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Efficient Road Transport System of Vehicles using Wireless Sensor Communication

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ABSTRACT: The aim is to achieve enough accuracy to enable in vehicle cooperative collision warning. Systems that provide warnings to drivers based on information about the motions of neighbouring vehicles obtained by wireless communications from those vehicles. Data is obtained while driving in urban environments including stops, intersection turns, U-turns, lane changes at both low and high speeds. Vehicle position estimation for intelligent vehicles requires not only highly accurate position information but reliable and continuous information provision as well. A low-cost Global Positioning System (GPS) receiver has widely been used for conventional automotive applications.

KEYWORDS: wireless communication, vehicle position, Global positioning system (GPS).

I. INTRODUCTION

Communication is based on dedicated short range communications (DSRC). The on-board Wi-wireless and GPS equipment has the advantage of being potentially inexpensive compared to the ranging sensors, like radar, required to provide 360° coverage. The importance of accuracy and integrity in a positioning system has increasingly been emphasized for intelligent transportation system (ITS) applications based on position information, including advanced driver-assistance systems, electronic toll collection, intersection collision warnings, and traffic control. Traffic management on road networks is an emerging research field in control engineering due to the strong demand to alleviate traffic congestion in urban areas. Interaction among vehicles frequently causes congestion as well as bottlenecks in road capacity. In dense traffic, waves of traffic density propagate backward as drivers try to keep safe distances through frequent acceleration and deceleration. The vehicle driving system regulates safe intervehicle distance under the bounded driving torque condition by predicting the preceding traffic. It also focuses on alleviating the effect of braking on the vehicles that follow, which helps jamming waves attenuate to in the traffic.

During the last decades, incessant efforts have been made to improve the efficiency of traffic control systems to meet ever-increasing traffic demands. This survey focuses on the control side and aims to highlight that the design philosophy for traffic control systems. It involves the wireless exchange of critical safety and operational data between moving vehicles and roadway infrastructure.

It is useful to resolve position error into longitudinal and lateral components, i.e., along and orthogonal to the lane centerline, respectively. The lateral position errors requirements turn out to be more stringent than the longitudinal error requirement. It is desirable that the standard deviation of the lateral position error stay within 50 cm. Speed errors are expected to stay within 2 m/s. The heading error limits are set by blind spot warning systems. If the heading error is

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greater than 5°, a vehicle that is behind and in the same lane may be incorrectly assumed to be behind and in the adjacent lane, i.e., in the blind spot.

II MEASUREMENT SYSTEM

Our GPS gives measurements for position, heading, and initial velocity. Under the best conditions, i.e., eight satellites or more with line of sight signals, the GPS error has a standard deviation of about 30 cm and no bias. However, when the number of satellites is seven or less due to buildings or trees, the errors are as large as 10 m.

The measurements directly drive the process model . This is used to predict the states of the system at time k based on all measurements till time $k-1$. This prediction is then combined with the GPS measurement in the "update" block to produce the estimate of the states at time k based on measurements up to time k. An IMM filter-based positioning algorithm that considers the variety of driving conditions in which a vehicle can be operated. To adapt to changing vehicle dynamic characteristics under various driving conditions, the MM set of the IMM filter includes both kinematic and dynamic vehicle models. While the kinematic vehicle model is appropriate for low speeds and small wheel slip driving conditions such as those in an intersection, the dynamic vehicle model is suitable for high speeds, such as experienced in normal traffic and highway conditions. The IMM filter weights the appropriate vehicle model according to the driving conditions using a stochastic process. Therefore, the IMM filter-based positioning system is able to provide better accurate positional information than can single model filter-based positioning algorithms under various driving conditions.

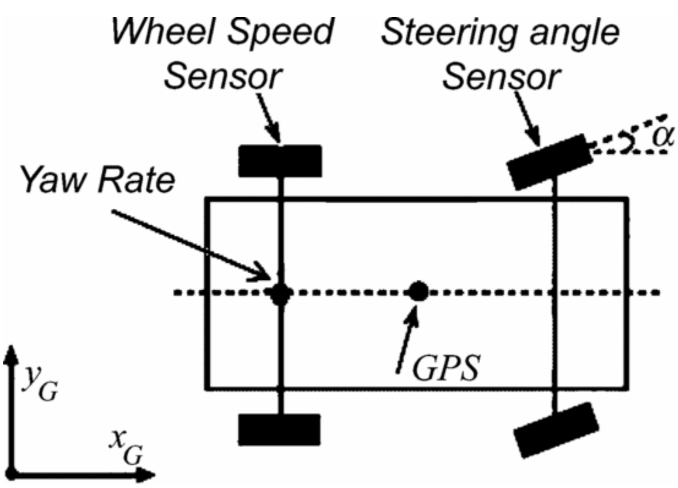

Fig. 1. Vehicle sensors and GPS on the car

III FILTERS

Filter is able to correctly discriminate the lane of the vehicle except in two kinds of conditions. If GPS is lost or goes bad for a long time (order of 10 s or more) the position errors become large enough to place the vehicle in the wrong lane. The exact duration of outage depends on factors like speed, number of lane changes, etc. The second kind of condition refers to bad GPS during a turn. If GPS is bad during a turn involving a large change of heading, such as a U-turn or an intersection turn, the filter is off on the heading at the end of the turn by a small amount (less than a degree). However, if the GPS remains bad or unavailable after the turn, this small heading error cannot be corrected. It is integrated by the process model eventually resulting in large position errors. The major problem is that it is very difficult to choose an optimal model for all driving conditions. Higher-order advanced vehicle models that can account for various driving conditions are not suitable for positioning systems because of the unobservability of some of the parameters and the heavy computing load in real-time embedded systems. To adapt the vehicle model for application under variable driving conditions, an innovation-based adaptive estimation technique such as an input estimation method and a variable state dimension approach is proposed.

IV LANE DIVISION

A low-cost GPS receiver that has widely been used for in-car navigation applications allows for the determination of global positioning and velocity estimates of a vehicle with a bounded error. However, although a GPS can provide absolute positional information, the measurement frequency is low and discontinuous. Furthermore, signals from a GPS are affected by the external environment. In contrast, vehicle motion sensors provide continuous measurements and are not affected by the external environment; however, they are prone to integral errors due to sensor drift. The complementary features of the two types of sensors permit the positioning systems to achieve increased update rates, accuracy, and integrity due to application of the information fusion algorithm. Current vehicle safety systems utilize inertial sensors to estimate vehicle sideslip. The vehicle sideslip is estimated by integrating a lateral accelerometer to obtain the lateral velocity. Note that vehicle sideslip is not observable from acceleration measurements alone, but this is the predominant method used to obtain sideslip in vehicle control systems. We are able to detect turns and lane changes with delays of the order of 100 ms. It is important to keep this delay small because this filter is a component of on-board safety systems (CCW). Driver reaction time of an unalerted driver is greater than 1 s. The system warns the driver within 500 ms or less to avoid the driver perceiving a threat before the system. 100 ms of the 500-ms delay budget is being consumed by the filter. Thus, the filter does not give too much weight to the GPS. It remains sensitive to the accurate and fast . At the same time, if GPS is good and there is a big difference between the position estimated by the filter and GPS measurement, we would like the filter to converge fast to the GPS measurement.

The time constant of the response to a GPS step is about 500 ms. Thus, the filter is responding in about 2.5 GPS sample times. It seems it would be hard to get faster while remaining sensitive for fast response to turns and lane changes. Thus, the filter cannot be tuned to do much better. Significantly enhanced performance would require significantly different design. A linear Kalman filter is proposed in order to accomplish the fusion task. The Kalman filter is proven to be effective when the process model of the system is known. For instance, the numerous examples of Kalman filter application in navigation where the state variables are position, velocity and acceleration.

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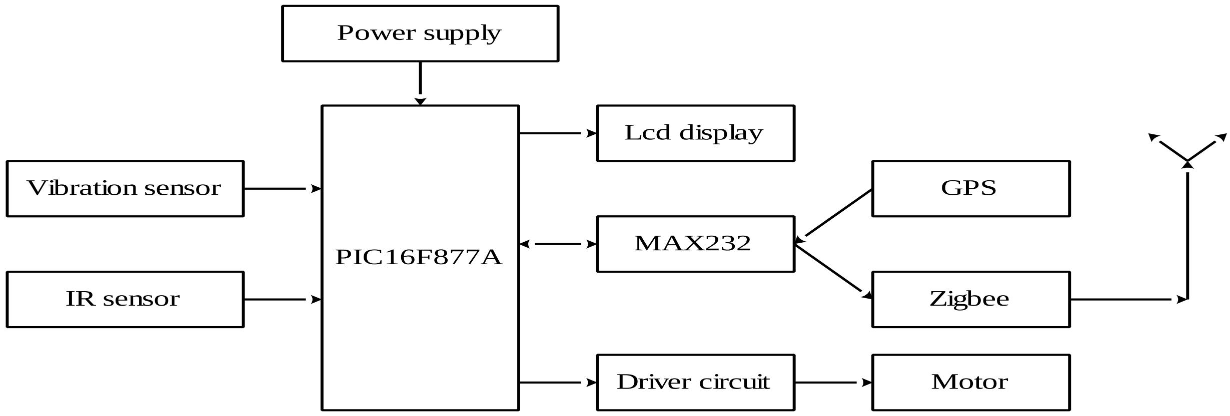

Fig 2 VEHICLE-1 SECTION

V SENSORS

Vibration Sensor is used to detect the accident occur in vehicle, if it is detected the accident information passed to other vehicle. IR_Sensor is used to detect the nearest vehicles, if it is detected the information will be displayed in LCD and speed will be reduced. GPS (Global Positioning System) is used extract the accident location of latitude and longitude through the satellites. The zigbee is used to transmit the GPS location of latitude and longitude to other vehicle. MAX232 is used to logic converter (RS232 <---> TTL or CMOS). GPS and Zigbee works based on RS232 logic (-v and +v), microcontroller works based on TTL logic (0 and 1). Driver circuit is used to drive the motor (vehicle motor) because the motor operated high voltage than microcontroller. Motor is electrical device controlled by microcontroller clock pulses, while nearest vehicle detected. if the speed is about 20 m/s when going straight and 10 m/s during the turn. Similarly, the curves for total position error show the dynamic model does better. During many tests the car just goes straight and there is a GPS .

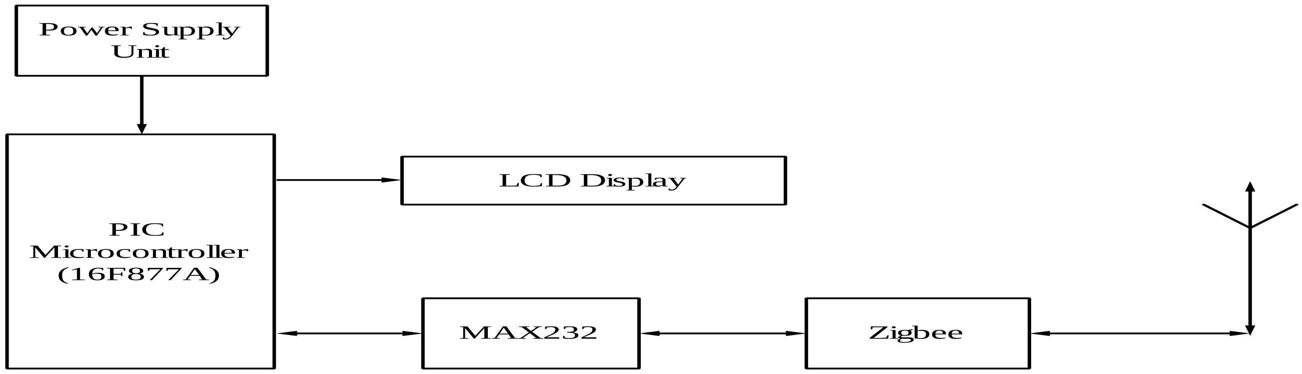

Fig 3 VEHICLE-2 SECTION

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The average number of satellites for this run is less than 5, which means average GPS position errors worse than 2–3 m. To see the misleading effect of bad GPS readings, consider the portion of time the car travels along the loop.GPS outage before and after 4 together with faulty observations at 4 mean the filter is essentially running open loop with bad initial conditions. This causes divergence from the true path and significant error. On reaching good GPS coverage, the filter removes the error using the GPS observations. The difference between the GPS measurement and the filter position output must also be taken into account. One can see the filter is stable. Thus, the filter time constant seems to be about 500 ms or about 2.5 GPS sample times. The filter appears to reduce error reasonably fast. GPS heading is very poor at low speeds and it appears completely random when the vehicle stops. The RFS runs are almost all with the vehicle traveling under 15 m/s. It starts and stops frequently.

VI .CONCLUSION

A real time position estimator, designed and implemented on cars. An extended Kalman filter integrated vehicle sensors including wheel speed, yaw rate gyro, and steering angle with DGPS observations. A dynamic bicycle model was used as the process model in order to enhance the performance at high speeds and during fast turns. Analyzed the performance of the filter using about 60 km of experimental tests carried out in environments with good and bad GPS coverage. The filter is designed to enable CCW systems. The data indicates it can meet CCW requirements in many but not all circumstances.

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