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LANDMINE DETECTION THROUGH DRONES IN UNDERWATER

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ABSTRACT: The advancement in use of machines in submarines has become a essential for defense in military application. Here the underwater sublime recogonisition is necessitous to unmanned underwater drone namely spontaneous sensored vehicle (SSV).We have progressed an SSV to sense the bobby trap (antipersonnel mine) and anti tank mine which remain in the deep sea levels. We used a drone equipped with magnetometer with metal detector and dataset augmentation based on 3d modeling which detect the unusual objects under a submarine .The ssv vehicle is fitted with the active radar actively sends out a radar pulse in which listens for the return signals. Passive radar becomes an alternative to active radar system that offers an more operational decisive system against the landmine attacks.

INDEX TERMS:
SSV, 3D modeling, radar sensing, analyses of landmine attack.

INTRODUCTION:

Landmines are the eruptive device covered in underwater that are designed to demolish enemy targets ranging from combatants to vehicles and tanks, as they streme or near it. Such device is typically denoted mechanically by the way of pressure when a objective steps on it or drives over it, although other unblast mechanisms are also sometimes used. Here the spontaneous sensored vehicle SSV attached with a 3D modeling augmentation and magnetometer enables to scan the area and detect metals several times faster compared to handheld devices and allows obtaining geo-referenced maps of the area and the 3D modeling augmentation is a 3 dimensional visualization of an object captures the data about the landmines and its stage of designing combained with rador sensing technology here the active rador detects the data about the mines and transfers the data to the users alternatively the passive radars monitors the mines and offers the operational defense system against the mine attack. Many times the defense system need to inspect the areas which are insurmountable for any individual these type of drone based on observation useful to those underwater marines.

BACKGROUND STUDY

AUTHORS	TITLE AND YEAR	PUBLICATION	OBJECTIVES
Lee-Sun Yoo, Jung-Han Lee, Sung-Hyub Ko, Seom-Kyu Jung, Seung-Hun Lee, and Yong-Kuk Lee.	**A DRONE FITTED WITH A MAGNETOMETER DETECTS LANDMINES** [2020]	IEEE Geoscience and Remote Sensing Letters	We used a drone fitted with a magnetometer to detect landmines. The magnetic characteristics of landmines were measured, and altitude and flight conditions (altitude <; 1 m) required for successful landmine detection were derived.
Leonida Giunta	**THE ENIGMATIC JURIDICAL REGIME OF UNMANNED MARITIME SYSTEMS [2015]**	OCEANS 2015 - Genova	UMS are some of the most energy-efficient ones since they are usually equipped with small engines or they can even fly in the water without any propulsion but just using waves and currents as gliders

Chua-Chin Wang, Chia-Yi Huang, Chu-Han Lin, Chia-Hung Yeh, Guan-Xian Liu, Yu-Cheng Chou.	**3D-MODELING DATASET AUGMENTATION FOR UNDERWATER AUV REAL-TIME MANIPULATIONS[2020]**	2020 IEEE Asia Pacific Conference on Circuits and Systems (APCCAS)	DEEP LEARNING technology evolves swiftly lately, and the attempt for AUVs to fully understand the surrounding environment becomes an emerging demand for marine or military applications.

APPLICATION OF DRONES IN LANDMINE ATTACK

Spontaneous sensored vehicle (ssv) can scan large areas rapidly and lavishly. Algorithms for detecting mines via montage processing of images from video cameras attached with 3D augmentation dataset to drones have been formulated to send the information to the particular sites .However, most landmine-containing areas are covered with foliage, rendering it difficult to detect landmines visually. Recently, airborne magnetic surveys (AMSs) using UAVs have become popular along with sample mine-detecting drones have been designed . One prototype is a quad copter with an infrared (IR) camera for detecting low metal content mines, and a magnetometer with metal detector for detecting metallic mines mounted on it. However, it has only been studied theoretically with no actual field tests. We measured the magnetic characteristics of landmines, and conducted field tests to determine the flight conditions for mine detection.

As the level of the magnetic field of a hidden metal mine is proportional to the mass, we expected magnetic field capacity would effectively detect even invisible metallic landmines. The magnetic field was measured using military training versions of the M14, M15, M16, and M19 mines, a single projector and a metal plate.

DRONESYSTEM CONFIGURATION:

The SSV a flight control system, with a magnetometer and a ground control system (GCS) attached with 3D revelation .The GCS uses a Px4 flight controller(FC) is the nerve centre of drone can trace their root back to the R\C plane . The 3d modeling augmentation approach to resolve the inadequate metaphors of landmines and these model involves with enforced methods of well-known approaches analyzed as follows

- Geometry-based operations: Due to the shortage of Specific underwater object image, many researchers proposed to apply basic image processing skills, e.g., rotary motion, partition, mirroring, and scaling to generate more images for landmine, lacking variety of viewpoints is the major problem of this approach.
- Trap pointing: In fact, internet is an abundant resource for any image to detect the landmines. Lots of researchers developed various web searching technologies to propel the enrichment of underwater images, e.g. monitoring mines.

LANDMINE TARGETS:

OBJECT	REGARDING	PROVISION	PICTORIAL REPRESENTATION
M14	A system uses a Belleville spring to flip a the boot pin downwards into a stab denote when a pressure is applied.	Weight: 108grms Explode content:29 grams Diameter:56 mm Height :40 mm Pressure:9-6klg	

M16	An antipersonnel mine consists of cast iron body in the thin steel covering with a central faze on top fitted with trip wires it usually make an delay on its techniques to allow the victim to move upwards once it move its black power charge is ignited .	Mass: 4.1kg Height:127mm Diameter:102mm Filling :TNT Filling weight:1LB	
M15	An anti blast mine with a artificial cased metal, used against the scuffle tanks and track-breaker creates mobility kills with crew fatalities**.**	Weight: 14.3 kg Explode content:10.3 kg Diameter: 333 mm Height: 150 mm Operating pressure: 160 to 340 kg	
M19	An antitank blast mine with the copper detonator capsule and firing pan with a minimum metal mine.	weight: 12.56 kg Explosive content: 9.53 kg Length: 332 mm Width: 332 mm Height: 94 mm Operating pressure: 118kg	

CHARACTERISTICS OF MINES

Military training landmines (not Real) were obtained from the Army of the Republic of Korea (AROK), including M14, M15, M16, and M19 mines, 40-mm metallic projectiles, and these magnetic anomalies produced by the M14, M15, M16, and M19 mines were deliberate by changing the drone elevation to 1, 2, or 3 m above the surface . The ssv vehicle flow underwater in a straight 30-m line from south to north, repeatedly flying at the different altitudes at a speed of 2 m/s. The mines were located at the midpoint of the straight line. To remove earth magnetic field's value for determining the magnetic characteristics of the landmines, we subtracted the mean value from observation.

DETECTION OF LANDMINES

Mine detection using a supervision drone is a modern theoretical model, which has been designed to detect landmines. Landmines were primarily used to create defensive and strategical barriers during the Second World War. They are still very much employed in large quantities in countries such as Afghanistan, Korea. A lot of these land mines still go undetected, increasing the death rate and creating havoc on the backdrop. The prototype developed helps us to detect a landmine using a flying drone. The prototype has a quad copter which has a mine detector mounted on it. This utilizes two different modes of detection, which are an augmentation 3d dataset and a metal detector. These are extensively used in aiding this whole operation. The location of the mine can be traced back by the magnetometer and the detected location can be transmitted using the rador module. There is a lot of intact potential and scope of improvement for this prototype in the future.

CONCLUSION

The compelling characteristics of mines and metallic objects were verified using a drone outfitted with a three-axis flux-gate magnetometer. To minimize the magnetic noise generated by the drone itself, the magnetometer was install ed 70 cm isolated from the motor. The movement of the drone should be kept as stable
as possible, and the height of the magnetometer should be maintained at about 1 m for detecting landmines successfully. The metallic AP (M16) and AT (M15) mines, and low metal content AT (M19) mines were detected successfully in field tests under the proposed conditions. The low metal content AP (M14) mines was not detected. However, the landmines tested were all training devices, and the low metal content M19 training device had a magnetic abnormality; we are not sure whether the real military M19 mine produces the same anomaly .In the future, it will be necessary to study a drone system that can operate the magnetometer stably regardless of the movement of the drone, and to study data-processing techniques that can handle magnetic anomalies during movement.

REFERENCES

1] https://scitechvista.nat.gov.tw/c/hK4J.htm.
[2] https://www.ecagroup.com/en/solutions/h300-or-rov-remotely-operatedvehicle.
[3] https://www.ecagroup.com/en/solutions/a27-m-auv-autonomousunderwater-vehicle.
[4] https://www.itread01.com/content/1548042482.html
[5] T.-L. Wey, C.-H. Wu, C.-H. Lin, and H.-H. Lin, "Fish recognition based on deep learning," in Proc. 2016 Conference on Information Technology and Applications in Outlying Islands, pp. 31-38, May 2016.
[6] https://tw.openrobot.club/article/index?sn=10999
[7] H.-J. Jeong, K.-S. Park, and Y.-G. Ha, Image preprocessing for efficient training of YOLO deep learning networks, in Proc. 2018 IEEE Conference on Big Data and Smart Computing (BigComp), pp. 635637, May 2018.
[8] J. Redmon, S. Divvala, R. Girshick, and A. Farhadi, You Only Look Once: unified, real-time, object detection, in Proc. 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 779788, Dec. 2016.
[9] Singapore Maritime Dataset (SMD), https://sites.google.com/site /dilipprasad/home/Singapore-maritime-dataset
[10] H.-C. Shin, K.-I. Lee, and C.-E. Lee, "Data augmentation method of object detection for deep learning in the maritime image," in Proc. 2020 IEEE International Conference on Big Data and Smart Computing (BigComp), pp. 463-466, Feb. 2020.

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REFERENCES

1] https://scitechvista.nat.gov.tw/c/hK4J.htm.
[2] https://www.ecagroup.com/en/solutions/h300-or-rov-remotely-operatedvehicle.
[3] https://www.ecagroup.com/en/solutions/a27-m-auv-autonomousunderwater-vehicle.
[4] https://www.itread01.com/content/1548042482.html
[5] T.-L. Wey, C.-H. Wu, C.-H. Lin, and H.-H. Lin, "Fish recognition based on deep learning," in Proc. 2016 Conference on Information Technology and Applications in Outlying Islands, pp. 31-38, May 2016.
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[7] H.-J. Jeong, K.-S. Park, and Y.-G. Ha, Image preprocessing for efficient training of YOLO deep learning networks, in Proc. 2018 IEEE Conference on Big Data and Smart Computing (BigComp), pp. 635637, May 2018.
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[9] Singapore Maritime Dataset (SMD), https://sites.google.com/site /dilipprasad/home/Singapore-maritime-dataset
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