Technological Developments in the Intelligent Transportation System (ITS)

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Abstract.

The background of this research is to want to know the technological developments that exist in the intelligent transportation system, by knowing the developments it will be able to add to the repertoire of research and deepen similar research. The method used in this research is to conduct a literature review, by reading many journals that can be the basis for this research, reading will be able to develop the problems that have been researched. The problem raised in this research is wanting to know technological developments in the smart transportation system and making one example of a system that will be developed in smart transportation. This research will produce technological technologies that can be developed in smart transportation systems, and provide examples of research that can be developed on smart transportation systems.

Keyword: *Technological, Intelligent, Transportation, System.*

I. INTRODUCTION

Intelligent Transportation System in Indonesian means intelligent transportation system. This system has the basic objective of creating a transportation system that has intelligence, so that it can help transportation users and transportation users to get information, simplify transactions, increase the capacity of transportation infrastructure and facilities, reduce congestion or queues, increase security and comfort, reduce environmental pollution, make it more efficient. transportation management[1].

The Intelligent Transportation System or commonly abbreviated as ITS in principle is the application of advanced technology in the fields of electronics, computers and telecommunications to make transportation infrastructure and facilities more informative, smooth, safe and comfortable as well as environmentally friendly[2].

ITS has been implemented in developed countries such as, the United States, Japan, Canada, South Korea and so on. Developing countries have also started to implement ITS on a limited scale, for example, an electronic toll bidding system and a traffic information system. Examples of several neighboring countries that have used toll collection systems are Malaysia and the Philippines[3].

Organizing ITS in developed countries is carried out jointly by the government, police, transportation operators and industry. Apart from policy issues, related industries support in terms of research and technology development. The industrial circles involved are generally from the automotive, electronics, computers, telecommunications, aviation, transportation and toll road industries. Because of this, ITS has become the prima donna and is considered the future of transportation[4].

The scope of ITS can be different in each country depending on the policies made. In principle, this system is an information system that guides the vehicle to get an optimal road route. In further development, this system is even expected to be able to help drivers control the vehicle so that it gets to its destination safely, comfortably and smoothly[5].

Advanced Traveler Information System is a terminology from ITS America, while ITS Japan develops a type of Advances Navigation System. The technology used is a digital map based on Geographic Information System (GIS), which is installed on the on board unit in a vehicle similar to a PDA (Personal Digital Assistant)[6].

The method used in this research is to conduct a literature review in order to add to this research and be able to find renewable problems for the basis of renewable research. This research produces a system proposal that can be used for a smart transportation system that can be applied to the current transportation system[7].

II. METHOD

Parallel control and management have been proposed as new mechanisms for performing complex system operations, especially those involving problems of technical complexity and social dimensions, such as transportation systems. Parallel control and management is a data-driven approach to modeling, analysis and decision making that takes into account the engineering and social complexities of the process. This paper summarizes our research and development efforts over the past decade in establishing new mechanisms for parallel parallel management of complex transport systems. These control and management mechanisms are the result of the integration and fusion of concepts and methods developed in AI, intelligent control, computational intelligence, smart systems, smart spaces, complex systems, complexity theory, social computing, CPSS, and advanced computing technologies, such as programmatic programming. and cloud computing. . We believe that it has opened up new fields in new directions that can significantly advance the level of effectiveness and intelligence of smart transportation systems and promote their future applications. However, more effort is needed in research and application before concepts and methods in ACP-based approaches, in particular, parallel systems approaches, including parallel control and parallel management, can become established, effective, and widely accepted in solving complex real-world problems. Clearly, the nature of many problems in transportation has made it ideal for testing, evaluating and implementing such concepts and methods. The main aim of this paper is to promote and solicit more broad discussions, investigations and practices in new and interdisciplinary directions in this ITS community[8].

The ITSUMO system is able to handle several aspects of traffic scenario simulation, such as driver behavior, traffic light coordination, traffic congestion prediction, and others. The ITSUMO system provides useful tools to simulate traffic conditions and to support urban planning tasks. We plan to extend ITSUMO to consider other types of information such as those related to weather forecasts and information providing via the internet and / or mobile phones[9].

The CV system creates new possibilities in the road transport sector. They promise to reduce greenhouse gas emissions and fuel consumption, improve safety and security, increase efficiency, mobility and accessibility; and fostering economic opportunities for high-tech clean-tech jobs and investment. The potential of CV has been recognized with the establishment of ambitious research programs around the world. In particular, radiospectrum has been allocated in North America, Europe, and Japan for special short-range communications to facilitate safety technology and applications for Intelligent Transport Systems[10].

Vehicle positioning has played an important role in the smart transportation system. A new sensor model was created to extend the sensor aperture, which is similar to a nested sensor model combined with a fourth order cumulant. The proposed algorithm estimates the number of vehicles, which is much higher than the actual number of sensors. The ideal characteristic equation based method is used to avoid the use of eigenvalues decomposition and spectrum peak searches, thereby greatly reducing computational complexity. In addition, a weighted coefficient matrix is introduced for optimization. The theoretical analysis and simulation show that the proposed algorithm has lower computational complexity, avoids 2-D parameter matching, and has high array utilization while still ensuring accurate parameter estimation[11].

Road speed limits contribute to driving safety, but when conditions are foggy or severe darkness they become less meaningful to drivers. To overcome these limitations, there is a need for an adaptive speed limit system to improve road safety under various driving conditions. The information needed to determine speed limits is captured via a roadside unit that collects environmental data and captures road images, which are then analyzed locally. The proposed analysis is carried out using two image processing algorithms, namely previous dark channel enhancement (DCP) and image entropy weighted (WIE), and a vector engine classifier (SVM) is used to generate real-time visibility indicators. The results obtained from an analysis of various sections of roadways in Canada, provided by the Ontario Ministry of Transport, show that the

proposed technique can produce a credible indicator of visibility to motorists. The analytical results corroborated by the wide field measurements confirm the superiority of the proposed system when compared to other visibility estimation methods such as conventional DCP and WIE, where the results of the proposed system show about 25% increase in accuracy over other techniques considered. In addition, the proposed DCP is approximately 26% faster than conventional DCP. The promising results obtained potentiate the integration of the proposed techniques in real-life scenarios[12].

A fast-moving research area, driven in part by rapid changes based on cyber-physical systems. It should be acknowledged that existing vehicle communication systems are vulnerable to privacy vulnerabilities that require addressing. The tactical challenge is that many vehicle communication applications and services take advantage of basic safety messages that contain vehicle identity, location and other personal data. A popular way of dealing with this privacy issue is to take advantage of a pseudonym change scheme to protect the identity and location of the vehicle. However, many such schemes suffer as costs grow and the difficulty of certificate management increases with the number of pseudonyms generated and stored, raising doubts about the economic viability of the approach. A decentralized blockchain-based solution for pseudonym management that overcomes this limitation. This scheme consists of a distribution of pseudonyms and random operation, which allows the reuse of existing pseudonyms for different vehicles. The results, reported here, indicate that the proposed scheme can reuse existing pseudonyms and achieve a better level of anonymity at a lower cost than existing schemes[13].

Intelligent Transport System (ITS) to improve safety and create traffic flow, simultaneously. This may increase the number of trips with the Colombo City Council (CMC) area. Colombo City Council (CMC) is the economy will improve through access. This is the influence of the business and residential areas that have negative social and environmental impact. These are the factors to consider at the Colombo Municipal Council (CMC) for an information trip[14].

ITS is basically a combination of developments in computing, information technology and telecommunications combined with expertise in the automotive and transportation sectors. ITS main developing technology is taken from mainstream developments in these sectors. Therefore ITS can be defined as the application of computing, information and communication technology for vehicle management and real-time networks that involve the movement of people and goods[15].

Systems and techniques to improve traffic prediction accuracy include a system of one or more computers that can be operated to receive requests related to traffic predictions, comparing the first prediction error for the first traffic prediction model (moving average) with the second prediction error for the second (average historical average) traffic prediction model, calculated using a historical data set selected from the previously recorded traffic data according to the day and time associated with the demand, select the use of the first model or the second prediction error comparison model, and provide the output for use in traffic prediction, where the output comes from applying the first traffic prediction model when the first prediction error is less than the second prediction error, and the output comes from applying the second traffic prediction model when the first prediction error is not less than the second prediction error[16].

ITS is a real-time, efficient and comprehensive transportation management system. Speed, vehicles and traffic are the main dynamic parameters of intelligent traffic detection information acquisition system, accurate knowledge of these parameters can make the traffic scheduling signal control effectively, thereby ensuring efficient circulation of the entire traffic system. At the same time, on time, accurately understand the speed, traffic volume, and vehicle traffic information for road traffic prediction to improve long-term planning from basic data, and have great guiding meaning. As part of ITS, the current traffic detection technology that is commonly used at home and abroad is for different test objects designed and used independently, if the system design can be integrated to detect each object, the unified use of communication engineering, engineering theoretical information in the RRs traffic detection technology and the two most combined data processing technologies, which not only reduces the complexity of traffic data detection, but also saves due to different object detection systems for construction and increases construction costs, is more conducive to increasing the application effect of smart transportation system. Guide this idea and propose a comprehensive traffic data detection system based on laser scanning data, can also run speed detection,

traffic detection and vehicle recognition modules, and process detected data, and build a database, realizing data acquisition and diversification of processing functions[17].

Two-wheeled vehicles, commonly called Segways, are a growing research topic, and the Line Tracer is a robot that can walk alone by reading predefined lines and lanes and balancing automatically based on changes and shifts in the balance point. This research aims to expand the research that has been done before, which combines a two-wheeled balancing robot and makes a two-wheeled robot that can run on its own using a Line Tracer. Segway is expected to produce a design that can run on its own (automatically) carrying goods without human assistance. In the previous research, the two-wheeled robot lego was successfully created using the Predictive Control Model using an inverted pendulum. Another Q-Learning study to make robots can learn how to solve a problem finding a route with the robot itself after some time learning through the same path. This research will be conducted by making a Segway design that uses a robot as the object of research. Lego NXT is a robot that is used as a Segway model, and will be given a color sensor that uses a PID controller for the testing process. The Lego NXT robot will be a model and an algorithm control test tool that will be examined. The PID control algorithm is programmed in high-level C language and has good performance for tracking stability. A color sensor is a device that can distinguish colors, in this case a color sensor is used to make the robot recognize the color of the path that has a color. The suitability of the control algorithm performance, color sensors and robot performance will be investigated in the framework of the Segway robot which uses the concept that runs on a track that has been provided and can run automatically without a driver. How to adjust the performance of two motors, each of which is owned by the two wheels, so that the motor can take turns balancing and making the place shift[18].

Information acquisition system detection, accurate knowledge of these parameters can make the traffic scheduling signal control effectively, thereby ensuring efficient circulation of the entire traffic system. At the same time, on time, accurately understand the speed, traffic volume, and vehicle traffic information for road traffic prediction to improve long-term planning from basic data, and have great guiding meaning. As part of ITS, the current traffic detection technology that is commonly used at home and abroad is for different test objects designed and used independently, if the system design can be integrated to detect each object, the unified use of communication engineering, engineering theoretical information in the RRs traffic detection technology and the two most combined data processing technologies, which not only reduces the complexity of traffic data detection, but also saves due to different object detection systems for construction and increases construction costs, is more conducive to increasing the application effect of smart transportation system. Guide this idea and propose a comprehensive traffic data detection system based on laser scanning data, can also run speed detection, traffic detection and vehicle recognition modules, and process detected data, and build a database, realizing data acquisition and diversification of processing functions. For this predictive information, drivers implicitly project future conditions based on historical (if they experienced it before) and current traffic information. Therefore, short-term prediction of traffic conditions is required for traffic management and tourist information systems[19].

Fig 1. Research Methods

Based on the picture above, the explanation will be given below:

1. Literature Review
In the first stage of this research using the literature review method by reading many journals and many books related to this research, with a lot of reading will strengthen the research raised.
2. Research
In the second stage of this research using research, by doing research it will be able to answer the research problems raised in this study, by conducting research you can also carry out the stages of research according to the direction of the research, so that this research is not biased.
3. Result
In the third stage, this research will produce data and system proposals that will answer the research problems raised, with this stage the research stage is finished.

III. RESULT AND DISCUTION

For system development, innovations made to ITS or Intelligent Transportation System Improve defense in an Intelligent Transportation System such as carrying out maintenance on the System (Maintenance) every time the vehicle is turned on. So that there is no data encroachment on the system, which one can find out the whereabouts of the rider. If that happens, it will be very dangerous for the rider which can cause unwanted things, therefore it is recommended that periodic system maintenance be held. How the system works can be seen from the following flowchart.

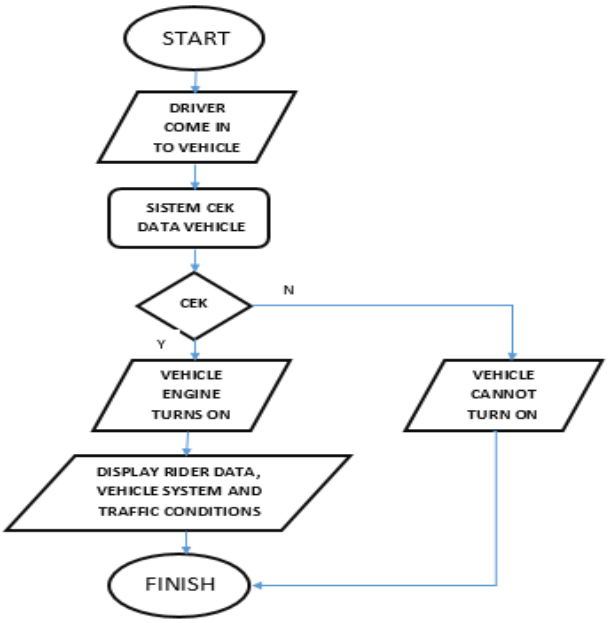

Fig 2. Flowchat

The flowchart above is one of the smart transportation systems which can be without a crew (driver), this system will work using Autosteer, Auto Lane Change, Automatic Emergency Steering and Side Collision Warning, as well as the Autopark feature. In the flowchart above, when the driver / driver enters the transportation vehicle, he will check the driver's data. If the data is registered, the vehicle engine will start, whereas if the driver's data is not registered, the vehicle will not start. Furthermore, if the vehicle's engine is running, it will display traffic conditions such as congestion points anywhere, looking for alternative routes and even the vehicle directly directs you without having to find any paths that are traversed.

Intelligent transportation systems and rapid development in recent years have become one of the effective ways of understanding traffic problems. Advanced information technology, computer technology has injected new vitality, data communication transmission technology and electronic recognition and application of automatic control technology for the further development of intelligent transportation systems, traffic information collection and detection technology in intelligent transportation systems to achieve

automatic detection, recognition and detection technology. tracking of moving vehicles is the most important part. To avoid things that are undesirable when driving smart transportation, the system that has been created must often carry out periodic maintenance.

IV. CONCLUTION

With the rapid socio-economic development, a comprehensive modern network of traffic has become an important index to evaluate the level of social development. At this time, an explosion began to form in China's traffic, which is a great convenience for people's daily life and travel, but also with the growth of traffic, also brings a lot of trouble and inconvenience. Vehicles moving in the intelligent transportation system from automatic detection and recognition technology to make some exploration and research, other advantages and disadvantages of vehicle detection technology and testing equipment with analysis and comparison, combined with the actual situation of current technology developments that provide a new way of detecting traffic, detection by laser scanning data analysis and processing for traffic information data. In view of the current domestic and foreign general traffic detection technology, and detection equipment is the basis for different test objects independently.

Designing and using the status quo, the integrated use of communication engineering, information theory and engineering, traffic detection technology in intelligent transportation systems is designed to achieve an integrated detection object acquisition system, namely a traffic information acquisition platform based on laser scanning data that can run concurrently,

set the timing of the vehicle speed detection function module, traffic flow statistics and vehicle type automatic recognition, processing and detected data, database creation at the same time, realizing multi-functional data acquisition and processing. This not only reduces the complexity of traffic data detection, but also saves construction because each corresponds to a different object in this paper, considering the current common laser detection equipment, laser detection technology than traditional detection systems and increasing construction costs, is more conducive to increase smart application effect transportation system.

REFERENCE

[1] G. Aisyah and P. Bestari, “Implementation E-Tilang in Bandung to Increase Awareness of Cross as Moral Law Passed Citizenship (Civic Virtue),” vol. 251, no. 22, pp. 664–667, 2018, doi: 10.2991/acec-18.2018.148.

[2] Arman Syah Putra, “Smart City : Ganjil Genap Solusi Atau Masalah Di Dki Jakarta,” ***J. IKRA-ITH Inform***., vol. 3, no. 129, pp. 1–10, 2019.

[3] H. M. Khudair, T. Alawsi, A. A. Aldergazly, and A. H. Majeed, “Design and implementation of aerial vehicle remote sensing and surveillance system, dehazing technique using modified dark channel prior,” *Adv. Sci. Technol. Eng. Syst.*, vol. 5, no. 5, pp. 1111–1117, 2020, doi: 10.25046/aj0505135.

[4] A. S. Putra, “Teknologi Informasi (IT) Sebagai Alat Syiar Budaya Islam Di Bumi Nusantara Indonesia,” *SINASIS (Seminar Nas. Sains)*, vol. 1, no. 1, pp. 567–573, 2020.

[5] A. S. Putra, “Penggabungan Wilayah Kota Bekasi Dan Kota Tangerang Ke Wilayah ibu kota DKI Jakarta Berdasarkan Undang-Undang Nomor 23 Pasal 32 Tahun 2019 Dapat Membantu Mewujudkan DKI Jakarta Menjadi Kota Pintar,” *Ipsikom*, vol. 7, no. 2, 2019.

[6] A. S. Putra, H. Leslie, H. Spits, and W. Budiharto, “Intelligent Vehicle Monitoring System (IVMS) for Counting Vehicles That Commit Violations with Internet of Think (IoT),” vol. 29, no. 7, pp. 2118–2126, 2020.

[7] A. S. Putra *et al.*, “Examine Relationship of Soft Skills, Hard Skills, Innovation and Performance: the Mediation Effect of Organizational Learning,” ***Int. J. Sci. Manag. Stud.***, vol. 3, no. 3, pp. 27–43, 2020, [Online]. Available: http://www.ijsmsjournal.org/2020/volume-3 issue-3/ijsms-v3i3p104.pdf.

[8] A. S. Putra and S. I. Pembangunan, “Analisa Dan Perancangan Sistem Tata Kelola Parkir Cerdas Di Kota Pintar Jakarta,” vol. 4, no. 3, pp. 13–21, 2020.

[9] A. S. Putra and F. R. Radita, “Paradigma Belajar Mengaji Secara Online Pada Masa Pandemic Coronavirus Disease 2019 (Covid-19) ى أ ْ ش ُ َ ف ه,” ***Mataazir J. Adm. dan Manaj. Pendidik.***, vol. 1, no. I, pp. 49–61, 2020.

[10] A. S. Putra and H. L. H. S. Warnars, “Intelligent Traffic Monitoring System (ITMS) for Smart City Based on IoT Monitoring,” *1st 2018 Indones. Assoc. Pattern Recognit. **Int. Conf. Ina.** 2018 - Proc.*, pp. 161–165, 2019, doi: 10.1109/INAPR.2018.8626855.

[11] A. S. Putra, H. L. H. S. Warnars, B. S. Abbas, A. Trisetyarso, W. Suparta, and C. H. Kang, "Gamification in the e-Learning Process for children with Attention Deficit Hyperactivity Disorder (ADHD)," *1st 2018 Indones. Assoc. Pattern Recognit.* ***Int. Conf. Ina.*** *2018 - Proc.*, pp. 182–185, 2019, doi: 10.1109/INAPR.2018.8627047.

[12] A. S. Putra, H. L. H. S. Warnars, F. L. Gaol, B. Soewito, and E. Abdurachman, "A Proposed surveillance model in an Intelligent Transportation System (ITS)," *1st 2018 Indones. Assoc. Pattern Recognit.* ***Int. Conf. Ina.*** *2018 - Proc.*, pp. 156–160, 2019, doi: 10.1109/INAPR.2018.8627013.

[13] A. S. Putra, H. Waruwu, M. Asbari, D. Novitasari, and A. Purwanto, "Leadership in the Innovation Era: Transactional or Transformational Style ?," ***Int. J. Soc. Manag. Stud.***, vol. 01, no. 01, pp. 89–96, 2021, doi: https://doi.org/10.5555/ijosmas.v1i1.10.

[14] K. Ravikanth, M. Swetha, K. Swathi, and T. A. Roseleena, "Video Surveillance System for Pedestrian and Vehicle Detection Using Convolutional Neural Networks," vol. 4, no. 1, pp. 25–27, 2020.

[15] R. J. Reisman, "Air traffic management blockchain infrastructure for security, authentication, and privacy," *AIAA Scitech 2019 Forum*, pp. 1–14, 2019, doi: 10.2514/6.2019-2203.

[16] S. Sathasivam, S. A. Alzaeemi, and M. Velavan, "Mean-field theory in hopfield neural network for doing 2 satisfiability logic programming," ***Int. J. Mod. Educ. Comput.*** *Sci.*, vol. 12, no. 4, pp. 27–39, 2020, doi: 10.5815/ijmecs.2020.04.03.

[17] D. Selvida and M. Zarlis, "Implementation process the design model business of e-ticket transportation bus in Medan," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 420, no. 1, 2018, doi: 10.1088/1757-899X/420/1/012134.

[18] T. Taleshian and S. Minagar, "Motion planning for an autonomous underwater vehicle," ***Conf. Proc.*** *2015 2nd Int. Conf. Knowledge-Based Eng. Innov. KBEI 2015*, pp. 285–290, 2016, doi: 10.1109/KBEI.2015.7436061.

[19] K. Wang, Z. Li, Q. Yao, W. Huang, and F. Y. Wang, "An automated vehicle counting system for traffic surveillance," *2007* ***IEEE Int. Conf. Veh. Electron. Safety, ICVES***, pp. 0–5, 2007, doi: 10.1109/ICVES.2007.4456360.