

Hyperloop -The Future Transportation System

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ABSTRACT

The paper includes the study of Hyperloop Pod and Hyperloop system. The introductory idea of Hyperloop as envisaged by Elon Musk is that the passenger capsules or capsules travel through a tube, either above or below ground. To reduce disunion, utmost but not all of the air is removed from the tubes by pumps. Prostrating air resistance is one of the biggest uses of energy in high speed trip. The Hyperloop may be a proposed mode of passenger and freight transport. This term was constructed to explain the fashionable open- source design. Hyperloop is described as a sealed tube or system of tubes with low air pressure through which a cover may travel substantially free of air resistance or disunion. The Hyperloop has the potential to be energy effective compared with high- speed rail systems. This, if executed, may reduce trip times compared to train and airplane trip over distances.

Keyword – Hyperloop, Pod, capsule, speed, air pressure, transport.

1. INTRODUCTION

The Hyperloop is a conception for high speed ground transportation, conforming of passenger capsules traveling at higher speed in completely vacated tube. The concept was firstly proposed in a white paper published by SpaceX in 2013. The Hyperloop conception could be a growing need for an indispensable transportation mode for short- haul trip. Likewise, the request share for high- speed transport is projected to grow fleetly over the coming many decades, and the Hyperloop conception could take some pressure of decreasingly congested airfields and flight routes. The Pod uses an electro-dynamic suspense maglev system for levitation, which operates at fairly large gap heights and which becomes further efficient at high speed. The retardation system uses the same physical principle to decelerate the cover down, only now optimized for maximum drag. The retardation system is suitable to decelerate the cover down at overhead of 2.4 G and is designed similar that it can be used as an exigency retardation system on a full-scale Hyperloop cover, and is fully fail-safe. The side stability is shielded by two Side Control Modules at the front and reverse of the cover, which again use endless attractions to give a stabilizing force. The maturity of the electronics on the cover are thus used for monitoring, similar that the performance of the system can be snappily bettered after each run. Eventually, all these systems are covered by a feather light aerodynamic shell. The HL (Hyperloop) system is a unique and new transport technology in abstract stage that can give higher performance as compared to HSR (High Speed Rail) and APT (Air Passenger Transport) system [1].

1.1 Basic Principle

Hyperloop is works on the simple principle of magnetic levitation. The principle of magnetic levitation states that a vehicle can be suspended and propelled on a guidance track made with permanent or temporary magnets. The capsule which is on the top of the track is propelled by the induction motors [2].

2. LITERATURE REVIEW

Mohit Bansal et al, in the paper reviewed Hyperloop transportation system, the basic working principle and various components used in that system and its working. They have mentioned the features, challenges, safety factors, advantages disadvantages of Hyperloop technology [1].

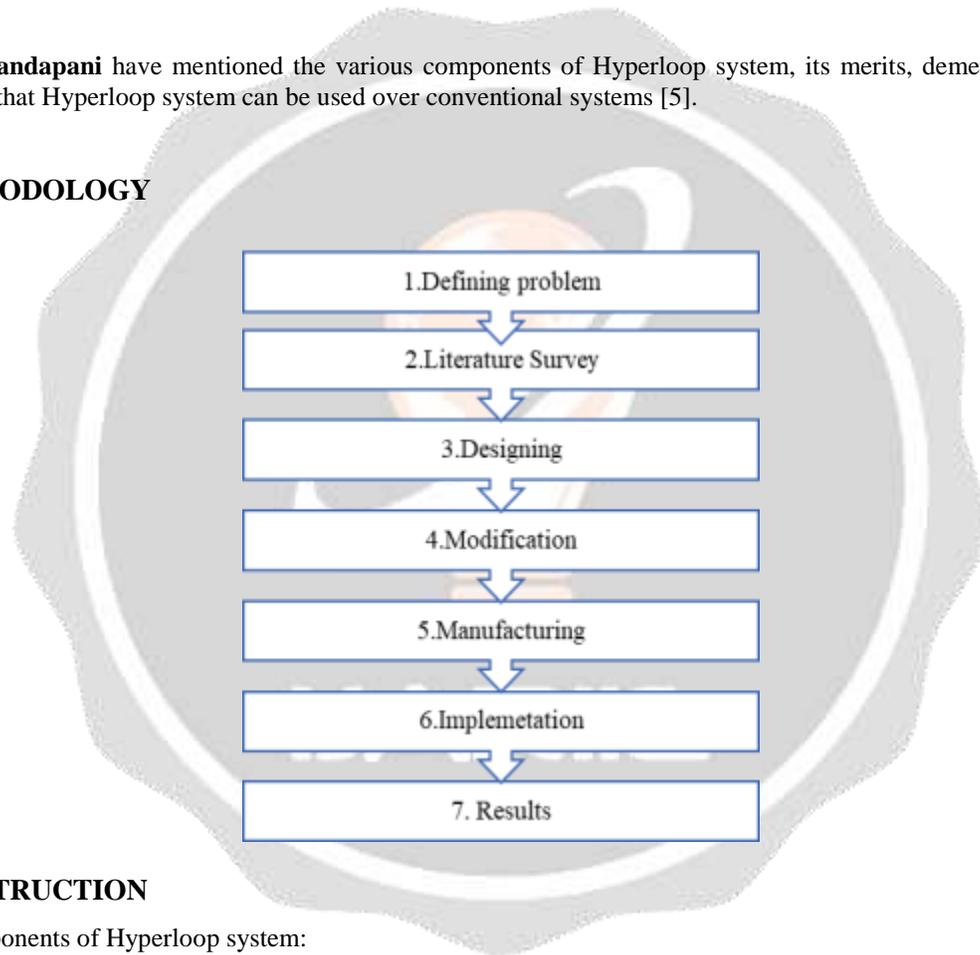
Aditya S. Dhote, in this paper has discussed about the major components of a Hyperloop system their dimensions and their working. The author has concluded that Hyperloop system is a good alternative for transportation [2].

Konstantinos Gkoumas, in this study has aimed to provide a baseline with regard to the topics and challenges identified in the scientific research for the effective testing and deployment of Hyperloop [3].

Kees van Goeverden et al, have explained in detail the analysis and modelling of performances of the Hyperloop transport system. The authors have also mentioned the social/environmental performance and indicator performance. [4].

Dr. C. Dhandapani have mentioned the various components of Hyperloop system, its merits, demerits and have concluded that Hyperloop system can be used over conventional systems [5].

3. METHODOLOGY



3. CONSTRUCTION

Main components of Hyperloop system:

1. Tube
2. Capsule
3. Compressor
4. Suspension
5. Propulsion

3.1. Tube

Tube is one of the main components of hyperloop system which is made of steel. Two tubes are welded together side by side or up and down to allow the capsules travel in both directions. These tubes will be supported with the help of pillars. There is a solar arrays are provided on the top of the tubes which provide power to the whole system. The expected air pressure inside the tube will be maintained around 100Pa.



Fig -1: Hyperloop Tube

3.2. Capsule

The capsule is a container in which the passenger travel. It has the capacity of carrying specific number of passengers. It is a moving part and thus it travel at a very high speed inside the tube. The magnetic linear accelerators are used to accelerate the capsules. Each capsule contain rotors fixed at the bottom and the stators on the tube walls. The combination of stator and rotor gives momentum to the capsule.

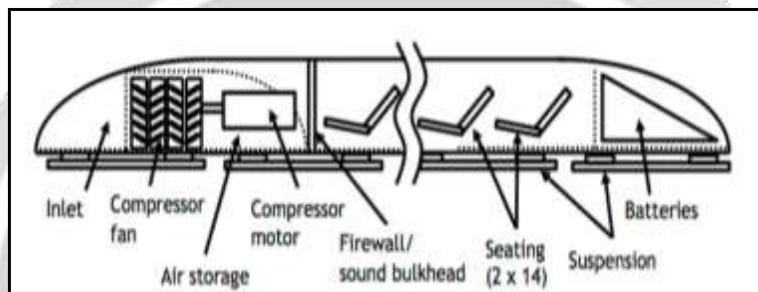


Fig -2: Capsule

3.3. Compressor

The compressor is fitted at the front side of the capsule. It sucks the air and transfer to the air bearings which supports the weight of the capsule. The compressor allows the capsule to traverse through low pressure tube without choking the air flow that travels between tube walls and capsule. Tube air is compressed with a compression ratio of 20:1 via an axial compressor. Up to 60% of this air is bypassed. The air travels via narrow tube near bottom of the capsule to the tail. A nozzle at the tail expands the flow generating thrust to mitigate some of the small amount of aerodynamic and bearing drag.

3.4. Suspension

Air bearing suspension are used which has stability and low drag. Due to high stiffness, air bearing suspension is required to maintain stability at very high speed. Aerodynamic and pressurized air bearing suspensions are superb for the hyper loop system. The skis are pushed away due to the increased pressure which creates considerable discomfort for passengers. The skis support the weight of the capsule by pressurized cushion of air.

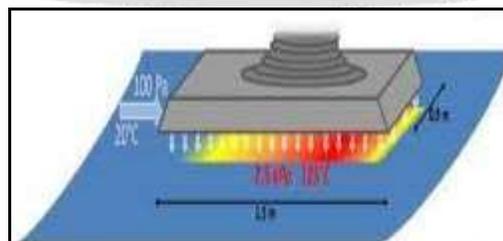


Fig -3: Ski

3.5. Propulsion

It is an important component of Hyperloop system to accelerate as well as to decelerate the capsule from 0 to 300mph. Propulsion helps the capsule to maintain required speed in urban areas as well as in the hilly areas. To accelerate and decelerate the capsule linear induction motor is used which provides advantaged over permanent

magnet motor. Linear induction motor lowers the material cost, reduces the weight of the capsule and also lowers the dimensions of capsule.

3.6 Components of Project Model

The following are the components of Project Model:

- 1) Linear Induction Motor
- 2) Acrylic pipes (as Vacuum tube)
- 3) Aluminum Sheets
- 4) Iron Rod
- 5) Transformers
- 6) Nuts and Bolts
- 7) Wheels

Table -1: Cost Estimation of Model

Sr.no	Components	Cost (Rs.)
1	Linear induction motor	25000
2	Acrylic pipes	2000
3	Aluminum pipes	1000
4	Iron rods	3000
5	Transformers	500
6	Nuts and bolts	500
7	Wheels	1000
8	Other components	5000
Total		38000

3.7 Advantages:

1. Low cost than high speed trains
2. High speed than other transportation method
3. More convenient
4. Immune to weather
5. Sustainable self- powering

3.8 Limitations:

1. High speed can cause dizziness to some passengers.
2. Difficulty in maneuvering at high speeds.
3. Puncture/Damage in tunnel can be dangerous.
4. Higher initial cost.

4. FUTURE SCOPE

As society aims to recover from the Covid-19 epidemic and find ways to “make back better”, hyperloop technology can contribute to the reduction of direct emigrations, especially carbon dioxide, while delivering an analogous trip experience to state trip along certain routes.

5. CONCLUSION

It has number of advantages as it is very helpful for transport people as well as goods at very short time and also in low cost. It does not affect environment. It requires less cost than airplane and any other mode of transportation. It

consumes less electricity. This projects design is open source which gives an opportunity to startups. The implementation still needs time but I coming years, this technology will definitely be a boon.

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