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MODIFICATION OF AN HOVERCRAFT BY DEVELOPING A PROTOTYPE MODEL

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Abstract:- *The design and development of a hovercraft prototype with full hovercraft basic functions is reported. The design process is quite similar to that of boat and aircraft. In-depth research was carried out to determine the components of a hovercraft system and their basic functions; and in particular its principle of operation.*

Keywords:- *Hovercraft, Design, Performance, Functions, Parts.*

I. INTRODUCTION

A hovercraft is a very vehicle capable of travelling over most surfaces on a cushion of air trapped under the body for lift. Air propeller, water propeller, or water jets usually provide forward propulsion. Air cushion can attain higher speeds than can either ships or must land and vehicles due to lower friction force and use much less power than helicopters the same weight. Specifically for our hovercraft, there are three main design groups: the lift, thrust is steering system.
The propeller shown must be designed for a vehicle as typical fans act by creating vortices to mix the air, reducing the ejected air's translational kinetic energy and significantly reducing efficiency. We outline key features of the three main groups below. Vehicle designed to travel close to but about ground or water. These vehicle are supported is various ways. Some of them have a specially designed wing that will lift them just off surface over which they travel when they have reached sufficient horizontal speed (the ground effect). Hovercraft is usually supported by fans that force air down under the vehicle to create lift, air propellers, water propellers, or water just usually provides forward propulsion.
Air-cushion vehicles can attain higher speed than can either ships or must land vehicles and use much less power than helicopters of the same weight.
Air-cushion suspension has also been applied to other forms of transportation, in particular train, such as the French aero train and the British hover train. Hovercraft is a transportation vehicle that rides slightly above the earth surface. The air is continuously forward under the vehicle by fans, generating the cushion that greatly reduces friction between the moving vehicles and surface. The air is delivered through ducts and jacked at the periphery of the vehicles in downward and inward direction. This type of vehicles can equally ride over ice, water marsh or relatively level land.

II. PRINCIPLE OF OPERATION

The hovercraft floats above the ground surface on a cushion of air supplied by the lift fan. The air cushion makes the hovercraft essentially frictionless. Air is blown into the skirt through a hole by the blower as shown in Figure 1. The skirt inflates and the increasing air pressure acts on the base of the hull thereby pushing up (lifting) the unit. Small holes made underneath the skirt prevent it from bursting and provide the cushion of air needed. A little effort on the hovercraft propels it in the direction of the push.

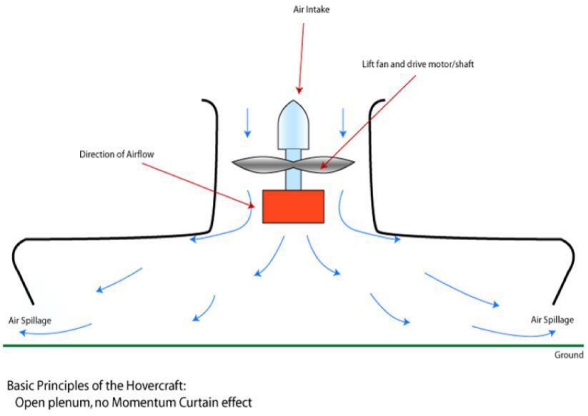


Figure 1: Pressure Development in Skirt

Figure 1 shows how pressure is developed in the skirt. As soon as the assembly floats, a blower incorporated in the thrust engine blows air backwards which provides an equal reaction that causes the vehicle to move forward. Little power is needed as the air cushion has drastically reduced friction.

III. PROTOTYPE DESIGN OF AN HOVERCRAFT

Figure 2: Prototype Hovercraft

Parts		Material
1)	Base Support	Trovicel Sheet
2)	Case	Thermocol
3)	Electronics	Battery
4)	Others	Screws, Nuts and Adhesives etc

IV. 2D VIEW OF AN HOVERCRAFT

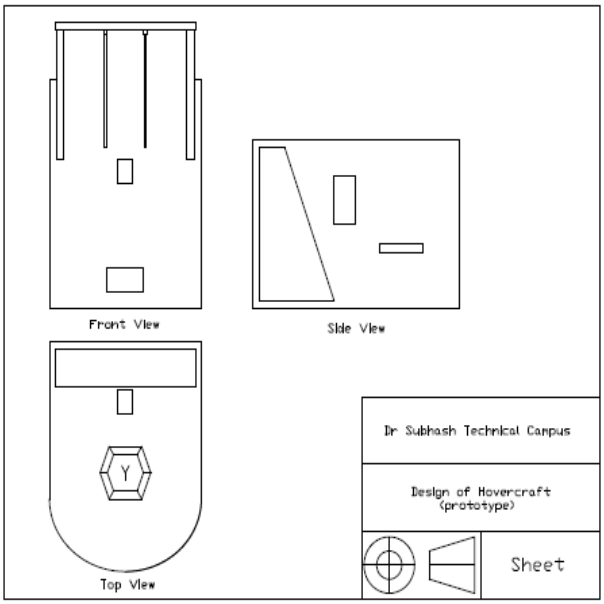


Figure3: 2D View

ALL DIMENSIONS ARE IN CM			
COMPONENTS			
1) BASE PLATE	LENGTH - 57	WIDTH - 42	
2) RADIUS OF ELLIPTICAL	MAJOR AXIS - 42	MINOR AXIS - 9	
3) HEXAGON	INNER SIDE - 10 HEIGHT - 6	OUTER SIDE -12 THICKNESS - 2	
4) GUIDE VANE	HEIGHT - 28	THICKNESS - 5 MM	WIDTH – 8
5) GUIDE VANE SUPPORT	HEIGHT - 32	THICKNESS - 2	UPPER WIDTH - 10 LOWER WIDTH – 18
6) GUIDE VANE CLAMP	LENGTH - 12	THICKNESS - 2	WIDTH – 3
7) SUPPORTING STRUCTURE	LENGTH - 39	THICKNESS - 2	WIDTH – 9
8) THRUSTER FAN	HEIGHT - 12	THICKNESS – 4	WIDTH – 6

V. DESIGN CONSIDERATIONS FOR COST & ESTIMATION

ESTIMATE OF PROJECT

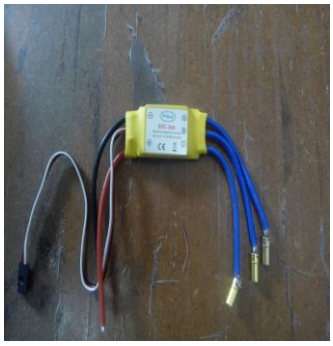
TYPE OF INSTRUMENT	SATYAM ELECTRONIC	DELTA ELECTRONIC	ONLINE PRICE
BLDC MOTOR	1200*4	1000*4	498*4
LI-PO BATTERY	NOT AVAILABLE	2500	1800
REMOTE	NOT AVAILABLE	3000	2700
ESC CONVERTER	600	500	400
SERVO TESTER	550	600	449
SERVO MOTOR	500	530	200
FAN BLADE	200	180	100
BATTERY CHARGER	NOT AVAILABLE	700	500
DC MOTOR	50	50	20
CONNECTING WIRE	50	20	10
TOTAL	**6750**	**12260**	**8201**

❑ **Servo Motor**

❖ Specification:

Weight : 13.4g
Dimension : 22.8×12.2×28.5mm
Stall torque : 1.8kg/cm (4.8V); 2.2kg/cm (6.6V)
Operating speed : 0.10sec/60degree (4.8V);
0.08sec/60degree (6.0V)
Operating voltage : 4.8V~ 6.6V
Temperature range: 0℃_ 55℃
Dead band width : 1us
Power Supply : Through External Adapter
Servo wire length : 25 cm

❑ **E.S.C. Controller**



❖ Specification:

Constant Current : 30A
Burst Current : 40A
Battery : 2-4S Li-poly / 5-12s NiXX
BEC : 5v / 3A
Motor Type : Sensor less Brushless
Size : 54 x 26 x 11mm
Weight : 32g

❖ Programming Functions:

Battery Type : Li-po /NiXX
Brake : On / Off
Voltage Protection : Low / Mid / High
Protection mode : Reduce power / Cut off power
Timing : Auto / High / Low
Start-up : Fast / Normal / Soft
PWM Frequency : 8k / 16k
Helicopter mode : Off / 5sec / 15sec (Start up delay

❑ **Transmitter**

❖ Transmitter parameters

Channels : 6 *Charger port: Yes
Frequency band : 2.4GHz
Simulator port : PS-2 *Power resource : 1.5V*8 "AA"Battery
Program type : GFSK
Modulation type: FM
RF power : 19db
Static current : ≤250mA
Voltage display type : LED
Size : 189*97*218mm
Weight : 575g
Colour : Black
Antenna length : 26mm
Sub Trim : Yes
Pitch Curve : Programmable

- Heli-140/Heli-120/Heli-90/Acro
- Support multiple user model
- Support trim movement
- Support rudder angle overturned
- Support rudder angle adjustment
- Support both hand software adjustment
- Support swash plate adjustment
- Support programmable channel output

❖ Receiver parameters

Channel : 6
Frequency band : 2.4GHz
Power resource : 1.5V*4 "AA"Battery

Program type	:	GFSK
Modulation type	:	FM
RF Receiver sensitivity	:	-76db
Static current	:	≤85mA
Size	:	45*23*13.5mm
Size	:	25*16.8*6.5mm
Weight	:	12g
Colour	:	Gray semi-transparent
Antenna length	:	26mm

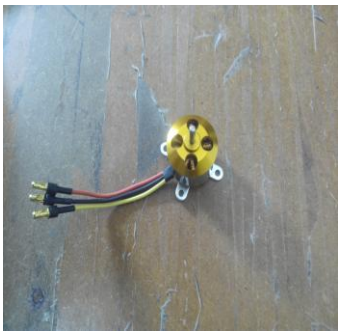
❑ **Fan**

- The Fan works on DC motor at high rotational speed with the help of motor rpm as per requirement.
- It is used for cushion for pressurized air at surface, which is located above the cushion.
- It is used for forward propulsion with the help of thrust fan which located in front of vanes at behind part of an hovercraft.

❑ **Brush-less DC Motor**

❖ Specification:

Model	A2212/13T
RPM/Volt	1000
Stator Diameter	22 mm
Stator Arms	13 mm
Magnet Poles	14
Motor Winding	22
Idle Current	0.55/8 (A)
Max Current	17 (A)
Max Power	190/3 (W)
Rotor Diameter	28 mm
Shaft Diameter	3.17 mm
Motor Length	28 mm
Overall Length	42 mm
Biggest Thrust	1200/4 (g/S)
Package Weight	60 gm



VI. PERFORMANCE TEST

Classical method was used to establish the speed of the craft.

Distance covered=10m; Time taken = 4.78 sec

Speed of craft=10/4.78 = 2.092 m/s

Mass of the craft = 1.4 kg

VII. CONCLUSION

The craft principle has been demonstrated using low cost material and has proved capable as a viable means of transport both on land and water after series of tests. The propulsion and lifting systems gave excellent performance and with good manoeuvrability.

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