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SYSTEM FOR VEHICLE CLASSIFICATION, VEHICLE COUNTING AND SPEED MEASUREMENT

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Abstract – *The development of a sensor system for vehicle counting, classification, and speed measurement. Today vehicle classification applies to various new automatic real-time applications such as automatic toll collection, the planning of road construction and maintenance. The proposed system can make these traffic measurements reliably for traffic in the lane adjacent to the sensors. Vehicle classification is done based on the magnetic length and an estimate of the average vertical magnetic height of the vehicle. The developed sensing system is compact, portable, wireless, and inexpensive.*

***KeyWords*: Sensors, speed measurement, vehicle classification, vehicle detection.**

1. INTRODUCTION

Nowadays, the urban traffic became a big problem with the rapid increase of vehicle quantity, and it disturbs the normal life of urban residents and travellers [5]. Vehicle surveillance, including detection and classification, that provides real time traffic data for traffic light control system with the needs to optimize the spatial and temporal allocation of traffic resource [5]. And consequently, the performance of vehicle surveillance is significant to traffic light control, optimal traffic resource allocation and maintenance of the pavement system. Transportation agencies often use the results of Speed studies as the basis for important decisions such as enforcing speed violations, setting speed limits, and timing traffic signals, placing traffic signs, and determining the effectiveness of countermeasures [4] .Today an advance in VLSI technology allows an implementation of tiny magnetic sensor. Variation of Earth's magnetic field due to moving vehicles therefore can be measured and analysed vehicles different in size, height and structure can then be differentiated. Various magnetic sensors are under more attention because of their smaller sizes, easier Installation and maintenance, power efficiency, and high sensitivity [1]. Inductive loop detectors (ILDs) are a widespread technology used by many transportation agencies for vehicle detection and measurement of traffic flow rates. Single inductive Loops, by themselves, do not measure individual vehicle speed [4]. Vehicle detection and classification based on feature extraction from camera. An evaluation of three commercial camera based vehicle detection systems is presented in [2] under adverse weather conditions of snow, fog, and rain but performance of systems deteriorates under adverse weather, under snow conditions in both daytime and night time.

1.1 Need for vehicle classification, vehicle counting and speed measurement

Sensor node has advantages such as low costs, small size, wireless communication, high sensing accuracy, and can be deployed with great quantity [8]. Vehicle classification is useful in a number of applications, including road maintenance, emissions evaluation, multimode traffic model development, traffic control, traffic signal design, and toll systems development [13]. Road traffic safety refers to methods and measures for reducing the risk of a person using the road network for being killed or seriously injured. The users of a road include pedestrians, cyclists, motorists, and passengers of on-road public transport. Safe road design is now about providing a road environment which ensures vehicle speeds will be within the human tolerances for serious injury and death wherever conflict points exist.

2. Survey of work done

In 2008, S. Jeng and S. Ritchie studied real-time vehicle classification using inductive loop signature data present a method for vehicle identification based on analyzing the inductive signatures in the frequency domain instead of working in the time domain. Transform domain will be used for vehicle classification by means of a simple threshold-based method [13].

In the study of double-loop detectors done by Y.-K. Ki and D.-K. Baik [4], in 2006 are generally used for vehicular speed measurement a new model that uses an error-filtering algorithm to improve the accuracy of speed measurements. In the field tests, all percent errors of the vehicular speeds measured by the proposed model were within the error tolerance limit (±5%). Furthermore, the variance of percent errors was reduced.

In year 2010, S. Kaewkamnerd, J. Chinrungrueng, R. Pongthornseri, and S. Dumnin [1], introduced Vehicle classification based on magnetic sensor that is the system consists of a low power microprocessor together with AMR magnetic sensors and an RF transceiver. Vehicle classification tree based on above extraction features and it focuses on low computational feature extraction and

classification processes suitable for implementing on microcontroller.

In 2009, J. Lan and Y. Shi [5], introduced magnetic sensor fabricated with Microelectro-mechanical system (MEMS) technology is a apparatus for vehicle detection, because it is low cost, low power, small volume and light weight. In this vehicle detection and noise removal solution based on shorttime transform (STFT). Magnetic signals of typical vehicles are researched in order to extract features and recognize targets. To enhance the recognition speed, a technique of improved Support Vector Machine is used for recognition. The system and the algorithm have been used for detection and recognition of magnetic signals of vehicle targets in outdoor environment.

In May 2010, W. Zhang, G. Tan, H. Shi, and M. Lin [8] introduced real time vehicle surveillance, utilize the advances in wireless sensor networks to develop a magnetic signature and length estimation based vehicle classification methodology with binary proximity magnetic sensor networks and intelligent neuron classifier. In this algorithm, use of low cost and high sensitive magnetic sensors to measure the magnetic field distortion when vehicle crosses the sensors and detect vehicle via an adaptive threshold. The vehicle length is estimated with the geometrical characteristics of the proximity sensor networks, and finally identifies vehicle type from an intelligent neural network classifier.

In 2012, Y. He, Y. Du, and L. Sun [14], introduced new single-point magnetic sensor. Vehicle classification algorithm based on Clustering Support Vector Machines(C-SVM). Particle Swarm Optimization (PSO) is used to search the optimal kernel parameter and slack penalty parameter. It demonstrates that the vehicle classification method would be able to enhance efficiency of data mining, capability of machine learning and accuracy of vehicle classification [14].

In 2008, D. Nan, T. Guozhen, M. Honglian, L. Mingwen, and S. Yao [6], introduced Low-power vehicle speed estimation algorithm based on WSN. A three nodes model to capture the vehicle speed based on the two nodes detection model using the Magnetic sensitive signal with WSN. In the model, the Collecting Node A and B were mainly detected the vehicle and transmitted the detection information to the third node, the Detecting Node. The Detecting Node was the key node of the mode. The speed calculation and the command of the whole system were executed on it. [6].

3. CONCLUSIONS

A portable and low-cost sensing system based on sensors that can be placed adjacent to the road and be used for traffic counting, speed measurement, and vehicle classification in the lane adjacent to the sensors. A vehicle classification based on wireless magnetic sensor is proposed. The simplicity for feature extraction and classification is mainly focused while maintaining a highly classification accuracy.

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