident it will be able to send the message accordingly and survival becomes easy.

D. Control Room Receives The Message

With the raspberry pi 3 model B it will be having GPS and Wi-Fi the GPS [3] provides continuous positioning and timing information anywhere in the world under any weather conditions. The scientific uses of gps is increasing day by day in the field of military. Gps [3] used in the major communication networks so as to find the location as well as to find the accident spot in terms of latitude and longitude.as soon as the car met an accident it will be able to produce vibration and it will send the type of accident as well location in form of latitude and longitude and from that control room with location, images will know the exact condition of accident and send the information to the rescue Centre. Here to classify the type of accident we use watchdog timer algorithm, here we will classify the type of emergencies it will set the mode of operation as either manual or automatic mostly it will be automatic because the person who meets an accident will not be able to send the message by himself.so it sets the mode as automatic and it will be able to classify the emergencies as type 1 (accident) and type 2 (medical),if it is type1 it will be on automatic mode and as well as it will be able to send the message to hospital and police station. Hospital is for saving lives as well as police station is for knowing about the accident.

E. Watchdog Timer Algorithm

1) Emergency Situation Occurred;
2) if mode of activation = AUTOMATIC the
3) SET type = type1; /* type1 = Accident */
4) else if mode of activation = MANUAL then
5) START watchdog time
6) Wait time = 10 seconds;
7) if type SPECIFIED then
8) SET type = new type; /* Enter Emergency Type */
9) Else
10) SET type = type1;
11) end
12) END watchdog timer;
13) SET type = new type;
14) Else
15) SET type = type1
16) 16 end
17) GET location FROM GPS/ Network/ Geolocation; /*Enter Emergency Start location tracking system
18) SET location (lat, long) = current location (lat, long); /* Get location
19) GET car info FROM database;
20) MESSAGE = (type, location, image, car info); /* Emergency message building */
21) CONNECT available wi-fi/ Bluetooth/ network; /* only for not IoT enabled vehicles *
22) Send MESSAGE to control room;

F. The Control Room Sends for The rescue Center

When the emergency is occurred with the help of gps it will be able to find the location [3] and moreover it will be able to classify the type of emergencies as type-1 and type -2 here type-1 is taken as accident and type-2 is taken as medical. The control room will have the list of hospitals and police station in an area around by with attached GPS for type-1 emergency it will send information to police station as well as hospital and for type-2 it will be able send information to hospital. The GPS[3] attached to the raspberry pi 3 model b will be able to give the location of the emergency.to find the nearest rescue center to the emergency spot it will be using harvershine formula like comparing both the latitudes and longitudes of both locations. Here ‘x’ could be taken as latitude values and ‘y’ could be taken as the longitude values [3]. The x1, y1 could be latitude and longitude of emergency spot. And x2, y2 could be latitude and longitude [3] of the rescue Centre. The square root of the difference between the latitude and longitude values of both rescue Centre and as well as emergency spot. The minimum difference will be taken as nearest one and the control room will be able to send the message to the rescue Centre. The message contains information like latitude and longitude [3] of the emergency spot and also the images of the emergency, so as the rescue Centre will be able to take necessary precautions to save human life. Clear example of working of rescue Centre if the emergency occurs in the spot ‘a’ the control room will be able to get the latitude and longitude of the ‘a’ now it will be having the images from the emergency spot. The control room will be classifying the type of emergency and it will having the list of hospitals and police stations nearby moreover it will compare and it will send the message to the rescue Centre.

G. The Rescue Center Searches For Nearest Life Saver

After the message from the control room, it will be able to analyze the location as well as the condition of the emergency. Moreover for the hospital if they have more than two ambulance then they will be able to find the nearest ambulance near the accident zone and they will be having the location too [3].

V. CONCLUSION AND FUTURE SCOPE

In this paper, we have proposed an emergency contact and location tracking system for vehicular emergencies on road. The system is fully automatic in nature that can help us to minimize accidental and other emergency damages.

This prototype is mainly designed for smart cities and IOT device enabled vehicles. . However, this system may also be used with existing infrastructure in any cities

This proposed system is only able to send emergency information from a vehicle to nearby rescue centers, but it can’t help to avoid any emergency issues.

Also, the system is dependent on several mechanical and electrical devices in a car to detect accident or other emergencies. In future, we would like to include these concerns.

Also, we are aiming to design a hardware secured on chip (System-on-Chip / Network-on-Chip) system featuring these services in future.

The Tracking system is nowadays most important system for the person who want their car security in efficient hands.

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