Advanced Navigation System for Vehicle Communication
Performing Conditional Automation Using Deep Learning

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Abstract

Intelligent Transport System applications play a significant role in accident prevention at the roadside. ITS system was introduced to find the solutions in vehicle parameter failures. Nowadays the transport security system can automate the vehicle driving task that means to give proper instruction to human, as well as to provide automated communication to control the vehicle. In this paper, the vehicle was connected with the internet environment that can interact with other vehicles with its range using the method as mobility services. All the communicated information stored at the cloud database server, that will help to retrieve the data and also aids to produce the data when the vehicle parameter gets failed. The interruption will found when it get disturbs with its normal functionalities. So the system can predict the vehicles at the roadside environmental conditions and to counter the deeds of other accidental incidents. The acquired value is analyzed with the stored value to check whether the vehicle parameter gets failed or not through an EVNS emergency vehicle notification system. If Vehicle failure was initiated, the alert system informs the vehicle and automatically gets slowdown at the road site.

Keywords: Accident prediction, ITS System, Cloud Database, EVNS, Parameter Failure Analysis, Auto Retrieval.

1. Introduction

Self-assistance and automation vehicles is one of the increasing technology for providing the assistance to the vehicle driving on road. The safety measurements can automates the driving as easy task, which means to give proper instruction to the human and the controller of the vehicle by communicating with each other to avoid unexpected conditions happened on road. So the prevention technology is being used on the vehicle that can able to sense the condition of the road types and the traffic information to have a comfort drive on the road without any collision. The ultimate objective of this paper is to provide the safety system and to predict the vehicle from accidents due to the parameter failure.

The challenge is to stabilizing the toughness and reliability of the vehicle parameter analysis and communication from the sudden situation on roadside from different vehicles. Different technologies are avail to provide this system, in order to get best outcomes of industry 5.0 which takes the concept of personalization to the next level, the deep learning algorithm such as Recurrent neural networks [2] is applied here to get better performance on navigate self-ruling vehicles. These technology transformations are sensor, antenna, and data connectivity, these kinds of technologies are integrated together that can senses the surroundings, in and around the vehicle. The software architecture for a conditional autonomous vehicle is introduced [4], which has two inner loops of perception and planning having the main work for analyzing (SLAM) [3].
The proposed algorithm can able to get the lateral position between the vehicle and lane of one the side and on other side the speed and the performance of camera installed in the vehicle can be taken as input to analysis the outdoor environment. The vehicle will be designed to acquiring the vehicle parameters by using the corresponding sensor and the data can be stored in the cloud for the future analysis of hidden error.

2. Related Works

Sensors are the device that measures or detects a property of the environment, or change to a property and stores the acquired data in to a computer. A sensors’ has the capability to sense the devices which may affects its actual function. Arrived input will be calculated and the critical analytic statistics can be attained anywhere, at any time without necessity for recalibration.

Categorization:
- Exteroceptive = extero + surrounding
- Proprioceptive = proprio + internal

2.1 Lane Detection Camera (Exteroceptive)

Deep learning is a related field of AI that is motivated by an artificial neural network. A particular sort of such a deep learning is the convolutional neural network algorithm, which is ordinarily alluded to as CNN or ConvNet. The distinction of CNN in contrast with the
customary neural organization, is the quantity of neural in a class might be decreased however the quantity of hidden layers is more noteworthy and is called as a deep learning [2] [3]. They are prepared by back propagation system, so it can construct wise frameworks with high precision. Fundamental for effectively seeing climate, recognizing two lines need to ascertain and draw a virtual line at the middle at that point gauge the balance point between the body of the vehicles and the virtual line to change guiding of the vehicle so the vehicles are consistently in the center of two lines under any situation [1] [2]. The controlling point that are referenced above are convoluted and can cause numerous mistakes.

The subsequent explanation is objective. A few of the streets are absence of path or the path stamping is obscured. Additionally, when the vehicles are running in the inclining road, the camera was mounted at past will go to the sky and not stay aware of path at the ahead. This can likewise prompt discovery will be erroneous. The speed-adaptive proportion based calculation is appeared in figure 2.2. So as to apply our proposed thought, just paths must be distinguished in a picture first. The path location is a notable issue and an ordinary technique can be utilized. At the point when paths are distinguished through a few pictures handling calculation as appeared in red lines in figure 2.2, a virtual longitudinal queue which demonstrates the focal point of the vehicle can be acquired. Enables depth estimation particle from picture information

At that point, the parallel position proportion can be determined by the good ways from the longitudinal queue to left-right paths. The vehicle speed and edge speed of the camera can be anticipate to foresee how the vehicle moves longitudinally at the following picture outline from the current figure 2.3. The real moving separation of the vehicle between outlines, DA (in meter) can be roughly determined as follows

\[ D_A \approx \frac{0.28 \times V}{F} \]  \quad (1)

Where, \( V \) is the current vehicle speed (km/h) and the \( F \) is the edges every second (fps) of the camera. The \( V \) is a variable and ongoing boundary which is given from the speedometer and the \( F \) is a fixed boundary showing the exhibition of the camera. For each edge, when the estimations of \( F \) and \( V \) are entered in condition (1), which implies the normal real separation of vehicle between the current edge and the following edge will be determined. The genuine separation \( DA \) diminishes exponentially as moving from the bottom to head of a picture because of the mathematical attribute of the info picture.

\[ F_p = -65.81e^{-\frac{D_A}{3.67}} + 65.98 \]  \quad (2)

Thus, the value is obtained by equation (1) with ongoing velocity data and the FP can be determined by the DA with the observational model as appeared in condition (2). If the pixel purposes of xmax/2-organize (Px) and arrange (Py) at the separated rate line in a current picture are resolved as appeared in figure 2.2, the parallel vehicle position proportion (R) which is characterized as

\[ \text{Lateral vehicle position ratio}(R) = \frac{D_l}{D_r} \]  \quad (3)

Where \( D_l \) and \( D_r \) are pixel-wise good ways from the normal vehicle area point (PC) to one side and right paths individually.
2.2 LIDAR (Exteroceptive)

LIDAR represents Light Detection and Ranging (LiDAR). It goes about as an eye of oneself driving vehicles and, it likewise give a 360-degree see. Lidar is utilized to decide the separation between the sensor and a close by object [8]. Most current LIDAR's utilization light in the 900 nm frequency range, albeit some LIDAR's utilization longer frequencies, which perform better in rain and fog. Constantly pivoting the LiDAR framework sends a large number of laser beats each second. The lasers are beat, and the beats are reflected by objects (or) these heartbeats crash into the surrounding objects and reflect back. Those reflections point are re-visititation of a cloud that speaks to each articles, in a vertical bearing having bigger number of sweep layers, and LIDAR focuses give the high thickness per layer. 3D representation assists with deciding the vehicle's situation with other encompassing items made by estimating the speed of light and the separation

![Figure 2.4: LIDAR position and Comparison Metrics](image)

1. Number of beams  
2. Rotation rate  
3. Points per second  
4. Field of view Upcoming solid state LIDAR

This kind of LIDAR's can't quantify the speed of items legitimately and need to depend on the diverse situation between at least two sweeps. LIDAR's are more influenced by climate conditions so; the observing framework records every laser's appearance point and refreshing qualities to cloud in 3D portrayal. Then again, LIDAR's with a MEMS (Micro-Electromechanically System) vibrating miniature mirrors have a likelihood to filter the laser radiates [10]. Rather than moving a mechanical laser shaft, exhibit radar are staged to a comparable rule that can be utilized. High goal is significant for recognizing objects. LIDAR's can plan a static climate just as recognize and distinguish moving vehicles and natural life.

2.3 RADAR (Exteroceptive)

Radar represents Radio Detection and Ranging. Radar is sensor that incorporated into vehicles for finding the situation of moving articles in various purposes like adaptive cruise
control, blind spot warning, impact cautioning and crash shirking [11]. Indeed, even radar is developed innovation; it actually gets improved particularly for utilization of independent driving. While measure the speed by computing the contrast between readings of different sensors, to quantify a speed radar utilizes the Doppler impact, While other sensors measure velocity by calculating the difference between two readings.

Doppler Effect is critical to sensor combination since it gives the data about speed as a free measure boundary, and it causes the combination calculations to join a lot quicker. Lung-range radar is microwave radar at 77 GHz, has a low goal yet can measure speed and recognize vehicles and snags to 200 m away. Show medium range radar is full grown and cheap innovation in 24 GHz and 76 GHz groups. Despite the fact that radar is more effective than cameras and LIDAR in select circumstances like terrible climate, radar has less precise exactness and creates less information than LiDAR. Work in poor ability like fog and precipitation strong item identification and relative speed assessment. In contrast to cameras, radar doesn't have any information substantial video feeds to measure yet has lower preparing speeds required for taking care of information yield contrasted with LiDAR and cameras. Radar can be utilized for restriction by producing radar guides of the climate; can see different vehicles, structures and items that multitude of sensors on the vehicle, radar is influenced by downpour or mist and can have a wide field of view, around 150 degrees, or a long-range, more than 200 meters. Contrasted with LiDAR's and cameras, radars have a low goal, particularly in the vertical direction. The two arrangements are WFOV Short reach and NFOV, long reach.

2.4 Ultrasonic Waves (Exteroceptive)

Ultrasonic sensor is a fundamental rule of sound propagation and reflection by any material in the ultrasonic recurrence range. By applying this standard, ultrasonic sensors can work when the force is low or dim. In all climate separation estimated in short reach [7], ultrasonic sensor likewise improves a few favorable circumstances over camera, for example, dealer size, less expensive value, simpler to be actualized, and utilization of low force. It has been generally utilized in different purposes, for example, deciding surface structure, estimating the position, and computing the speed of an item. To decide the shape or structure of each article utilizing ultrasonic sensors, one can orchestrate some ultrasonic sensors mounted equal, and afterward place an item inside the discovery region.

2.5 Measurement Principle of Ultrasonic Sensor

The ultrasonic sensor is a calculation of the non-contact contraption by using ultrasonic waves which gives the specific division between the valuations of every object [19]. This transmitter sensor has conveyed ultrasonic waves, exactly when waves hitting an
entity, that energy reflected back to the authority of the sensor as an indication of the Echo. A partition L₀ (Fig. 2.6) to the entity can be resolved through the speed v in the media of the ultrasonic waves and the point ø by Eq. 1

\[ L_0 = \frac{vt \cos \theta}{2} \]  

(1)

![Figure 2.6: Ultrasonic sensor distance measurement](image)

By get-together every data are mostly recorded by all sensors, structure of a thing in the surface that can be redrawn. Choosing the position and speed of moving things, for instance, vehicles, flights, equipped power force and sea constrain, it can be evaluate by ultrasonic sensors at the road side where the vehicles will passed. Regardless, human or other article passing, [19] if any discovery spot can be redirecting that measurement can be recorded. This paper proposes a vehicle disclosure and analyzing data for each programming area that provides better assessment results. Comparison metrics of the sensor: Range, Field of view, Cost, Idle for low cost parking solution, Unaffected by lighting, and precipitation.

2.6 GNSS/IMU

The state vector includes position, velocity, and attitude, the two commonly used systems for vehicle navigations are GNSS and INS [17]. Within the integration system the core filtering algorithm is introduced as well as the stochastic error modeling (expected values and observed values must be unpredictable) of Inertial Measurement Unit (IMU). GNSS use signals from orbiting satellites to compute position, time and velocity. GNSS navigation has excellent accuracy for provided the antenna has line of sight visibility at least four satellites [17]. Determination of each Trajectory relates to the derivation of the state vector of an object at any given time. When the satellites is blocked in line of sight by obstructions such as trees or buildings, navigation becomes unreliable.

An Inertial Navigation System (INS) use rotation and acceleration information from an Inertial Measurement Unit (IMU). It is mostly compute a relative position over time. An IMU is having six sensors that are complimentary arrayed on orthogonal of three axes. Each of the three axes is coupled an accelerometer and a gyroscope. The accelerometers are found out to measure linear acceleration and the gyroscopes is find out to measure rotational acceleration. With these help of sensors, an IMU can perform to calculate relative movement in 3D space [4]. The IMU measurements are provide an angular solution about the three axes. The INS translates the angular solution into a local attitude of roll, pitch and yaw solution which it can provide in addition to the position and velocity.

The ability of the INS to provide attitude determination is an important addition for several applications, such as aerial survey and hydrography. For example, in aerial surveys not important to know where the camera have, when the picture was taken, but also what angle the camera are relative to the ground. When the GNSS conditions line of sight to
several satellites are good, the GNSS receiver provides accurate position and time to the navigation system. When the conditions technique for GNSS becomes poor, the INS provides the position and navigation until improve the GNSS conditions. Global navigation satellite system and inertial measurements units. It is incorporated into Inertial Navigation System because it’s utilizing the raw IMU measurements to calculate angular rates, linear velocity and global reference position according to the frame. Direct measure of ego vehicle states

**Comparison metrics:** Position, velocity (GNSS),

1. Varying accuracies: RTK, PPP, DGPS
2. Acceleration (IMU)
3. Angular rotation rate (IMU)
4. Heading (IMU, GPS)

**Limitations:**

a) IMUs for each navigation is suffer from accumulated error.
b) Because the guidance system is continually integrating acceleration with respect to time

c) Monitoring systems analysis were it is located and the actual location.

2.7 Wheel Odometry (Proprioceptive)

This odometer, use of data from a starting position of motion sensor and a wheel displacement calculation to estimate change in a position over a time t. This technique is generally very inaccurate and leads to an accumulation of errors due to measurement inaccuracies, wheel slip [9]. Tracks wheel velocity and orientation, it is used in robotics by some wheeled robots to estimate their starting location.

![Figure 2.7: Odometer wheel sensor](image)

This method is sensitive due to the velocity measurements over time to give position estimates. Accurate data collection, instrument calibration, and processing. These are the required cases for odometer to be used effectively. It drives forward for some time and then would like to know how it has traveled. It can be measure how the wheels have rotated, and it knows the circumference of each wheels, compute the distance.

Suppose that a simple cars has four wheels which can both move forward or reverse and that they are positioned parallel to one another, and equidistant from the center of the car [20]. Further, each motor has a rotary encoder, and it determine if either wheel has travelled forward or reverse along the floor. This unit is the ratio of the circumference of the wheel to the resolution of the encoder. If the left wheel to move forward one unit while the right wheel remained stationary then the right wheel acts a pivot, and the left wheel acts a traces a circular arc in the clockwise direction. Since one's unit of distance is usually small, by assuming that arc is a line. Thus, the original position and final position of the left wheel and the position of the right wheel form a triangle.

**Comparison metrics:** Speed accuracy, Position drift.

3. System Architecture

The basic structure of typically self-driving software system in those things have to be modify partially search driving software system shown in the figure 3.
Figure 3.1: Architecture of self-driving vehicle communication system
4. Host hardware structure

The Host consists by the LCD display, easy operation and flexible set key, Host receives monitoring parameters information that obtained by the sub-machine through nRF24L01 module, and displays the important parameters in turn. It stores the important data in the U disk through the USB interface. Then send this important information in the U disk to the expert analysis system in the PC for further analysis and processing. Host is also equipped with 16 Mb serial flashes M25P16. The M25P16 supports speed up to 50 MHz of the SPI bus access operation and uses to store the fault information of the brake [18]. When a sub-machine sent over the monitoring data and fault information, the host will immediately generate an interrupt and display sub-machine fault information. Host also can send broadcast commands to all sub-machines, such as setting all sub-machine at the same clock, maintains the host and sub-machine time synchronization, which ensures the transmission of sub-machine fault information more accurate. The Host comprises by the LCD show, simple process and adaptable set key, Host gets checked parameter data that acquired by the sub-machine through nRF24L01 module, and showcases the significant boundaries in turn. It stores the significant information in the U disk through the USB interface. At that point send this significant data in the U circle to the master investigation framework in the PC for additional examination and processing. Host is additionally furnished with 16 Mb sequential glimmers M25P16, support to accelerate 50 MHz of the SPI transport access process and utilize to store the error data of the brake [18]. At this point, when a sub-machine sent over the observing of fault information and flaw data, the host will promptly generate an interrupt and show sub-machine issue data. In addition host can send broadcast orders to all sub-machines, for example, setting all sub-machine at the same clock, keeps up the host and sub-machine time synchronization, which guarantees the transmission of sub-machine flaw information more exact.

![Figure 4.1: Host Hardware structure](image)

5. Module Description:

5.1 Phase 1(Environment Perception):

The process of perception in independent driving vehicle uses a grouping of modern sensors and cameras, joint with process and realize the atmosphere around the vehicle, in real-time [21]. Perception in self-driving vehicles is critical to the safe and reliable process since the data expected from these processes fuel the fundamental decision-making that figures out how the vehicle should move next; such that, the vehicle is regulated in the accurate and is not endangering the breathes of humans in, and around the vehicle, while doing so. Sensors like radars and LIDAR’s in grouping with a series of cameras, are the visualization of the vehicle. Programming frameworks, such as convolutional neural networks, act as the ‘brains’ of the
vehicle. Together, the vehicle can part together a complete thoughtful of what’s happening in the world.

5.2 Phase 2 (Environment Mapping):

The abilities of energized 3d planning route framework, are particularly the blend of both in one control operation was obviously encouraged by the reenactment framework [23]. For the 3D mapping procedures, option to set up unpretentious geometric situations and to associate the mapping outcomes with ground truth. Simulating a real-time moving vehicle with its physical properties is able to get exact the localization method with the help of an intuition for achieving dense and accurate maps. To compare the relative results, different sensor, placements, configurations, and data rates are becomes much simple and easier.

Figure 5.1: Environment Mapping

Upon this localization can be tested widely and verified to correct outcomes and reliable in an urban location [23]. The result is gained by during the validation part. Is narrates to image find ability to the things represented in them below figure by applying Bayes’ rule which gives a successive framework for apprising the position posteriors, given a map and a transition function

\[
P(m_{t+1}, x_{t+1} | o_{1:t+1}, u_{1:t})
\]

Similarly the map can be updated sequentially to determine framework by

\[
P(x_{t} | o_{1:t}, u_{1:t}) = \sum_{m_{t-1}} P(o_{t} | x_{t}, m_{t}, u_{1:t}) \sum_{x_{t-1}} P(x_{t} | x_{t-1}) P(x_{t-1} | m_{t}, o_{1:t-1}, u_{1:t}) / Z
\]

To confront numerous deduction issues, to choose the arrangements of two variables can be found, to ideal arrangement, by rotating refreshes in a type of EM calculation

\[
P(m_{t} | x_{t}, o_{1:t}, u_{1:t}) = \sum_{x_{t-1}} \sum_{m_{t-1}} P(m_{t} | x_{t}, m_{t-1}, o_{t}, u_{1:t}) P(m_{t-1}, x_{t} | o_{1:t-1}, m_{t-1}, u_{1:t})
\]

The figure speaks to the processed direction of the vehicle exaggerated on the Ortho-photograph of the EPFL grounds [24-22]. During this trial, the vehicle drove on regions now GPS was not accessible or of terrible quality (near structures, underground).

5.2.1 Localization Map:

It is one of the synchronous location awareness and recording of the environment in a map of computer, device, drone, robot or other autonomous vehicle [22]. It is effectively map, navigate, avoid obstacles and adjust to changes.

Equation: \( P(m_{t} | x_{t}, m_{t-1}, o_{t}) \)

Comparison metrics: Collect continuous set if LIDAR, Lidar maps are used to calculate the movement of the autonomous vehicle.
5.2.2 Occupancy Map:
It define which address the problem of generating maps from noisy and uncertain sensors measurement data, with the assumption is known[19]. To represent a map of the environment as spaced field of binary random variables, it representing the presence of obstacles at the location in the environment.

**Equation:** \[ P(m_i | z_{1:t}, x_{1:t}) = \pi^2 P(m_i | z_{1:t}, x_{1:t}) \]

**Comparison metrics:**
- Discretized fine grain grid map can be 2D or 3D.
- Occupancy by static object.
- Curbs and other non-drivable surface.
- Tree and building.
- Dynamic object are removed.

5.2.3 Detailed Road Map:
A map that exhibitions highways and transport links rather than geographical information (natural). It is categories of direction-finding map that generally affords political borders and labels, marking it also type of political map [24]. Create a vector size 3p, selecting p points on the entity. Intuitively a sampling of the entity is Euclidean domain. For configuration q, embed (q) is the vector of p points converted by the translation and rotation that is configuration q. Transformation each of the p points into the vector embed (q).

**Equation:**
- Euclidean distance between the 3p vectors,
  \[ D(p, q') = ||\text{embed}(q) - \text{embed}(q')||. \]
- Calculate a weighted distance function,
  \[ d(p, q') = w1||x - x'|| + w2 f(R, R'). \]

**Comparison metrics:**
- Fully online.
- Fully offline.
5.3 Phase 3 (Motion Planning):
Path planning and decision making for partially autonomous vehicles in urban environments enable self-driving cars to find the safest, most convenient, and most economically beneficial routes from point A to point B [18-19]. The complicated task for analysis the routes finding by all of the static and maneuverable obstacles that a vehicle must identify and bypass. Now a day, the major path planning approaches include controlling the predictive model, feasible model, and behavior-based model.

Table 1: Analysis overall coverage

<table>
<thead>
<tr>
<th>State/Analysis</th>
<th>Highway</th>
<th>Urban/Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic speed</td>
<td>High</td>
<td>Low – Medium</td>
</tr>
<tr>
<td>Traffic volume</td>
<td>High</td>
<td>Medium – High</td>
</tr>
<tr>
<td># of lanes</td>
<td>More</td>
<td>2 – 4 typically</td>
</tr>
<tr>
<td>Other features</td>
<td>Fewer, Gradual</td>
<td>Many turns and curves</td>
</tr>
</tbody>
</table>

5.4 Phase 4 (Controller):
The controller methodology can be divided in many different ways
Control input two and four Wheel Steering.
Direct yaw control, neural network, Input scaling

Several aspects of designing a control system for a vehicle have been examined extensively in the past, both in the physics as well as in control theory studies. The problem of control in dynamic setting. Using measurement a head of the vehicle [19]. The system used a feedback of 2WS controller. As mentioned before, the vehicle controller requires a model of the vehicle behavior, either a dynamics or kinematics model. Phase portraits provide graphically control insight into non-linear system dynamics. These vehicle display the plots stability and map
location to change the parameter and system inputs [8]. The relationship between the boundaries of stable vehicle operation and stage derivative in the yaw rate slide phase plane. Closed loop phase demonstrate the portraits of potential augmenting.

6. Results
The Open loop vehicle over steering and braking are active technique by applying phase portrait investigation to control yaw strength and surface for sliding controller in drifting.

Table 2. Urban analysis and high-way analysis overall coverage:

<table>
<thead>
<tr>
<th>Urban Analysis Overall Coverage:</th>
<th>High-Way Analysis Overall Coverage:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency stop, over-taking</td>
<td>Emergency stop</td>
</tr>
<tr>
<td>Emergency stop, maintain speed, lane change, overtaking, intersection, roundabouts</td>
<td>Emergency stop, Maintain Speed</td>
</tr>
<tr>
<td>Over-taking, intersection</td>
<td>Maintain Speed, Lane Change</td>
</tr>
<tr>
<td>Over-taking, intersection</td>
<td>Lane Change</td>
</tr>
<tr>
<td>roundabouts</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Urban analysis for Over-Taking

<table>
<thead>
<tr>
<th>Longitudinal Coverage:</th>
<th>Lateral Coverage:</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Longitudinal Coverage Diagram]</td>
<td>![Lateral Coverage Diagram]</td>
</tr>
<tr>
<td>1) If overtaking a parked (or) Moving vehicle</td>
<td>1) Always need to observe adjacent lanes.</td>
</tr>
<tr>
<td>2) Need to detect oncoming traffic beyond point of return to own lanes</td>
<td>2) Need to observe additional lanes if other vehicle can move in to adjacent lanes</td>
</tr>
</tbody>
</table>
## Table 4 Urban analysis for Intersection and Roundabouts

<table>
<thead>
<tr>
<th>Intersection:</th>
<th>Roundabouts:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Longitudinal Coverage:</strong></td>
<td><strong>Longitudinal Coverage:</strong></td>
</tr>
<tr>
<td>1) Requires near Omni-directional sensing for arbitrary intersection angles</td>
<td>1) Due to the shape of the roundabout, need a wider field of view</td>
</tr>
<tr>
<td><strong>Lateral Coverage:</strong></td>
<td><strong>Lateral Coverage:</strong></td>
</tr>
<tr>
<td>2) Observe beyond intersection for approaching vehicles, pedestrian crossing, clear exit lanes</td>
<td>2) Vehicles are slower than usual, limited range requirement</td>
</tr>
</tbody>
</table>

![Diagram of Intersection and Roundabouts]

## Table 5 High-way analysis for emergency stop

If any blockage ahead, the system alerts the vehicle notification to stop in time.

<table>
<thead>
<tr>
<th>Longitudinal Coverage:</th>
<th>Lateral Coverage:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1) Assume we are speeding at 120kmph</strong></td>
<td><strong>1) To avoid collision either we stop or change lane</strong></td>
</tr>
<tr>
<td><strong>2) Stopping distance could be 110 meter aggressive deceleration.</strong></td>
<td><strong>2) At least adjacent lanes since we may change lanes to avoid hard stop</strong></td>
</tr>
</tbody>
</table>

![Diagram of High-way Analysis]
**Table 6 Maintain Speed** *(Relative speed so typically less than 13 kmph)*

<table>
<thead>
<tr>
<th>Longitudinal Coverage</th>
<th>Lateral Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
</tbody>
</table>

1) At least 100 meters in front both vehicles are moving so don’t need to emergency stop

1) Usually current lane adjacent lanes would be look as far as performed for merging vehicle detection.

**Table 7 Lane change for longitudinal coverage and lateral coverage**

<table>
<thead>
<tr>
<th>Longitudinal Coverage</th>
<th>Lateral Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
</tbody>
</table>

1) Need to look forward to maintain a safe distance

1) Need to look not just in adjacent lanes, but probably further

2) Need to look behind to see what Rear vehicles are doing

2) Need wider sensing

---

**7. Conclusion**

The ultimate aim of this paper is to presents a suitable instruction for achieving the process of programmed vehicles, also provides a flexible metrics and methods which can be improve the performance evaluation. In this system the sensors are used to acquire the parameters values of a vehicle such as measuring the speed of the moving vehicles. Initially image processing technologies are applied on moving object in the consecutive image frames was founded and stored in cloud. The sensors are installed to acquire the vehicle parameters to find if the fault occurrence interrupts the actual function of a vehicle, also the proposed algorithm can calculate sensors input value like speed, break, pressure, conditions and matches with the stored reference value in the cloud. It will be helpful to detect the vehicle parameter failure in advance to prevent the self-driving vehicles. Examined results are verified the effectiveness and accuracy of the proposed idea. The method of self-governing vehicle that will be added trustworthy than a human, by using the sensors. The vehicles must have not only cameras that will emulate the human sight, but the sensors are used to sense the failure that record by the vehicle at every movement. This method can perform real-time status of observing fault data initiated at the vehicles parameter, which can be stored and helps in future analysis for the uncovered failure. The detection and monitoring system provides high accuracy, reliability to prevent the vehicle from accidents with low cost development.
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