A SURVEILLANCE VEHICLE FOR PERFORMING SURVEY IN A MARINE ENVIRONMENT

IITM Technology Available for Licensing

Problem Statement

- In bathymetric survey, a depth with reference to Mean Sea Level (MSL) or Chart Datum (CD) of a water body is measured and underwater features of a water body are mapped for preparation of a bathymetric map.
- Due to bulky size of conventional survey lounges, marine surveillance in close grid lines is not possible by survey lounges.
- Conventional survey lounge utilizes hydrographic sensors, connected to an onboard computer preloaded with a proprietary software tool, for collecting data associated with marine surveillance. Transferring the data manually from a survey lounge to a station involves high cost, more time, and human effort.
- Moreover, conventional survey lounges use fossil fuels that pollute the environment, while requiring human intervention for navigation and control.
- There is a need for a marine Unmanned Autonomous Survey vehicle (UASV) that is capable of real-time transmission of data to remote stations while being capable of autonomous operation using renewable energy

Figure: The Unmanned Autonomous Survey Vehicle (UASV) in operation at Kamarajar Port Ltd (KPL), Chennai, India

Intellectual Property

- IITM IDF Ref 2266
- **IN 543627 Patent Granted**

TRL (Technology Readiness Level)

TRL 6 Technology demonstrated in relevant environment

Technology Category/ Market

Category- Robotics & Automation

Industry Classification:

- **NIC(2008)-72-** Scientific research and development**; 2829-** Manufacture of other special-purpose machinery**; 26515 –** Manufacture of radar equipment, GPS devices ,search ,detection ,navigation ,aeronautical and nautical equipment **;30112-** Building of warships and scientific investigation ships.

Applications:

Bathymetric surveys, Marine surveillance, Survey of water bodies such as reservoirs.

Market report:

Global autonomous marine vehicle market was valued at USD 2.9 Billion in 2023 and is projected to grow to USD 8 Billion by 2032 with a CAGR of 12%.

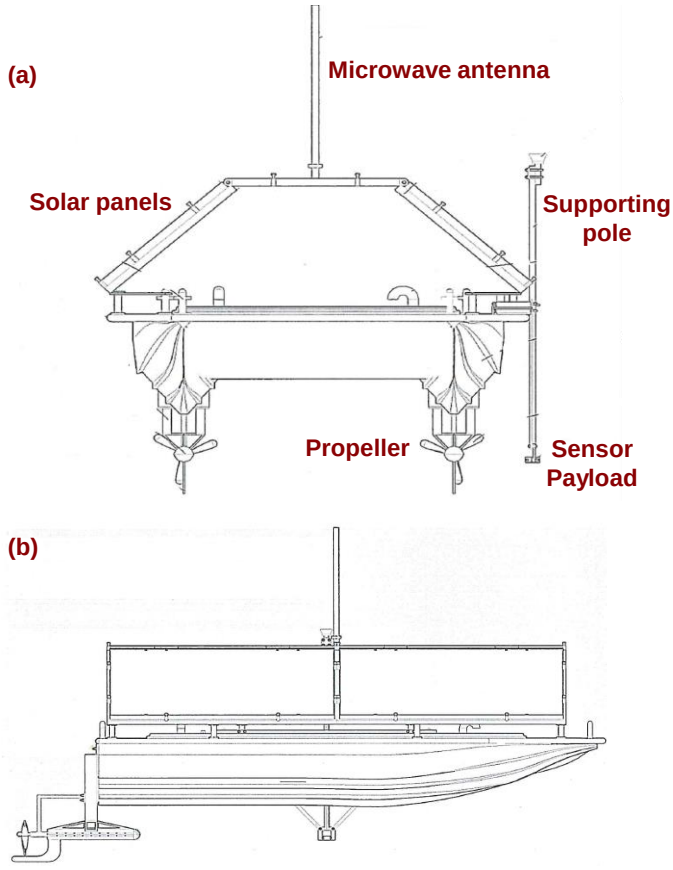

Figure: (a) front-view of the UASV **(b)** side-view of the UASV

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Figure: Autonomous Survey data collected by the UASV at Chettinad Jetty, KPL,Chennai, India

Figure: Obstacle avoidance tests carried out at Netaji Subhash Chandra Bose Dock (NSD) Kolkata

Technology

- The UASV comprises of sensors for surveillance of marine environments and a communication system to transmit data such as parameters and health data of the vehicle in real time to a remote station
- Sensors comprise echo sounder, multi beam apparatus, water current meter, Acoustic Doppler Current Profiler (ADCP), Conductivity, Temperature and Depth (CTD) sensor, a side scan Sound Navigation and Ranging (SONAR), a submerged density meter, a sound velocity sensor, a weather station, a distance sensor, a camera, a sound velocity meter, a motion sensor, and a Global Navigation Satellite System (GNSS) receiver.
- The electric power is stored in battery units through one or more of photovoltaic panels, an Alternating Current (AC) power source, and a Direct Current (DC) bus panel.
- The electric propulsion system provides thrust force to the surveillance vehicle in a controlled manner. the surveillance vehicle is operated in one of a differential steering mode, an azimuth steering mode, and an azimuth differential steering mode through a multiphase electric drive controller, a navigation controller, and a centralized controller.
- **The navigation module is configured to detect presence of an obstacle in the pre-defined trajectory to be followed by the surveillance vehicle, determine, using a distance sensor, a distance relative direction between the surveillance vehicle and the obstacle through a collision avoidance and annunciation system, and alter the pre-defined trajectory**
- **The distance sensor is one or more of a Light Detection and Ranging (LiDAR) sensor and a Radio Detection and Ranging (RADAR) sensor interfaced to collision avoidance and annunciation system.**
- The communication system transmits near real-time post processed data by acquiring nearby tide in form of tide data from an Automatic Tide Gauge (ATG) using Message Queuing Telemetry Transport (MQTT) and File Transfer Protocol (FTP) through the Smart Telemetry System (STS).

Key Features / Value Proposition

- The invented UASV has been successfully demonstrated in all three modes of operation suitably for the hydrographic requirements of major Indian ports such as KPL, Chennai and SMP Kolkata.
- Conventional systems have time consuming data processing systems. Whereas, the edge computing in the invented UASV enables near real-time post processing by acquiring nearby tide the Tide data from the Automatic Tide Gauge (ATG) using MQTT, FTP to compensate the motion data to the acquired depth by the echo sounder. This enables the possibility to make quick and reliable decisions during studies such as dredging estimates without much survey effort.
- Compared to fossil fuel based conventional systems the invented UASV uses clean solar energy to power its operations.
- The invented UASV with inbuilt obstacle avoidance system can be easily preprogrammed for autonomous surveys requiring little human intervention. Whereas, conventional systems required high-skill human intervention.

Figure: A photograph of the survey by UASV (shown in red circle) during port operation

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