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Title : MODELLING AND FABRICATION OF IONIC WIND POWERED BOAT

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Introduction :

Ionic wind is the airflow induced by electrostatic forces arising at the tips of sharp conductors subjected to high voltage. Net electric charges on conductors, reside entirely on their external surface and tend to concentrate more around sharp points and edges than on flat surfaces. This means that the electric field generated by charges on a sharp point is much stronger than the field generated by the same charge residing on a large smooth spherical conductive shell. When this electric field strength exceeds what is known as the corona discharge inception voltage (CIV) gradient, it ionizes the air about the tip, and a small faint purple jet of plasma can be seen in the dark on the conductive tip.

The motive of this study is to model and fabricate a boat using an Ionic wind generator with light weight materials by additive manufacturing 3D printing technology to fabricate boat and the support members which uses a grid of knife edged copper wires as sharp points acting as the anode and grid of blunt edge copper tubes acting as cathode arranged in multiple stages. High voltage electricity provided to the positive terminal ionizes the air around the sharp edges resulting in flow of ionized air towards the negative edge thus producing thrust. Two ionic wind generators are mounted on both sides of a boat which propels the boat using only electricity replacing fuel and mechanical engines.

Objectives :

1. To develop a model of an ionic boat, taking into account its material properties and dimensions.
2. To design a model of an Ionic Wind Thruster and evaluate its performance.
3. To fabricate the boat and thruster using 3D printing technology and evaluate the performance of the system.
4. To generate the model which uses air and high voltage DC current to produce thrust.
5. To determine the changes in thrust caused by distance between the electrodes.
6. To determine the amount of thrust produced at different voltages.

Methodology :

1. Conceptual design: In this stage, the basic principles of ionic wind propulsion and the desired characteristics of the boat are defined. This may include determining the size and shape of the boat, the type of electrolyte to be used, and the arrangement of the electrodes. The design made is based on catamaran type of boats which has a main boat in the middle with small boats on either side.

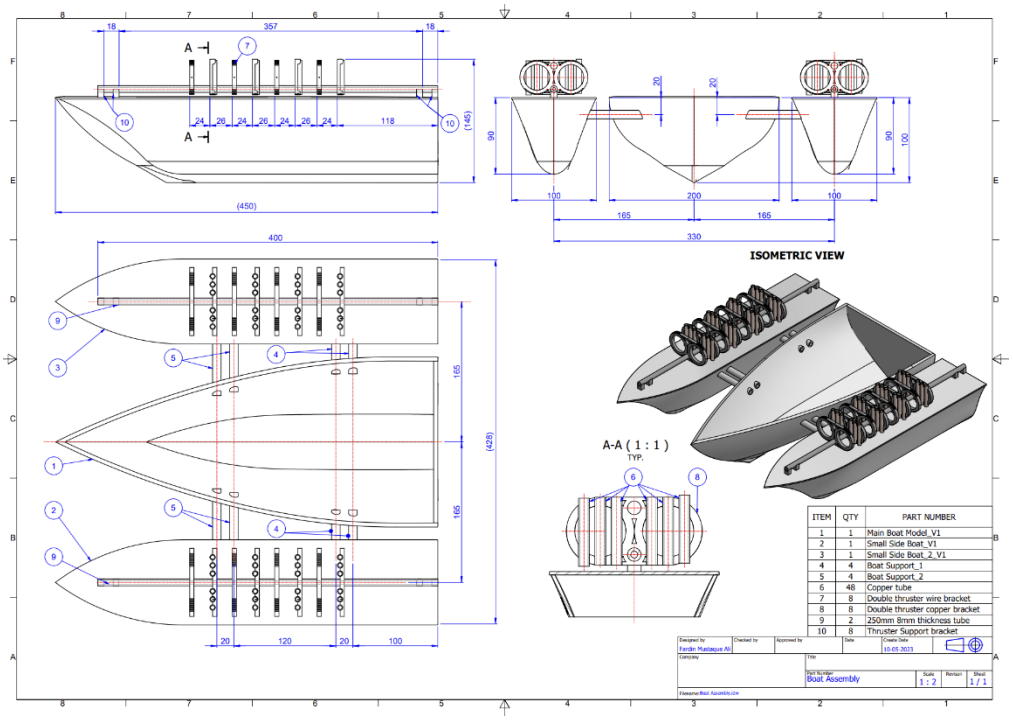
2. Prototype construction: In this stage, a prototype of the ionic boat is constructed, including the electrodes, the electrolyte, and any necessary electrical connections. The modelled boat is 3D printed using Fused Deposition Modelling and the electrical parts necessary to provide high voltage supply is made by using battery, flyback transformer and voltage multipliers.

3. Material selection: In this stage, the materials for the boat components, such as the electrodes and electrolyte, are selected based on the requirements of the design and the operating conditions of the boat. The materials must be chosen to provide the desired electrical conductivity, durability, and chemical stability.

The boats will be made of PLA which has a density of 1.24g/cm3, is lightweight and have good durability. The brackets for the thruster is made from ONYX which is a carbon fiber composite material which has heat deflection temperature of 152 C

4. Electrode fabrication: The electrodes must be fabricated to precise specifications, ensuring the correct dimensions and surface area, and ensuring that they are properly aligned and spaced. Copper wires and copper tubes are used as copper have very good electrical and thermal conductivity.

5. Assembly and testing: The components of the ionic boat are assembled, and the prototype is tested to verify its performance. This may include testing the current flow and voltage, as well as measuring the velocity and direction of the boat.



Expected Outcome of the project:

1. A Boat which replaces fuel powered motors with a type of thruster which uses air and High voltage DC current to produce thrust and propel the boat.
2. Creation of a working prototype of the ionic wind boat that demonstrates the feasibility of ionic wind propulsion.
3. Optimization of the design of the ionic wind boat for maximum performance and efficiency, taking into account factors such as the arrangement of the electrodes, the properties of the electrolyte, and the materials used in the boat's construction.
4. Characterization of the performance of the ionic wind boat, including the velocity and direction of the boat, the current flow and voltage.

Scope for Future work :

1. The design of the thruster can be changed by covering the thruster inside a body with an exit nozzle which will help in producing more thrust .
2. Different materials can be used to make the brackets of thruster more durable and which can withstand more heat.