International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 3, Issue 5, pp 6-8, May-2019

The Future of Transportation: Hyperloop

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***Abstract* - The rapid increase in the lifestyle of human has bought up a requirement of faster mode of transportation. This has led to the development of one of the fastest transportations which will be coming in the future called as Hyperloop. Hyperloop is a proposed mode of passenger and other goods transportation that propels a pod like vehicle through a near vacuum tube at more than airline speed. This paper presents a faster mode of transportation by eliminating all different kinds of resistances acting on the current mode of transportation. A controller is used and the commands to it will be sent through a Bluetooth module for the functioning of the system. The pod uses a maglev system for levitation, which operates at a relatively larger height and which becomes more efficient at high speed and it overcomes the friction caused by the present railway tracks. The breaking system is able to slow the pod down and can be used as an emergency braking system. A tube is used where a vacuum is created to overcome the air resistance. Also a motor is used which is attached to the pod and it will generate huge amount of thrust causing the pod to move at a faster speed. This new technology can become a better mode of transportation helping people to travel longer distances in a short span of time. It can also be used to supply goods or any other material such as medicines for any emergency purpose.**

Keywords: Hyperloop, Magnetic levitation, Vacuum tube, Pod, Capsule.

I. INTRODUCTION

The present public transportation includes locomotives such as diesel and electric, maglev trains and airline transportation system. Out of which the diesel locomotive can travel at a speed of 60 kmph, electric locomotive at a speed of 110 kmph, maglev at a speed of 603 kmph and the airline (passenger aircraft) at a speed of around 900 kmph. The speed of the maglev train is more as compared to the other two types of locomotives because it eliminated the friction caused due to the wheels of the trains with the tracks by using the levitation principle. The fastest mode of transportation till date is the airlines, but they have to face huge resistance due to the wind.

The conventional mode of transportation will be replaced with the new mode of transportation which is being developed known as Hyperloop. Hyperloop is a concept for high speed ground transportation which will be consisting of passenger pods traveling at transonic speed in a partially evacuated tube. This concept was proposed by Space X which believed that it will prove to be an alternative to the high speed rail system. As studied from KPMG, the Hyperloop could cut down travel time by 75%.

a) Working of the system

The Hyperloop system eliminates both factors that reduce the speed. These factors are friction between wheels and path and air resistance. The Hyperloop is controlled through cell phone using Bluetooth. Whenever we send command to model, the BLDC motor and vacuum pump turns on. The turning of BLDC motor creates thrust which helps in forward movement of pod.

Vacuum pump creates low pressure inside the tube. Air resistance reduces to great extend because of low pressure tube. For reducing the friction magnetic levitation principle is used. Because of opposite poles of magnet present at wheels and track, the pod floats in the air .The microcontroller is used to control motor and vacuum pump according to Bluetooth input. When we send off command both motor and vacuum pump turns off and pod decelerates.

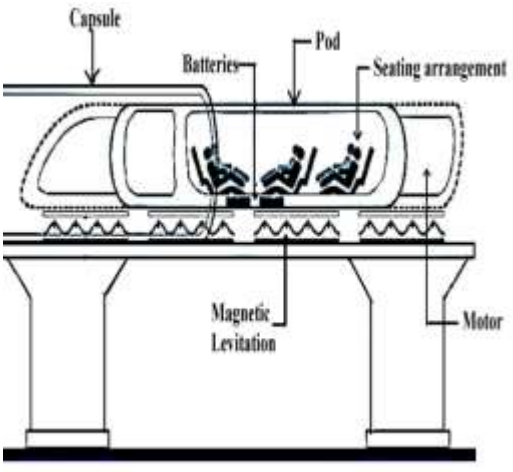

Figure 1: Working of Hyperloop

ISSN (online): 2581-3048
Volume 3, Issue 5, pp 6-8, May-2019

II. LITERATURE SURVEY

Ahmed S. Abdelrahman, Jawwad Sayeed, Mohamed Z. Youssef,"Hyperloop Transportation System: Analysis, Design, Control and Implementation".

This paper introduces a methodology based on mathematical analysis, with an approach to use both permanent magnets and electromagnets to levitate, propel and control a pod. The magnetic levitation system prototype was implemented in the laboratory and proved the concept to validate and verify the results. The results assured the validity of the design procedure and magnetic analysis.

Ahmed E. Hodaib, Samar F. Abdel Fattah, "Conceptional Design of a Hyperloop Capsule with Linear Induction Propulsion System".

This paper presents the methodologies of the capsule design which got a design concept award at SpaceX competition in 2016. In this MATLAB scripts are written for the levitation and propulsion. The design procedures of a single-sided linear induction motor were analyzed in detail and its geometric and magnetic parameters were determined. A structural designed is also introduced and the Finite Element Method was used to analyze the stresses in the different parts. They also studied that 3 phase power can support very high speed, but there are end effects which will reduce the motors thrust. Thus linear induction motors are less energy efficient for required force output as compared to the normal rotary motors.

Kees van Goeverden, Dimitris Milakis, Milan Janic, Rob Konings, "Analysis and modeling of performances of the Hyperloop transport system".

This paper explores the performances of Hyperloop and compares these performances to high speed rail and air passenger transport systems. The performances of the Hyperloop system which are analytically modeled and compared to the other conventional mode of transportation are operational performances, financial performance and social and environmental performance. The result is that the capacity of Hyperloop is low which means there will below utilization of the infrastructure. The system will perform very well regarding the social and environmental aspects due to the low energy use, no pollution and hardly any noise.

Mark Sakowski, "The Next Contender in High Speed Transport Elon Musks Hyperloop".

This paper provides historical literature review of high speed transport to very high speed transit and discusses the limitations of the existing technologies of Maglev trains and evacuated tube transport. This paper attempts to highlight several features of the Hyperloop that distinguishes it from the traditional transport and evacuated tube by making use of capsules or pods to travel in a medium-pressure environment as opposed to the difficult to maintain vacuum surroundings.

Jeffrey C. Chin, Justin S. Gray, Scott M. Jones, Jefffrey J. Berton, "Open-Source Conceptual Sizing Models for the Hyperloop Passenger Pod".

In this paper, they concluded that the refined analysis illuminates several interdisciplinary couplings that alter two major aspects of the initial concept, first is the traveling speed and the second aspect is the steady state temperature.

Figure 2: Pod of Hyperloop system

Figure 3: Hyperloop system with tube and pod

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III. RESULTS AND DISCUSSIONS

The speed of transportation increases to high level with the help of Hyperloop system. The friction is reduced due to magnetic levitation similar to maglev trains. Low pressure tubes reduce air resistance. Since both factors reducing speed are eliminated, speed is increased to extend.

IV. CONCLUSION

1. This system will be very helpful for public transport as well as goods in a very short period of time because of its number of advantages.
2. The speed of the Hyperloop system about 1220 kmph can be gained.
3. This system provides better comfort at high speed with lower cost.

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Citation of this article:

Khandagale Mohini Mahendra, Shinde Sneha Netaji, Sonawane Amol Dattatray, "The Future of Transportation: Hyperloop" Published in *International Research Journal of Innovations in Engineering and Technology (IRJIET)*, Volume 3, Issue 5, pp 6-8, May 2019.

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