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A Smart Driving Assistant System using Internet of Things

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Abstract: *Current technologies have been evolved day by day for the betterment of the human life style, because of these technologies necessary comfort and safeties are enjoyed by the people. Due to increased vehicle density, infringement of rules and rashness many accidents may occur. The main objective of this paper is to prevent the vehicle accident while crossing the pavement edge line of the road and using mobile crowd sensing system, distribute the alert message to the drivers travelling on the congested roads. Bat algorithm is used to predict the edge line and calculating the distance between the vehicle and the edge line. The proposed edge line detection algorithm is helpful for preventing the road accident caused by the car drivers while crossing pavement the edge line of the road. When the driver crosses the edge line of the road, the speed of the vehicle is to be controlled by ESC (Electronic Stability Control) program inside the vehicle. By using mobile crowed sensing architecture, collect alerts from people driving on the congested roads and then distributes the alerts to other drivers. The drivers from other roads can be benefits from real time traffic information. In this proposed edge line detection method an additional feature such as sending SMS to the registered mobile number along with GPS location of the car and the information about the route, traffic signal and distance to reach the destiny is also given based on the user's request.*

Keywords: *edge line, bat's algorithm, accident, internet of things*

1. Introduction

The transportation industry is highly connected with maintenance costs, disasters, fatal accidents, injuries and loss of life. More number of people across the world is losing their lives in car accidents and road disasters every year. This problem can be addressed by using the Internet of Things and preventing the accident by predicting the edge path line by using bat's algorithm. With the right implementation of IoT technology, the fatal accident may be prevented as well as help the blind people while using the edge line. The proposed method makes predictions and reaches destination that will make our roads safer. In each country, there are rules and regulations that impose safe driving. But while rules are rather reactive in nature and force drivers to drive safely to avoid punishment, IoT can play a more proactive role in helping drivers adopt safe habits.
"Road sensors are going to be one of the most crucial developments that will take place in the world of transportation with the introduction of the Internet of Things technology"
[1] The term ―things in the IOT refers to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, or field operation devices that assist fire-fighters in search and rescue. Current market examples include thermostat systems and washer/dryers that utilize Wi-Fi for remote monitoring.
[2] To solve the problem of death caused by accident which occur because of the delay in help provided by rescue, can be solved by a new system of accident detection technique which finds out the occurrence of accident through various sensors and intimate the occurrence of accident to the nearest rescue teams or patrol services by the use of GSM and GPS system.

Hence the proposed method has come up with the system to reduce the risk and effect of accidents. The remainder of this paper is structured as follows. In Section 2, we introduce basic concepts related to pavement line, global positioning system, Bat Algorithm. In Section 3, we introduce the proposed Edge line detection using bat algorithm. Section 4 is dedicated to results and discussion. Finally, we present the conclusion of our work in Section 5.

2. Related work:

2.1 Pavement Edge Lines

Pavement edge lines are used to indicate the edges of carriageways which have no curbs. They serve as a visual guidance for the drivers, indicating to them the limits up to which the driver can safely venture. They especially are useful during adverse weather and poor visibility where the paved shoulder is of a lesser structural strength than the main pavement, the edge lines are used to promote travel on the main pavement itself. Edge lines are in the form of a single continuous line placed about 150 mm from the edge.

2.2 Global Positioning System (GPS) is a popular technology which was developed by American Department of Defense (DoD) for military use. Later on it was available for civilian use. It is utilized for wide range of applications such as

location, direction, speed, timing, surveying, logistics, traffic management, security etc.GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile), is a standard developed by the European Telecommunication Standard Institute (ETSI) to describe protocols for second generation digital mobile networks used by cellular phones.

2.3 Smart Human Security Framework

[3] Vivek Kumar Sehgal et al.,(2015), proposed the smart human security framework using IoT, Cloud and Fog Computing. Providing a security framework incorporating pervasive and wearable computing, IoT, Cloud and fog computing to safeguard individuals and preclude any mishap [3].

2.4 Bat algorithm:

Zakaria Abd El Moiz Dahi et al.,(2015) depicts an adaptation schema is the use of a mapping function to decode real-valued solutions into binary-valued ones. The Antenna Positioning Problem (APP) is an NP-hard binary optimization problem in cellular phone networks (2G, EDGE, GPRS, 3G, 3G +, LTE, 4G). The efficiency of the principal mapping functions is investigated through the proposition of five binary variants of one of the most recent metaheuristic called the Bat Algorithm (BA) [4].

The Bat Algorithm (BA), is one of the recently proposed metaheuristics [5]. It was inspired by the natural phenomenon of echolocation used by bats. The BA was originally designed to tackle optimization problems within continuous search space and it has shown encouraging performances.

2.5 Internet of vehicles for smart and safe driving:

The idea is to utilize Internet of vehicle's dashboard camera (Smart-Eye) to enhance the control and accident prevention/monitoring services. The smart-Eye has capability to capture and share their real-time accident/traffic footage into text, audio and video forms to the related authorities such as nearest vehicles, police staff, hospital, family members and insurance company instantly along with the location. Hence, the Smart-Eye solutions can support automotive markets for smart and safe driving [6].

2.6 Internet of Intelligent Things

It focused on surveying current approaches for the Internet of all these intelligent things connected and communicating. It addresses artificial intelligence techniques employed to create such intelligence, and network solutions to exploit the benefits brought by this capability [7].

2.7 Mobile Crowd Sensing

Mobile crowd sensing will turn out to be a prevalent method for collecting sensing data from the real world once the data consistency issues are appropriately addressed. Several application domains that can benefit from mobile crowd sensing as well as a number of applications for each domain: Smart Cities, Road transportation, health care, marketing and advertising [8]

3. The Proposed Method:

Notwithstanding its benefits, the proposed method dealt with two key issues: (1) preventing the fatal accident by using bat algorithm which would easily predict the edge line. When the vehicle deviate the edge line an alert signal will be indicated. (2) By using mobile crowd sensing architecture, pull together the alert message from anyone driving on the jam-packed roads and share out the alerts to other drivers. The driver from other roads can be benefited from the real time traffic information. The additional features such us sending the SMS to the registered mobile number along with the GPS location of the car, directing the blind people by providing information like distance to reach their destiny, traffic signal indication.

In the proposed method, smart cities are constructed by placing the reflector in the edge line. The reflectors on the edge line always emit the IR signals. In the vehicle, a receiver is attached to receive the signal emitted by the reflector.

Mobile crowd sensing platform allows users to collect many types of sensing data from smart phones carried by mobile users. The interacting entities in the mobile crowd sensing architecture are:

McSense: A centralized mobile crowd sensing system which receives sensing requests from clients and delivers them to providers

Client: The organization or group who is interested in collecting sensing data from smart phones using the mobile crowd sensing system.

Provider: A mobile user who participates in mobile crowd sensing to provide the sensing data requested by the client.

By using Bat's algorithm, measure the distance between the edge line and the receiver.

1. Initialize the bat population xi and velocity v_i.
2. Define frequency f_i

3. Initialize pulse emission rate r and loudness A
4. Repeat
5. Generate new solutions by adjusting frequency and updating velocity and location by eqs 2 to 4.
6. If rand > r_i then
7. Select a solution among best solutions.
8. Generate new local solution around selected best solution.
9. End
10. Generate new solution by flying randomly.
11. If rand < A_i and $f(x_i) < f(xn)$ then
12. Accept the new solution
13. Decrease A_i, increase r_i by eqns 6 & 7.
14. End
15. Rank the bats and find the current best x.
16. Until termination criteria is met.
17. Post process results and visualization.

If the vehicle crosses the edge line, the ESC (Electronic Stability Control) program inside the vehicle is used to control the speed of the vehicle.

The speed can be controlled in three ways. Let us consider Speed Controlled (SCi)

- If SCi>= 120 km/h stop the vehicle
- If SCi >= 60 km/h && <120 km/h slow down the speed of the car with alert signal.
- If SCi >= 20 km/h < 60 alert signal will be indicated.

If the blind people cross the edge line an alert signal with vibrator is to be initialized. In Addition to these, based the user request distance to reach the destiny and traffic signal information is also provided to the user with the help of Internet of Things.

The mobile crowd sensing has two major components: (1) the server platform that accepts tasks from clients and schedules the individual tasks for execution at mobile providers; and (2) the mobile platform (at the providers) that accepts individual tasks from the server, performs sensing, and submits the sensed data to the server. The communication among all these components takes place over the Internet.

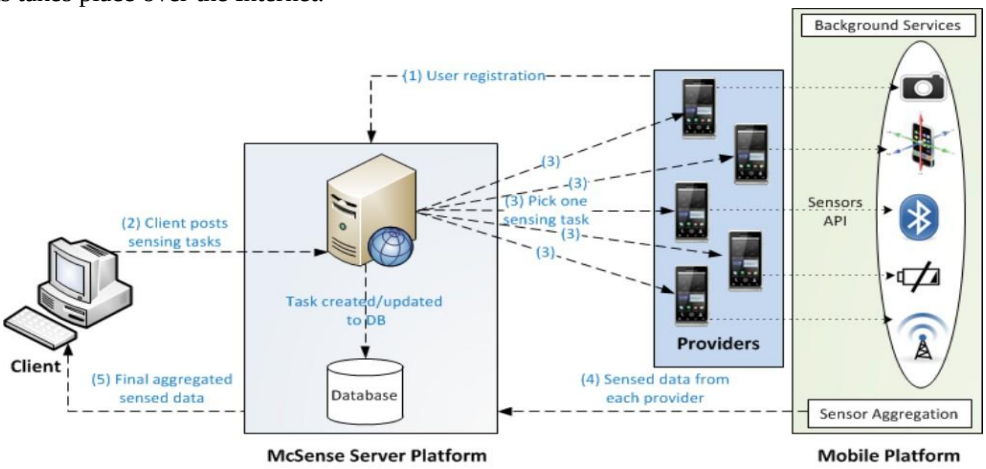

Fig 1.1 Mobile Crowd Sensing Architecture

Figure 1.1 depicts the Mobile crowd Sensing Architecture. It consists of the following key components:

User Registration: the first time users using their smart phone register their email address and a password in the registration form. During the registration process, the user phone's MEID (Mobile Equipment IDentifier) is captured and saved in the server's database along with the user's email address and password. User chose to store the phone's MEID in order to restrict one user registration per device. Also, the server restricts duplicate registrations.

Posting new sensing tasks: The client posts sensing tasks using a web interface and submitted to the server database. Once a new task is posted, the background notification service running on the provider's phone identifies the new available tasks and notifies the provider with a vibrate action on the phone.

Provider: A mobile user who participates in mobile crowd sensing to provide the sensing data requested by the client.

Background services on phone: When the network is not available, a completed task is marked as pending upload. A background service on the phone periodically checks for the network connection. When the connection becomes available, the pending data is uploaded and finally these tasks are marked as successfully completed. If the provider phone is restarted manually or due to the mobile OS crash, then all the inprogress sensing tasks are automatically resumed by the Android's BroadcastReceiver service.

The sensing tasks that client can chose fall into two categories: Manual tasks, e.g., photo tasks, Automated tasks, e.g., sensing tasks using accelerometer

4. Results and discussion

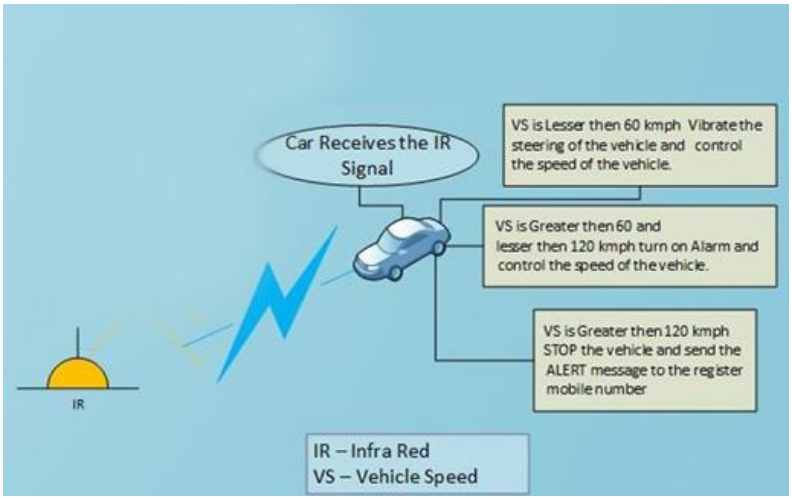

Fig. 1.2 Block Diagram of on Edge Line Detection Algorithm

The Fig. 1.2 shows the block diagram Edge Line Detection Algorithm If the car crosses the edge line, using bat algorithm calculate the distance from the car to the edge line vibrator is initialized. The vehicle speed is controlled in three ways. If Vehicle speed > 60Kmph the vibrate steering of the vehicle and control the speed of the vehicle. If Vehicle speed >60 <120 kmph, turn on alarm and slow down the speed of the vehicle. If vehicle speed > 120kmph, stop the vehicle and send the Alert message to the registered mobile number.

(a) **(b)**

Fig 1.3 (a) Depicts the reflector with IR transmitter b) Shows the road at Night mode

In figure 1.3 shows that a) Depicts the reflector with IR transmitter. b) Shows the road at Night mode.

5. Conclusion and future enhancement

The proposed method has come up with the system to reduce the risk and effect of accidents. The proposed system provided the better accident prevention system and also alerts the person driving on the congested roads & distributes the alerts to other drivers using mobile crowd sensing platform.

The following future enhancement can be made into
1. Solution for indentifying the drunken drivers.
2. Solutions for emergency speed control of vehicles.
3. Solution for rash driving by obstructing Spark-plug.
4. Solution for wheel grip using gravity sensor.
5. Voice based real time advice for drivers by their loved ones when they are over-drunk Or Rash-driving.
6. The system has to make sure the alert authority as an unauthorized user may perhaps attempt to pro-actively reroute the traffic on road for their own benefit.

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