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Editorial: Unmanned marine vehicles for ocean observation

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Editorial on the Research Topic
Unmanned marine vehicles for ocean observation

With the growing need for ocean observation in extreme environments like the deep sea and polar regions, unmanned marine vehicles, including unmanned surface vehicles (USVs) and unmanned underwater vehicles (UUVs), play a crucial role in monitoring our oceans to safeguard our precious natural resources. Leveraging unmanned marine vehicles for ocean observations offers numerous advantages over traditional methods and can greatly enhance the quantity and quality of data collected across various oceanographic disciplines. This Research Topic aims to showcase recent advancements and future implications of unmanned marine vehicle technology for ocean observation, encompassing areas such as sensing, control, navigation, and communication of these vehicles.

Comprising 5 original research papers authored by 28 contributors, this Research Topic delves into some of the key challenges surrounding the operation of unmanned marine vehicles in the realm of ocean observation, including planning, navigation, visual perception, and underwater manipulation. Collectively, these studies offer valuable insights into the most complex aspects of unmanned marine vehicles and ocean observation. In this summary, we present the key findings from the 5 research papers featured in this Research Topic.

Babiarz et al. designed a five degrees of freedom (5DoF) underwater manipulator system for underwater vehicles, that imitates the movements of the human arm based on signals from IMU sensors. Compared to the control of a manipulator using keyboards or joysticks, the developed control system significantly facilitated the manipulation process.

Wang et al. proposed a U-shaped generative adversarial network with multi-scale and an attention mechanism for image feature extraction. Multi-scale dilated convolution modules, novel attention modules, and residual modules were introduced in the proposed network, to address degraded underwater images caused by due light absorption and scattering for better quality and visual effects.

Mei et al. presented a coarse-to-fine localization method (CFLM) to achieve accurate acoustic localization in underwater wireless sensor networks (UWSNs). They reformulated

the localization problem into an alternating non-negative constrained least squares (ANCLS) framework and then solved it by combining constrained ellipse fitting and Taylor series expansion.

Chen et al. developed a terrain-aided navigation (TAN) system for underwater vehicles. This TAN system used a multi-beam echosounder to measure the bathymetry of the seabed in real time and estimated the position of the vehicle using a Markov random field model, considering the strong correlation between the terrain data. The accuracy of the designed TAN system was tested using the playback experiments.

Wang et al. described calibration and planning strategies based on error models and acoustic positioning, to yield accurate navigational results in underwater full-coverage scanning scenarios where stealth is considered. Especially, a path planning method using a traceless Kalman filter and acoustic localization is proposed to achieve full-area coverage of AUVs.

The Guest Associate Editors express their gratitude to all the authors and reviewers for their hard work on this Research Topic. We are hopeful that this will serve as a catalyst for future research in unmanned marine vehicles for ocean observation missions.

Author contributions

SP: Supervision, Writing – review & editing. YL: Supervision, Writing – review & editing. LX: Writing – review & editing. FR: Writing – original draft. TM: Writing – original draft.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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