ROBOT FOR RELIEF

ASME

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ABSTRACT

The contest of student organized by ASME give a bench for the student's members of present their solutions for some problems of design from the daily tasks of the home to the innovation in the space exploration. Each team is obliged to design, build and operate a prototype that satisfied the requirements of problems that is determined annually. The contest of student design show the great talents of the students of mechanical engineering and careers related , of this way encourage to development innovative ideas for a best life quality for whole. Every year, several team of four students each one race in student conference of professional development in the sections of the world.

1. - INTRODUCCIÓN

Participate in the SPDC increase the knowledge, extend our vision in the real world , world that deal the engineer for join their theory knowledge with the applications, the winners then going to the final contest in the congress international of Mechanical Engineering organized by ASME called IMECE.The award is money and the permission for pass to the next phase that will be the final competition. Likewise, the preparation of the project give us several benefits, for example:

- Development and practice of skills of leadership.
- Extend the contact networks and knowledge outside of the university.
- Know the practice of engineers.
- Show design projects
- Improve of skills of works in group
- Get ideas for future projects

2. - APPROACH OF THE PROBLEM

The delivery of the help, including water, food, oil and medical supply to places like philipinas for the "Tifon haiyan", is a difficult task because the transport of grain is for a terrain irregular and rough, in space reduced, and large distance often necessary for help to the affected. The challenge of this year is design and develop a version reduced of a vehicle able to deliver the grains materials that will be guided for a one person.

The challenge is designed for catch the different vehicles that could solve the problem in a way optimal reducing energy, time and increasing the useful weight.

3. - DESIGN CONDITIONS

- The vehicle has to be supplied for rechargeable batteries, in this way is not allowed any kind of source of power.
- The mobile must be controlled for devices like RF or a cable of transmission of information
- Before of start the route, the vehicle must be able to enter in a box whose size is 25cm x 25cm x 30cm.

- The vehicle has to pass for a ramp whose dimensions are 75cm-125cm length and 10cm height completing with a section of water of 40cm x 40cm and 10cm height.
- Also has to pass a section of sand whose size are 40cm x 40cm.

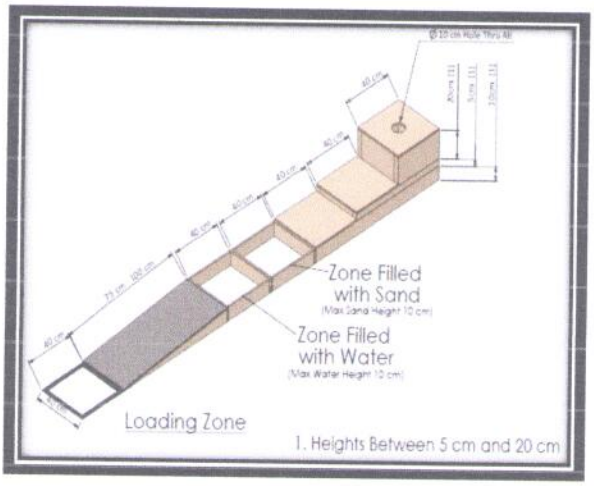

Fig. 1.- Circuits for proof

$$S = \frac{usable\ payload}{time * energy\ capacity}$$

where:

- S is the team's total score
- Usable payload is measured in grams
- Competition time is measured in seconds (maximum: 180 sec.)
- Energy capacity is measured in Volts*milliAmpere-hours

Ecuación 1

4. - OBJECTIVES

- Design a vehicle able to travel the route and overcome the obstacles of water and sand.
- The robot must be able to steps whose height is 20cm.
- Optimize the cost of energy.
- Maximize the useful charge.

5. - SOLUTION OF THE PROBLEM

Given that the challenge that set this year, is reduced to a optimization problem taking as a reference the equation of score. It is decided does not approach our effort in transport more useful charge, given that the other parameters are dependents between themselves else find the optimal useful charge, that required a waste of energy and a minimum time that gave us the maximum score.

For find those parameters firstly was realized a mathematical model of the system and its calculate the score S taking as reference this , then was used the tool of MATLAB called Optimtool for optimize the function of score , thanks to this get some reference of design as the radio of the wheels , the velocity and the charge.

The project was divided in two parts: Mechanical and electronic parts.

5.1. - MECHANICAL

The mechanical challenges that the robots should overcome are get up the stairs whose dimensions are 20cm of height, can handle easily in sandy terrains with a height of 10cm, for this way we proposed the next design:

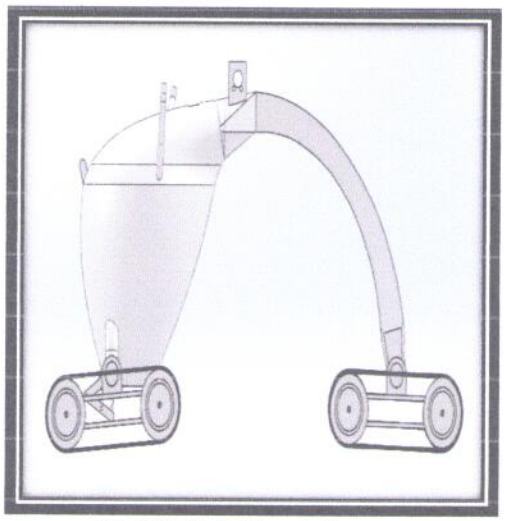

Fig.2 Vehicle lateral view

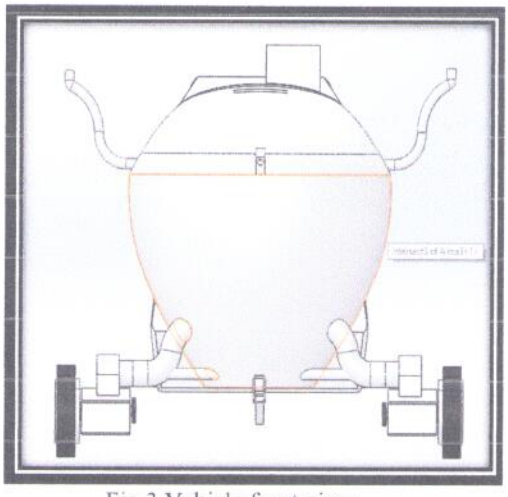

Fig.3 Vehicle front view

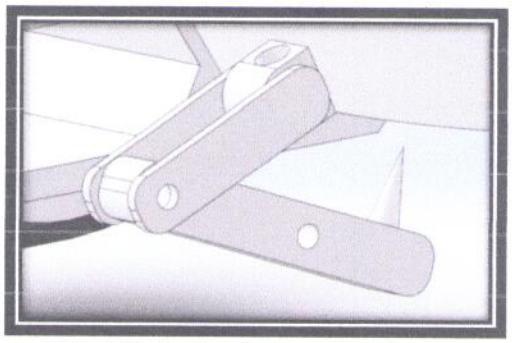

Fig.4 Mechanism for deposit grain

NOTE:

The mechanism for deposit the grains contains also a motor in the upper part of the mobile for be able to activate the movement as consequence comply with the function of set free the grains of the place stored.

5.2. - ELECTRÓNICS PHASE

In the electronic phase, we design 3 PCB's in the software Eagle CAD, that belong to the hand control RF, the controller of the robot and the driver of the motors.

In each part is considered parameters of design as example, scope, viability of the communication, flexibility of the use of hand control maximum current of the motors and amount of pines I/O necessary.

The hand control has a lot peripherals like buttons and analog inputs of joystick , for give the flexibility necessary in the moment of control the robot. Also we used a microcontroller Armega 328p for get data od the signals and the communications like module of communications we used a RF of 2.4GHz of frequency of work.

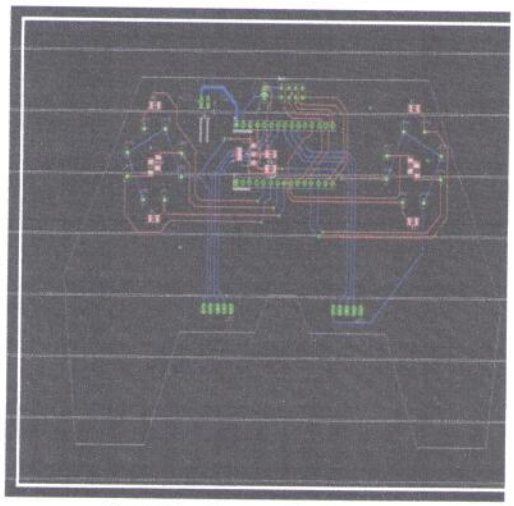

Fig.5 Hand controller RF

For the part of control of motors it take in consideration the amount of motors(eight) and the maximum current used for each one(1.6A) ,for this reason it decided use Bridges – H L298 that give an maximum output of 2A by channel.

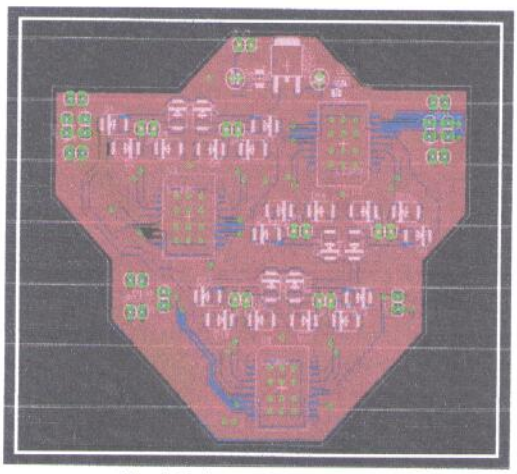

Fig.6 Driver of the motors

For finish, In each shield of control it use an Atmefa 328 for the enough amount of output and input for control the robot.

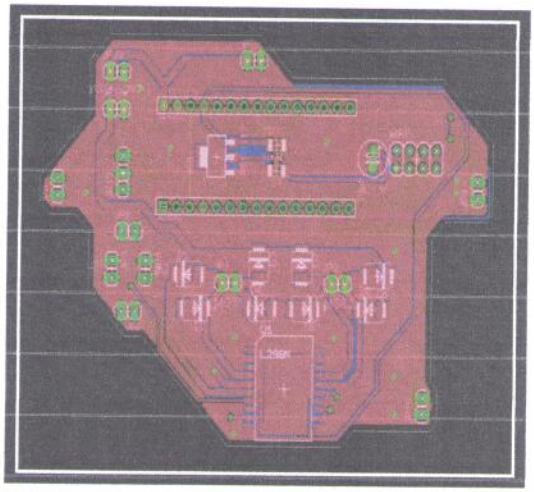

Fig.7 Controller

6. - RESULTS

- The robot was able to realize the route complete given in the contest.
- The weight of the mobile was minimized for avoid an excess in the waste of energy.
- It was achieved get the first place in the Student Design Competition organized by ASME realized in Quito – Ecuador.

7. - CONCLUSIONS

The mechanism used that consists in have got eight independents actuators increasing of the power given and the use of girdles and pulleys , increase of the area of contact and with them the friction improvement of this way the traction

The main application of the project is supply means in places of difficult access like food , tools etc. The robot is in the capacity of pass obstacles like ramps , sand with water also of sand move inside of the water without have some change in its dynamic.

8. - BIBLIOGRAPHY

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9. - APLICATIONS

The main application of the Project is supply source in places of difficult access like foods, tools etc. The robot is in the capacity of pass obstacle as ramps, sand with water also of can move inside of water without have any change in its dynamic.

One of its main advantages is its big efficiency, in other words given that one of objectives is transport the maximum amount of charge in the less time possible using the minimum amount of energy has as consequence the efficiency in the moment of transport the source.

10. - BUDGET

Mechanical	Materials	Amount	Price dolars	Price Soles	total
	Pololu motors 75:1	8	16.95	53.05	424.42
	Pololu tracks 30T	2	14.95	46.79	93.58
	estructura 3D	1		500	500
	Piezas de unión y rodamientos	1		100	100
	Envió pololu	1	25	78.25	78.25
Electronics					
	PCBs	1		70	70
	Driver L298	4		30	120
	Arduino nano	2		35	70
	nrf24l01	2		35	70
Consumibles					
	black grease RSE3005	3	4.49	14.05	42.161
	Envio black grease	1	14.3	44.759	44.759
	Plastic DIP	1	17.3	54	54
	Envio plastic DIP	1	15	46.95	46.95
Tools					
	Estación de calor	1		60	60
				Total	1834