An alternative Solution for traffic in fast growing city Ahmedabad:Automated Pod Car

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Abstract
India is developing at a rapid pace with increasing population.This increasing population is now become major problem in mega cities and this lead to the increase number of personal vehicles, pollution and traffic. Therefor it is necessary to provide transport system which fulfil all requirements of people like personal travel, rapid travel, easy to travel,point to point travel ect.As well as provide such transportation which do not harm environment and provide healthy life.For this system like Automated Pod Car(APC) can be proved efficient and sustainable in urban Environment.Here model of APC is design for study area in Ahmedabad of length 18km,where no other rapid transit system is available like BRTS,MRTS.In our study area due to lack of transport facilities traffic and pollution problem is increasing and land consumption is more due to private vehicles so to fit in this environment APC is a best solution for this problem.

Keywords: *Personal transit, Rapid transit, Traffic, Pollution, Land consumption*

INTRODUCTION

Automated Pod Car(APC) is Personal Rail Transit System which is also known as a PRTS. APC provide rapid transit and point to point transportation on permanent guide way. This system can be operated by electricity or any other renewable resources. It is a personal rapid transit which carries maximum 4 persons at a time in a single pod car. As in the road transit system, this system does not face any kind of traffic congestions problems. This system does not required more land as compared to road and other transportation .which is most beneficiary now a days where urbanization of area is at higher level.Automated pod car vehicles are sized for individual or small group travel, typically carrying not more than 3 to 4 passengers per vehicle. Guide ways are arranged in a network topology, with all stations located on sidings, and with frequent merge/diverge points. This allows for nonstop, point-to-point travel, bypassing all intermediate stations. The point-to-point service has been compared to a taxi or a horizontal lift (elevator).

This transport system is rapid due to point to point transport. This system reduces traffic conjection near that area.This system provide driverless travel thus each person can use without age limit or without the knowledge of traffic rules and regulation.due to driverless travel less fear of accidents and damages. This system reduce journey time due to rapid and point to point transportation. This system provide smooth journey without any jerk like road transportation.This system is like sky train, which take very less ground space as compared to other transportation system which is most likely advantage of automated pod car.Automated pod car is running by electricity or may in future by any renewable source of energy which is eco-friendly. Thus due to uses of this system environment do not harm and no problems occurred related to noise and air pollution because fuel does not use in this system.

Personal Rail Transit is using by Israel country and in Abu dhabi.In abu dhabi yhis system is on land instead of guideway which may consume more land compared to guideway system but the cost become little less because saving of materials in construction of elevated guideway,columns and

elevated station.. In India also this system will be implemented between Delhi to Gurgaon having span of 13 km long.

NEED OF STUDY

In India people spent more than 100 minutes average time per day in driving due to traffic and increasing use of personal vehicles which lead to environmental & health problem as well as increasing cost of transportation and vehicular cost.

OBJECTIVE OF STUDY

To plan such system which is sustainable in urban areas having more traffic and pollution problems, and to provide point to point rapid transport.
To provide personal rapid transit system in urban environment having more traffic problem.
To provide system having point to point transport,easy travel,reduced journey travel time.
To reduce noise and air pollution to some extent by providing this system.

DATA COLLECTION/STUDY AREA PROFILE

Based on traffic conjunction of the city and other problems related to point to point transportation or accident problems in that area we plan particular path of the APC which will prove efficient and can solve the problems to some extents. On this path still now no other rapid transport system is provided like BRTS and METRO.APC‘s smaller scale can help planners connect remote site to regional results.

Vehicle speed overview of Ahmedabad

Table 1: Vehicle speed Overview of Ahmedabad

Time	Sunday	Monday to Friday	Saturday
6-8 am	Fast	Fast	Fast
8-10 am	Fast	Slow	Slow
10-12pm	Medium	Medium	Slow
12-2pm	Medium	Medium	Medium
2-4pm	FAST	Fast	Medium
4-6pm	Medium	Medium	Medium
6-8pm	Very slow	Very slow	Very slow
8-10pm	Very slow	Slow	Very slow

Table 1 shows the average speed of vehicles in the Ahmedabad city at different time internal and at different days. As we can observe from the table that in weeked days (Saturday and Sunday) speed of vehicle is very slow in evening and early night while in the other days speed of the vehicles is very slow at pick hours.

All the people are using their own vehicles which leads to decrease speed of vehicles and causes traffic problems and other environmental problems like air pollution and noise pollution. In many patch of the cities this traffic problem may also lead to the economy of the city because people may choose to go there where they can easily reach in less time as well as parking and transportation facility should be there.

Study area

RTO – Parimal Garden via Ashram Road --------7.3 KM
Income tax –Parimal Garden via C.G Road -------3.4 KM

Income tax – Kalupur circle via Gandhi Road --- 3.5 KM
Kalupur circle - Nehru Bridge -----3.5 KM
Total guide way length -------18 KM

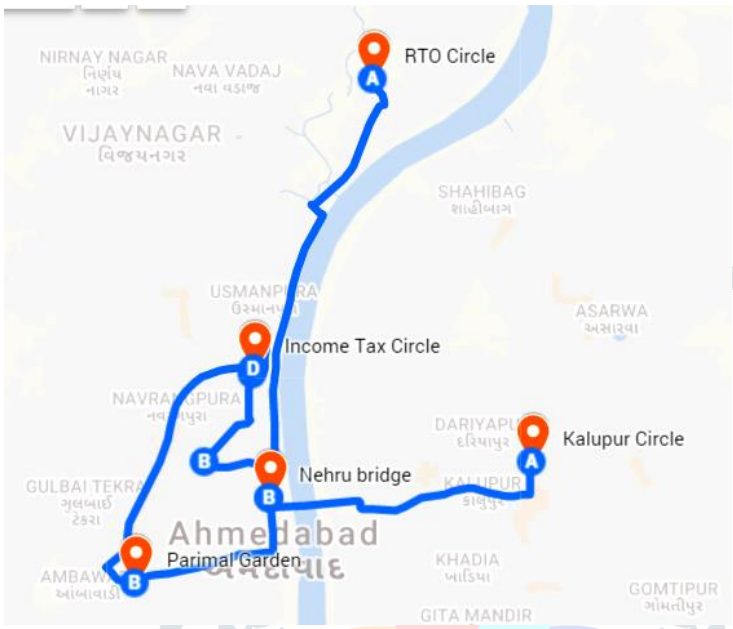

***Fig. 1**: Route of Automated Pod Car*

Above figure 1 shows the Route of Automated Pod Car where there is no rapid transit services like Bus Rapid Transit System(BRTS) or Metro Rail Transit System(MRTS) is there or it is not in development plan of the City.

The reason behind no transit facility is there is the land availability.This area have very less land to develop rapid transit system and in these situation APC is the best solution as it consume less land as well as economical compared to other system.

PHYSICAL CHARACTERISTICS OF APC

Guide way

Guide way of pod car is compact and light weight as compared to Light Rail Transit System(LRTS) and MRTS.

Station Layout

Station layout is such that while one pod car is on station for loading/Unloading passenger other can pass from the other Guideway provided over there.So time consumed at station is reduced.

Pod car design

Pod car design is compact and comfortable as well as having good aesthetic appearance.

Columns

Column size is such that it do not obstruct other moving vehicles on the road.

Land consumption

Land consumption in construction and operation of APC is very less compared to other rapid transit system which is the biggest benefit of fast growing cities like Ahmedabad.

Fig.2: conceptual plan of station layout

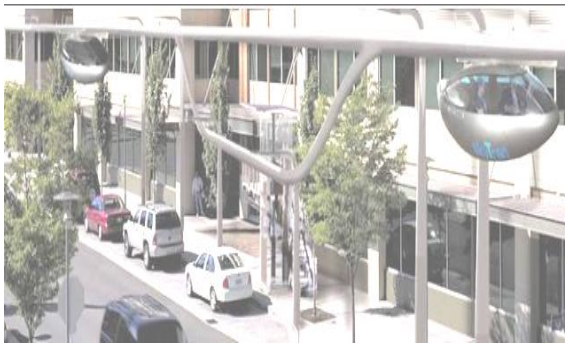

Fig.3:Real layout of APC System

OPERATATIONAL CHARACTERISTICS

Travel speed of pod car

For any given peak speed, nonstop journeys are about three times as fast as those with intermediate stops. The starting and stopping time do not influence it. Scheduled vehicles are also slowed by boarding of passengers and exits for multiple destinations.Therefore, a given PRT seat transports about three times as many passenger miles per day as a seat performing scheduled stops.PRT designs have operating speeds of 100 km/h (60 mph){operating speed of a pod car is the speed at which pod car generally operate on the guide way} ,and one as high as 130km/h, most are in the region of 40–70 km/h (25–45 mph). Our rail systems generally have higher maximum speeds, typically 90–130 km/h (55–80 mph) but average travel speed is reduced about three fourth by scheduled stops and passenger transfers.

Headway of pod car

Maximum passenger capacity depends upon the spacing between two successive vehicles, so smaller headway {headway is a measurement of the distance or time between vehicles in a transit system.} is preferable for measuring distances. Very short headways are not feasible. The UK Railway they evaluated the ultra design and is willing to accept one-second headways. The headways are calculated in terms of absolute stopping distances, which would restrict capacity and make PRT systems unfeasible. Headway of 2 second in beginning is taken in automated pod car. As operational experience increases, headways can be reduced.

Capacity

PRT can be compared with a rail as it is an alternative of rail. PRT vehicles seat can accommodate fewer passengers as compared to trains and buses, but can be counterbalance by combining higher average speeds, diverse routes, and shorter headways. Overall capacity can be increased or can be equivalent by this means.

Single lane capacity

Theoretical maximum capacity can be calculated as follows:
Consider Headway = 2 sec
Person capacity = 4
Theoretical maximum capacity = 7200 passengers/hr
Capacity is inversely proportional to headway.

we can predict that vehicles will not generally be filled to its full capacity, due to the point-to-point nature of PRT. At more typical average vehicle occupancy of 1.5 persons per vehicle, the maximum capacity is 2,700 passengers per hour.

Calculation of capacity

n = p*3600/t
n = No of passengers per hr on a single lane
p= Max. passenger capacity per POD car
t = Min safe Headway in sec.

APROX ANALYSIS OF COST OF THE AUTOMATED POD CAR

Here, for approximate cost analysis of the project we take Gurgaon project as a reference.

In Gurgaon project as per pilot plan it has 13 km span from Delhi to Gurgaon and estimated cost is Rs.850 crore. Total 16 station have planned.

While metro cost Rs.300 crore per kilometre and monorail costs Rs. 170 crore per kilometre, pod car network can built for just Rs.30 crore per kilometre.

Here in our network route is of 18 kilometre and total 19 station and substation**.So approx. cost of the whole project may be Rs.600 crore
(** this is calculated based on the area located near public or commercial land use with more public movements.)

COMPARISON OF PERSONAL RAPID TRANSIT WITH EXISTING TRANSPORT SYSTEMS

Table 2: Comparison of PRT with existing transport systems

Similar to Cars	Vehicles are small—typically two to six passengers Vehicles may be individually hired, like taxis, and shared only with the passengers of one's choosing Vehicles travel along a network of guideways, much like a network of streets. Travel is point-to-point, no intermediate stops or transfers Potential for on-demand.
Similar to trams, buses, and monorails	A public amenity (although not necessarily publicly owned), shared by multiple users pollution control (electric powered) Passengers embark and disembark at discrete stations, analogous to bus stops or taxi stands
Similar to automated people movers	Fully automated, including vehicle control, routing, and collection of fares Usually above the street ,typically elevated,reducing land usage and congestion
Distinct features	Vehicle movements may be coordinated, unlike the autonomous human control of cars and bikes. Small vehicle size allows infrastructure to be smaller than other transit modes Automated vehicles can travel close together. Possibilities include dynamically combined "trains" of vehicles which is separated by a few inches such that drag is reduced and speed will increases and it become energy efficient

CONCLUSION

APC is the emerging approach to sustainable transportation of the city. It full fills almost all the requirements of modern transportation with cost efficiency and environmental safely.It provides a good solution to the increasing transportation demand as well as traffic and pollution problem of the fast growing urban areas.It provides solution to limited land resource and helps in decreasing burden on fossil fuel resource which is most important things now a days..Its cost effectiveness make it accessible to every individual and comfort and safety of user make it more attractive.APC also helps in economic development of the society.

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REFERENCES

Journal Article

1. Devam Patel, Shakil Malek. Application of performance management system in infrastructure sector IJEDR 2016; Volume 4, Issue 2 : ISSN: 2321-9939
2. Jishnu Gohel A Comprehensive Review of BRT System Introduced in Ahmedabad IJEDR 2014; Volume 3, Issue 1 : ISSN: 2321-9939
3. Manjurali Imadadali Balya, Bhimaji Krishnaji Katti, Krishna Saw spatial transit accessibility modeling of indian Metropolitan city in gis environment International Journal for Traffic and Transport Engineering; 2016; UDC: 656.1.02

Reports and other Government Publications

1. Modal Shift and High-Speed Rail:A Review of the Current Literature. San José: Mineta Transportation Institute:June 2014.