Study on Improving the Safety and Performance of Vehicle Traffic Assistance Systems

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ABSTRACT:

More intricate applications for road safety have come from advances in information technology. These systems offer a lot of potential for improving road transportation. The integrated method provided in this research addresses two primary topics: protection and performance. As a result, it is recommended that Vehicle Traffic Assistance (VTA) for rural and intercity contexts be developed and implemented. VTA is made up of an electronic control unit (ECU) that receives data from cameras positioned strategically around the vehicle to recognise traffic conditions and deliver data to the ECU. In the event that the driver deviates from the traffic laws, the ECU compares the input data from the cameras to reference data stored in the ECU memory and assists the driver by offering instructions through the output speaker device. VTA not only assists drivers, but it also monitors and prevents them from breaking traffic laws. It also ensures safety by personalising driver information in the ECU to avoid car theft.

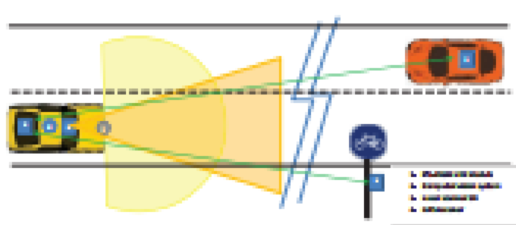
Index Terms – Vehicle Traffic assistance system, automation, ECU, safety, efficiency

1. Introduction

In India, traffic conditions are changing as a result of a rise in vehicle population, which has resulted in an increase in traffic violations, causing traffic congestion and an increase in casualties from road accidents, both for passengers and pedestrians. Driving patterns have evolved, resulting in a rise in reckless driving, traffic rule violations, lane traffic diversion, and speed limitations, all of which contribute to harmful traffic conditions in India. It is hard to regulate such traffic situations by simply establishing traffic lights and laws, and traffic control by a traffic control team has become challenging. As a result, an embedded system in every vehicle is required to regulate traffic violations by requiring drivers to properly adhere to traffic laws.Because of the growing demand for mobility and the increased distance between places, the vehicle industry has seen enormous expansion in recent years. Due to the rapid expansion of the city limits, it is difficult to install traffic signals and sign boards and have them monitored by the traffic control department, as well as to place traffic police at all locations. In such areas, traffic violations cause congestion, accidents, and vehicle stagnation. Drivers' poor driving habits and attitudes result in traffic violations, which generate traffic congestion by failing to obey traffic signals and sign boards, resulting in accidents. In India, the number of people killed in road accidents has risen due to bad driving practises and a driver mindset that disregards traffic laws.

2. Materials and Methods

There are various elements that influence traffic conditions in India, as stated in the previous article. It is necessary to improve driving habits and driver attitude in order to control traffic in an orderly manner. Because it is difficult to monitor individual vehicles in such heavy traffic conditions, an inbuilt traffic guidance system (VTA) is required, which can assist drivers according to traffic conditions and also prevent drivers from breaking traffic rules. As a result, this technology will enhance driving behaviours while simultaneously preventing drivers from breaking traffic laws. Smart technologies can help with road mobility difficulties while also improving safety and performance. As a bonus move, both targets can be merged. The primary goal of this project is to develop an integrated strategy. Driving assistance systems for inter-urban regions, especially single-carriage roads, strive to boost both safety and efficiency by creating a range of specific applications that fit with this integrated approach, given their unique constraints. These implementations will be seen as cooperative systems, with a focus on multisensory awareness and coordination between cars and infrastructure to give extra information and support multi-vehicle behaviour. As a result, the system makes use of data from two sources: on-board perception systems and vehicle-infrastructure communication systems (Fig 1)



1).

Fig 1: Overall Traffic Assistance System

That is, they deliver information autonomously and independently, detecting impediments that, by their very nature, are difficult to discover via communication technology. Furthermore, communication systems may offer information in areas where perception systems may be malfunctioning, broadening the field of action. As a result, all sources are complimentary and are complementary; integration drastically enhances capacity in terms of protection and performance.

The technology also features vehicle automation, which may move automatically if a risky scenario is identified and the driver fails to react appropriately.

The development of four IT-supported applications that combine safety and energy efficiency is the focus of this integrated VTA road safety and efficiency application (Fig 2).

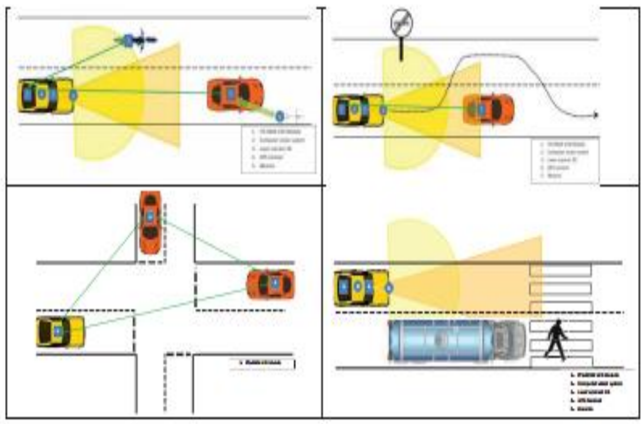


Fig 2: Applications and Scenario

The device, in particular, can evaluate critical manoeuvres that are extremely complex, such as overtaking, entering other vehicles' paths, and detecting the presence of pedestrians, cyclists, and motorcyclists, alerting the driver of these conditions and scenarios and, if an accident is unavoidable, taking control of the vehicle to slow down and/or adjust its course in accordance with environmental analysis and operating on the impending

3. POSSIBLE SOLUTION

VTA might be a feasible way to remedy the problem, as described in the introduction regarding the existing traffic scenario and the need for improvement to minimise traffic congestion. VTA is a built-in system in a vehicle that collects data from video cameras positioned throughout the car to determine traffic conditions surrounding it, as well as information from the vehicle speed sensor, which is relayed to the electronic control module (ECU). These inputs are received by the ECU, which compares them to data stored in its memory. After analysing the data, the ECU uses a speech output device to tell the driver about the traffic situation. For violations of traffic rules, a series of 5 alerts are issued to the driver through the output speaker device; if the driver ignores the alerts and continues to violate traffic rules, the ECU issues a warning at the 5th alert, and at the 7th alert, the ECU issues a warning stop the vehicle with a delay timing of 10 to 15 minutes; within that period, the driver should park the vehicle in a safe location. Once the car is brought to a halt by the ECU. Through a GSM/GPRS sim card module, the ECU transmits SMS with driver and vehicle information to a registered mobile number in the traffic control centre. Once the driver has paid the fee for breaking the traffic laws, the traffic control room can start the vehicle by sending a START command SMS to the ECU through the GSM/GPRS sim card module.

WORKING

Humans may see traffic signal lights, stop lines, road divider line markings, sign boards, pedestrians, and other cars nearby through cameras placed at various locations.

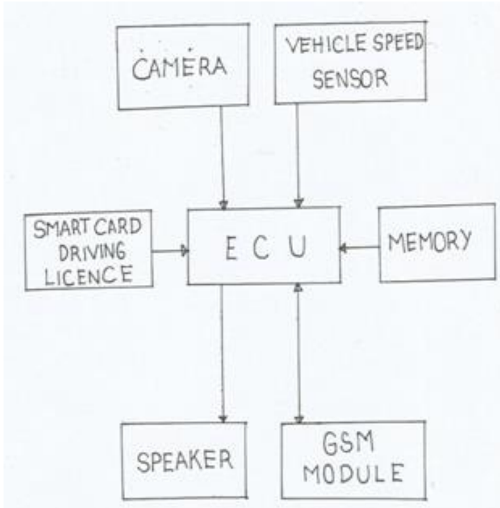
The command from the ECU is fed to the output device as an instruction, which assists the driver in the event of a traffic rule violation. Through the GSM module, driver and vehicle information is relayed by SMS to the traffic control room's registered cellphone number. Once the fee paid by the motorist for the violation has been cleared by the traffic control room. Through the GSM module, a START instruction is transmitted back to VTA to activate the engine.

SIGNAL FLOW CHART

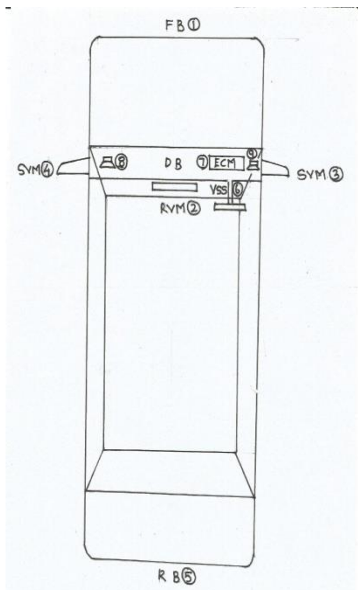
The flow of input signals to the ECU is depicted in the diagram below. The ECU compares the input signals to standard reference values recorded in memory.

1. To start the vehicle, the driver must enter the smart card driver's licence into the VTA.
2. The traffic situation is fed via a camera positioned in various positions inside and outside the car. VSS detects the vehicle speed and sends information to the ECU at the same time.
3. The ECU compares the data from the cameras and VSS sensors to standard values recorded in memory before controlling the output device.
4. According to the ECU, the output device speakers provide alerts and warnings.

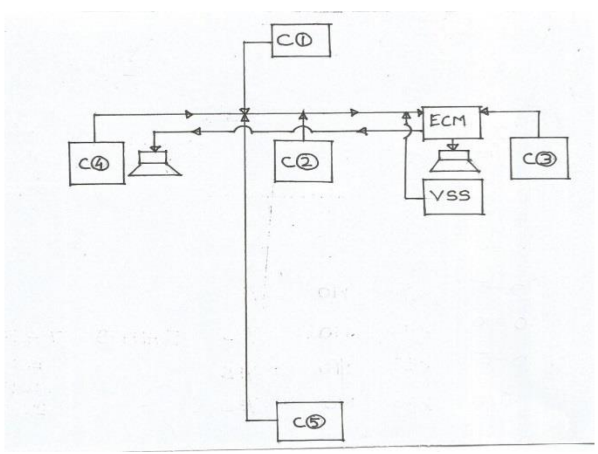
SIGNAL FLOW CHART



LAY OUT DIAGRAM



WIRING DIAGRAM

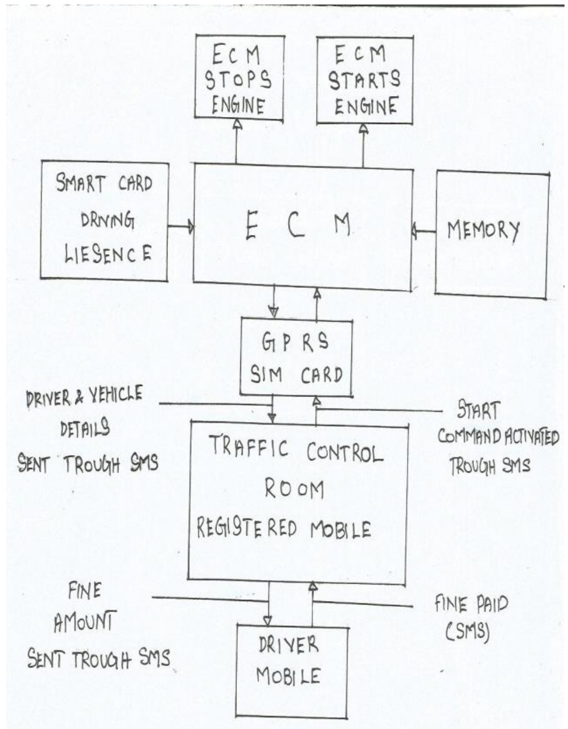


In the event that an unauthorised person tries to start the car, the VTA will identify the illegal person and prevent the vehicle from starting by regulating the ignition system and sending a message to the owner's cell phone. As a result, car theft can be avoided. It detects traffic violations and instructs the driver to take corrective action; however, if the driver continues to break traffic rules, VTA will issue a series of warnings; if the driver does not take action, VTA will warn the driver and stop the engine, as well as send a message to the TRAFFIC CONTROL ROOM's registered mobile number. The message includes vehicle and driver information that is saved in VTA memory.

VERIFICATION TABLE

INPUT DEVICES			OUT PUT DEVICES			
CAMERA	VEHICLE SPEED SENSOR VSS		ALERT		WARNING	ECM CONTROL
SIGNAL STATUS	SPEED WITH IN LIMIT IN KMS	SPEED OUTSIDE LIMIT IN KMS	SPEED WITH IN LIMIT	SPEED OUTSIDE LIMIT		
RED	0-5	>5	NO	YES		
YELLOW	0-10	>10	NO	YES	5 ALERTS	7 ALERTS ECM STOPS ENGINE
PEDESTRIAN	0-5	>5	NO	YES		
SPEED LIMIT 40	<40	>40	No	YES		

SMS FLOW CHART



WORKING

1. When the ECM stops the vehicle. To lodge a complaint at the traffic control room using GSM module, VTA follows the given procedure chart.
2. ECM obtains driver information from a stored memory location through a smart card driving licence and vehicle registration number. This information is provided through SMS to the registered cellphone number of the traffic control room.
3. Fee information for traffic violations will be communicated through SMS to the driver's mobile phone, and once the driver has paid the fine, a START instruction will be issued via SMS to the VTA, allowing the vehicle to start.
4. The traffic control room can efficiently regulate traffic violations with the use of VTA.

Conclusion

Artificial vision and 3D laser scanning barrier detection systems, as well as wireless communication modules, are described in this study as part of an integrated framework for preventing collisions. Additional data may be acquired using this method than with a single device, broadening the digital horizon and forecasting more threats along the way. Four basic operating scenarios, directed to single highways, were developed based on their increased dangerousness and the higher expense of implementing infrastructure-based security measures.

Furthermore, in normal driving conditions, the system suggests more efficient actions and provides alerts to the driver if a hazard is detected. Furthermore, the system may take control of the car (both the steering wheel and the speed) to do evasive manoeuvres or autonomously stop. Several tests were performed on the system modules independently to ensure correct operation. Experiments are also carried out in controlled circumstances of the complete support technique. The final results were excellent.

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