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Keynote Speech Title: New Era and Technology Trends on Maritime Autonomous Surface Ships

Biography:

Dr. Ismail Bayezit joined the Samsung in 2023 as a Principal Technology Expert of Autonomous Ship Research Center at Daejeon, Korea. His main responsibilities include the establishment of the autopilot system for the SAMSUNG Autonomous Ship (SAS) System, contributing the model-based design culture within SHI in order to create better validation/verification environment, outreaching the potential fellow ecosystems to collaborate for developing autonomous systems and technologies.

Prof. Ismail Bayezit is a double-major graduate of Electronics and Control Engineering programs of Istanbul Technical University (ITU), Turkiye and received his Ph.D. in Mechanical and Mechatronics Engineering in 2014 from the University of Waterloo, Canada. He has worked as the professor and the department vice chair at the Aeronautics Engineering of ITU in between 2014 and 2023. Additionally, he did academic consulting to many engineering companies in Turkiye and international level focused on advanced and autonomous vehicle solutions. His professional and industrial expertise is mainly on high-fidelity modeling and autonomous control of advanced vehicles, mainly including marine and aerospace applications.

Ismail is a well-known expert on MASS, Intelligent Vehicles (IV) and Advanced Autonomous and Collaborative Vehicle Technologies. He has had a professional career of over 14 years contributing to various aspects of autonomous vehicle systems, as a researcher, educator, and industrial product developer through his service to the IV community. He has been author of more than 50 publications which have had over 500 citations. He is the member of IEEE Control Systems, Robotics and Automation, and Oceanic Engineering societies.

The Design and Development of Fully Autonomous Unmanned Surface Ship Technology: A Case Study on Samsung Autonomous Ship

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Abstract: This abstract outlines the creation of the Shift-Auto, a completely autonomous vessel designed by Samsung Heavy Industries (SHI). SHI is a leading entity in the advancement of intelligent and digital solutions for maritime vessels. Since 2019, SHI has engaged in the advancement of Autonomous and Smart Ship technologies. Samsung developed and tested many autonomous missions with small ships and big ships retrofitted with marine grade sensors and processors in compliance with COLREG regulations. In October 2020, SHI successfully converted the 38-meter Samsung T-8 Tugboat integrated with the Samsung Autonomous Ship system. The tugboat subsequently undertook a voyage of approximately 70 kilometers around Geoje Island without any support from the onboard crew. SHI is presently constructing the development and research on 12-meter fully autonomous sea shuttle called Shift-Auto, as illustrated in Figure 1. The inaugural iteration of the Shift-Auto catamaran is regarded as the primary testbed for proving our proprietary autonomous vessel technology aimed at enhancing large commerce ships. Initially, Shift-Auto is employed to evaluate ship autonomy by verifying waypoint navigation, trajectory tracking, collision avoidance, autonomous berthing and unberthing, and auto-mooring functionalities.



Figure 1. SHIFT-AUTO – Fully Autonomous Ship Test Laboratory

The evolution of autonomous navigation technology is important in improving the safety, efficiency, and sustainability of big merchant vessel operations. Vessels equipped with sophisticated navigational assistance systems can mitigate human error, a major contributor to

maritime accidents, and enhance operational efficiency through accurate decision-making. The intricate nature of maritime navigation, characterized by fluctuating environmental conditions, diverse traffic situations, and the necessity for instantaneous decision-making, poses significant problems. Navigating a vessel necessitates a profound comprehension of maritime laws and regulations, as well as the capacity to interpret and adapt to swiftly changing conditions, a responsibility often undertaken by extensively trained specialists.

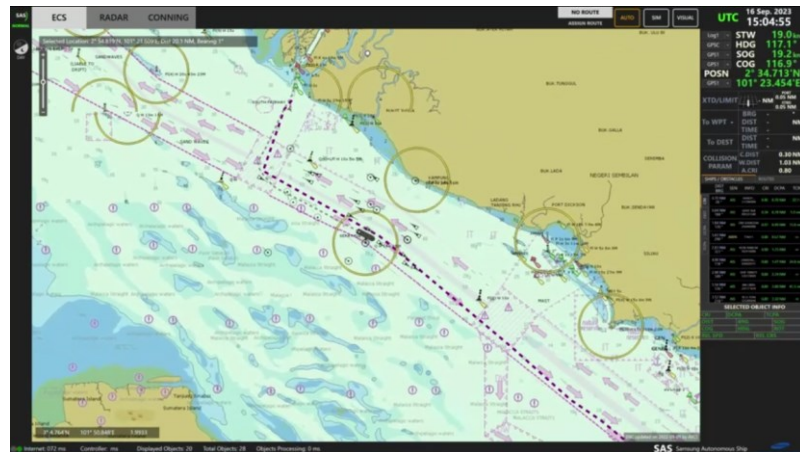


Figure 2. SAS Scenario-based Simulation using a recorded ship data

Samsung Autonomous Ship (SAS) system, an advanced autonomous navigation system created by Samsung Heavy Industries R&D, is engineered to address difficulties connected to environmental disturbances and maritime traffic as given in Figure 2. SAS incorporates modern technologies including ENC chart handling, sensor fusion, and real-time data processing to establish a comprehensive perception and decision-making framework. Although now limited awareness exists among shipping corporations, autonomous vessel technology and associated navigation support systems are expected to achieve considerable momentum in the maritime sector in the imminent future. The execution of our primary digital technologies is essential for attaining complete ship autonomy, while also offering an interface that is pivotal in the development, certification, and subsequent commercialization of our autonomous ship technologies.

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Keywords: Shift-Auto, Samsung Autonomous Ship, SAS, Autonomous Navigation, Control System Design, Collision Avoidance, Autonomous Berthing, Auto-Mooring