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A Survey on Application of Automatic Braking and Pedestrian Safety in Intelligent Transport System

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Abstract:
Pedestrian Safety is one of the most typical problems meet in many situations. The main aim is to create an empowerment not only for pedestrian safety but to keep in mind to make the driving safer especially in specific scenarios. This logic robust to, special focus on the area of pedestrian in traffic to avoidance accident using devices fitted onboard vehicles and also to enhance vehicles safety. The innovative service is the important of timely identifying the pedestrians in traffic and alerts the vehicle which is closer for Automatic Braking and also to the entire successor vehicles for reducing the consequence of crashes. So, there is a need of through study on pedestrian safety and automatic braking in Intelligence Transport System (ITS). In this paper, a detailed survey has been collected to study the importance of the problem. This survey mainly focuses on the application of evolutionary based algorithms for the pedestrian safety in ITS. At end, formulated a problem along with few directions for further research.

Keywords: *Intelligence transport system, pedestrian safety, automatic breaking, evolutionary algorithms, genetic algorithm*

1. Introduction

The main purpose of the pedestrian detection in video surveillance is for safety of the human in the world. As lots of people are killed in road accidents every day, there should be a system which can reduce the pedestrian accidents fatalities in the world. Another problem is the traffic control. Frequency of traffic accidents and traffic blocking has become a significant problem towards traffic control. So to manage traffic, efficient video surveillance system is necessary. Researches on intelligent transportation systems and algorithms for enhancing the accuracy have been proposed for improving road traffic's safety and decreases traffic blocking. Vehicle detection and human detection is one of the major problems today in the world. So for the detection purpose many different methodologies have been proposed up till now and also advanced research is going on for the betterment of the existing techniques and to get more accurate detection results. Current scenario has been improved by giving alarm to the pedestrian or the driver of the vehicle.

This technique has been implemented in VOLVO S60 car. It is having automatic pedestrian detection with full automatic braking capability. So if the driver does not respond to the alarm then the brake will be applied automatically. Object detection algorithms vary according to the application. Human detection and vehicle detection both require different approaches to get better results. As the shape, height, width, area and length are different for human as well as for vehicle. So we have to develop a system such that it can detect and recognize the object as per the application. Detection requires basic stages as follows: Pre-processing, background removal, filtering, object detection and object tracking. There are several ways to detect pedestrian or human by the shape or pattern, skin color and movement of the object. Also the light condition and environment condition affect the detection result in case of skin and motion-based detection techniques. By using combination of two or more information, we can detect pedestrians more precisely. The motion based detection is helpful in case of traffic signals as the pedestrian are crossing the road. Most of pedestrian victims are at crossroads or at traffic signals.

The rest of the paper is organized as follows, section II presents an overview to guide pedestrian away from dangerous streets and crossing points (traffic safety), Section III presents an overview to guide pedestrians in their dangerous situation and automatic braking, Section IV presents detailed literature survey in intelligence transport system, Section V presents problems and directions to initiate ideas for further research and Section VI summarize the work and quoted references are provided in the end of the paper.

2. Pedestrian away from Dangerous Streets and Crossing Points

It is possible to improve the guidance and safety of pedestrian traffic flows by the current location of pedestrians and vehicles. GIS technology is much improved for GPS to monitoring pedestrian movement on certain network or area. We can follow the following ways to safe the persons who need help at the time of crossing the road.

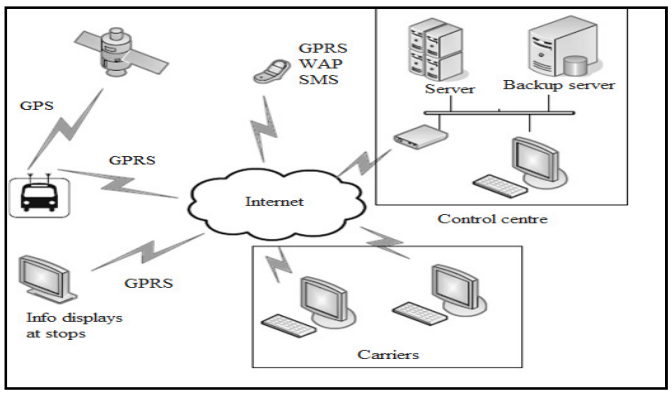

Figure 1: Components of Pedestrian Tracking System Courtesy [1]

i) Disabled persons always use wheelchairs they cannot use staircase due to their disability. They can reach their destination by means of PDA *(Personal Digital Assistants)* interface. A work presented by Simunovle, Ivan Bosnjak [1] is one of the ITS system. By voice, graphical and touch interface and by using special pens *(touch screens)* they can receive information like how to shorten the distance and time of travel and how to navigate to their destination. So the disabled pedestrians navigate to escalators, i.e. elevator shown in Figure 2.

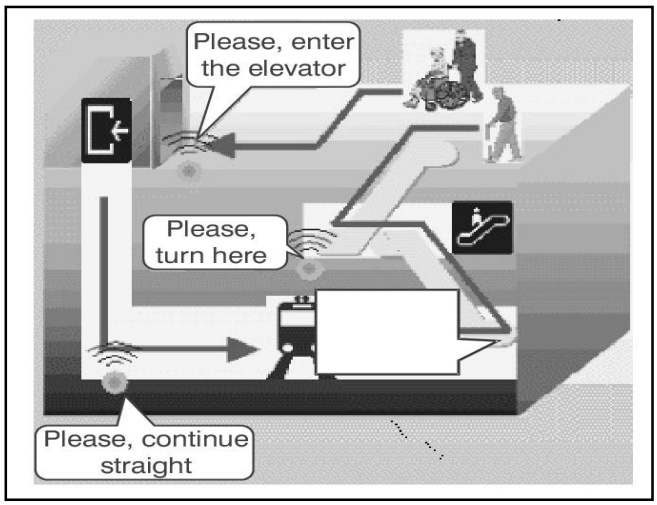

Figure 2: Pedestrian Navigation with Touch Screen Interface Courtesy [18]

ii) The Blind Pedestrians orient themselves by touch or contact and sense of hearing. They always have a stick and in some cases they bring their trained dogs for guide. They always take more time to cross the street. They feel difficulties in maintaining the direction of path at the intersection. Pedestrian navigation using RFID *(Radio Frequency Identification)* technology, ultrasound sensors and IR sensors *(infrared sensors)* - In case of the blind persons it should be precisely determined where they may walk along the road, where the road can be crossed, etc.

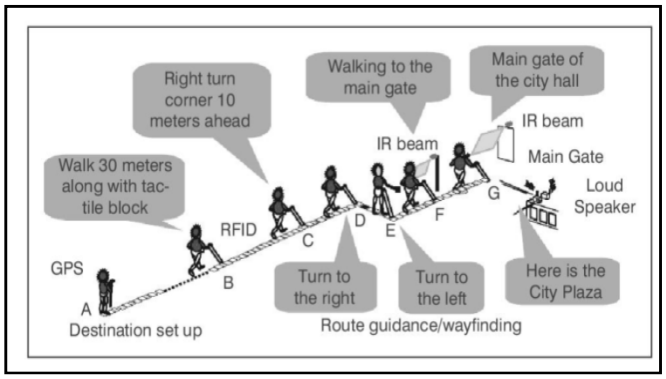

Figure 3: Pedestrian Navigation using RFID technology and IR sensors Courtesy [18]

iii) The Deaf and Dumb Pedestrian depend on large visibility indicators and an environment free of visual obstructions. The mentally retorted pedestrians have lack in observation, identification, understanding, interpretation and reaction to information. They didn't read the received information but they use pictures, shapes, symbols and colors as signs in traffic. For e.g., it is good to use a pedestrian animation on the traffic signal indicator instead of write the message "GO" in traffic signals.

Figure 4: Traffic light with a Pedestrian Animation Courtesy [18]

3. Guideline for Pedestrians in their Dangerous Situation and Automatic Braking

Giving safety involves not only for pedestrian but it is needed for vehicles also. It is necessary to give more importance to the situation where frequent vehicle – pedestrian accident are raised. In Figure 5 the drivers can easily detect the pedestrian who are in front of the vehicle we can't easily neglect it, we must focus on depending upon the situation because pedestrian movements are not to be predefined until the pedestrian went to the safer zone.

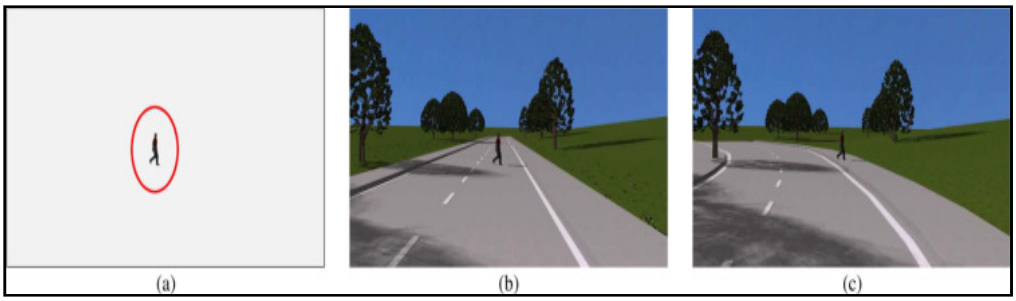

Figure 5: Pedestrian crossing in uncollision scenario courtesy [17]

The most common scenario is, when vehicle are moving on a road, the pedestrian may mix with vehicle therefore successful detection is important. We must check for the presence of pedestrian even in case of fusion with the vision. There are some situations may occur that vehicles are parked or stopped on the road or road edges, for example: zebra crossing, bus stop, vehicle breakdown, obstacles. The above mentioned vehicles blocking the visibility of pedestrians this is one of the main causes of accidents. By using Scenario-Driven Search (SDS) we can search for possible Pedestrians in the specific scenario for that particular position in addition to that localize stopped vehicles and then search for pedestrians in their close proximity or in the areas partly hidden by them. The main applications of SDS are

1. When pedestrian suddenly appearing behind an obstacle, with particularly high danger of collision - Quickly detect the pedestrian with in the short working area.
2. Detect pedestrians as soon as they appear, even when they are still partly occluded;
3. Limit the search to specific areas, which are determined by a quick preprocessing.

In Figure: 6 the first row shows some examples of situations in which the visibility of a crossing pedestrian is partly or completely occluded by stopped vehicles. The second row of Figure: 6 highlight, for each situation, the areas on which the system will perform a check for the presence of a possible pedestrian.

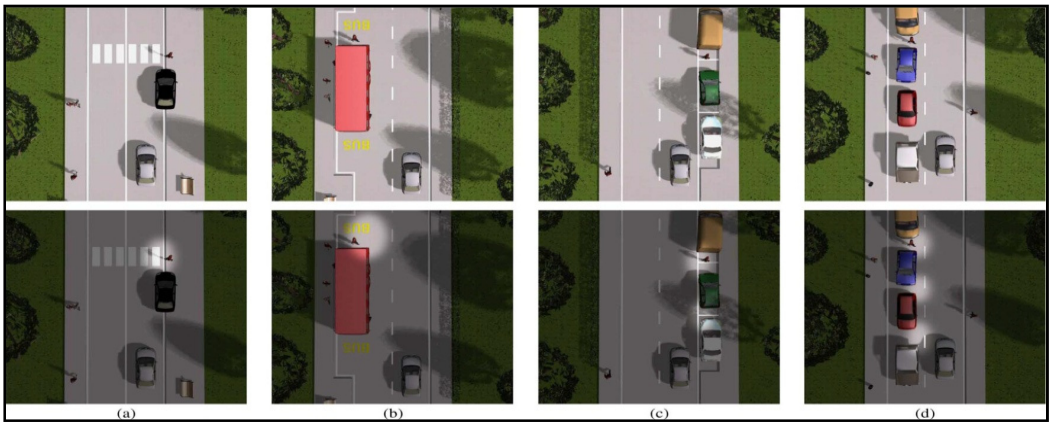

Figure 6: Vehicles blocking the visibility of Pedestrians courtesy [17]

The fusion of laser scanner is placed in the front bumper. Monocular vision and Near-Infrared (NIR) vision camera is placed inside the driving cabin near the rear-view mirror can provide a quick and robust detection in case of suddenly appearing pedestrians: The laser scanner provides a list of areas in which a pedestrian may appear, whereas the camera is able to detect the pedestrian, even when he/she is not yet visible to the laser scanner.

The following steps save the live of Pedestrian, Driver and also avoid the vehicle from crash and also shown in Figure: 7.

- A warning is sent to the driver, When the pedestrian is detected with a sufficiently high confidence level.
- When the driver not promptly reacts to the warning, to control the speed of the car. The system would issue a second level of warning by blowing the vehicle's horn. The main goal of this loud warning is to attract the attention of both the pedestrian itself and once again to the driver.
- If the Dangers level is not reduced due to a continuous action of the driver *(or the pedestrian)*, the intelligent vehicle will trigger automatic braking.

4. Literature Survey of the Paper

There have been many approaches presented for the detection of pedestrians and vehicles. A lot more research is going on for the improvement of the detection methods. Many researchers have proposed methods to detect pedestrians as well as vehicles. In [2], the authors have presented the hybrid method using advanced mean-shift algorithm to detect and track multiple objects and also to handle occlusion problem. In [3], the authors have used human skin color, shape and motion feature to detect human in dynamic scenario. The authors have used Hough transform for extracting the head position of the human. This paper shows very good detection result in different light conditions. In [4], also the color and motion statistics are used for detection of the human. In this paper, the authors have used Histogram Oriented Graph (HOG) descriptor and 4-D color histogram to detect a person.

The results are quite satisfying but if two persons wearing same color clothes, then the detection fails. In [5], Gaussian model is used for background modeling and HOG is used for feature extraction. In this paper, new method to detect head- shoulder shape of human is used. In [6], to differentiate pedestrians from other objects, the authors have considered shape analysis. Pedestrian feature like area, height, perimeter is considered for better detection of the pedestrian. Authors have used Mean-shift and particle filter combination for better real time pedestrian detection. In [7], the authors have proposed more robust algorithm for moving object detection. In this paper, automatic braking is applied if the object is detected and stopping the vehicle is possible otherwise automatic evasive steering is applied. In [8], blob based detection method is used by the author. Here the trajectory periodic motion analysis is used for human detection and tracking purpose and vertical position is used for the better prediction of the object.

In [8] Blob motion based and HOG based method results are shown but combination of both methods give more accurate result. We need to make our cities walk able for all kind of human beings, at least above a certain age. But today, many people feel that their cities are not safe, even for their adult age. An inadequate traffic planning regarding pedestrian needs can lead to an unfriendly "walking environment" with people feeling unsafe. This led to go as a real fear of walking in cities. In addition, public transportation cannot take people from door to door, so transportation system must give importance to walker or pedestrians as well. The pedestrians in traffic can be divided into the following categories:

- Slow walker pedestrian – e.g.: children, seniors, pregnant women, pedestrians with luggage and baby carriages.
- Disabled pedestrian - e.g.: physically disabled, persons with low vision, impaired hearing and mental disorders.
- Occlude Pedestrian – e.g.: parked cars on the road edge, vehicles temporarily stopped on the road, vehicles queued in a line- in front of a traffic light or zebra crossing, or simply jammed cars, Bus Stop.

We will not move towards a sustainable society unless we accept that pedestrians are people with transportation needs. We will need to make our cities walk able for pedestrians, at least those above a certain age. It is difficult to judge a pedestrian movement because each pedestrian has different behavior. Children don't know the traffic rules they show an irregular reaction so they must need an adult supervisor apart from the solution of pedestrian safety. Senior citizens have weaker response, lower eyesight and hearing and also limited attention and memory. Determining of the current location of the pedestrian is necessary because some pedestrian need

emergency assistance because of heart attack, pedestrian mugging, and even sometimes pedestrian cases injury during walk. The human behavior is the main object and it is uncertainty so we can't easily predict the movement of pedestrian.

The detection of the pedestrian more complex in occludes visibility when a vehicle stopped on the road. There are three notify functions provided for pedestrian safety they are locating, mapping (assigning position to the map), and communication. The underlying idea is to locate the stopped vehicle and then search for pedestrian in their close proximity or in the areas partly hidden by them. When a vehicle is found to be stopped, the road side edges are to be trigger to search for the pedestrian. In the case of automatic braking, the number of false detections to zero because the number of false detection is even more important than the number of correct detections. More over each traffic light affect other junction evaluation function and it is the combination of mixture of traffic flow of all junctions. Additionally, there has been a lot of work in the field of crowd estimation and people counting. Some of the earlier work in this area has relied on heavily confined environments.

For instance, Terada et al. [10] count people going through a gateway that only allows for a small number of people to go through at the same time. The stereo cameras used in this system are mounted overhead in order to avoid occlusions. Work by Velipasalar et al. [11] use a similar setup of ceiling–mounted cameras in order to avoid the problem of occlusions. The camera view is also very narrow and does not cover a large scene, unlike what we are trying to achieve. Work realized by Zhao and Nevatia [12], [13] segments and tracks humans in crowded scenes using a human model composed of ellipses corresponding to the different parts of the body. This model helps keep track of individuals and is thus capable of giving a count of people in the scene. In [14], Rabaud and Belongie describe a method of counting crowded moving objects. Their counting technique is based on clustering a set of features in a video sequence and estimating the trajectories of these different detected clusters over time. The object counting is then performed based on these trajectories. Kong et al. [15] present a viewpoint– invariant way of counting people in a crowd. The key idea in this work is to use feature histograms in conjunction with feature normalization to make the algorithm viewpoint– invariant. In [16], Kilambi et al. present a technique to count groups of pedestrians utilizing camera calibration information. They project the foreground blobs onto different planes and use an area–based heuristic to estimate the number of people in a group.

5. Problems and Directions

In traffic flow the pedestrian and the vehicle often share a common surface, which causes numerous problems to both. It is difficult to expand the existing roads and to construct a new road because of lack of space in the city areas. To overcome this all the traffic participants should be treated in the same way. Emergency response is needed at the time of facing difficulty to use in mixed traffic environment. In many traffic scenarios, we face the difficulty of Crowd Pedestrian - e.g.: Procession, Rally, Car Festival, Groom Procession, PadaYatra, Funeral, etc.

The innovative idea present here is the important of timely detection of the Crowded pedestrians in traffic and alert the vehicle which is closer and apply automatic braking wherever necessary. This can be achieved with the help of the warning message. A warning message or alarm is send to the entire successor vehicle which is in mixed traffic environment for reducing the consequence of crashes or reducing the possibility of a crash and dashes. If the crowd pedestrians keep on moving in such situation timing of green in traffic light is extended and the information is passed to the heir vehicles, so that pedestrians and automobiles can share the same space. This framework can be optimized and pedestrians are detected. The rear vehicles can be warned with the help of an evolutionary algorithm based vehicle selection.

6. Conclusion

This paper provides the brief introduction about pedestrian safety in intelligent transport system and a brief summary about a decade of developments in the field of intelligent transport system. By its new approaches and solutions ITS hold a desirable place that will provide the answer to the entire world's transportation problem. The deployment of ITS technologies has the potential to enhance safety and mobility. For this reason, the current investigation has begun with the identification of the critical scenarios user needs, in order to find the most promising ITS systems. Increase passive safety particularly in critical environment for better traffic flow.

In addition to that possibly avoid collision between vehicles–pedestrian. On the other hand, too high vehicle situational speeds have been repeatedly found to be a very important factor in fatal pedestrian collisions. It is well known that even small decreases in vehicle travelling speeds prevent a large number of pedestrian fatalities. For this reason, Intelligent Speed Adaptation as well as automated speed enforcement has significant potential to reduce the injury consequences. This paper addresses the few limitations in present ITS and also suggested few directions for further research.

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