This paper describes the design and implementation of an autonomous sailing vessel.

I. INTRODUCTION

The introduction only marginally supports the purpose of this paper. Further research in the area of unmanned vehicles is absolutely an acceptable reason, but the authors should describe thoroughly how the proposed system at the form of "software" could be used in manned sailing vessel "by actively supporting the sailor in dangerous situations by piloting the sailor rudders". In a semi-autonomous system, when a dangerous situation occurs, the system usually switches to human and not to fully autonomous control mode which is quite risky.

The review of the existing literature, regarding autonomous sailing boats, needs further improvement. The authors refer to five other cases of autonomous sailboats. The authors should dedicate a few lines to briefly analyze previous works and compare existing sailboats to the proposed one, proofing in this way the significance of their work relatively to previous ones.

In the Introduction section, the authors claim that the purpose of this paper is to present the following three aspects of the AVALON sailboat:

1) Mechanical & Electrical Design

2) Software implementation for optimal path planning

3) The design of a controller which takes into account environmental conditions, such as wind speed and wave height.

Regarding (1), the electrical design of the proposed system is not analyzed in this paper. Only the embedded system design is presented but this is a quite different thing.

Regarding (3), there is no description about how the controller accounts for wave height, or how wave height is measured or estimated. The last is of utmost importance when dealing with sailing boat navigation issues.

II. A BOAT DESIGN FOR SURVIVAL

A. Rig

Please explain sufficiently, how the three aspects (high loads and forces, highest demands on reliability, efficient force transmission from the actuator to the sail in order to save energy) were actually considered and affected the authors' choice for a balanced rig.

B. Hull

What was the optimization algorithm used for the estimation of the hull parameters? Please provide the cost and constraints functions for the optimization process. How the parameters of the hull affect (or not) the choice of other components such as the rig, keel and rudder?

D. Power Supply

Please clarify the role of direct-methanol fuel cell "in case of endurable bad weather or other unforeseeable circumstances". Can it serve as an emergency actuator (like small gas or diesel engines in conventional sail boats), or it just charges the batteries?

III. EMBEDDED SYSTEM DESIGN

B. Sensors

Please describe the estimation algorithm used for fusing data from the GPS and the IMU. Information regarding velocity can only be estimated and not measured directly using GPS/IMU set of sensors. What is the frequency of the state estimation and the accuracy of the boat's position?

Please provide the model of all sensors.

What are the technical specs of the wind sensor (frequency, accuracy) and on what kind of technology is based on?

How AIS is incorporated with the complete system?

How the authors deal with the multi-rate phenomenon which comes up from fusing data acquired with different sampling frequencies?

Please, briefly describe the hardware interface and connection type of each sensor with the main PC (i.e. RS-232, USB etc).

IV. AUTONOMOUS SAILOR

B. Existing works

Please describe why the proposed autonomous sailor system is better in comparison with the other systems described in literature. What is the novelty of this work regarding previous works?

C. System Modeling

The authors should provide the analytical equations of the system, or at least provide sufficient references. As far as the reviewer understands, a dynamic model of the system is implied.

How was this system identified?

Rudder angle and sail angle cannot simultaneously be considered as state and input variables.

A detailed description of the model should clarify some pending issues regarding modeling of the sail boat.

Please explain further how rudder force is modeled. Provide the appropriate equations and/or references.

D. Controller Principle

The system's equations should prove if the rudder and sail are two separate SISO systems and not a testing procedure.

Please explain further the design of the PID controller. Is it a simple heading error minimizing controller? Are you considering the dynamics (i.e feed-forward) of the system during the PID design?

E. Test Results and Analysis

As it can be seen from Fig.7 the system's response is characterized by significant overshoot and large errors between current and desired heading. How do you explain that, considering that the boat is in Normal Sail?

Were PID gains selected using trial and errors or a different method (i.e. Ziegler-Nicols?)

The authors should also provide a Figure describing heading response in lower wind speeds, so the reader can make the appropriate comparisons.

In Fig.9, the experiment should have been let to evolve further, in order to have a more complete idea of the sail boat's position with respect to the desired course.

V. Navigation Strategy

F. Cost Factors

Please describe how the cost factors are related to the navigation algorithm and what the effects on the sail boat trajectory are.

G. Trajectory Tracker

The reviewer is confused whether the authors are following a trajectory tracking (as mentioned), or a path planning technique. From the content of this paper the reader assumes the second, as the goal of the sail boat is to reach predefined waypoints without considering specific velocity requirements.

VI. CONCLUSION AND OUTLOOK

The system is characterized as "robust". Was a related analysis performed? How is this proven?

GENERAL NOTES:

The reviewer suggests that literature survey should appear only in the INTRODUCTION section of the paper and not at different subsections of the paper. The experimental results and discussion should be at the end of the paper and before conclusion section.

Page 3 IV.A, 5th line, an unnecessary period exists. ("For that.").