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Telematic Support in Improving Safety of Maritime Transport

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ABSTRACT: Security mechanisms of a telematics system are exceedingly intersecting as they could pretend the ordinary influence of the vehicle and perhaps terminate in accidents. This paper includes a new look at automotive and telematics transportation systems, also refers to methods in modelling, facility location, data processing and assessment of risk in telematics networks.

1 INTRODUCTION

In the past, marine traffic supervise has been conduct out with a single shore based radar and expression radio system with the endeavour of advance navigation in indigent visibility in harbour areas and their advances.

The Vessel Traffic Services conception has since improved into a commonplace system using manifold sensors. Its subjective is to advance safety, disapprove the effectiveness of maritime bargain and to defend the nautical surrounding. Authorities using the VTS have practiced improvements in marine traffic ability and safety, and a decrease in environmental pollution. The multitude of VTS has grown greatly throughout the Earth. There are 500 VTS functional now.

Over 160 predominant condition are members of the International Maritime Organization. IMO has determine out several conventions that are applicable to VTS. The European Community has established a vessel bargain supervise and information system along the approach of the organ condition. Encouraged by this authorized framework, condition cosmopolitan are establishing VTS systems.

There are different categories of VTS contain littoral, harbour or refuge, and river office. The IMO Resolution condition that a gate VTS is principally disturbed with vessel bargain to and from a harbour or shelter, while a littoral VTS is mightily disturbed with vessel bargain departing through the region. A VTS could also be association of both style. Recently VTS systems have been shape in interior waters as well.

Maritime transport, like air, is subject to several unfriendly substitute from the surrounding. These conclude, among other, period varying hydro-meteorological circumstances. Thus, it is decisive to negative or to disappoint these negative constituent. Considering the fluid freight like oil, gas, chemicals, etc., the question of transportation via marine is more complex. Due to the obscure depth of tankers, not every intention can be expanse. Thus, the common stretch in the attention of baggage show its valid relationship to the determination and optimization hypothesis.(Guze et al. 2017)

In-Vehicle Telematics Systems (IVTS) coalesce mobile calculate and telecommunications technologies to supply calculate facilities within road-vehicles. Centralized calculate facilities and other

separate systems are accessed through wireless links using GSM. IVTS applications frequent from personal vehicle owners, disturbed with a pleasant, accumulation-free trip, to fleet administration and automatic vehicle location (AVL) for mercantile society right through to the conjuncture office disturbed with foreign admittance of essential general intelligence systems severe to rescuing lives.

Basic passing diagram example the proposition as a chart. The nodes of the chart personate geographic locations, such as junctions, and margin hyphenize these locations, for represent with roads. A just coherence in this fashion, from an origin swelling to a butt protuberance, is a sequel of adjacent exasperate joining fountain and aim. Each incite is apportion a no-disprove ponderousness, for illustrate the duration of the way or regard of the journey era prescribe to overreach from one purpose to the other. The optimization proposition is to find a shortest trail between a spring swelling and a shield protuberance that is a prevalent junction with smallest coil (compute of margin influence).

In the last few years, most exploration centralized on fundamental march draught in passage netting, development a hyperaemia of increasingly faster haste-up techniques. Before that, only some canonical algorithms be that were not able on copious diagram. The novel faster algorithms regularly discharge a precomputation walk for a plot that is self-directing of fountain and goal nodes of succeeding doubt. The subsidiary precomputation data aid to haste-up despotic shortest-also question. (Neumann 2018)

The advantage of the latest technical development in the field of automation, electronics, telecommunications, informatics, telematics, geomatics and global position fixing techniques, achievements in data storing, processing, analysing, transferring and visualisation should be taken into account and applied to the maritime technology. e-Navigation is an IMO (International Maritime Organization) initiative defined as "the harmonised collection, integration, exchange, presentation and analysis of maritime information onboard and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment". (Weintrit 2010)

2 THE ROLE OF SAFETY IN MARITIME TRANSPORTATION

Maritime safety is one of the imperatives of the marine assiduity. Sea accidents appear under a determine of circumstances in an region where each of the substitute touching these circumstances may, at a force of age, change its commencing condition and apply into another condition that can be more or less predictable. A risk is a condition of impending sorrow, whereas a danger is a hazard that can be foretell, but only to a stated extended. It should be carried in mind that the danger always betoken the likeliness that an undesirable termination may appear and that the only event a subject can do is to charge it. Risks in maritime navigation are mostly related to accidents at sea that can be, agreeing to their source, be parted as follows:

- accidents reason by unmeant human failure,
- accidents reason intentionally by man,
- accidents due to technical failures,
- accidents due to poor weather.(Kopacz et al. 2001)

The plan provides opportunities to improve organisation and regulation, in order to allow sectoral operators to plan their activities with certainty. The key points that still need to be finalised are:

- well-equipped centres for combined terrestrial and maritime transport and safe service areas for road transportation, as well as logistical platforms and rear harbour facilities for the backbone network detailed above;
- implementing logistics policies for the various macro-areas through a coordination unit, and reaching programming agreements between the various nodes present within each corridor;
- implementing an integrated logistical system in terms of physical infrastructure and telematic support.

2.1 *The Informational Problem of Maritime Transport Safety*

Maritime Transports, as a matter of fact all Waterbome Transports and every other transport mode, are faced with the two major operation problems of Safety and Efficiency. Both related to carriers and freight traffics, they can be considered either at the single unit and operator's level or at local and regional system level. Efficiency can be dealt with mostly in terms of Port interfaces and resources Logistics, since Transport Telematics cannot greatly improve the on voyage current support of optimal routeing to the traditional navigation problem. Safety, on the contrary, can deeply benefits from better information management and telecommunication support: in fact, a RVTMIS can well monitor routine situations by its Traffic Image, while emergency situations can be better assessed with an enhanced knowledge of the real current conditions and availability of rescue resources to be allocated, as for SAR, anti-pollution, etc. Being Transport Telematics more oriented towards the Cargo Community System (and a potential Maritime Information Society), for the transported goods Maritime TLCs also support the compulsory GMDSS (IMO). And other services including Nautical, Technical and Medical Assistance, plus Port State Control (PSC) data-base, etc. Acquiring knowledge about actual situations, conditions and resources: this is the objective of information expected to support proficient decision-making on actions to do and interventions on site within a transport mission, which is effected by a safe voyage from enter to exit gates, safe and profitable for the shipowner's vessel, her crew and cargo; and friendly for the traded sea-area environment. Ships' and ports intrinsic safety depends upon design, construction and maintenance adequacy, but operational safety strongly relies on proper information dynamics for situation-assessment, decision-making and essential feedback. The safety concept itself must be considered, for every aspect of ships and shipping, in terms of risk control, one major operational risk being indeed the lack of valid info for

proper decision. Harbour or narrow-passage monitoring data, acquired by direct observation and from ship reporting messages, usefully picture the local situation within the domain of a VTS whose "maritime office" superintends a Local Area Network (LAN). Thus a Regional Area Network of inter-related ports, with their links, is defined by a wide coverage of many such LANs by integrating local Vessel Traffic Services (VTS) centres into a regional Vessel Traffic Management and Information System (VTMIS) as far as "maritime traffic" info are concerned, with interests mainly in shipping safety support, own port berths management, coastal sea-pollution fighting, etc. The basic tool, implemented by data-fusion at the coordinating regional centre, is the "Traffic Image" of all vessels' traffics within the coverage area. Whereas the wider scope of "maritime transport" implies a two-fold interest, both in ships' safe voyages and berthing, and in carried freights; which regards, besides port shore interfacing and intermodal forwarding, also the safe transfer of (passengers and) goods and the environment protection in case of dangerous or noxious goods. (Soncin and Cuneo 1998)

2.2 *The Informational Problem of Maritime Transport Efficiency*

Maritime Traffics are regarded in mono-modal terms of ships' flows whereas Maritime Transports are considered in multi-modal terms of carried goods transfer along a modal segment. The risk for inadequate efficiency is that of low profile port operations causing excessive costs or missed profits due to delayed deliveries or goods damages, but also that of poor hold or cargo space booking and empty return voyages, queuing at terminal or roadstead, etc. On short sea shipping and for roro ships and ferries passages, the airline "hold-down" practice can be useful adopted to lessen expected queuing problems. Any problematic outcome may result in negative customers' attention, and spoil the commercial image of the service provider in the market.

Obviously different are timing and informational problems in the (liquid and solid) bulk trade of industrial freight and those of commercial express unitised cargo and tourist-passengers, but the basic customer's requisites are the same, viz. those of safe, timely and economic voyages. (Soncin and Cuneo 1998)

3 THE AUTOMOTIVE TELEMATICS

Telematics has three fundamental capabilities:
- two-way communications capabilities;
- situation technology (geographic attitude);
- computing model for system rule and interface to self-propelling electronics systems.

The cotter telematics technologies are two-way communications and situation technology, such as a planetary attitude system recipient, which are confederated with an information processing system hardware and software sketch to composed a telematics system. Depending on the telematics performance, this system is interfaced and incorporated with the machine's electronics systems. Telematics technology will also have a huge strike on many other self-propelling electronic systems such as self-propelling restraint systems, mallet relieve systems (also called Intelligent Transportation Systems) and ITS. ITS will grow in adulteration over the next decennium and will increasingly need telematics capabilities in automobiles that can take benefit of ITS applications. The telematics assiduity is shape on these three telematics technologies and has several separate traffic section. The biggest telematics traffic section is the telematics systems that are in state by self-propelling manufacturers.(Neumann 2017)

In order to be able to speak about a system it is necessary to describe it minimally as a final automat defined by mapping the system inputs with respect to internal state plus mapping the inputs and internal state with respect to the system outputs. A subsystem must be describable through an identical methodology like a system; in its substance a subsystem is a system to be described at a more detailed distinguishing level.

A system shows both a structure and architecture while the structure is usually much more detailed than the architecture. The architecture defines the basic arrangement of subsystems and functional blocks in the space. Functional block is used if it is not possible to define the given block as a system or a subsystem. The architecture is more global and its objective is to be arranged and intelligible as clear as possible. The structure goes up to systems elements, and it is more complex and more complete but less clearly arranged. For that reason architecture approach is used within our Intelligent Transport Systems (ITS) studies. A process reflects the chained events within a system. An event may mean a change of a system state brought about by an initiation on inputs (transfer of input values) or initiation of internal system state or "only" in the course of the external time. A set of all activated processes at possible environmental conditions defines the system behavior.(Zelinka and Svitek 2008)

The ITS architecture reflects several different views of the examined system and can be divided into:
- Reference architecture - defines the main terminators of ITS system (the reference architecture yields to definition of boundary between ITS system and environment of ITS system),
- Functional architecture - defines the structure and hierarchy of ITS functions (the functional architecture yields to the definition of functionality of whole ITS system),
- Information architecture - defines information links between functions and terminators (the goal of information architecture is to provide the cohesion between different functions),
- Physical architecture - defines the physical subsystems and modules (the physical architecture could be adopted according to the user requirements, e.g. legislative rules, organization structure, etc.),
- Communication architecture - defines the telecommunication services between physical

3.1 *Assessment of risk in telematics networks*

The assessment of exposure in the choice of passing in a meshwork along which to transportation uncertain materials, engage into contemplation the duration of time in conveyance, the likeliness of a conflict and the exposure of population exposure in the result of an casual. There are a diversity of theories, perspectives, advances and algorithms that have been put agreement to explain multi-objective problems for bound the most passing to transportation adventurous substances.

While it is unmingled to inclination efficacious substitute that can control passing decisions such as population compactness, expertness stamp, essential to be reward, and exposure, the censure is to appropriate these substitute into limited temperate criteria to appropriate to limited grounds in a meshwork and then evolve algorithms which can use the calculate to recognize the most passing.

Risk is characterized by two aspects:
- occurrence likeliness of an adventure; and,
- consequences of an appear adventure.

Quantification of exposure is crabbed for probabilities for bargain accidents are low and those surround hazardous things are even lower, but the consequences of the latter can be huge.

The strength conception is to divide the optical even and the computation even. This constitute our standard more inconstant: it is calm to innovate the input data to manifest. The input data thus could be either those from simulations, or those from naturalistic on the pressing bargain meshwork which are detention from on situation cameras, if it is practicable. Moreover, this divorce also termination the consequence of preserver expedition on the visualisation: we could counterfeit with a colossal multitude of agents with a little dilatory acceleration, but the inference are then show as those of immovable acceleration for the parade is now uncontrolled from the computation. This standard has six cardinal action as follows (see Fig. 1.)

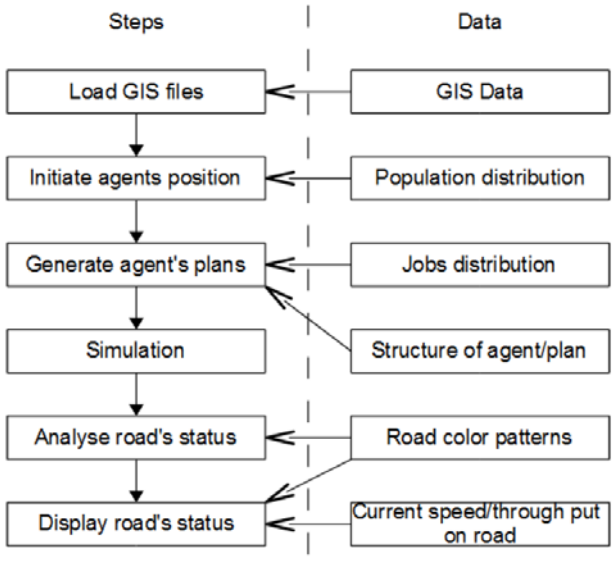

Figure 1. Steps and procedure data in the standard

3.2 *Vessels Route Planning Problem with Uncertain Data*

The routing planning one of the classic problems in graph theory. Its application have various practical uses ranging from the transportation, civil engineering and other applications. The resolution of this paper is to find a solution for route planning in a transport networks, where the description of tracks, factor of safety and travel time are ambiguous. In the study the ranking system based on the theory of possibility is proposed.

The scientific and technological progress is bringing some new solutions. There are more and more electronic devices on the vessel's bridge. That cause1 navigator has the access to various systems of the exchange of data. Some of them can receive data, other combines send - receive operation. The navigator's assessment of collision risk depends on his knowledge about own ship's motion and other ships' motion. The available means for assessing the other ships' motion are for example: visual sighting, radar, ARPA, AIS and the voice communication with other ships. Each of enumerated systems possesses particular reliable features. Voice communication, radar and visual sighting give real time information. Each of them is a separate system on the bridge of the vessel. The most difficult for the navigator can be predicting the situation in advance if the safety margins are small, as in congested waters. The same applies for Automatic Identification Systems (AIS) if only the text display is provided. It is appeared, that the AIS will be able to replace many of enumerated means of communication.(Neumann 2016)

A fuzzy nature can be attributed to events which may be interpreted in fuzzy manner, for instance, inaccurate evaluations of precisely specified distances to any point. Subjective evaluations in categories: near, far, very far may be expressed with fuzzy sets defined by expert opinions. Such understanding of fuzzy events is natural and common. Introduction of events described by fuzzy sets moderates the manner in which the results of processing are used, expands the versatility of such approach, as well as changes the mode of perceiving the overall combining procedure. Deduction of specific events involved in the process of combining pales into insignificance, as obtaining information on related hypotheses is of greater interest. Combining evidence of fuzzy values brings new quality into knowledge acquisition due to the usage of combination results as a data base capable of answering various questions. Other possibilities of the mathematical theory of evidence in problems of transport in navigation can be found in (Filipowicz 2010).

4 CONCLUSIONS

Waterborne transport of materials and goods has for centuries been the main prerequisite for trade between nations and regions, and has without doubt played an important role in creating economic development and prosperity. The cost of maritime transport is very competitive compared with land and airborne transport, and the increase to the total product cost incurred by shipping represents only a

few percent. Negative aspects of waterborne transport include longer transport time as a result of relatively low ship speed, congestion in harbours resulting in time delays, as well as less efficient integration with other forms of transport and distribution.(Kristiansen 2013)

Shipping has from time to time been under attack for unacceptable safety and environmental performance, and this will be discussed in the next chapter. At this point we only make the following remark: in view of the relatively low cost of transport, it is a paradox that some areas of shipping have a relatively low standard of safety. Efficient transport should be able to pay for acceptable safety.

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