REAL-TIME SPEED ANALYZER

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LITERATURE REVIEW

S.No.	Paper Title	Dataset Used	Algorithm /Methodology/Model	Limitation of the Model	Summary in your words	Future Scope	Cite in APA style
1	Vehicle Speed Control and Security System	Real-time data used	Raspberry Pi, GPS/GSM module, Telegram	Does not work efficiently due to a small problem with the GPS and GSM modem, use of hardware, funding required	This paper aims to reduce the exponential increasing theft of vehicles recently. It introduces a multi-layer security system which includes a theft alerting feature, owner speed-limiting system, and emergency monitoring vehicle feature. The first part of the model introduced in this paper deals with the limiting the speed of the vehicle if it is robbed. For this a motor driver IC(controls two or more motors at a time), a DC motor(as a vehicle) and Raspberry Pi(control voltage provided to the vehicle) is used in order to limit the speed of the vehicle or DC motor in this case. The second part deals with geolocation tracking using GPS and GSM module. By GPS module we get the longitude and latitude and	Funding required for hardware and installation in vehicles	Aziz, T., Faisal, T. M., Ryu, H. G., & Hossain, M. N. (2021). Vehicle Speed Control and Security System. In *2021 International Conference on Electronics, Information, and Communication (ICEIC)* (pp. 1-4). IEEE.

					using that we get our location on the map and by GSM module we get the text message where the location is mentioned. Finally, the third part of this paper deals with monitoring the vehicle through a webcam. The webcam looks for any motion and if any kind of motion occurs, it clicks images(40 images per second) and a little microphone inside the webcam records audio and sends through telegram software.		
2	Machine Learning Techniques to Identify Unsafe Driving Behaviour by Means of In-Vehicle Sensor Data	26 hours of total driving time spent by ten different drivers (https:// ocslab.hksecurity.net/Datasets/driving-dataset)	Machine learning techniques(SVM, Artificial Neural Network), Controller Area Network (CAN) bus	CAN bus access parameters differ from model to model and company to company, difficulty in getting accurate dataset.	This paper aims to identify unsafe driving behaviors of a driver by taking advantage of sensors already present in modern vehicles using machine learning techniques(SVM, Artificial Neural Network). They have taken a short time window of 10 seconds with 50% overlap of the dataset and extracted features like vehicle speed, engine speed, engine load, throttle position, steering wheel angle, brake pedal pressure by On Board Diagnostics(OBD-II) from it and defined a quadratic relationship between acceleration and speed which	More dataset collection and can be used in insurance companies for better services	Lattanzi, E., & Freschi, V. (2021). Machine Learning Techniques to Identify Unsafe Driving Behavior by Means of In-Vehicle Sensor Data. Expert Systems with Applications, 176, 114818.

					when plotted, it splits out in two areas representing safe and unsafe driving domains. In particular, the points falling outside the curve represent unsafe driving conditions while those inside are safe. Each time window from the dataset is marked according to the quadratic equation. Then the labelled data was used to train the two classifiers: Support Vector Machines(SVM), Artificial Neural Networks. A binary-class SVM was used to find a hyperplane that best divides the dataset into the desired classes. A simple feedforward network was used with a single hidden layer composed of 50 neurons. The network was trained by means of a backpropagation Levenberg–Marquardt algorithm with a traditional mean square error (MSE) performance function. Lastly, graphs were plotted for dataset showing safe(blue circle) and unsafe(red triangle) against different features obtained from OBD-II.		
3	An Enhanced Map-Matching Algorithm	Real-time data used	Iterative Closest Point(ICP)	Reduces horizontal error	This paper proposes a method for enhancing the position accuracy of a low-cost GPS	Enhanced to reduce vertical	Kang JM, Kim HS, Park JB, Choi YH. An Enhanced Map-Matching

	for Real-Time Position Accuracy Improvement with a Low-Cost GPS Receiver		algorithm, Map matching algorithm	not the vertical error	receiver based on map data without using any additional sensors. Firstly, they loaded the digital databases .i.e., the Map Set Point(MPS, vector points extracted from the center of roads) is loaded from the memory. The current position and heading of a vehicle are acquired from the GPS receiver at each sampling time and stored in Source Point Set(SPS, vector points of the vehicle trajectory) till a predefined scalar value. Reference Point Set(RPS, created from the selected vector points in the MPS that a vehicle is expected to pass) is created based on MPS and SPS .i.e., all those vector points of MPS are chosen whose headings are parallel to that of the trajectory of the vehicle. It increases the horizontal accuracy by considering the direction of the road. After constructing RPS the Iterative Closest Point(ICP) algorithm is used to compute the rotational and translational errors between RPS and SPS which outputs the rotation matrix and the translation vector from which minimized horizontal	error and computational speed even when buff size and area size is larger	Algorithm for Real-Time Position Accuracy Improvement with a Low-Cost GPS Receiver. *Sensors*. 2018; 18(11):3836. https://doi.org/10.3390/s18113836

					position error is concluded. However, this transformation does not sufficiently reflect the change value between the trajectory and the GPS information, which were newly obtained, hence least squares method was used to calibrate the rotational error. The state estimation which implies the correct position of the vehicle is linked to RPS to eliminate the residual disparity using vector projection theorem, which is from the current state estimation and the two points near the estimation point. The lateral error is reduced, and the vehicle position is located on the road of the digital map.		
4	Smartphone GPS accuracy study in an urban environment	Real-time dataset used	Shapiro-Wilk test, Mann-Whitney test, RMSE(Root Mean Square Error), Pearson's correlation coefficient	Unable to sufficiently explain why horizontal position accuracy improved during periods of time when WiFi usage was high, lack of access to the technical specifications of the WiFi network, lack of measurement of	This paper aims to understand relative position accuracy in an urban environment by an iPhone 6 using Avenza software for capturing horizontal position. The locations were captured during two seasons of the year(leaf-on and leaf-off), two times of day(AM and PM) and two perceived WiFi usage periods(High and Low, when human activity was hight and low respectively). Data was collected from six monumental	Complementary study to better understand the impact of the spatial arrangement of features, further investigation the role multipath plays in error, it would be useful to set up a device at each sample point and continuously	Merry, K., & Bettinger, P. (2019). Smartphone GPS accuracy study in an urban environment. *PloS one*, *14*(7), e0219890.

				the strength of the WiFi signal at each sample point, lack of study to better understand the impact of the spatial arrangement of features	locations across the campus with difference surroundings. One trip entailed visiting each of the six points once in a clockwise or counter-clockwise order, as opposed to zig-zagging from point to point. During each data collection period, each point was visited 20 times. The data was collected in two ways- GPS-only and WiFi enabled. The data was collected using a unipod and a level, the phone was positioned over each survey cap, with the data collector oriented to face north. The sets of static horizontal position errors data collection scenarios were tested for normality using a Shapiro-Wilk test and was found that the sets of data was not normally distributed. Mann-Whitney test was implemented to test that the static horizontal position error collected during GPS-only data collection was not significantly different than the static horizontal position error collected when WiFi was enabled. Further, to describe the positional error, descriptive statistics including minimum and maximum error, and the	collect data over a period of time and at specified time intervals, a similar research endeavour using a newer smartphone with an improved GPS chip would be valuable.	

					RMSE(illustrates the error between the known location and the collected location) of the horizontal position error were calculated for data collected at each sample point and under each of the eight data collection periods. Pearson’s correlation coefficient was used to determine whether land cover was correlated with the horizontal position accuracy of data. It was also used to determine whether weather characteristics were correlated with the horizontal position accuracy of the data collected. A multivariate regression analysis was performed to identify the influence of weather conditions on positional error. It was concluded that overall average horizontal position error of the iPhone 6 is in the 7–13 m range, depending on conditions, which is consistent with the general accuracy levels observed of recreation-grade GPS receivers in potential high multipath environments. The time of year did not influence the average horizontal position error		

					observed when GPS-only parameters were assumed, or when WiFi was enabled and average horizontal position error only seemed to improve with time of day (afternoon) during the leaf-off season. Horizontal position error seemed to improve in general during perceived high WiFi usage periods (when more people were present) within each season and during each time of day most prominently in the afternoon. In general, directional error was consistent at each data collection point during both GPS-only and WiFi collection. Finally, weather conditions had little to no influence on the accuracy of data collected.		
5	An Improved Strong Tracking Cubature Kalman Filter for GPS/INS Integrated Navigation Systems	Real-time data used	Cubature Kalman Filter	The proposed method is complex and difficult to understand, greater time complexity for the algorithm.	In this paper, an improved strong tracking cubature Kalman filter is proposed to suppress the process uncertainty induced by the severe manoeuvring for the low-cost GPS/INS integrated navigation systems. Based on the improved strong tracking technique, the process uncertainty can be detected and suppressed by modifying the prior state estimate covariance	Development of modified multiple fading factors strong tracking method that is more suitable for CKF.	Feng, K., Li, J., Zhang, X., Zhang, X., Shen, C., Cao, H., ... & Liu, J. (2018). An improved strong tracking cubature Kalman filter for GPS/INS integrated navigation systems. *Sensors*, *18*(6), 1919.

					online according to the change in vehicle dynamics. Moreover, the seventh-degree spherical simplex-radial cubature rule, which can be used to compute the more exact Gaussian type integral, is integrated into the strong tracking cubature Kalman filter to further enhance the estimation accuracy. Thus, the proposed IST-7thSSRCKF possesses the advantage of 7thSSRCKF's high accuracy and strong tracking filter's strong robustness against process uncertainties. The car-mounted experiments are utilized to demonstrate that the proposed IST-7thSSRCKF can achieve high estimation accuracy and has better robustness for the suppression of process uncertainties.		
6	An Approach for predicting vehicle velocity in combination with driver turns	The main data source is the conducted Field Operational Test (FOT). Smartphones track approximately 90 taxis	The concept provides a two-stage approach. The first stage is the prediction of upcoming turns and trip segments	. The model mainly emphasizes on prediction of trip and speed of vehicle which	The model revolves around the two main stages, The first stage is the prediction of upcoming turns and trip segments based on the historical features and the currently driven road	1. Displaying Points of Interests as per user will make the model more user friendly.	Lohrer, J., & Lienkamp, M. (2016). An approach for predicting vehicle velocity in combination with driver turns. *Automotive and Engine Technology*, *1*(1), 27-33.

		and 20 commercial vehicles equipped with an internal combustion engine in the area of Munich and Upper Bavaria. Besides the mobility data acquisition, an electric vehicle is simulated in a smartphone application . The original GPS, speed information, and the simulated data are transferred to the server infrastructure. The sample time of the GPS data as main	based on the historical features and the currently driven road segments. The second stage uses this information to predict the vehicle's speed. The dataset obtained from Field Operational Test is utilized for the above mentioned steps. The approach combines a trip prediction algorithm with a speed profile prediction.	reduces the efficiency. 2. Calculation of velocity of vehicle is completely based on prediction and other factors like Traffic flow, inner city mobility etc. 3. The model is not suitable for new trips as it cannot predict the new destination.	segments. The second stage uses this information to predict the vehicle's speed. The model is completely based on the prediction, it analyses the data obtained from Field operational testing in order to detect the future turns, trip and vehicles velocity. The main set back for the model is, if the destination is unknown, the preview is limited to the end of the road section, which limits the user to a particular region.	2. The major future scope of this model is, it can be used as a virtual driving assistant.	

		information is one second. The FOT started in 2013 and was in progress till 2016 . As additional data source, live traffic information is used.Traffic flow information is accessed at regular intervals of approximately 15 min for the corresponding regions. The data is stored in a PostgreSQL database. For map-based approach, OSM is used which provides open source map					

		data with road and location-specific attributes. These attributes contain geometrical information, maximum allowed speed, position of traffic signals, stop signs, and road class amongst others. Since original OSM data are not routable, the map data are converted using OSM2PO . As a result, road segments are split at intersections, which enables the map-						

		based approach.					
7	Monitoring Vehicle speed using GPS and Categorizing driver.	Eleven attributes from speed data have been considered to categorize the driver, these attributes are Mail id, user id, project id, maximum speed, distance, time , average speed, eligibility, accuracy , GPS Satellites	Eleven attributes from speed data have been considered to categorize these drivers, these eleven attributes (Mail id, user id, project id, maximum speed, distance, time , average speed, eligibility, accuracy , GPS Satellites) are recorded for effortlessness, these attributes are utilized based on GPS service of	1. The methodology used in this model limits its implementation in the real world. 2. The model is completely dependent on different API in order to give desired output.	The proposed work is an endeavor to control speed of the vehicle structured with Pc programming to empower the outsider or proprietor to get the area, speed and action of the driver. GSM/GPRS are utilized to track the objects and provide the up to date data. This data is stored in the server and sent to the users.	1. The model is limited only to public transport vehicles and other commercial vehicles, while it can be modified to keep track of personal vehicles as well. 2. Displaying the data in proper analysed form to the	Reddy, N. R., & Subhani, S. (2019). Monitoring Vehicle Speed using GPS and Categorizing Driver.

			the smartphone and fire base to predict the speed of vehicle and categorize the driver.	3. The Accuracy of the model is unknown. 4. The output given to the Director/admin is in raw form and needs to be analyzed before implementation.		user, to save users time. 3. The model can be modified into a virtual driving assistant. 4. An alarm mechanism can also be embedded in this app so that when a person crosses the speed limit, an alert is displayed on the screen.	

8	Vehicle tracking and speed estimation from the traffic videos	The available dataset has been captured by stationary cameras located at urban intersections and free ways.Following are details of the dataset: • The Track 1 dataset contains 27 one-minute 1080p videos (1920x1080) recorded at 30 frames per seconds (fps). Those videos	The method takes a detect-then-track approach and can use object detections from any vehicle detection algorithms input; the vehicle is tracked using vehicle tracking algorithms enhanced with optical-flow based features to provide robust vehicle trajectories. The method takes a data-driven approach to	1. The model is only able to detect the constant speed of the moving vehicle and sudden variation in the speed of vehicle goes undetected. 2. The predictive speed calculated by the model suffered from both lower detection rate and high	The model was basically designed to aid the traffic department in empowering the traffic rules, to prevent vehicles from rash driving and over speeding. the basic approach of the model to track the vehicles using vehicle detection algorithms and then detecting the speed of vehicles using optical flow and speed estimation algorithms. In order to predict the speed of a moving vehicle and track the vehicle the camera recording traffic should be static, which also adds ups as a downfall of the proposed model. Overall the approach used in the model was impressive but due to some factors the model	1. The model can be improved and used by traffic police to empower traffic rules. 2. The model can be implemented in the vehicles in order to predict the speed of vehicles and speed of other vehicles passing users' vehicles, this will help users to claim	Hua, S., Kapoor, M., & Anastasiu, D. C. (2018). Vehicle tracking and speed estimation from traffic videos. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops* (pp. 153-160).

		are captured at 4 different locations, locations 1 and 2 being highway and 3 and 4 intersection locations, respectively. • The Track 2 dataset involves 100 videos, each approximately 15 minutes long, recorded at 800x410 resolution and 30 fps. • The Track 3 dataset has 15	estimating the speed of vehicles and relies on several strong assumptions. First, the camera recording traffic should be static, Secondly, assume that the maximum speed limit is known for the road segments captured in the footage and at least one vehicle drives on the segment at that speed.	root mean square error than the constant speed model. 3. The performance of the vehicle depends on the quality of video and other physical factors like wind and position of the camera.	faces challenges in the real world situations.	for insurance in case of an accident. 3. The model finds its implementation in the virtual driving assistant.	

		videos of 1080p resolution recorded at 30 fps, in four different locations. Each video is 0.5 to 1.5 hours long.					
9	Speed Determination of Moving Vehicle using Lucas-Kanade Algorithm.	The dataset used for this model are the video sequences captured using a digital camera with 15 fps sample rate and resizing the images to 120	The model implements the lucas-kanade algorithm which uses the video recording to determine the speed of moving objects. The optical flow of the recorded video is utilized	1. The output of the model depends on the quality of video recorded by the camera. 2. The model is good for calculating vehicle speed but will not	The model takes simple video file as input and calculates speed of vehicle using Lucas-kanade algorithm, which makes use of Optical flow of the input video to derive the necessary equations which are then replaced by the values as per rate of change of pixels will give the velocity of the moving vehicle.	1. The model can be used in implementing a virtual driving assistant. 2. The model can be integrated with a speed alert system in order to alert drivers of	Shukla, D., & Patel, E. (2013). Speed determination of moving vehicles using Lucas-Kanade Algorithm. *International Journal of Computer Applications Technology and Research*, *2*(1), 32-36.

		X160 pixel resolution.	by the lucas-kanade algorithm to get numerical values related to the rate of change of pixels and hence predicting the velocity of the vehicle.	be able to display it to the user in real time which limits its functionalities.		crossing the speed limit. 3. The model can be used to calculate the speed of nearby vehicles.	
10	SenSpeed: Sensing Driving Conditions to Estimate Vehicle Speed in Urban Environments	The data obtained from mobile phones, accelerometers and gyroscopes is analysed to calculate the velocity of the vehicle.	The model implements Accelerometer and gyroscope readings to calculate the actual velocity of the vehicle, in order to obtain the vehicle speed, a series of	1. We need to align the mobile phone in such a way that the y axis of mobile phone and vehicle point in the same direction.	The models make use of mobile phones Accelerometer and Gyroscope to calculate the velocity of the moving vehicle, the readings of accelerometer are continuously observed for the same purpose. The basic drawback of the model is, in order to use an accelerometer for velocity calculation the mobile phone should be	1. The model can be implemented in creating a virtual driving assistant. 2. An alert system can be integrated with the current model	Yu, J., Zhu, H., Han, H., Chen, Y. J., Yang, J., Zhu, Y., ... & Li, M. (2015). Senspeed: Sensing driving conditions to estimate vehicle speed in urban environments. *IEEE Transactions on Mobile Computing*, *15*(1), 202-216.

		Therefore, readings of the accelerometer and gyroscope serves as the dataset for the model.	the acceleration samples are taken and monitored by the accelerometer continuously. The position of a smartphone can be determined by using GPS. The average vehicle speed is utilized by the position and time interval from adjacent GPS data. Gyroscope data is used to detect the smoothness of roads.Modern motion sensors usually have 6	2. The efficiency of the model is directly depending on the mobile phones alignment.	placed in such a way that the y-axis of the mobile phone and the vehicle are parallel.gyroscope is used to check the smoothness of the road but because it consumes more power than accelerometer ,it is preferred to use only accelerometer and not gyroscope this step optimize the power consumption. After performing various experiments on the model it was concluded that SenSpeed can estimate the vehicle speed in real-time with a low average error of 2.12km/h, while achieving 1.21km/h during the offline estimation.	in order to help drivers to drive below the speed limit. 3. The model can be modified so that the device's alignment with the vehicle may have very little impact on the accuracy of the model.	

			power modes, i.e. Idle Mode, Accelerometer Low Power Mode, Accelerometer Mode, Gyroscope Mode and Gyroscope & Accelerometer Mode. Energy consumption is the lowest when the motion sensor is running under Idle Mode, which is only 5μA. Besides, energy consumption is also relatively low when				

			Accelerometer Low Power Mode is on, which is 10−140μA.There is no low power mode for gyroscopes. Once the gyroscope starts running, it consumes much more energy than the accelerometer, which is 3.6mA. Therefore, there are two important principles in reducing power consumption of Senspeed: Since the power				

			consumption of a gyroscope is much higher than that of an accelerometer. Avoiding use of gyroscopes in order to reduce the power consumption is the better option; Since the low power mode is available when the sampling rate is low, a significant amount of energy could be saved by reducing the				

			sampling rate of SenSpeed.				
11	Estimating true speed of moving vehicle using smartphone-based GPS measurement	Recorded GPS measurement (timestamp, horizontal accuracy, latitude, longitude).	It proposes the use of correction filters to remove the error in measured reading due to low update frequency of GPS.	The GPS measurement provide less accuracy due to weather changes, loss of signals, canyon effect.	This paper proposed a speed calculation approach using the gps measurement in smartphones. The readings may get suffer due the urban canyon effects, also the accurate speed turn measurements are required to be captured. Since the gps measurements are not dependent on phone orientation, it is better to use. Gps data provide the values timestamp, horizontal accuracy, latitude, longitude. The gps measurement take some time to deflect the reflect the sudden change in speed. To overcome this the model proposes the use of two	The model can further be enhanced by use of Kalman filter to provide more accuracy.	Chowdhury, A., Chakravarty, T., & Balamuralidhar, P. (2014, October). Estimating true speed of moving vehicle using smartphone-based GPS measurement. In 2014 IEEE International Conference on Systems, Man, and Cybernetics (SMC) (pp. 3348-3353). IEEE.

					moving average filters with normalised weight coefficients. The raw GPS data is passed through data selection filter that filter out the reading having horizontal accuracy > 16 m. then the output is passed through SDA filter followed by two digital filter (CW, EW) and then the result is passed through composition filter to combine the result.		
12	GPS Estimation using Kalman Filter	Usage of GPS data collection file stored in XML format.	Kalman Filter Model	It can be helpful in reducing the variance in data values to some extent only.	GPS receiver link with four satellite provide four values (longitude, latitude, elevation). The accuracy of gps values rely on the respective devices. To avoid this Kalman filter is brought in use which take noisy data as input and provide less noisy data. Applying the equations $X_k = A * X_{k-1}$	Accuracy can be improved further using extended Kalman filter.	Laghari, S. M. N. U. Z., & Farrukh, M. A. M. GPS Estimation using Kalman Filter.

					$Z_{K} = H * X_{K} + R$ The values can now be used for further calculation.		
13	Speed estimation using smartphone accelerometer data	The data from the accelerometer (embedded in smartphones) is collected and used.	The paper was based on the methodology that the integration of the acceleration values theoretically provides the estimated speed.	The calculation depends on the position of smartphone kept in moving vehicle. Also, it provides that estimated speed is on average within 10 mph to actual speed.	The integration of the acceleration values theoretically provides the value of speed. Using this basic approach, the idea of the paper was to estimate the speed using the accelerometer (embedded inside the smartphone) readings. However, this may accumulate other factors also like gravity component, sensor bias, noise effect, vibrations etc. The accelerometer provides with three readings (along x, y, z axis). For the purpose of calculation readings along y axis is only taken into consideration.	Making use of gyroscope and re-orienting the mobile device to align with the vehicle orientation. Taking into account more than two points (start and stop) to calibrate the speed.	Ustun, I., & Cetin, M. (2019). Speed estimation using smartphone accelerometer data. Transportation research record, 2673(3), 65-73.

					The estimated speed when plotted observe some linear trends from which it is found that speed can be corrected at some calibration point. Here start, stop point is used. What we do is once the start and stop points are detected, the slope of each segment is computed. The mean of these slope is used for further calculations.		
14	Sen Speed: Sensing Driving Conditions to Estimate Vehicle Speed in Urban Environments	Real time phone accelerometer readings along the vehicles moving direction.	The paper starts with estimating the speed using integral of accelerometer readings giving the large deviation from actual speed. It then provides	The accuracy of the model decreases under high speed. The accuracy of the system is more in slightly better in offline mode to that of online mode	Estimating the speed using GPS reading often suffer from low accuracy, low update frequency. To overcome this new approach of estimating the speed using accelerometer (embedded in phone) reading come into play. But it is observed that directly integrating the speed provides	Natural driving condition present unique feature and can be exploited to enable accurate real time vehicle speed estimation.	Yu, J., Zhu, H., Han, H., Chen, Y. J., Yang, J., Zhu, Y., ... & Li, M. (2015). Sen speed: Sensing driving conditions to estimate vehicle speed in urban environments. IEEE Transactions on Mobile Computing, 15(1), 202-216.

			various correction methods to estimate the speed with low average error of 1.32 mph.	since the value of acceleration error is not exactly accurate due to lack of next reference point information.	a large deviation ang is linearly dependent on time. This is because the accumulative error cause large deviation. Therefore, to overcome this the accumulative error needs to be eliminated hence model proposes the use of unique reference points (making turns, stopping (at traffic light, due to traffic or at stop sign), even road surfaces). Then the model measures the error in the readings between two adjacent reference point and eliminates such error to obtain high accuracy. The model uses two kinds of sensors (accelerometer – acceleration and gyroscope – angular speed). Coordinate Reorientation is done to align		

					phone coordinate system with vehicle. It senses the reference point by analysing the aligned reading from accelerometer and gyroscope and infer the speed. Finally, the correction is done in reading and the estimated speed result is calculated.		
15	Android Based Vehicle Speed Control System in Critical Zones Using GPS Technology	Real time GPS measurements are used.	This paper proposed a technique to develop an android application with GPS technology in order to identify the critical location and control the speed of vehicle	In this proposed system, the speed is always maintained down to 30 km.	This paper proposed a technique to develop an android application with GPS technology in order to identify the critical location and control the speed of vehicle automatically in two wheelers. The speed measurement and control are accomplished via microcontroller with signal being received wirelessly from gps. In this system when the vehicle reached the critical	As for the future scope, the system should be enhanced in accordance with timer concept i.e., slowing down the speed only at peak hours.	Tamilselvan, K., Murugesan, G., & Suthagar, S. (2018). Android Based Vehicle Speed Control System In Critical Zones Using GPS Technology. International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE), 1(6).

			automatically in two wheelers.		zone, the GPS device transmit the message to the hardware(receiver) to reduce the speed through Bluetooth and the mechanism automatically reduced the speed.		
16	Geofencing on the Real-Time GPS Tracking System and Improving GPS Accuracy with Moving Average, Kalman Filter and Logistic Regression Analysis	Users position	1.Arduino:Arduino is an electronics development board. 2.Sim908:Sim908 has GSM and GPS modules together. 3.NodeJS:NodeJS is a runtime JavaScript platform that can be used for both background and	GPS does not always show the exact correct position; it has a certain margin of error.	In this study, real-time tracking and geofence were performed. This geofence was performed by measuring the distance between the coordinates on the hardware side.the geofence process is performed on the map application screen after the data is transferred to the server-side.In real-life applications, the smooth circle-shaped geofence area is useless. This problem was solved by defining geofence in	There are many efficient scope can be introduced that can help in calculate more efficient gps location.	ÖZDEMİR, Z., & TUĞRUL, B. (2019, October). Geofencing on the Real-Time GPS Tracking System and Improving GPS Accuracy with Moving Average, Kalman Filter and Logistic Regression Analysis. In *2019 3rd International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT)* (pp. 1-6). IEEE.

			foreground applications. 4.Leaflet.js:The leaflet is an open-source JavaScript library written to create maps. 5.Kalman Filter:It is a filter that is dynamic and can predict the location of the next system in a system with known state space using previous data. 6.Moving Average Filter:The average		the form of polygon., the geofence area is customized in two ways as static and dynamic. Static predefined polygon. The home where the child lives is always defined as static because the school he/she goes to is always immutable. The fact that the polygon drawn in real-time in a newly travelled area can be used as a geofence without saving is defined as dynamic geofence and has provided a very flexible use to the study.GPS data has errors for various reasons. It is aimed to reduce the error rate in the data in order to make the system run faster and to be stable.The comparative results of the three methods are		

			algorithm is to obtain a certain number of data and divide it by the number of data.		given. Moving average, logistic regression and Kalman filter were applied for error reduction.		
17	An Approach to Improve the Positioning Performance of GPS/INS/UWB Integrated System with Two-Step Filter	The position, velocity and orientation error vectors, respectively. ωen is the angular rate of navigation frame with respect to earth, and ωie is the angular rate of earth with respect to an inertial frame.	1.Position Error Prediction with UWB Observation. 2.Position Error correction schema with two-step filters.	1. When the road environment has changed, the performance will become worse.	AN enhanced GPS/INS/UWB integrated schema with position error correction is proposed to improve the position accuracy, which is based on predicting the position difference between GPS/INS and GPS/INS/UWN. Based on analytical and experimental results, the GPS/INS/UWB integrated navigation with error correction outperforms the GPS/INS integrated navigation by 48% and 23% in the north and east directions,	In our future work, the potential of cooperative work for the multi-sensor and more application conditions will be investigated. The construction of a more appropriate model considering the state of motion and environment	Li, Z., Wang, R., Gao, J., & Wang, J. (2018). An approach to improve the positioning performance of GPS/INS/UWB integrated system with two-step filter. *Remote Sensing*, *10*(1), 19.

					respectively, when the UWB signal is unavailable. The integrated positioning method based on a multi-sensor is able to realize the integration of advantages from different sensors. The ability of UWB was tapped further in the proposed method, but the cooperative level of different sensors was also not high, such as the modification of system error from the UWB observation and robustness of the original observation.	is therefore the next step in our research work.	
18	Design and Development of GPS-GSM based tracking system with Google Map based monitoring	It consists of two units one is transmitting side (vehicle unit) i.e., GPS, GSM, Atmega microcontrolle	Decoding the NMEA (National Marine Electronics Association) protocol is the main purpose of	GPS does not always show the exact correct position; it has a certain margin of error.	GPS is one of the technologies that are used in a huge number of applications today. One of the applications is tracking your vehicle and keeps regular monitoring on them. This tracking system can	This project can be further enhanced by the use of camera and by developing a mobile based	Verma, P., & Bhatia, J. S. (2013). Design and development of GPS-GSM based tracking system with Google map based monitoring. *International Journal of Computer Science, Engineering and Applications (IJCSEA)*, *3*(3), 33-40.

		r MAX 232, 16x2 LCD.	developing this software. The NMEA protocol consists of set of messages. These messages are ASCII character set. GPS receives data and present it in the form of ASCII comma – delimited message strings. ‘$’ sign is used at the starting of each message. The locations (latitude and longitude) have the format of ddmm.mmmm. i.e. .degrees		inform you the location and route travelled by vehicle, and that information can be observed from any other remote location. It also includes the web application that provides you exact location of target. This system enables us to track target in any weather conditions. This system uses GPS and GSM technologies	application to get the real time view of the vehicle instead to check it on PC, which would be more convenient for the user to track the target	

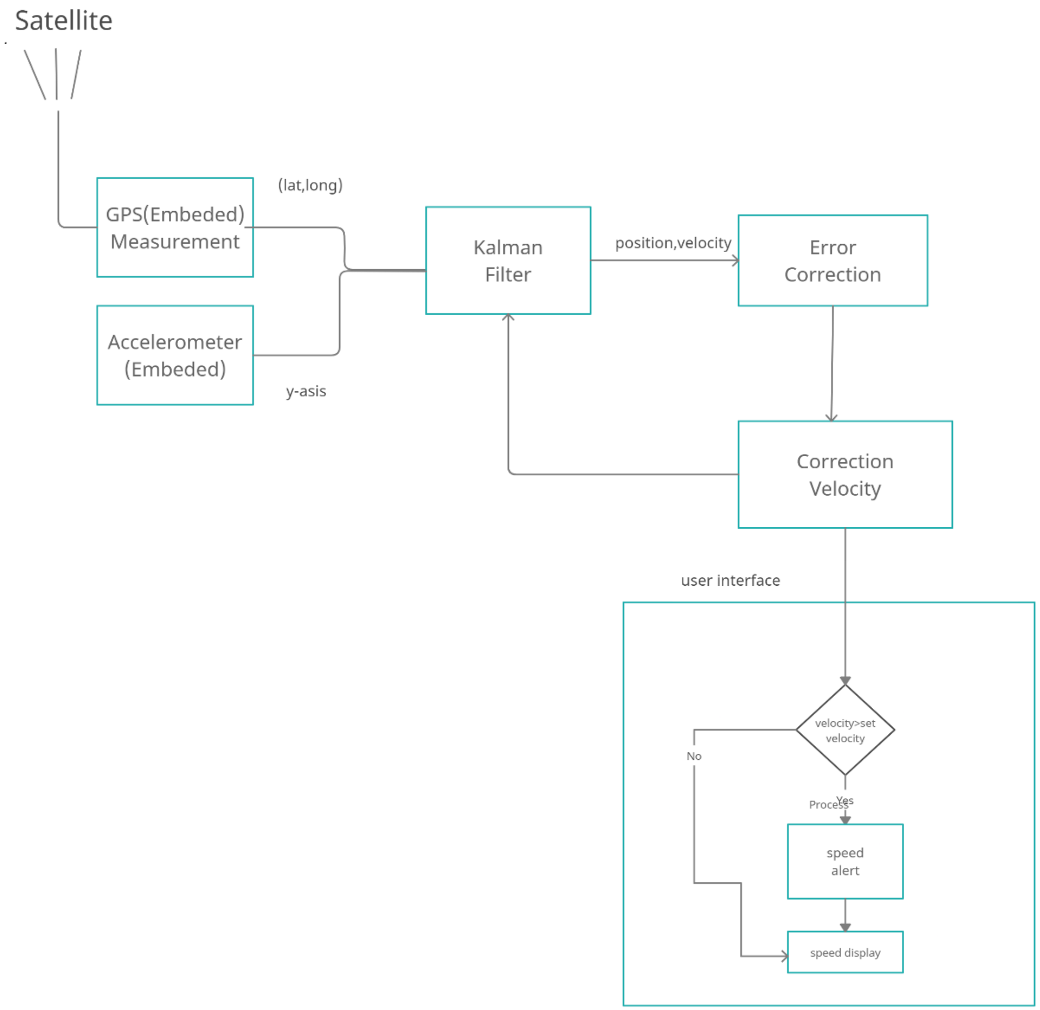
			minutes and decimal minutes.				
19	Implementation of Location based Services in Android using GPS and Web Services	Android Mobile Operating System	Android Location API, Google place api, Public Transportation API , Stop search Api	A-GPS server cannot utilize any of the three standby satellites available for GPS connections. There needs to be communication over the wireless for processing of GPS information so this could be expensive.	Location based Services offer many advantages to the mobile users to retrieve the information about their current location and process that data to get more useful information near to their location. With the help of A-GPS in phones and through Web Services using GPRS, Location based Services can be implemented on Android based smart phones to provide these value-added services: advising clients of current traffic conditions, providing routing information, helping them find nearby hotels. In this paper, we propose the implementation	In future, we make availability of cheap GPS enabled handsets. The issue of cost remains to be tackled, since these phones are still all high-end units.	Singhal, M., & Shukla, A. (2012). Implementation of location based services in android using GPS and web services. *International Journal of Computer Science Issues (IJCSI)*, *9*(1), 237.

					of Location based services through Google Web Services and Walk Score Transit APIs on Android Phones to give multiple services to the user based on their Location.		
20	Automated Vehicle Extraction and Speed Determination From QuickBird Satellite Images	Real – time object	1.Methodology of object-based vehicle to find the position of vehicle. 2.Vehicle extraction from pan image. 3.Speed determination from qb image.	Due to the limitation of extracting vehicles from a MS image, highly accurate speed determination cannot be expected. From the results of a simulation, it was found that the speed of a moving vehicle can be determined from	A new method has been developed to automatically extract moving vehicles and subsequently determine their speeds from a pair of QuickBird (QB) panchromatic (PAN) and multispectral (MS) images. Since the PAN and MS sensors of QB have a slight time lag (approximately 0.2 s), the speed of a moving vehicle can be determined from the difference in the positions of the vehicle observed in the PAN and MS images due to the time lag. An object-based	In future we hope to increase the efficiency of finding moving vehicle from 94 to near 100 percentage.	Liu, W., Yamazaki, F., & Vu, T. T. (2010). Automated vehicle extraction and speed determination from QuickBird satellite images. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, *4*(1), 75-82.

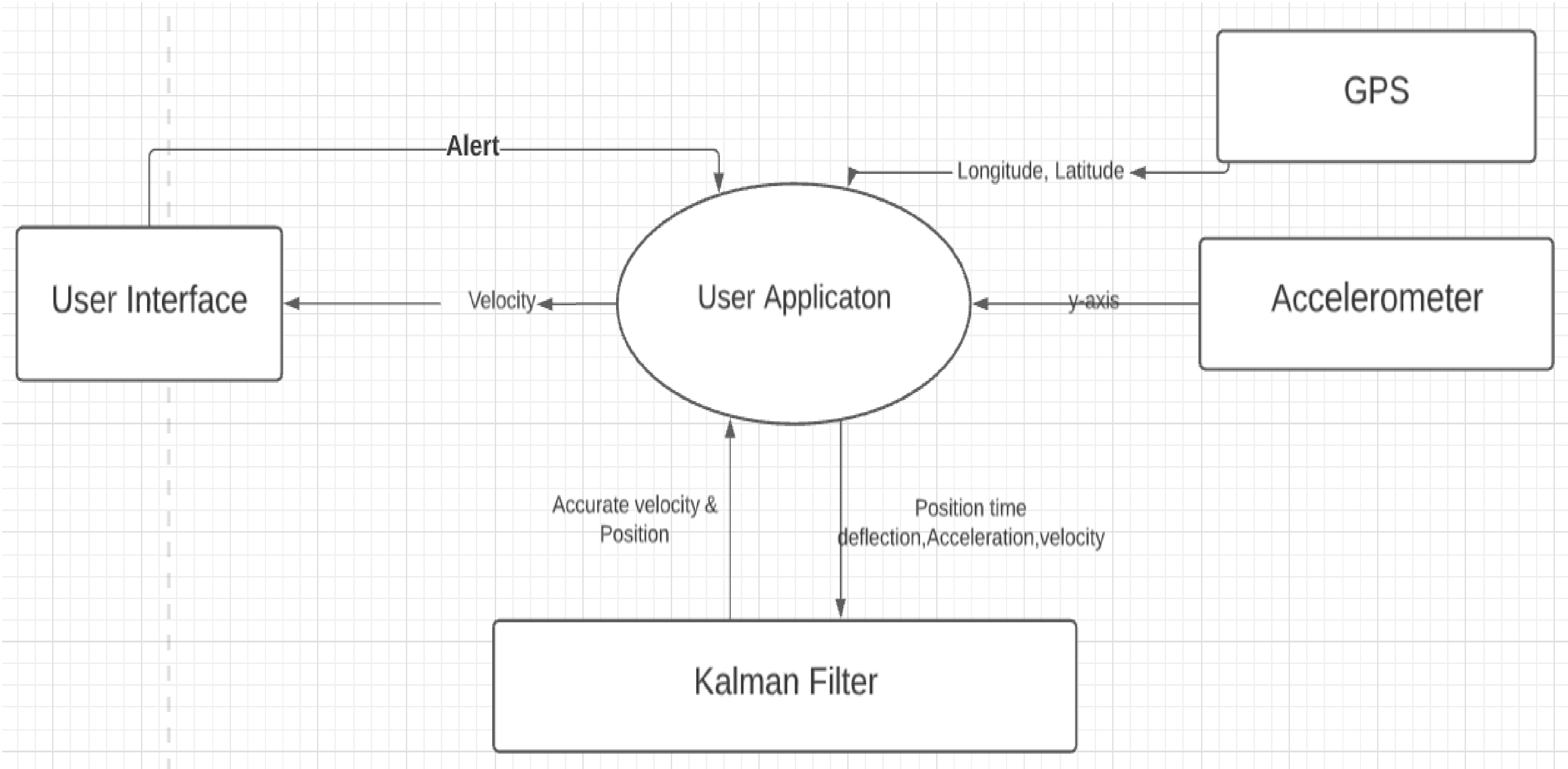
				a QB bundle product to within an error range of 16 km/h.	approach can be used to extract a vehicle from the PAN image, which has a resolution of 0.6 m. However, it is difficult to accurately extract the position of a vehicle from an MS image because its resolution is 2.4 m. Thus, an area correlation method is proposed to determine the location of a vehicle from an MS image at a sub-pixel level. The speed of the moving vehicle can then be calculated by using the vehicle extraction results.		

DESIGN PHASE

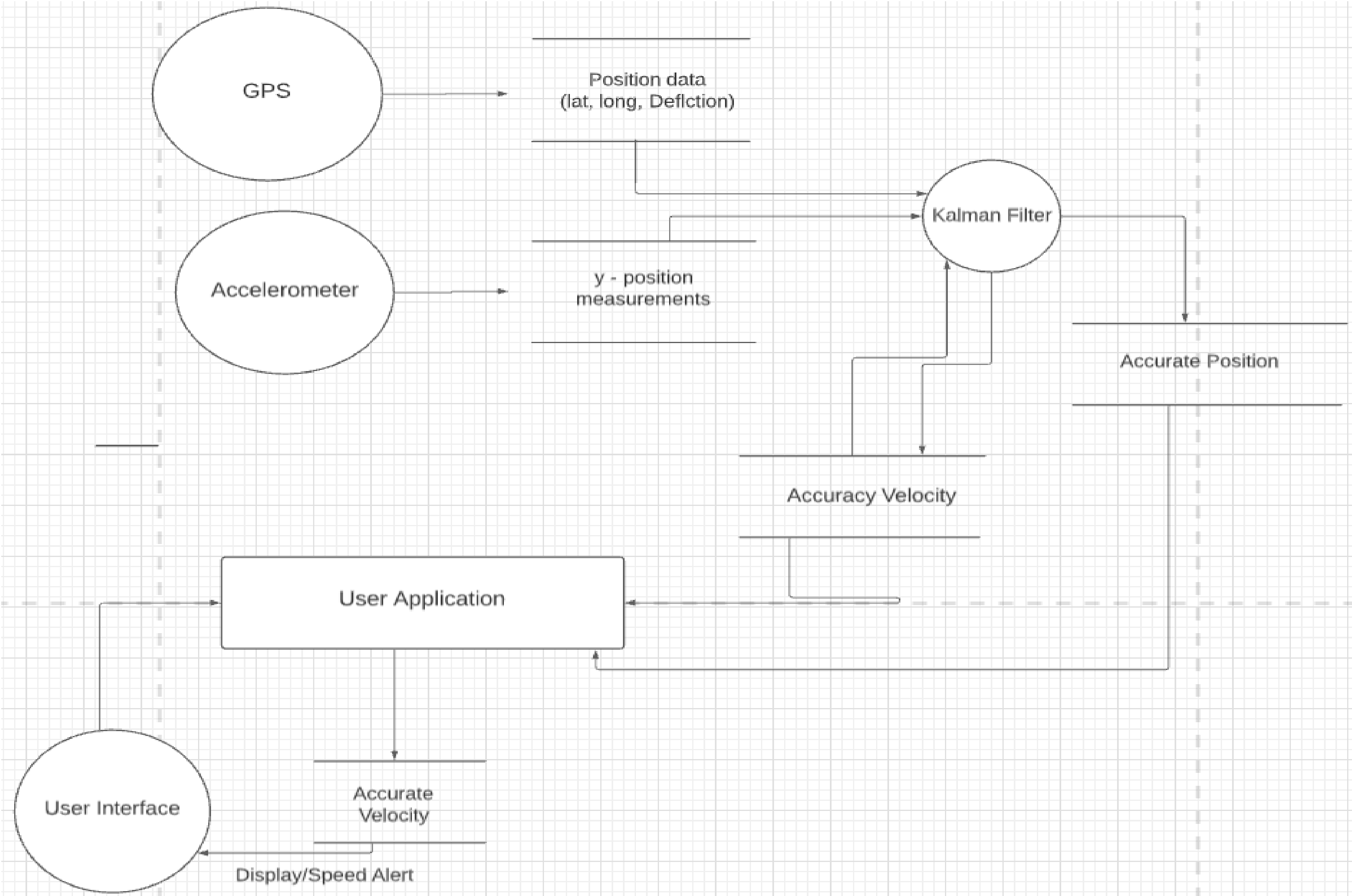
1. Proposed Architecture



2. DFD 0


GPS
Alert
Longitude, Latitude
User Interface
Velocity
User Applicaton
y-axis
Accelerometer
Accurate velocity &
Position
Position time
deflection,Acceleration,velocity
Kalman Filter

3. DFD 1


GPS
Position data
(lat, long, Deflction)
Accelerometer
y - position
measurements
Kalman Filter
Accurate Position
Accuracy Velocity
User Application
User Interface
Accurate
Velocity
Display/Speed Alert