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Hyper Loop: Conceptual Overview of Hyper Loop Model, Its Futuristic Features and Challenges

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Abstract – Hyper loop is a Conceptual mode of transportation designed for saving the travel time and traffic jam around the metro cities of the world. The concept deviates from existing high-speed rail designs by eliminating the rails, enclosing the passenger pod in a tube under a partial vacuum, and suspending the pod on air bearings.

Existing conventional modes of transportation of people consists of four unique types: rail, road, water, and air. These modes of transport tend to be either relatively slow (i.e., road and water), expensive (i.e., air), or a combination of relatively slow and expensive (i.e., rail). Hyper loop is a new mode of transport that seeks to change this paradigm by being both fast and inexpensive for people and goods. Hyper loop is also unique in that it is an open design concept, similar to Linux. Feedback is desired from the community that can help advance the Hyper loop design and bring it from concept to reality.

Hyper loop consists of a low pressure tube with capsules that are transported at both low and high speeds throughout the length of the tube. The capsules are supported on a cushion of air, featuring pressurized air and aerodynamic lift. The capsules are accelerated via a magnetic linear accelerator affixed at various stations on the low pressure tube with rotors contained in each capsule. Passengers may enter and exit Hyper loop at stations located either at the ends of the tube, or branches along the tube length.

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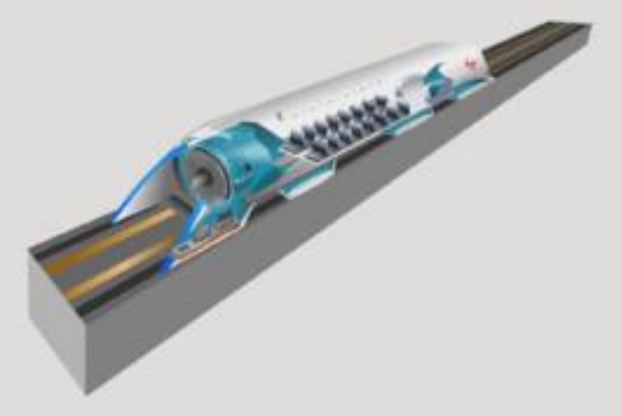
1. INTRODUCTION

Elon Musk and a team of engineers from Tesla Motors and Space Exploration Technologies Corporation (SpaceX) proposed the idea in August 2013 as an open design to be vetted and further refined through public contribution (Musk, 2013). The Hyperloop concept has been explicitly "open-sourced" by Musk and SpaceX, and others have been encouraged to take the ideas and further develop them.

In the 1910s, vacuum trains were first described by American rocket pioneer Robert Goddard. While the Hyper loop has significant innovations over early proposals for reduced pressure or vacuum-tube transportation apparatus, the work of Goddard "appears to have the greatest overlap with the Hyper loop [2].

Drawing heavily from Robert Goddard's vactrain, a hyperloop is a sealed tube or system of tubes through which a pod may travel free of air resistance or friction conveying people or objects at high speed while being very efficient.



Source: Google

Figure1: A Proposed Model of Futuristic Transport

Elon Musk's version of the concept, first publicly mentioned in 2012,[2] incorporates reduced-pressure tubes in which pressurized capsules ride on air bearings driven by linear induction motors and axial compressors.[3]

The Hyperloop Alpha concept was first published in August 2013, proposing and examining a route running from the Los Angeles region to the San Francisco Bay Area, roughly following the Interstate 5 corridor. The paper conceived of a hyperloop system that would propel passengers along the 350-mile (560 km) route at a speed of 760 mph (1,200 km/h), allowing for a travel time of 35 minutes, which is considerably faster than current rail or air travel times. Preliminary cost estimates for this LA–SF suggested route were included in the white paper—US$6 billion for a passenger-only version, and US$7.5 billion for a somewhat larger-diameter version transporting passengers and vehicles—although transportation analysts had doubts that the system could be constructed on that budget; some analysts claimed that the Hyper loop would be several billion dollars over budget, taking into consideration construction, development, and operation costs.[4][5]Mark Sakowski (2016) after a theoretical evaluation of the current maglev as well as the evacuated tube technology and concluded that the Hyper loop is feasible if properly designed. It has the potential to be much more efficient in terms of energy usage of pods traversing down the tube (Mark Sakowski, 2016).

2. BASIC PRINCIPLE OF HYPER LOOP:

Hyper loop is based on a principle of magnetic levitation. The principle of magnetic levitation is that a vehicle can be suspended and propelled on a guidance track made with magnets. The vehicle on top of the track may be propelled with the help of a linear induction motor.

3. CONCEPTUAL DESIGN OF HYPER LOOP MODEL:

3.1 Tube:

The tube is made of steel. There are two tubes which are welded together side by side configuration to allow the capsules travel in both directions. The tube will be supported by pillars. There is a solar arrays are provided on a top of the tubes for the purpose of power to the system

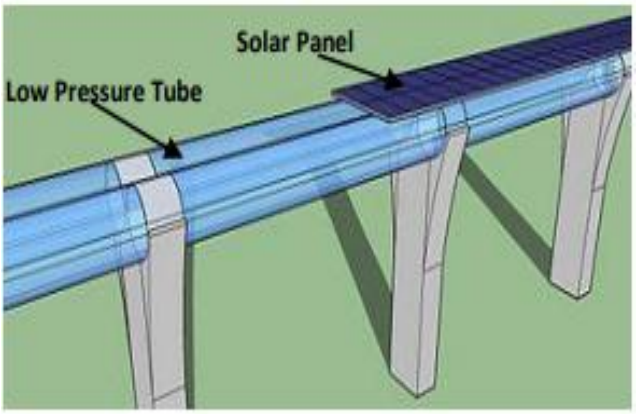


Fig-2: Construction of tube

3.2 Capsule:

The capsule can carry 28 passengers at a time and it send at a very high speed and it is levitated by a high pressure air cushion. The design of capsule is start with the aerodynamic shape. There are two version of capsule are being considered: a passenger only version and a passenger plus vehicle version.

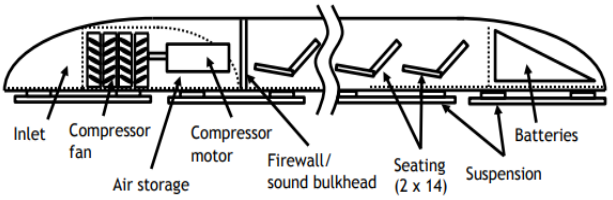


Fig. 3: Arrangement in capsule

3.3 Compressor:

The compressor is fitted at the front side of the capsule. It supplies the air to the air bearings which supports the weight of the capsule. The compressor allows the capsule to traverse to the low pressure tube without choking the air flow that travels between tube walls and capsule.

Fig. 4: Compressor

3.4 Suspension:

Air bearing suspension offers stability and extremely low drag at a feasible cost. A stiff air bearing suspension is superb for reliability and safety. When there is a gap between ski and tube walls is high then it shows the nonlinear reaction and which results in large restoring pressure.

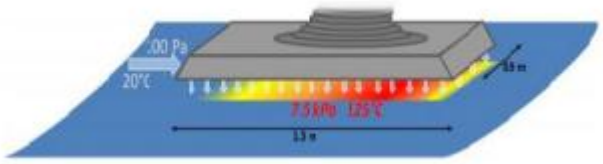


Fig. 5: Schematic of air bearing skis that support the capsule

3.5 Propulsions:

To accelerate and decelerate the capsule the linear induction motor is used in hyperloop system. It provides some advantages over a permanent magnet motor. To accelerate the capsules there is linear accelerators are constructed on a length of the tube. Stators are placed on the capsules to transfer momentum to the capsules via the linear accelerators.

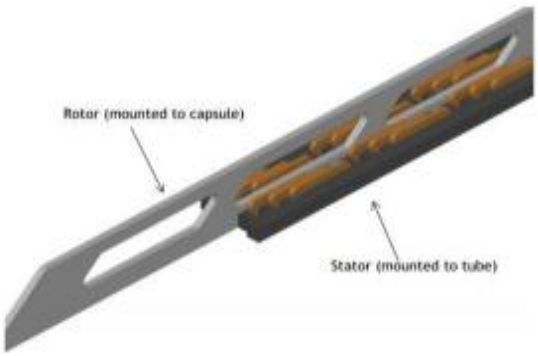


Fig. 6: Propulsion

4. SPECIFICATIONS:

1. By using this transportation, saving the travelling time.
2. Hyper loop is powered by the solar panel.
3. It can travel in any kind of weather.
4. It is more convenient.
5. It is Resistance to earthquake

5. CONCLUSION:

To that end, a few companies have been formed, and several interdisciplinary student-led teams are working to advance the technology, but Real-world trials will prove the validity of the concept and also Cost of construction may undermine economic benefit

Some experts are sceptical, saying that the proposals ignore the expenses and risks of developing the technology and that the idea is "completely impractical". Claims have also been made that the Hyper loop is too susceptible to disruption from a power outage or terror attacks to be considered safe.

6. FUTURE WORK

For the future work, we can say that Implementation Cost of hyper loop tunnel is very high. It should be more economically feasible .Beside that more work is possible in order to increase the capacity of the passengers per pod.

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