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DEVELOPMENT OF THE METHOD OF RESETTING THE KINETIC ENERGY ALONG THE GRADIENT IN THE EVENT OF AN INEVITABLE COLLISION

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A method of releasing kinetic energy in the event of an inevitable collision of vessels has been developed, which allows to minimize vessel damage and loss of cargo.

Formulation of the problem. The number of sea transportations is constantly increasing, which is the reason for the increase in accidents of sea transport. As statistics show, most accidents on sea transport occur due to the human factor. It is difficult for a person in a stressful situation to make the right decision due to the emotional factor and time constraints [1]. It is possible to reduce the influence of the human factor on control processes through the introduction of automated systems [2-5]. The most promising are automated systems with automatic control modules, which are able not only to solve the task, but also to solve it optimally.

The purpose of the study is to minimize damage to the vessel and loss of cargo in the event of an unavoidable collision with another vessel.

List of resolved issues: the method of resetting the kinetic energy of the collision along the gradient was developed; control is obtained, which ensures the reset of the kinetic energy of the collision along the gradient.

The essence of research. In fig. 1 shows the scheme of mutual approach of vessels.

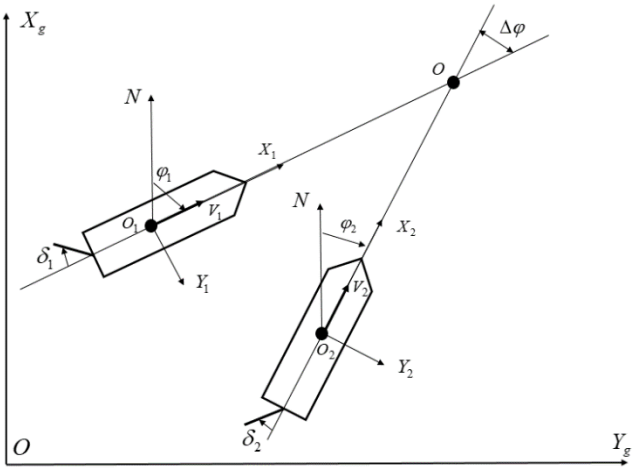

Figure 1. Scheme of mutual approach of vessels

The own ship O_1 moves on a course φ_1 with speed V_1, the target ship O_2 moves on a course φ_2 with speed V_2. Vessels move on courses that intersect at a point O and are at a distance

where collision cannot be avoided [6]. -The kinetic energy of the collision of ships can be written in the form

$$K = m\frac{\Delta V^2}{2} = \frac{m}{2}(V_1^2 - 2V_1V_2\cos(\varphi_1 - \varphi_2) + V_2^2) \quad (1)$$

The gradient of function (1) can be written in the form

$$\frac{dK}{dt} = \frac{\partial K}{\partial V_1}\frac{\partial V_1}{\partial t} + \frac{\partial K}{\partial \varphi_1}\frac{\partial \varphi_1}{\partial t} = <\mathbf{grad}K, \frac{d\mathbf{P}}{dt}>, \quad (2)$$

The maximum negative value $\frac{dK}{dt}$ will be in case

$$\frac{d\mathbf{P}}{dt} = -\mathbf{grad}K.$$

The components $\frac{\partial V_1}{\partial t}, \frac{\partial \varphi_1}{\partial t}$ of the second equation of system (2) are determined by the mathematical model of the own vessel

$$\begin{cases} \frac{\partial V_x}{\partial t} = f_1(\mathbf{X}, \Theta, \delta) = V_2\cos(\varphi_1 - \varphi_2) - V_1, \\ \frac{\partial \omega_z}{\partial t} = f_3(\mathbf{X}, \Theta, \delta) = \frac{1}{\Delta t}[-V_1V_2\sin(\varphi_1 - \varphi_2)]. \end{cases} \quad (3)$$

The solution of the nonlinear system (3) may not always exist due to the existing control constraints $|\Theta| \le \frac{\pi}{2}, |\delta| \le \delta^{\max}$. In this case, the kinetic energy is minimized within the permissible control area $|\Theta| \le \frac{\pi}{2}, |\delta| \le \delta^{\max}$, using a nonlinear optimization procedure with inequality-type constraints similar to the procedure fmincon(*) MATLAB.

Parameters of own vessel's state vector $\mathbf{X} = (V_x, V_{y,}\omega_z)$, used in the optimization procedure, can be measured by linear and angular speed sensors of own vessel, and the target motion parameters V_2, φ_2 can be estimated from radar measurements using Lewenberg or Kalman observation devices.

Conclusions. The issues of automatic control of the ship's movement in the event of an inevitable collision with the target in order to minimize damage are considered. In order to reduce damages in case of inevitable collision of ships, a method of resetting the kinetic energy of the collision along the gradient has been developed.

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LIGHTWEIGHT DISTRIBUTED DATA STORAGE FOR WEB-ORIENTED DATA CENTRIC APPS

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PROBLEM STATEMENT

The rapid growth of data generation and consumption by the surplus of web applications in contemporary society has accumulated vast quantities of personal data by a limited number of organizations. This market behavior pattern when companies voluntarily and forcibly and without alternatives provide their storage under a conditional freemium license has adverse implications for the community and the market. Because companies can provide nearly unlimited access to user information based on their license agreements, data breaches have become increasingly common, affecting the market's uneven development.

Similarly, the ownership of virtual user identity is predominantly in the hands of platforms and corporations instead of the individuals who create and consume the data. This lack of ownership and control over personal data has resulted in censorship and deliberate deletion of content, further exacerbating concerns about data privacy and ownership. Additionally, the created content is often unavailable to users, interfering with data reuse and collaboration.

KEY WAYS OF IMPLEMENTATION

General approach. Distributed data storage systems, which rely on a network of decentralized nodes to store and manage data, have emerged as a potential solution to these challenges. These systems allow for greater security and data privacy, as well as the ability for users to retain true ownership of their data. Instead of storing data on the network as blockchain does or using centralized storage, the Distributed Storage Unit (hereinafter DSU) approach is supposed to be used. In the broadest sense, DSU is a protocol and specification of a personal distributed web server for data storage, which allows separate applications and storage. In addition, this approach can guarantee that users will have control over produced data.

Data storage and data model. Different from the solution proposed by Ethereum, storing data on the blockchain can be expensive and inefficient due to the cost of gas fees and the limited amount of data that can be stored in each transaction. This report proposes to use multi-modal database approaches that use a combination of relational, vector, and document-oriented approaches in a single package, allowing for simple querying with a NewSQL-like language with support for multiple persistence layers with the possibility to be scaled horizontally. The proposed system must be schema-less by default and schema-full by ad hoc when the data model becomes well-defined. It is ACID-compliant, allowing for transactions across multiple tables, which emit events when data changes in real-time, making it possible to listen to updates from a web application. In general, the such storing system is a core of DSU.

Decentralized Network and Routing. using cryptographic hashes to identify and locate files in a content-addressed file system, which breaks files into fixed-size blocks linked in a Merkle DAG. Lazy loading allocates disk space for file shards, storing only accessed blocks and caching the rest. Kademlia, a routing protocol, organizes nodes based on distance and maintains an efficient routing table. The Content-Addressable Network comprises a distributed hash table for storing and