Use of Maritime Decision Support System to Assess Risk

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ABSTRACT:

For just about few year the analysts and technologist of data framework have gathered and examined DSS networks that enable to settle on better business choice organizations using idea of an extemporaneous systems based framework. The DSS are intelligent systems based frameworks recommended to enable leaders to improve correspondences advancements, information and reports etc. This paper introduces a way to deal with break down the oceanic hazard, by evaluating progressively the hazard level of an individual ship, and in this way survey the security of sea transportation framework in the fleeting skyline. The paper describes different hazard elements and factors. The point of the approach is to encourage the programmed correlation of boats from the perspective of hazard. The paper utilizes a part of DSS networks for the group ships, which require a unique consideration. The paper exhibits a few business situations, where the way to deal with chance investigation can be connected. The paper shows the strength of maritime decision support system. Different types of maritime decision support system are described in paper. The best technique of maritime DSS to face the maritime hazard is also described deeply for future use in maritime DSS. The framework, architecture of maritime DSS is also described here.

KEY POINTS:

Decision support systems, maritime risk, maritime shipping, Techniques of maritime DSS, Hazard elements and factors

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1. INTRODUCTION

DATA frameworks analysts and technologist have assembled and examined choice emotionally supportive networks for just about 40 years, implying that the idea of an intuitive PC based framework that enables organizations to settle on better business choices. Choice emotionally supportive networks are made to enable individuals to settle on choices by giving access to data and investigation instruments. Choice emotionally supportive networks build up a class of PC based data frameworks including learning based frameworks that help basic leadership exercises. Settling on the correct choice in business is normally in view of the information quality and the capacity to look at. DSS are intelligent PC based frameworks and subsystems proposed to enable leaders to

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utilize correspondences advancements, information, reports, learning and models to finish choice process errands. Many organizations always download and investigate deals information, spending sheets and gauges and they refresh their procedure once they dissect and assess the present outcomes. Many potential responses are identified. Shipping has become so easier because of increasing technology methods. Global warming has also affected coastal, ecosystem and marine life as well. [19][20][22]

Choice help apparatuses are generally utilized as a part of a few fields, for example, operation arranging, transport, medication, back, ecological asset arranging and emergency administration at vital, strategic and operational levels [8][9][10].

The abroad sending is these days one of the key components of the worldwide exchange. Right now around 90% of load is conveyed via ocean. With the developing significance of the world seaborne exchange, the need to evaluate the hazard postured by ships shows up. The paper introduces a way to deal with break down the oceanic hazard, by evaluating progressively the hazard level of an individual ship,

and in this way survey the security of sea transportation framework in the fleeting skyline. The approach depends on a dynamic assessment of hazard, utilizing different hazard elements and factors. The point of the approach is to encourage the programmed correlation of boats from the perspective of hazard they posture. It can be utilized as a part of choice emotionally supportive networks to group ships, which require a unique consideration. The paper exhibits a few business situations, where the way to deal with chance investigation can be connected.

2. TYPES OF DECISION SUPPORT SYSTEMS

There are a number of decision support systems. These can be categorized into five types:

1. COMMUNICATIONS DRIVEN DSS

Supports more than one person working on a shared task. Many collaborators work together to come up with a series of decision to set in motion a solution or strategy. The most commons technology used to deploy the DSS is a web or a client server. In general, groupware, bulletin boards, audio and video conferencing are the primary technologies for communication driven decision support. It also helps doc officer to choose anti-collision ways. [23][24]

2. DATA DRIVEN DSS

model puts its emphasis on collected data that is then manipulated to fit the decision maker's needs. This data can be internal, external and in a variety of formats. This model emphasizes access to and manipulation of a time series of company data. Simple file systems accessed by query and retrieval tools provide the most elementary level of functionality. Most data driven DSSs are targeted at managers, staff and also product / service suppliers. It is used to query a database or data warehouse to seek specific answers for specific purposes. It is deployed via a main frame system, client server link or via web. [28]

3. DOCUMENT DRIVEN DSS

Document driven DSSs are more common, targeted at a broad base of user groups. The purpose of such a decision support system is to search web pages and find documents on a specific set of keywords or search terms. This model uses computer storage and processing technologies to provide document retrieval and analysis. A document driven DSS model uses documents such as text documents, spread sheets and database records to come up with decisions and manipulate the information to refine strategies. The usual technology used to set up such decision support systems are via web or a client / server system

1. KNOWLEDGE DRIVEN DSS

are a catch-all classification covering an expansive scope of frameworks covering clients inside the association setting it up, however may likewise incorporate others connecting with the association. It is basically used to give administration guidance or to pick items or administrations. It can propose or prescribe activities to directors. These DSS are individual PC frameworks with particular critical thinking aptitude.

The mastery comprises of learning about a specific area, comprehension of issues inside that space. The run of the mill arrangement innovation used to set up such frameworks could be customer/server frameworks, the web, or programming running on remain solitary PCs.

2. MODEL DRIVEN DSS

These are mind boggling structures that help analyze decisions or pick between different decisions. A model driven DSS underlines access to and control of cash related, headway or potentially reenactment models. Direct quantitative models give the most fundamental level of helpfulness. Show driven DSS use compelled data and parameters gave by boss to help pioneers in looking at a situation, however when all is said in done gigantic data bases are not required for show driven DSS. These are used by boss and staff people from a business, or people who connect with the relationship, for different purposes depending upon how the model is set up. These DSSs can be sent by methods for programming/gear in stay singular PCs, client/server systems or the web [1].

3. ARCHITECTURE

Choice emotionally supportive networks are not by any stretch of the imagination not quite the same as different frameworks and require a structure approach. The structure has tree fundamental levels innovation levels, individuals included and the formative approach. Innovation levels are separated into three levels of equipment and programming:

LEVEL 1 – PARTICULAR DSS,

particular DSS is the real application that will be utilized by the client. This is the piece of the application that enables the chief to settle on choices in a specific issue range. The client can follow up on that specific issue.

LEVEL 2 – DSS GENERATOR

DSS generator contains equipment and programming condition that enables individuals to effortlessly create particular DSS applications. This level puts forth utilization of defense apparatuses or frameworks.

LEVEL 3 – DSS APPARATUSES.

DSS apparatuses contain bring down level equipment and programming, DSS generators including exceptional dialects, work libraries and connecting modules [1].
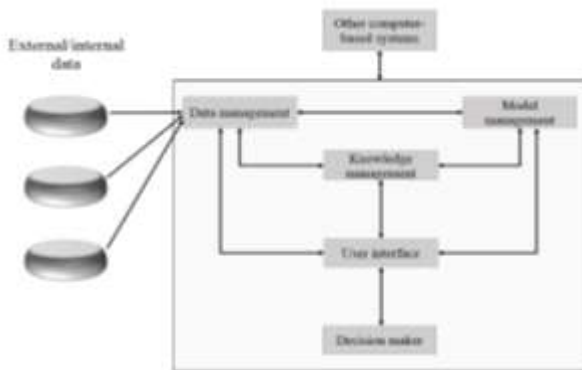

Fig 1: DSS components [2]

4. DSS IN MANUFACTURING:

Decision Support System supports many developed technological manufacturing application like Advanced Planning System (API) , Enterprise Resource Planning (EPI),manufacturing execution system (MES) and Business Intelligence (BI) are new trend and application which support DSS. Much new system was developed and technologies were adopted for changing consistency of environment. Mostly companies have to face problems in internal level data process system for transaction translation. In this case, decision support system helps to combine both human and computer to provide effective and efficient analytic data management and planning issues .DSS supports both structured and semi structure data to reduce deficiency of data. These process and methods are used for making decision for manufacturing progress. In addition these systems also help as to avoid problems and resolve them with better effective methodology.

Fig 2: Decision making process [2]

5. RISK ASSESSMENT IN MARITIME DOMAIN:

There are many literatures that define the concepts on risks that have faced in Maritime. Goerlandt and Monatewska [2015] described many definition about risks in maritime domain. In the classical approach risk assessment is consists on four basic steps

1. Definition:
2. Scenario:
3. Calculation of significances
4. Risk valuations

In this paper we discuss the basic threats and risks which can be found and who these risks can be solved by using different frameworks. In Maritime context, rational and symmetric scenarios are used to resolve risks issues. FSA (Formal safety assessment) is international standard institution which is responsible for ensuring and maintaining the safety and security of Maritime. FSA supports both rational and symmetric risk. FSA is based on five step by step procedures. [25][26][27]

IDENTIFICATION OF HAZARD-

In the first step its identify that what kind of aspect of shipping safety analysis and safety measurements is to know what risks mariners face in terms of hazards. Also identify all activity of shipping which includes ships category, functions and size.

RISK ANALYSIS:

In this step it understands the nature of things that what can be wrong with system and determined the chances and accepts of all risks models.

RISK CONTROL OPTIONS

Safety risk analysis is done to find which of all the available decisions can be nominated for practical purposes which voyage the important risks.

COST BENEFIT ASSESSMENT

In this step it analysis to understand how much cost will be estimated to resolve the risk and made an estimated risk control rank.

RECOMMENDATIONS FOR DECISION MAKING:

The final step of risk analysis to make final decision about the suitable solution to resolve the risks .experts analysis and decision are very useful for decision making.

6. RISK FACTORS

The threat, modeled by a given ship, depends on risks variables which work together to get level ship stances. Fours classifications are defined to group risk variables according to theirs types. .

6.1 STATIC RISK FACTOR:

Includes static factors of ship like size, Flag, age, owner, crew etc.

6.2 VOYAGE-RELATED RISK FACTOR:

Includes features of an definite ship's from seaports like type of cargo carried, departure port, destination port, destination country, departure country.

6.3 DYNAMIC RISK FACTOR:

Includes dynamic risks factors which can change during possible factors like loitering at high sea, ambiguous identification, close proximity, change of static parameters, meteo condition and missing AIS messages

6.4 HISTORY-RELATED SHIP FACTOR:

Included historical information such as visited ports , past accidents , port state control , past owners, past behavior anomalies .
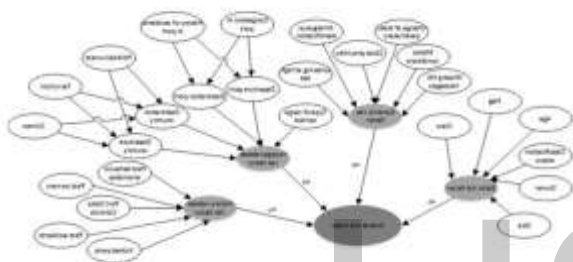

Fig 3: Risk variable and factors

6.5 SECURITY RISK FACTORS:

A lot of security issues are involved like theft, sabotage, terrorism attacks, surveillance system failure and arson. [21]

7. RISK ASSESSMENT

Using these above four risks factors, the estimated risk index can be found. The index is about potential threats get from ship. The risk index can be found getting the value from all four risks factors and calculated it on the base of weighted that can be adjusted according to required context:

$$\text{Overall Risk Index} = \sum_{i}^{N} wifi$$

N i=1 wi ≥ 1

wi N i=1 = 1

Where N indicated as number of risks factors, fi indicated as value of given risks factors and wi as weight.

8. DATA SOURCES

There are several open databases, which supply information related to ships and their features.

- Collection of data regarding ship's coincidences e.g. International Maritime Organization1
- Checkups and custodies of ships (Memorandum of Understanding of Paris2, Tokyo3 or Indian Ocean4),
- Ship's characteristics (e.g. IACS5, MarineTraffic6).

9. AUTOMATIC IDENTIFICATION SYSTEM (AIS)

Automatic identification systems are used for tracking ship which is installed in ship by VTS. Different information are tracked through state light such as speed, area, course can be monitor on screen. AIS integrate with standard VHF and different sensors are used for tracking, GPA also used to get information through sensor. it indicated data navigation, static data , voyage data and tracking.it also allow to maritime ship to monitor and control the traffic on ships on sea through state lights . AIS are used as one of the main data source in the maritime investigation.

Business Settings

The future process for approximation of the ship's danger index can be supportive or valuable for different stakeholders, employed in the maritime domain. The technique may be used in different situations and applied in decision support systems devoted for different sets of staffs. As a result, different business settings for operation of the future technique can be distinct.

Examples of the potential maritime users of DSS are:

- Maritime organization, taxes services, SAR and others concerned in a quick documentation of doubtful ships, which pretence a risk to the port security i.e. serious structure, permanence of stream etc. and should be examined.
- State powers want to know whether there happens any risk for supply of the key capitals to the state i.e. source of oil and gas.
- Sources of goods passed by a ship want to know whether the goods will be transported without disturbances and whether the ship is the safe mean.
- Receivers of goods accepted by a ship similarly to sources want to know what is the chance that the goods will be delivered without disturbances.
- Logistics corporations, which uses facilities of maritime transport companies built on the equal of threat stood by a ship, they can decide, which ships or transporters to select for cargo shipping.
- Ship workers concerned in execution a evaluation of danger modelled by their fleet of challengers and founded on that govern features of shipping service i.e. cargo and Ship's heads want to know about the risky ship nearby. [29][30]

 It needs to be stressed that for overhead revealed user, many risk qualities or risk issues can have different worth [3].

MARITIME RISK EXPLORATION

The ISO 3100 [5] standard for hazard organization portrays chance as the aftereffect of uncertainty on points. Two noteworthy points in the oceanic space are security and insurance, while hesitation normally imitates a nonappearance of the right data to help the leaders

decided. In this way, an imperative length of hazard organization in the oceanic space is to convey the arrangement of methodology and apparatuses that help and enhance the officers Situational Awareness Picture (SAP). To enhance the SAP, it can be considered into a numeral of challenges, from enhancing the gathering and communicate of data through the blend of information, to the conveyance of decided, estimate and esteem signs to help the leader's assurance. Many apparatuses have been arranged in the writing to give a framework level hazard picture.

Concealed Markov Models (HMMs) [7] are normal procedures [6] utilized as a part of this space trust on shrouded conditions to evaluated the changing parts of the framework level hazard picture. Well offer a genuine procedure for key hazard yet can be unequal in a vivacious situation while surveying framework level hazard. The interdependency starting with one model then onto the next ascending from the between reliance of properties, marks the framework steadiness powerless while testing a change in the circumstance. The cost to manage reality of enormous plans quiet of many brought together HMMs is extensive.

11. HAZARD IDENTIFICATION
11.1 DEFINITIONS

A hazard is characterized as a circumstance with a potential for making hurt human wellbeing, the earth, property or business. It might be a physical circumstance (e.g. a bus tanker is a hazard since it might slam into the creation establishment), a movement (e.g. crane operations are a hazard on the grounds that the heap may drop) or a material (e.g. fuel oil is a hazard since it may burst into flames). By and by, the expression "hazard" is regularly utilized for the mix of a physical circumstance with specific conditions that may prompt damage, e.g. a bus tanker impact, a dropped stack or a fuel oil fire. The substance of a hazard is that it has a potential for causing hurt, paying little respect to how likely or far-fetched such an event may be.

Hazard distinguishing proof (HAZID) is the way toward recognizing hazards, which shapes the fundamental initial step of a hazard appraisal. There are two conceivable purposes in recognizing hazards:

• To acquire a rundown of hazards for resulting assessment utilizing other hazard evaluation methods. This is here and there known as "disappointment case determination".

• To play out a subjective assessment of the essentialness of the hazards and the measures for lessening the dangers from them. This is now and then known as "hazard evaluation". Similar systems can be utilized for both, yet the accentuation and conclusions will be unique. 17

11.2 GENERAL APPROACH

Hazard ID is typically a subjective exercise construct fundamentally in light of master judgment. Most HAZID strategies include a gathering of specialists, since couple of people have ability on all hazards, and gathering connections will probably invigorate thought of hazards that even very much educated people may neglect.

Hazards are assorted, and a wide range of techniques are accessible for hazard ID. While a few techniques have turned out to be standard for specific applications (e.g. FMEA for counterweight framework disappointments), it isn't fundamental or alluring to indicate which approach ought to be embraced specifically cases. The system ought to be picked by the HAZID pioneer to meet the goals as productively as conceivable given the accessible data and aptitude. It might be a standard procedure, following a built up convention, an adjustment of one, or a mix of a few.

The accompanying highlights are basic in any HAZID:

• The HAZID ought to be imaginative, in order to energize recognizable proof of hazards not already considered.

• It should utilize an organized approach, so as to get far reaching scope of applicable hazards without skipping more subtle issue territories.

• It should influence utilization of mischance to understanding, where accessible, in order to catch the lessons from past mishaps.

• The extent of the HAZID ought to be plainly characterized, so as clarify which hazards ought to be incorporated and which have been rejected. For bunch based HAZIDs, (for example, HAZOP and SWIFT), the accompanying are likewise fundamental:

• They should draw on the mastery of individuals from various trains and foundations, incorporating pragmatic involvement in the action under examination where conceivable.

• The pioneer ought to be autonomous of the group (i.e. an outer expert, a hazard appraisal master or an accomplished pioneer from another office), and has the duty of avoiding "gather think" stifling innovative thoughts.

• Conclusions and proposals ought to be examined and recorded amid the gathering session, with the goal that they speak to the perspectives of the gathering as opposed to a person. CCPS (1992) gives point by point depictions of the different HAZID strategies utilized as a part of the procedure business. CMPT (1999) condenses HAZID strategies that are accessible for seaward establishments. Ambion (1997) outlines the HAZID strategies that are really utilized as a part of seaward wellbeing cases. The accompanying areas give a concise layout of the primary strategies appropriate for marine hazards on seaward.

11.3 HAZARD REVIEW

A hazard audit (otherwise called a hazard study or wellbeing survey) is a chiefly natural, subjective audit of an establishment to recognize the hazards that are available and to increase subjective comprehension of their hugeness. It is a standout amongst the most normally utilized HAZID methods for MODUs (Ambion 1997). A hazard audit should address issues, for example,

• Previous security appraisals - What is other individuals' evaluation of the hazards? For some sorts of establishment, past HAZIDs and hazard appraisals might be adequate give a diagram valuation for the hazards.

• Survey of past mischances - Have comparable establishments endured mishaps previously? This is one of the least demanding (and most often disregarded) methods for recognizing hazards. It gives a basic natural cautioning of the kinds of mishaps that may happen, in spite of the fact that it can't be exhaustive, particularly for new sorts of establishment. In any case, this is an imperative initial step, and guarantees that the lessons from past mischances are not neglected. A few controls in different businesses expect administrators to give 5-year mishap histories to their organizations, to support the hazard evaluation.

• Previous experience - If the establishment as of now exists, has it endured any close misses or working issues? Working staff are probably going to have thoughts on potential mishaps in view of their own understanding. Visual assessment of the establishment by may propose hazards, and this can be directed as a feature of a wellbeing review.

• Hazardous materials information - What hazardous materials will be taken care of on the establishment? The characteristic hazards of normal materials took care of seaward, for example, oil, gas, condensate, H_2S, diesel oil and so forth majorly affect the dangers of the establishment all in all.

• Guidelines and Codes of Practice - Does the establishment comply with great building practice and characterization rules? Codes of training for outline, operation and confirmation of seaward establishments incorporate lessons gained from past mishaps. Agreeing to these archives in this manner guarantees a typical level of wellbeing for a standard establishment. Nonetheless, in light of the fact that they are composed as aides for outline, operation or affirmation, these reports more often than not don't determine the hazards that each measure is expected to control, and thusly are hard to use for recognizing hazards.

12. PATTERNS AND FURTHER RESEARCH IN THE fiELD OF CHOICE HELP

Shrewd basic leadership is one of the ebb and flow subjects in this exploration field. The conceivable of enormous information and progressed artificial insight offers new dreams for curiosities on DSS and for decision creation as extra fair-minded and confirm based sharp outcomes. The social event, putting away and free utilization of information has no effect on decision creation [11]. A basic leadership process is productive when it achieves these attributes i.e. assortment, speed and volume in type of a premise of very much organized and investigated information. With reference to the said DSS applications in this paper, DSS innovative work will benefit from advance in enormous information bases, AI and human machine cooperation's [15].

a) Data-driven DSS will utilize constant access to bigger and better coordinated databases.

b) The multifaceted nature and authenticity of model-driven DSS will increment significantly.

c) Communication-driven DSS will have all the more continuous video correspondence bolster Choices made to streamline efficiency and effectiveness of assembling frameworks are coming to from the key level to strategic and operational generation booking and control. [27]

So as to explain such complex basic leadership and control issues by and by, more often than not an organizing of the question into sub-regions is done, with the goal that finally a system of operators is acknowledged, which is isolated both on a level plane and vertically [12]. Such operators may work generally self-ruling in light of their models and information bases or helpfully with human chiefs as recommender frameworks [16, 17]. To accomplish these targets the change of the examination, determination, anticipation and nature of the choices of helpful operators by techniques from the fields of model-based thinking, robotized basic leadership, machine learning, finding, information based configuration, arranging and booking, recommender frameworks are vital [18].

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