ERROR CORRECTION OF SENSORS USING KALMAN FILTER FOR AUTONOMOUS VEHICLE MOVEMENT

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Abstract : A novel method is proposed for reducing the errors in distance measuring sensors namely Radar and Lidar is proposed to accurately detect the relative distance of any Autonomous vehicle in a surface movement scenario. Sensor distance outputs are proposed to be taken with appropriate signal conditioning to be given as input to the well known Kalman filter and an appropriate program is proposed to be written in either Python or Mathematica on a Linux Operating system. The required hardware will also be taken from the market and suitable protocols are proposed to be adopted. For the above purpose a Literature survey is carried out to understand the situation in current surface movement scenario. Survey is carried out on eight papers keeping in view error correction, spatial kriging, kalman filtering, AWGN, ADS-B, BCM2837R.

***IndexTerms* - Radar Sensor, Kalman filter, Linux**

INTRODUCTION

The requirements of error signal processing and reduction of error analysis is still at a nascent state and can be used to improve current levels of knowledge. The following is the brief of each standard papers. We have covered the subject in a broad sense and keeping in view our requirements in a general perspective.

The automatic sensor drift detection and correction using spatial Kriging and Kalman filtering regarding a distributed network of a intelligence sensor which can measure various parameters for efficient management of city discussed regarding the data collected through a range of sensors is processed and delivered to the citizens or appropriate authorities [1]. The proposed technique will automatically detect and correct the drift in the sensor nodes. The interpolation of sensor reading of neighboring sensors is used to predict actual value of sensor and measured drift in kalman filter to get correct drift experiment and claimed that this method performs traditional average methods and able to estimate the drift and bias in the sensor reading and correct it with reasonable errors so that sensor network can be used for a long time.

A wireless underground sensor network using sensor nodes for earth's surface applications like smart irrigation in agriculture field is formed. Different modulation schemes as BPSK modulation been analyzed to select an optimum error correction mechanism has been simulated in AWGN channel [2]. The communication channel in soil medium has been considered as linear time varying filter which gives channel state information. The authors investigated to choose the best modulation method for WUSN and reported that BPSK is optimum method. By the error correction mechanism the bit error rate performance is also improved in AWGN channel. Where as in our paper the measured values for sensor are simulated using an algorithm in Mathematica-11 using the built in function for real random number generation under Linux environment with BROADCOM 2837R.

The accomplishment of new technologies like Air Dependent Surveillance Broadcast (ADS-B) are used to improve the accuracy and time response of data for air surveillance sensor, integration of sensor location and reliability of ATM system [3]. The CNS-ATM is used to calculate aircraft position through signal delay or time difference between transponder pulses. This work proposes a technique based on ADS-B for making an error calculation of each sensor using business intelligence techniques in geographical area. Were as in our paper we are proposing to address the error estimation and subsequent error correction for more accurate maneuvering the actuator by properly correcting the errors in the measurement.

The Extended Kalman filter (EKF) based method to detect Global Positioning System (GPS) errors and machine learning methodology for Kalman filter parameter tuning with application to GPS error correction in vehicle positioning is discussed [4]. A neural network is trained on GPS trajectories to predict the current vehicle position. The authors proposed several methods for improving vehicle position estimation and position errors. The authors claim that the neural network can give slightly better results than Kalman filter. However in our paper we are expecting Kalman filter is enough for error correction as the vehicle to be controlled to be on the road with average to peek traffic condition.

Radar and Vision sensors for accurate object recognition and introduced the co-ordinate calibration algorithms between radar and vision images and perform sensor calibrating using data obtained from actual sensor [5]. The authors mentioned sensor fusion process for radar and vision for autonomous vehicles. The algorithm used for sensor fusion is easy to implement and used to detect obstacle of an autonomous vehicle. In our endeavor we are also expecting the similar results.

A method for error correction for Very High Frequency Omni Range (VOR) Azimuth is defined and tested. The value of these errors will be around ±5 and processed by BROADCOM BCM2836R used in Linux environment with Mathematica 10 with Wolfram language to realize Kalman filter has been discussed [6]. The aggregate error is reduced to around ±1. The azimuth error of VOR is reduced from 10units to 2units. The aircraft density is increased significantly with reduce in flight time and cost of operations with improvement in surrounding VOR area. In our efforts we are expecting slightly better results as we are proposing to use more advanced processor with better features.

The location of vehicle is studied in contrast to relative location methods and absolute location of autonomous land vehicle are studied [7]. A data fusion location algorithm based on Kalman filter and fusion algorithm is simulated. The simulation results show efficient reduction in location error. There are several general data fusion methods discussed and relative location and absolute location are analyzed. The fusion location algorithm based on Kalman filter is simulated with efficient reduction in location error and our efforts are also in similar to the above efforts.

Multisensory data fusion for navigation is to control an autonomous vehicle such as GPS, Digital Camera, Digital Compass, Laser Scanners and Ultrasound sensor to gather data from structured surroundings [8]. These sensors are interfaced with onboard vehicle controller and navigate a certain path on basis of robust multi sensors data fusion algorithm. The algorithm implemented in multisensory data fusion which enables autonomous movement of vehicle. The GPS and compass data are fused together to give smooth filtered output which are global and local perception systems. The local perception system helps in detecting obstacles and global perception system helps in tracking paths.

CONCLUSION

The above literature survey show that the research work carried out by the authors of the eight papers are in sequence with the current work and it is also found that we are using the latest hardware and software so that the expected results will be much more accurate and relevant. Consequently better analysis of the location and subsequent tracking can be accomplished and the error of sensor is detected using kalman filter.

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