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Design of Solar Powered Unmanned Surface Vehicle [USV]

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Abstract: *Development of solar energy and efficient technologies is resulting in significant energy security, climate change, mitigation and economic benefits. This research work presents uses of solar powered Unmanned Surface Vehicles [USVs] useful for coastal surveillance in military applications, rescue and search and water quality and quantity measurement. Surveillance and security at coastal region borders is very important to avoid any harmful activity also to avoid drug smuggling through water and illegal fishing.*

Keywords: GPS, Thermal sensing, Proximity Sensor, Ultrasonic Sensor

I. INTRODUCTION

Drones is a common buzzword among the tech community since past few years. Drones have become extremely popular over the past few years. Though, it was used mostly for military and observatory purposes at the beginning, the commercialization of drones and using it for multitude of purposes have made them insanely popular during the latter years Unmanned Vehicles are indispensable for various applications where human intervention is impossible, risky or expensive. Unmanned Vehicles can be categorized into Unmanned Aerial Vehicles (UAVs), Unmanned and Unmanned Underwater Vehicles (UUVs). Conventional ship propulsion system is using diesel engine while the common conventional electrical producer in the ship is also diesel generator. They are reliable, fast and highly maneuverable allowing them to conduct a wide range of missions, including patrols of the coast, without endangering the Navy personnel. Even though, the history of USVs date back to World War II, it is only in the 1990s that a drastic improvement was seen in this field. This was largely due to the technological progress in the late 90s and the increase of terrorism activities worldwide.(Sharma et al. (2012))[1].

Those two instruments need a fair amount of diesel fuel. Therefore, marine engineer held the responsible USVs can be developed for a wide range of potential applications (as listed in Table 1) in a cost-effective way, such as scientific research, environmental missions, ocean resource exploration, military uses, and other applications[2].

II. LITERATURE REVIEW

2.1This article is devoted to the design of the easy-to do unmanned surface vehicle(USV) based on a 1.2-m fiberglass hull and cheap 32-bit controller aimed to environmental, cargo missions, fish farming support, and others. We propose a modular architecture for the USV.

2.2 Controller and a navigation system. Moreover, this cheap, reproducible and robust design is available for students' and small research groups, which makes it important for educational purposes as well. We calibrated a GPS module with the control point method and Achieved.

2.3 Reasonable accuracy. Additionally, the boat was tested experimentally, and we found that its performance corresponds to our expectations From test result wherever electrical energy is used to drive the devices gives the efficienence performance from that we conclude solar energy can efficiently generate electrical energy to drive the boat.

2.4 Our design of USV is designed economically and robust construction and give satisfactory performance in the river, and can also give proper results of all the sensors and camera included for the safety of coasts. Currently to manufacture a solar electric boat there are extra cost due to photovoltaic plant .battery bank and management control system these additional cost are partially.

2.5 Consumed by reduction of operation cost in solar electric water boat there is no consumption.

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III. HARDWARE REQUIREMENTS

A. Ultrasonic Sensor:

The ultrasonic sensor is used for obstacle detection. the ultrasonic sensor transmits the ultrasonic waves from its sensor head and again receives the ultrasonic waves reflected from an object. There are many applications use ultrasonic sensors like instruction alarm systems, automatic door openers, etc. An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.

Fig 1: Ultrasonic Sensor

B. Proximity Sensor

A proximity sensor is a sensor able to detect the 5.IR Camera: presence of nearby objects without any physical contact. Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between the sensor and the sensed object.

Fig: Proximity Sensor

C. Thermal Sensing Camera

Fig 3 –Thermal Sensor

Thermal Sensing Camera is a device that creates an image using infrared (IR) radiation, similar to a normal camera that forms an image using visible light. Instead of the 400–700 nanometre (nm) range of the visible light camera, infrared

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cameras are sensitive to wavelengths from about 1,000 nm (1 micrometre or μm) to about 14,000 nm (14 μm). The practice of capturing and analyzing the data they provide is called thermography.

D. Area Search

Functions are implemented as aids for the handling the manoeuvring along tracks devoted to the survey of areas, typically for underwater search or minehunting. Parallel segments that define the prescribed search tracks are generated with utilities to generate multiple parallel tracks in different preferred sequence orders. In this context part of the track, the conjunction between nonlinked waypoints, is determined by a complementary path planning algorithm that is not driven by external events but of the operating situation: e.g. designated speed, distance among the segments, length of the towed body (if any).

E. IR Camera

Fig.4 IR Camera

We can't see it, but infrared light is actually all around us. IR cameras detect these invisible infrared wavelengths, enabling the camera to see in the dark. Most IR cameras have a series of IR LEDs (often situated around the lens) that transmit infrared light at night, or whenever the camera switches to night mode.

G. GPS

Let's begin with the name, GPS, which stands for Global Positioning System. The system involves a network of satellites orbiting around the Earth and devices that can help determine an object or a person's location. Initially developed in the 1960s for military application, GPS technology eventually became available for public use in 1983, and advances and use cases have increased over the decades. These days, GPS has a range of uses, from military exercises across the globe to directions that help drivers find their way.

Fig 5 - GPS

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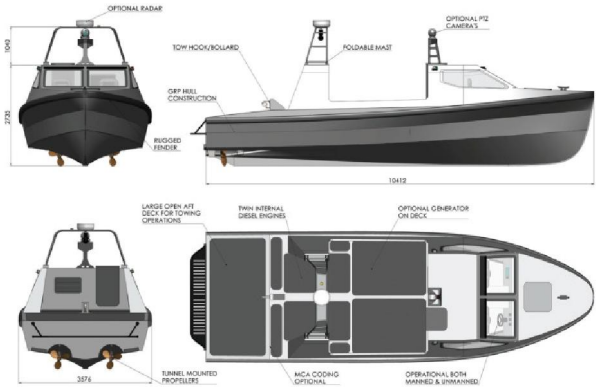

Fig-Circuit for Boost Converter

IV. BLOCK DIAGRAM

The overarching objective of the simulation model is to provide a physics-based platform for rapidly developing and evaluating a USV's autonomy management system. This means that in designing the simulation model, a compromise must be struck between the efficiency of evaluation, in order that simulations can be ran in real-time, and the accuracy of the solution. With this in mind, the simulation model need only retain the key physics sufficient to achieve good qualitative agreement with the sea-trials data.

Modern USVs vary in their shape, size and configuration. Smaller USVs which are O(10−1)-O(100) meters in length, tend to be deployed mainly for scientific research [5] as well as for security monitoring [6]. Larger USVs which are O(101) meters in length are used in a wider variety of roles including Defense-based roles. Halcyon, being O(101) meters in length and having a "patrol boat" hull form, is representative of a wide array of medium-to-large sized USVs which are currently being developed by the Defense industry.

Besides the boat dynamics model, a multiphasic wave environment model has been developed to simulate dynamic environmental disturbances. This model generates omnidirectional surface waves produced from the combined effects of gusting local wind, ocean swell, surface current and finite water depth. This is achieved by integrating several semi-empirical spectral models.

V. RESULTS AND DISCUSSIONS

Electricity produced by photovoltaic cell is safer and more environmentally benign than conventional sources of energy production, However there is environmental safety and health issues associated with manufacturing using and disposing of photovoltaic equipment. Beside the grate advantage of of use of renewable energy produced indirect socioeconomic advantage ecosystem prevention reduction of CO2, NOx and SOx emission etc. Published a research paper for making awareness of making solar operated USV.t 2.05%.

By using DTS CATIA V5 Software we have created the above 3D model od Solar Operated USV with the help of different commands like PAD command, POCKET command, SHAFT command, GROOVE command, RIB command, SLOT command etc.

VI. CONCLUSION

Based on stability, broad deck and large payload capacity of the catamaran, as well as reliability of wireless LAN, the USV presented in this paper can be used as universal platform for multi-mission applications. The modularized cabins equipped with universal data interfaces facilitate replacing various instruments and equipment's. Experiments show that the USV is applicable for harbor surveillance, water quality sampling, hydrologic survey, maritime search and rescue.

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