Personal Rapid Transit System Scope in India

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Abstract—Personal Rapid Transit (PRT) is a state-of-art amalgamation of automotive, computer, network and transit technologies which could prove to be very economical if properly managed. This research project investigates the status of personal rapid transit (PRT) applications in congested urban and developed environments, to understand the characteristics and attributes of these systems, to explore the viability of a PRT system in Indian cities, and to prepare a synthesis report and presentation that document the project’s findings. The system is running successfully at Heathrow Airport, Morgantown (US), Masdar City UAE and various other success stories are discussed in the paper. The paper deals with discussion and comparison of PRT with other modes of transport as well.


I. INTRODUCTION

Personal rapid transit (PRT) is a relatively new and ingenious on-demand system for developed or urban environments. It is designed to fulfill the need for low-congestion, multi-origin, multi-destination public transport service.

PRT is definitely the most energy efficient alternative to current mass urban transport systems so far. It subsists of small light weight 2-6 passengers vehicle mounted on an elevated guideway with an automated control. The vehicles are electrically operated but have no batteries. Instead they take power from electric contacts embedded in the guideways. PRT vehicles are intended to accommodate for individual or small group travel. Guide ways are arranged in a webbed topology, with every station located on claddings, and with frequent merge/diverge points. This allows for the facilitation of nonstop, point-to-point travel, bypassing all transitional stations. The point-to-point service may be related to a taxi or a horizontal elevator.

II. HISTORY

PRTS seems to be a relatively new concept for India but in reality, it has been developing since early 1950’s. Don Fichter, a city planner, was credited with developing early concepts of PRT in 1953 (Fichter 1964). He addressed the requirement for a transportation system that could utilise the smallest and lowest-cost guideways possible and a service designed to fulfill the needs of travellers with the lightest possible vehicles. In 1972 the University of West Virginia in Morgantown started a limited operation of PRT system which was expanded to current capacity in 1975. This system was developed in order to move students between three campuses of distributed across the city with congested streets. It is considered as GRTS (Group Rapid Transit System) as it can transfer up to 21 passengers. It included 8.7 miles of guideway, five offline stations and fleet of 71 vehicles that could serve 30000 riders per day at peak travel times.

Blide (1993) stated that feasibility study of PRT system in Gothenburg, Sweden revealed it to be a most feasible option for the city. This system had a unique grid and “Spiderweb” configuration and can accommodate 6,00,000 trips per day with an average wait time of only 1.3 minutes. One of the most significant PRT programs is Chicago/Raytheon program in mid-1990’s which resulted in the construction of 2200 feet long test track in Marlborough, Massachusetts accommodating three vehicles and one off-line station with 2.5 seconds headway operation (Anderson 2006). The edict (Evaluation and Demonstration of Innovative City Transport) program was a European program sought to develop PRT as a possible urban transportation solution to meet the need for viable new transport systems. It was a 30-month project that was started in December 2001 and ran through May 2004. The main objectives of this program were to study the opportunities for PRT implementation in Cardiff, (Wales), Huddinge (Sweden), Eindhoven (Netherlands) and Ciampino (Italy) and access the potential benefit of PRT in Europe (EDICT 2003).

In 2002, 2getthere unveils twenty-five, 4-passenger “Cyber-Cabs” at Holland’s 2002 Floriade horticultural exhibition. The system’s track was 1969 feet long and
is one way consisting of two stations. The six months operation of the system was to observe the public acceptance towards the system. In October 2005, BAA (British Airport Authority) and ATS (Automated Transport Systems) announced an agreement to adopt a pilot implementation of the ULTra PRT system for Heathrow Airport, London. In 2007, the Polish PRT system named as MISTER was prototyped and was permitted to be installed in two Polish cities. MISTER is a typical overhead PRT system engineered for economical aerial reuse of street’s right of way. In June 2006, a Korean/Swedish consortium, Vectus started constructing a 1,312 feet test track in Uppsala, Sweden. This system was demonstrated at the 2007 Pod Car City conference in Uppsala, Sweden (Carnegie & Hoffman 2007). A 40-vehicle, 2 station, 4.46 km double tracked system is known as “SkyCube” was opened in Suncheon, South Korea in April 2014 in order to reduce the pollution due to the impact of visitors transportation in nature reserves and bird sanctuary.

As of July 2013, four PRT systems are operational: Morgantown PRTS, which has been in continuous operation since 1975. A 10-vehicle 2getthere system is being operated since 2010 at Masdar City, UAE. A 21-vehicle Ultra PRTS is being operated at London Heathrow Airport since 2011 and a 40-vehicle Vectus system has officially opened in Suncheon, South Korea in April 2014 after a year of testing. India has yet to launch its first PRT system. However government in the year 2016 has laid the foundation stone for project Metro which would be first ever PRT system in India (Dash 2016).

III. WORKING

Guideway - The pods run on light, malleable and aesthetic guideways. These guideways are constructed at a height from the ground to ensure safety and stability, and avoid congestion in the operation of the PRT as well as road traffic. The piers of the guideway are not built very heavily as the guideway has to carry light pods with only few passengers inside them. The pavement surface is made in an intelligent way. Portion of the surface where wheels of the pod car are to run are smooth while rest of the area is made of either steel mesh with round wholes or parallel running horizontal steel bars. The width of pavement is in accordance with the width of the pod car. An array of power cables have to be laid in the pavement which will provide electricity to the pod cars. As the pavements are light weight and flexible, they can be easily routed as per the requirement. Also at turning points, a slight superelevation suffice. The problems of ice and snow are also kept in mind while construction in areas that might face such problems. Even though the snow passes from the gaps of the pavement, a “benign” de-icing fluid is applied on these pavements to prevent the icing action. This fluid allows perfect function at temperatures as low as -15 degree Celsius.

III(I) Pods

These are light weight cabs made to carry 3-6 people at a time. It is appropriately sized so as to carry its passenger capacity as well as extra materials like wheelchairs, bicycles, shopping carts, push carts etc.
They do not have heavy engines or other heavy mechanical parts driving these pods. These are run by electric motors that are individually installed in each pod. The motors receive electricity from the cables distributed in the guideway. The pods provide an enjoyable journey for passengers while ensuring their safety as well as their comfort. Pods can be air-conditioned if required. The wheels nothing but solid rubber to ensure least maintenance. They are small in size and run on a particular exact path.

III(II) Monitoring System
The monitoring system that operates PRT is one of the best available monitoring system in today’s world. This centralised system is responsible for smooth, fast, proper, safe and efficient functioning of PRT. The system is simple and intuitive; a touch screen panel allows users to choose their destination while an automated voice-over guides them through the process. Once on board passengers can relax as the vehicle takes them straight to their destination. The use of pre-existing technology, mostly from the automotive industry, provides a mature, sustainable and reliable system. The system monitors movement of pod cars. It keeps on analysing the locations of every pod and also the demand of pods at every different station. When the demand at a particular station is increased, the system automatically diverts pods from low demanding areas. The stations are made off the track to avoid any form of disruption in the movement of these pods. The most important work of the system is to check the status of each pod in real-time and prevent their collisions at intersections of cross-ways and of stations.

IV. ADVANTAGES OF PRT
Congestion free - Due to the advanced monitoring system and proper guided route, there are negligible chances of congestions like traffic jams, slow movement or any other obstruction in the movement.

Negligible chances of accidents - All the reasons of accidents in conventional transport system e.g. haphazard movement of traffic, human errors, vehicle defects etc. have been eliminated here due to the use of modern technology and advanced navigation systems.

Space restrictions - PRT is supported on piers which need very less cross-sectional area for their erection. It is so due to the lightweight of super structure.

Flexible routing - The guideways can be routed as per the demand of the passengers. This therefore, enables a smooth functioning of these pods as well as controlled traffic of the surrounding. Extensions of such guideways are possible with increase in demand only by tweaking the administering system.

24x7 availability - It ensures smooth and efficient functioning even under adverse climatic conditions. It requires minimal man power and can be operated round the clock.

On-demand service - This ultra-advanced system gives the provision of selecting desired routes based on customer needs. There are no pre-defined routes that the passengers will have to adjust to.

Greater privacy - It avails the facility of privacy. As if wished a person or a group of persons can travel in a pod car without sharing it with others.

Zero on-site emission - Pod cars are electrically driven and, hence, eliminate on site emission of any type of pollutant.

Extremely low overall energy use - Pod cars are very lightly built and utilise very little electricity. The monitoring system doesn’t consume large quantities of energy either. Thus, the overall consumption of energy is minimised.

V. PROPOSED SYSTEM
In the recent years, along with the local population of the country, tourism has grown in India from local economic activity to a major global industry giving
employment to a large number of people at various levels. Indian cities like Varanasi and Agra possess a great potential for tourism. Mixed traffic composition and narrow carriageways in old city areas of such a contribute to slow moving traffic. Even though there is great potential for tourism, most cities lack planning for tourism and supporting infrastructure. Core areas become chaotic during religious or cultural events as the number tourists increase exponentially. The problem has become much more pronounced due to continual annual increase in registered vehicles. The congestions constitute of mixed traffic with a predominance of two wheelers, auto-rickshaw and slow moving cycle-rickshaw, bicycles, and pedestrians. Frequent bottlenecks, poor traffic management and repetitive encroachments on the road by vendors increase troubles for people in epic proportions. Frequent braking of vehicles not only increases the air and noise pollution but also cause frequent accidents. Measures have been taken by local authorities in various cities like vehicle restricted zones, unidirectional traffic, no vehicular entry periods, etc. but they help to address congestion problems in a limited manner which is not sufficient.

Basic objective of this study is to provide a sustainable transport infrastructure solution by integrating PRT System from railway stations and airports to major and multiple stops across the city. Since there is a lack of proper public transport in some of the lesser modernised cities, it is expected that PRT would reduce congestion on roads by accommodating a large proportion of the traffic. The PRT network proposed is a two-way PRT network designed to connect major primary landmarks across each city. On these routes, apart from other primary tourist spots, well established authorised commercial areas which attract shopping and recreational locations are also present. The development of such a proposed system will provide solution to a major problem plaguing our country - Traffic congestion. Even in cities like Mumbai where the public transportation system is fairly well organised, there are extreme traffic problems throughout the city. Instalments of such a PRT System will solve major problems that the current systems fail to address. Each of the currently existing transportation systems work on the concept of a predefined route and do not provide the variability of a more dynamic selection of said route. The variable nature of the route in PRT Systems will allow travellers to avoid the excessive in-transit stops that they have to make just to get to their destination. This will not only provide convenience and privacy but will also save time and function on a much cleaner source of energy. This is a much needed solution to a much dreaded problem that this country faces.

VI. CONCLUSIONS

From the study done above it can be concluded that PRT is the technology of future for transportation system in a populated country like India. It is also pollution free that makes it more environment friendly. The cost and expense of it contributes in sustainable development of big cities or the tourist places in a country like India. If this study is managed and implemented properly, it will provide a fast, systematic, efficient, intelligent, safe and economical transport mode to big cities in India.

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