

вважаємо, що робота в цьому напрямку є перспективною та потребує подальших досліджень.

### СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ

1. Звіт з наукової роботи кафедри навігації і управління судном ДІ НУ «ОМА» за 2020 рік. URL: <https://dinuoma.com.ua/wp-content/uploads/2019/04/%D0%BA%D0%B0%D1%84%D0%B5%D0%B4%D1%80%D0%B0-%D0%9D%D1%96%D0%A3%D0%A1.pdf>

2. Звіт наукової діяльності Дунайського інституту Національного університету «Одеська морська академія» за 2021 рік. URL: [https://dinuoma.com.ua/wp-content/uploads/2022/09/zvit\\_z\\_nauky2021.pdf](https://dinuoma.com.ua/wp-content/uploads/2022/09/zvit_z_nauky2021.pdf)

3. Інформація про наукову та науково-технічну діяльність кафедри навігації і управління судном ДІ НУ «ОМА» за 2018 рік, URL: <https://dinuoma.com.ua/wpcontent/uploads/2019/04/%D0%BA%D0%B0%D1%84%D0%B5%D0%B4%D1%80%D0%B0-%D0%9D%D1%96%D0%A3%D0%A1.pdf>

4. Інформація про наукову та науково-технічну діяльність кафедри навігації і управління судном ДІ НУ «ОМА» за 2019 рік, URL: <https://dinuoma.com.ua/wpcontent/uploads/2019/04/%D0%BA%D0%B0%D1%84%D0%B5%D0%B4%D1%80%D0%B0-%D0%9D%D1%96%D0%A3%D0%A1.pdf>

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### **APPROACH TO CREATING THE AUTOMATED MONITORING SYSTEM FOR NAVIGATOR FATIGUE**

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**Introduction.** Every year, the European Maritime Safety Agency (EMSA) and others maritime safety societies publish their analytical publications of the accident

rate of vessels. According to these statistics, the overall accident rate of vessels decreases every year (Fig. 1) [1,2].

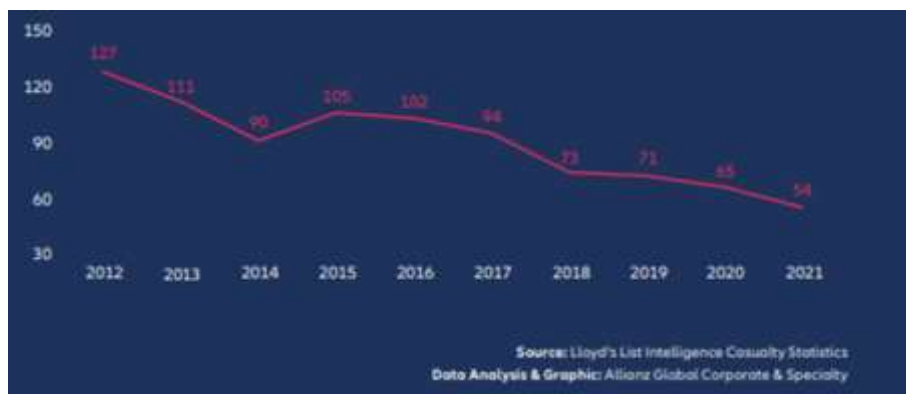


Figure1 – Allianz Global Safety and Shipping Review 2022

However, according to the same publications, it turns out that in percentage terms, the number of accidents due to human influence has increased from 53% at 2012 to 75% of cases in 2021. Therefore, the influence of the human factor is currently the main cause of vessel accidents. One of the most effective ways to reduce this negative impact is the automatization of work processes on the vessel [3]. However, due to many factors such as imperfection, instability and unreliability of equipment, breakdowns, wear and tear, the specifics of work, the high price of projects, etc., it is currently impossible to completely refuse the presence of a human. At the same time, partial automation of processes makes it possible to reduce crew quantity, which also creates problems in the safety of shipping due to fatigue, stress and detachment of the captain from the situation of the vessel during the watchkeeping by the mate.

**Main body of research.** Stress and fatigue are one of the most common factors affecting the condition of a navigator on watch. Various conventions, recommendations, management systems, etc. emphasize the importance of correctly perceiving these influencing factors and combating them [4]. However, despite all these recommendations and close monitoring of their implementation by the regulatory authorities from the side of the ship's flag and the port authority, no major changes

have been observed in this direction, and it does not seem possible to solve the problem of the impact of fatigue and stress using purely managerial decisions.

Various devices allow observing a person's psychophysiological parameters, as well as the quality and duration of sleep, but all of them do not give a comprehensive picture of a person's condition [5,6]. On some types of transport, equipment was invented and introduced that allows you to detect the operator falling asleep by the movements of the eyelids or by the pressure in the inner ear, but these technologies cannot be used on vessels due to the specifics of keeping a navigational watch and do not solve other problems related to the effect of fatigue and stress. The most common system used in the fleet to prevent falling asleep while wearing a navigation watch is the Bridge Navigation Watch Alarm System, abbreviated as BNWAS, which is several buttons randomly placed on the navigation bridge that the navigator on watch must press at certain time intervals, a timer and an alarm that works as the button will not be pressed in time. This system does not allow to determine the psychophysiological state of the watchman and the adequacy of his perception of the situation, but only gives a note of whether he is asleep or not, and therefore does not give any information to the captain about the correctness of decisions made and embodied by the navigator during independent watchkeeping and understanding when you need to step in and take control of the situation. Considering all of the above, there is currently no system for assessing human conditions that could be applied while keeping a navigational watch. Considering human conditions as a whole system, considering physiological, mental, emotional, psychological and psychophysiological manifestations, we will understand that each person, being in the same conditions, will react to them differently and therefore will have different manifestations of fatigue or stress [7]. Therefore, it is suggested to continue the study of the navigator's behavior during the navigation watch. Analyzing his mistakes considering the psychological portrait during the manifestation of physiological markers of excitement and decline. Based on the acquired knowledge, build an adaptive neural network for predicting the navigator's actions and monitoring system is proposed (Fig. 2).

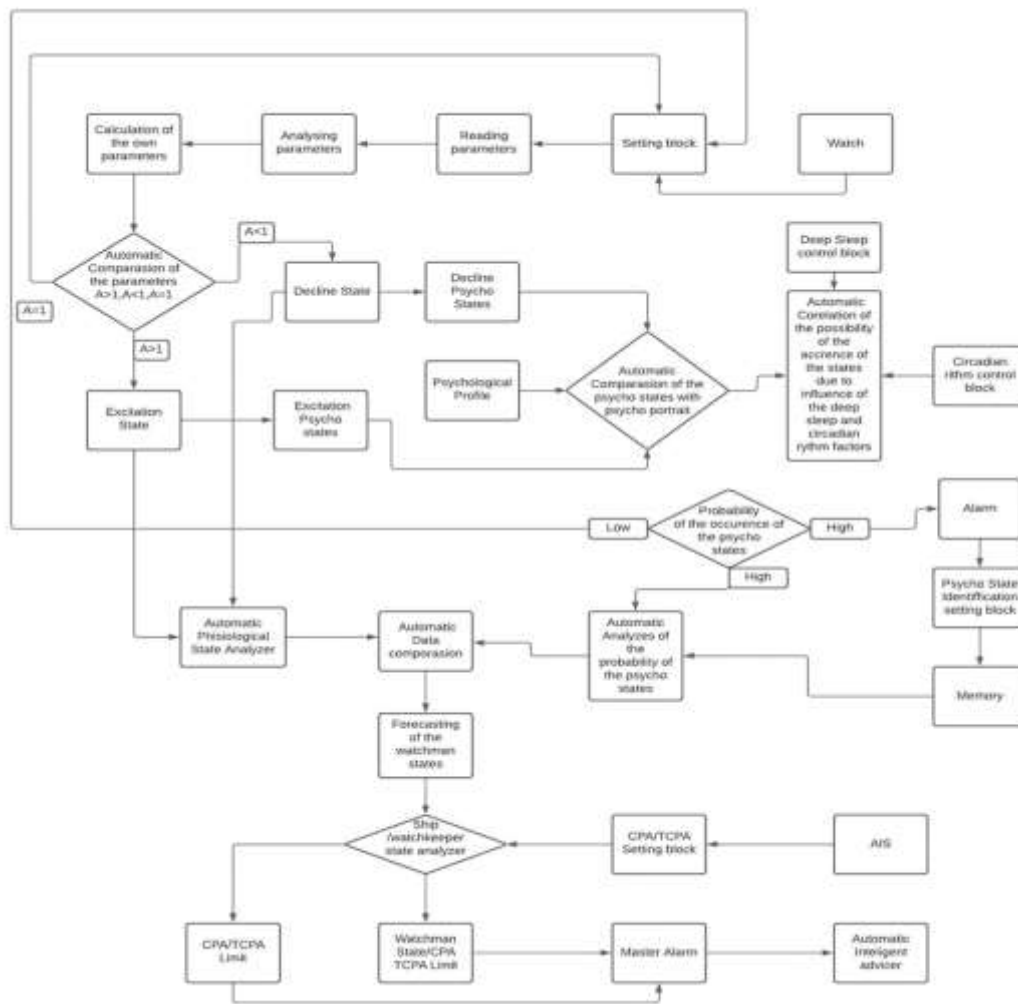


Figure 2 – Schematic diagram of the automated system for monitoring the navigator’s conditions with decision-making support

**Conclusion.** This structure is proposed based on the fact that the physiological manifestations of excitement and decline are universal for everyone and cannot help by themselves to identify the specific psychological state of a person, and therefore understand the logic of his actions and prevent mistakes, but always indicate the manifestation of a psychological reaction to the situation which is not universal, so can be predicted considering the psychological portrait. And this, in turn, gives knowledge, considering that the possibility of avoiding dangerous situations due to negative manifestations of the human factor increases significantly. The development of an automated real-time monitoring system for navigator fatigue will improve the safety of navigation in modern conditions.

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