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Study of Smart Transportation System Using IOT

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Abstract: Day by day the number of accidents is increasing at very high rates. In India, more than 150,000 people killed each year in traffic accidents. The large majority of accidents are occurred due to the unconscious states of the driver. Only few of the accidents occurred in conscious state. There are many victims of the accidents other than drivers. It is very challenging to develop an accurate system to prevent accidents. An efficient system should consist of the mechanisms for drowsiness detection, alcoholic detection and accident detection. After detecting the condition the system itself should take the appropriate measure. The main aim should be the safety of drivers. In this paper we are presenting a brief overview of different methods to prevent and detect accidents. Drowsiness can be detected by using IR sensor or camera. Alcoholic rate can be detected by using sensors like MQ-3. The accidents are detected by using accelerometer sensors. After detecting the unconscious state the system will alert the driver. Even after alerting, if the driver continues in the unconscious state due to drowsiness or drunken the system will stop the vehicle and inform the relatives or helpline numbers. If the system is implemented in all cars the number of accidents can be reduced.

Keywords: Alcohol, Sensor, Accident, Drowsiness, Detection, Unconscious, Vehicle

I. INTRODUCTION

In this busy world, the numbers of deadly traffic accidents are increasing day by day. Around 1.25 million people are dying every year, due to accidents. Driver drowsiness and alcohol intoxication are found as one of the major cause that can affect the driver's performance greatly. People do rash driving by consuming alcohol and finally lose control over them. In India, more than 70% of road accidents are found due to drunk driving. This can be reduced with the help of an automatic driver safety warning system. That can detect various misbehaviour of driver. For this, various characteristics of drivers are analysed by looking their head movements, facial features (such as blinking of eye and yawning) that detect whether they are conscious or not. Through this we can find whether a driver is fatigue, drunken, drowsy or distracted and warn them to improve their active safety performance. Today, a huge number of people are dying in road accidents due to the lack of finest emergency facilities. Through GSM module the accident spot can be sent to the registered mobile numbers of ambulance drivers or police. GPS system is used to find accident spot. This paper presents an efficient system that can detect driver drowsiness, alcohol rate, and it also provides a way to analyse various behaviours of drivers while driving. In this paper consist of four sections. In II section describe the theory of papers discussed in next section. Section III consist of number of survey paper related with detecting drowsiness, detecting drunken driver, detection of accident and analysing the driver behaviour. The last section dictates the overall summary of the paper

II. THEORY

- Detection of Drowsiness: In order to detect drowsiness use camera and sensors to monitor the facial expression evaluation, states of eyes and mouth.
- Detection of alcohol content: Using alcohol sensor MQ-3, the breath of the driver is continuously checked to detect any alcoholic content.
- Detection of Accident**:** Here accelerometer sensor is used to detect the occurrence of accident. During accidents, the speed of the vehicle is reduced to almost one- third of its speed.

III. RELATED WORKS

[1]Driver's fatigue has been causes to traffic accident. Fatigue causes driver's response time slows hence lead to accident. In order to discourage the effect of fatigue some methods are used. The methods are grouped under 5 categories, that are subjective reporting, biological feature based, physical feature based, vehicular feature based and hybrid of all these above. In subjective reporting Karolinska Sleepiness Scale (KSS)[2]technique is used. Here self-assessment questioners are used. But this is not in real, because processing of recording data takes time.

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In biological feature based fatigue detection methods uses biological features such as heart, brain, eye and skin based signal. The change in biological signal such as Electroencephalography (EEG) [3], electrocardiogram (ECG) [4], Electro-Oculography (EoG) [5] and Surface Electromyogram (sEMG) are used to detect fatigue. Here signal from brain, heart, eye and skins are monitored to detect fatigue. These methods are extremely intrusive. In physical feature based fatigue detection methods are mainly focused on head and face movement. Eye closure time [6], eye opening angle, rate of blinking and rate of yawning these are the obvious symptoms of fatigues. This technique is limited under low light and worst background.

In vehicular feature based fatigue detection is examined steering angle, lane deviation and posture based factors. SWA [7] is most popular metrics to fatigue detection. Posture based implementation can be done through placing pressure sensor in seat in order to detect the load centre position (LCP) [8]. In hybrid feature based implementation done through mixing of above methods to get more robust systems. It's identified that physical and vehicular feature are more powerful methods to spot the fatigue of a driver.

Nowadays, many researchers have been trying to find how to reduce road accidents that are caused due to driver's performance. The action of each driver is directly linked to these accidents. Most of these accidents are caused by improper behaviour of drivers. Therefore many researchers are trying to maintain the driver's state in a good condition. The proposed system calculates the physical states of driver's by collecting their head position and extracting other features. Through this they can find whether the drivers are having healthy driving or drowsy driving .This system detects abnormal behaviour of driver by detecting the head movements. The head positions are collected by using four IR sensors that are fitted on the headrest of the driver's seat.

Table-III: Comparison of Drive Fatigue Detection Methods.

Category	**Features**	**Parameter**	**Real Time Application**	**Disadvantages**
Subjective	KSS	KSS	no	Not applicable for real time
Biological	Brain Heart Skin	EEG, ECG PPG sEMG	No No No No	Highly intrusive and prone to human movement
Vehicular	Steering Lane posture	SWA Lane deviation Pressure sensor	Yes Yes Yes	Depend on driver and environment
Physical	Eyes Mouth Face/head	PERCLOS, blink Yawning Nod	Yes Yes Yes	

In [9] the proposed system expects to detect the drowsiness by detecting the head movements of the driver while driving. For this, driver's normal driving behaviour will be analysed and collected first, and then this data will be used to compare to detect the drowsiness. That is, the characteristics that distinguish between the drowsy driver and normal driver were extracted, which will be later applied to the real-time driver drowsiness detection system. For collecting the head movements of the driver, their circumstance and state is recorded using webcam with the help of IR sensor. A state recorder and a webcam are used for recording driver's state and circumstance. This collection was done with the help of 4 Male subjects, were each drove for 60 minutes and none of them have deficiency in driving. Then the drowsy data were needed and for this the subjects drove actually drowsy on a desolated road under strict supervision. An application named 'state player 'was used, were the user can categorize the state of the driver. The threshold values will be calculated based on the collected data. This value may not be absolute for each and every driver, therefore they need to be tuned and updated as per the driver's behaviour, by using the learning module. Using this method high success rate and accuracy can be achieved, as learning module is used for tuning each driver's behaviour. But it has some limitation that's Only 61% of success rate is there without using learning module and system development is somewhat complex as it uses four or five subjects in real driving situations.
In this era, there is a large number of accidents occurring day by day. An increased amount of efforts and techniques has developed to reduce these accidents. Most of these are usually occurring due to the driver's improper behaviour. So these must be monitored efficiently and hence should improve the driver's performance to reduce accidents. This method presents a low cost, fully automatic system to detect the driver drowsiness. Here a standard webcam that detects the pattern of eyelids are used.

In [10] this system, there is a video camera which is attached in front of the driver. The DDDs (Drowsy Driver Detection system) receives input from this video camera which detects the drowsiness by regularly checking the eye of the driver to detect the duration of eye blink. The face of the driver will also get detected. After the eye detection, vertical positions of both eyes are used to get the orientation of the face. The angle between the two pupils is computed,

if they are not in the same position. In this way we get the orientation of the face. Finally, the rectangular area from the pupil area of eye is get detected. The percentage of the eye closure is checked which is the value that is used as the drowsiness metric. It shows the percentage of time within a minute that the eyes are 80% closed. Average eye blink duration is 205 ms or we can say 6.17 frames for 30 fps videos. 272 eye blinks in 80 videos are identified in JZU database. This system detects 94% accuracy and 1% false positive rate in eye blinks. The plus point of this system is that it gives fast and accurate results when compared to other systems, for drowsiness detection. It works within the same frame which is an advantage when compared to other systems which uses data from the previous frame. But it subjected to some limitation such as the presence of glasses and high illumination changes can affect this system. It may affect certain components of the system including face, eye detection and symmetry calculation.

In[11] Driver face detection in night more difficulties, in order to get enhanced face at night we use adaptive attenuation quantification retinex (AAQR) method this method consist of 3phases,that are attenuation restriction ,attenuation prediction and adaptive quantification limiting the attenuation area of image and calculate the attenuation co-efficient done in first phase. The attenuation prediction phase involves the real processing of retinex and determines the inclination of images that were identified in previous phase and there for obtain attenuation range. In the last phase we get adaptive optimization area that is the enhanced image. The detected image frame is categorized in to three that are up-down, left-right and mixed. These produce efficiencies were 84%, 82% and 91% respectively. And which produce 2%-36% greater performance with other methods. It produces less time for single 640*480 images.

In [12] this paper has an efficient algorithm for multiscale image processing. And this has 3main phases. In first phase by using discrete wavelet transformation (DWT) convert the input image into four sub band images.DWT is used to transform spatial domain image into the frequency domain. This conversion is also preserves the information in the image. Here original image is down sampled using entropy analysis for extracting the salient face region in the image instead of looking for whole image. Then every image is classified into informative or non informative blocks. In second phase by using discrete cosine transformation (DCT) variance features are selected in zigzag manner.DCT co-efficient are enough to scale variation in noise and also diminish the use of memory and time. In the last phase train the classifier to classify accurately into seven generic expression classes. This system is insensitive to variation in the noise, occlusion and different resolution

In [13] here drowsiness is detected using eye blink sensor (CNY 70) which uses IR rays. The system has IR transmitter and IR receiver. The transmitter transmit the ray into eye, when eye is closed the output is high, otherwise output is low. The output is connected with alarm inside and outside the vehicle, the main constrain of the system is the eye transmitter and receiver should be in line of sight. The IR transmitter interfaced with comparator that is an OP AMP. The out from the op amp is fed into the microcontroller. This system consists of distance sensor which can detect if any vehicles are near to driver's vehicle and alert the driver to take some distance. The system consists of 12-20 sensors are embedded on front bumper. Here array of sensors are used for distributing sensing. The output of microcontroller is the mean of all these sensors. This can be also connected to the breaking system in order to stop the vehicle. Drawback of the system is transmitter and receiver should be in line of sight

In [14] this paper drowsiness detection is performed by monitoring the state of yawning and blink, these are different for normal states. Here dricare method is used which evaluate the yawning eye blinking, duration of eye closing, by using video images. Here by using 68 key points facial regions are detected. This system ensures 92%accuracy. Here use multiple convolution neutral networks (CNN)-KCF (MC-KCF) face tracking algorithm here combine KCF and CNN algorithm for improve the performance in complex situation such as low light. CCN used to monitor the eye states, in Dricare it measures the angle of opening of eye and duration of mouth opening. Also detect the frequency of blinking, eye closing duration and yawning. If result below the threshold it alert the driver.

In [15] this paper proposed a smart phone based drowsiness detection system. It uses smart phone front camera to detect the drowsiness of the driver. The camera captures the images or video of the driver's face. Haar Cascade technique is used to detect and crop the face to the desired dimension. It first locates the face, eye region and eye centre in the frame used for detection. After that it will crop the eye centre into desired portion to determine the eye state of the driver. It checks for the eye pupil in each frame. If the eyes are open, the pupil can be located and the driver is not in drowsy state. If the eyes are closed, the system cannot locate the pupil and it is considered as the drowsy state. Then the alarm in the phone is generated until the driver wakes and turn off the alarm. If the accident is occurred before the driver wakes up, the system will detect the accident via the shaking of the mobile phone. After detecting the accident, the system will send messages to the predetermined numbers stored in the mobile application. The system will consider only the biggest picture in front of camera to prevent the false detection of drowsiness of the passengers. So there is no false prediction of drowsiness.

In [16] this paper proposed a driver fatigue monitoring system. The system monitors the fatigue of driver by sensing the physiological signals like eye blink and head movement. The head tilt angled is recorded to check drowsiness by an accelerometer headgear. The drowsiness of the driver is also detected by using camera and eye blink sensor. The

camera captures the image of the driver and divided it into number of frames. By analysing each frames using eye blink sensor, the system determines whether the pupil is found or not after the predetermined time which is set as the normal blinking time of driver. If the pupil is not finding then it was declared as a drowsy state and alarm is activated. If the driver cannot stop the alarm, the speed of the vehicle is reduced gradually to zero by the auto brake system. Then a message is sent to the driver's mobile phone by GSM. This system uses two devices to detect drowsiness. We can guarantee that any of the two devices can detect the drowsiness.

In [17] this paper presents a system that will detect drowsiness and drunken driving. This project aims at detecting the tiredness of driver to avoid any collision before it happens. An eye blink sensor is used to detect whether the eyes of driver is open or not. It uses an alcohol sensor to check the drunken state of the driver. On ignition, the system checks whether the driver is drunken or not. If the driver is in intoxicated state, the vehicle doesn't get started. Alcohol sensor continuously checks the breath of the driver. If the system founds that the driver is drunken while driving, it will alert the driver through buzzer and immediately slow the vehicle. Also if the driver continuously closes the eye for 5 seconds (threshold), it will be determined as drowsiness. The system will alert the driver through buzzer and LCD. This will prevent accident caused due to drowsy and drunken state of the driver. It will prevent the alcohol throughout the entire journey.

In [18] this paper presents a model that will prevent the accidents due to the drunken driving using IOT. This model can reduce the number of accident up to an extent. The blood alcohol content of the driver's breath is calculated by using MQ-3 alcohol sensor. For the easiness of capturing the breath and to avoid the detection of alcohol level of the passengers, the sensor is placed on the top of the steering. On igniting the engine, the system will check the alcohol content. If the alcohol content in the drivers breathe is between the range 0.02-0.03percent, and the maximum speed allowed for the car is 30KMPH. If the alcohol content is above 0.03%, the car should not be able to move from its position. In both situations a message is sent to the drivers near and dear along with the location of the car by using GSM and GPS modules. The person receiving message can help the driver by tracing him with the location coordinates. The alcohol content in the breath is calculated continuously until the engine is switched off. So we are able to detect the drunken driving. The system does not want separate key for starting its operation. It will start along with the engine. Only the MQ-3 sensor need a specific place in the car, all other components can be placed anywhere in the car. It will reduce the overhead to the police officers that it is practically impossible to check the entire vehicle to prevent drunken driving. The car cannot move if the alcohol level is above the limit thus saving the life of unconscious driver.

In [19] this paper, we propose on method to understanding the driver's behaviour by using Smartphone and sensors. Mainly this system to estimate driving profile for the driver is capable of detecting dangerous driving like generated by drowsiness or traffic violations. The proposed system will increase the safe driving and provide passengers a safe travel. We propose a simple sensory setup with more based algorithmic design and visualized the same problem can be solved without the loss of quality. We only use sensory data from accelerometer, gyroscope and magnetometer that are also available in smart phones such as. The sensory data can be provides the vehicle speed, position and deflection from the regular algorithm. The final attaching of driving behaviour we use a Bayesian classification. This classification scheme provides how risky or safe the driving behaviour or habit of a drivers. The starting step of our design is the data obtained and pre-processing of data via smoothing filtering. Next we use endpoint detection algorithm. The endpoint detection algorithm can be estimate the related range of the signal. By using DTW algorithm, it can detect the event within the selected portion of signals. The DTW algorithms repeatedly collect data from the accelerometer, gyroscope and magnetometer. We assume dangerous events occur when there are unsafe sharp or sudden cramps, then left or right, lane departure, quick braking or speed up. These events can lead to risks driver, passengers, and pedestrian. Because of these strategies may be related to the presence of driver's aggressive driving, drowsiness and reckless driving while intoxicated. Here we used the sensory available in iPhone. Current smart phones are generally worth a look enter this sensory data and our implementation is not like that iPhone specific. Many sensors are located iPhone. Among others, we use a gyroscope, accelerometer data in this study. Accelerometer sensor data shows the amount of acceleration applied to the vehicles in the (x,y,z) planes. It also provides information about speed and position. And the gyroscope measure the lane departure and turning events. Then calculate the rate of acceleration, applying break etc. the good driver can use normal break system and choose the normal speed rate. This iPhone shows the speed rate and magnitude details. The implementation and computational cost is very low, compare to other methods. And this system can easily use. Because they can be fully work at mobile phones. But this is not work in any platforms like desktops, laptops.

In [20] this paper introduces the relationship between AHS and human psychological model. In recent years, the number of car accident rate has decreased. The main reasons of the accidents are due to the error of the drivers. So many researchers and engineers introduce the automation of driving tasks to prevent human error and road safety drastically. Advanced Cruise-assist Highway System (AHS) sensor installed into roadway, the communication devices connecting the vehicle with roadway and vehicle sensor and computer devices. The AHS sensor defined the

relationship between the vehicle, driver and roadway. AHS application makes successive planes and comprehensive traffic safety measures. The microscopic data on the vehicular motions can be extracted from video data by using image processing. AHS's information transfer depends on the navigation system and the computer controller centre transformer in vehicle communication system in vehicles. AHS can eliminate the abnormal traffic changes lead to human factors, which includes acceleration, deceleration etc. Human psychology, motivate psychology; cognitive psychology and physiology etc are mainly include on the AHS. Aggressiveness, motoric capabilities and vision can affect driving behaviour. In some case these features are not directly measurable.

In [21] this paper studied about individual drivers based on motor vehicle acceleration and deceleration. Here we using multiple vehicle sensor signals collected the naturalistic condition specified location. This paper mainly focused on older drivers. The main technology of this paper is Candrive Study. The candrive study can be used to identify the natural driving behaviour of older drivers and related effect of again on the ability of driving. This system could provide the medical assessment and records to driver. The naturalistic driving studies using sensors. These sensors are continuously collect measurements from driver. The sensors are internal sensors and Smartphone. The low cost sensors used for studying racing behaviour and vision based system used to predict driver's actions. The candrive study dataset includes annual medical assessment and records of in-vehicle sensor can measure everyday driving of older drivers. The CandrivePersentechOttoView-CD sensor was outfitted in personal automobiles. The CandrivePersentechOttoView CD sensor attached to an external GPS and plugs into the On-Based Diagnostic II port. In-vehicle sensor data is divided into trips, that are defined as the automatic start period sensor logging that turns the car on automatically turning off the car stops the sensor logging. The journeys less than 100 meters or less than 2 minutes, such as the periods inactive or rearranged parking has been removed. Acceleration and deceleration of the vehicle are two different actions, these actions are performed differ between individuals. The instantaneous acceleration was estimated from the measured speed by using two point central differences. And identify the instantaneous jerk. Extracted acceleration events and rejection events to identify the parts of the journey show from the each trip main acceleration and rejection of the vehicle. Then calculate average acceleration and deceleration rates from extracted the acceleration and deceleration events. These two classifiers are used to distinguish between two randomly chosen drivers. The most discriminative type was acceleration and least type was duration. We consider the older drivers behaviour. Since the classification accuracy of older drivers may be higher than the null model of random guessing, unique driving patterns different. This system more useful for a older drivers. Because of the medical records and assessments are already recorded. The limitation is CandrivePersentechOttoView CD sensor outfitted only the personal automobiles.

In [22] the main cause of road accidents and crashes on the distraction and fatigue present in drivers while driving. The driver's lack of concentration, slower reaction time and increase to Probability of falling asleep can lead the life to danger situation that may affect life of many. Excessive driver fatigues lead to drowsiness that may lead to severe physical injuries, deaths etc. By analysing the driver's behaviour observed while driving with the help of any feedback system will intent to keep the driver's attention. Activities like talking on mobile phone trading operating GPS for potentially distracting activities and result in severe situation. This paper AIMS at the behaviour and attitude related to distraction and Fatigue. All the sources of information about the driver's behaviour and condition of vehicle can be obtained by this platform technique. Driver's behaviour like position of head and eye closure are included. Infrared and stereo cameras are used to track these behaviours. Sensors such as EEG, ECG are also proposed to track the vehicle condition. This study employees the platform of car with multiple sensors like Controller Area Network- bus (CAN), cameras, microphone etc. The purpose of these is to identify the relevant features obtained from the front video camera and the CAN-BUS data. The behaviour patterns observed in the can bus that can lead to understand the drivers attention level. This information about the vehicle and drivers behaviour is analysed to identify the features that can employed to classify between different task and normal driving. Binary classifiers are used to detect this comparison condition.

In [23] driving style can be divided in to two categories, such as typical or non aggressive and aggressive. We introduce a system that uses Dynamic Tim Warping (DTW) and smart phone based sensor like accelerometer, magnetometer, gyroscope, GPS and Video. These sensors detect the features and record these actions without external processing. This system will be choosing to as MIROAD. And we using a single classifier dynamic time warping algorithm. The mobile phone is our sensor platform. The system is inexpensive and easily accessible. The MIROAD system mainly focused on the facing camera, accelerometer, gyroscope and GPS. The vehicle movement can be measured by accelerometer, magnetometer and gyroscope.

In [24] an Android based application is developed to detect the accidents and send message alerts to the emergency contact numbers, nearest police station or health care centre. There are three methods to detect accident based on the drivers and vehicle condition. One method is by using pressure sensor to detect the changes in pressure. Other methods are by using GPS receiver in the smart phone to detect the deceleration to the vehicle during accident and by using accelerometer sensor to detect changes in tilt. With pressure sensor, we can measure the external force and when it exceeds the threshold value it is considered as the accident. Using accelerometer sensor we can measure the tilt angle of

the vehicle with the road. When accident is occurred, the tilt angle varies. When the speed of the vehicle is reduced to one-third of its previous speed, the system considers it as an accident. The system will confirm the occurrence of accident by determining these three methods that are embedded in a smart phone. If any of these conditions is evaluated as true, an alarm arises. If the driver press a cancel button it is determined as a false prediction and no immediate messages are send. Otherwise, immediate alert message is sent through the smart phone application. An emergency switch is provided for the driver in the application to send the message without checking the conditions to detect the accident. The application could classify emergency situation from those are not. The application does not entirely depend on a condition to detect the accidents. But it is a post-accident fatality prevention system.

In [25] Automobile has most important part of human's life. But speed is the one of the main reason for vehicle accident. The modern technology, GPS has become most important part of automobile system. In this paper introduce the use of a GPS capability receiver to monitor and detect the speed of a vehicle send location based on data microcontroller using GSM network to alert service centre. Here we used different equipment and different kind of methodologies like GPS, GPRS, GSM etc. The GPS receiver can detect the accident. The GPS technology has more efficient and accurate. The GPS server continuously following all satellite and refuse the accurate positioning data and information. And the GSM/GPRS modem can send the location of the accident. Microcontroller can control by this system. The microcontroller is the heart of the system. Here we need large amount of RAM and low power consumption. In this paper uses accident detection algorithm for detecting the accident. First we calculate the kinetic energy of vehicle. The RS-232 protocol will provide Haicom HI-204III GPS. There are two memory space will be allocated one for sped and another for latitude and longitude. The latest information about time latitude and longitude save in the memory and MCU will compare the previous speed and latest speed. If the Result of speed is less than the maximum speed, the MCU will lower, the flag to indicate that an accident took place. The flag is raised for accident and MCU will generate an emergency situation automatically. The MCU can wait five seconds for the driver press the alarm button to cancel the accident report, otherwise a message will send to relative's number. The GSM/GPRS modem can show the accident location map and speed of the vehicle. In this method is popular and cheap technology. GPS systems also detect the speed and detect accident.

In [26] Road accidents are main issue in the human life. In this paper we used Flex Sensor. These sensors detect the accident and accelerometer measured the accident rate. The flex sensor and accelerometer attached to AVR microcontroller. There are limit values in this sensor output. If the sensors output is more than the threshold value, it indicates accident has occurred. With the help of GSM module a message can send nearest hospital, police station and vehicle owner or relatives. At the same time camera capture the live situation takes place. The camera receive module can connected to TV/PC. This is a simple camera. The accelerometer measured the acceleration of gravity. Accelerometer output is analog form. It should be converted into digital form. Nowadays, new communication technologies the automotive sectors has a great opportunity assistance and reduction of traffic accidents emergency services, response time and increase just before the start they have information about the accident the rescue operation. This paper design automatic accident detection system, location detection method and nearest hospital for necessary medical help.

IV. CONCLUSION

In this era of new technologies, we can use IOT based vehicle tracking system to detect the vehicle accident severity more easily than any other technologies. On detecting unconscious state of driver various devices connected by IOT all together can be used to alert the driver or contact the emergency helpline numbers or relatives. In this paper we have mentioned various methods to prevent and detect accidents. The prevention methods of accident detect drowsiness and presence of alcohol which is the main causes of accident. And the detection methods detect the occurrence of accident by monitoring the speed of the vehicles. In both methods, the system will automatically connect with the emergency numbers through GPS and GSM modules. All of these methods have both advantages and disadvantages over one another. We can combine all the methods defined in this paper to frame an efficient transportation system. It can reduce the number of accidents on each day by implementing this smart system.

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