TriMet Transit Tracker Implementation

Summary

Transit Tracker is a real-time bus arrival prediction system that provides information to riders at bus stops and light rail stations with a count down in full minutes to the arrival time of the next bus and the scheduled arrival time of the next train. The system uses a global positioning system (GPS) unit on-board every bus and in-track sensors for light rail to provide 90-second updates to the bus electronic display signs and to a web, WAP and phone based system.

The objective of the Transit Tracker program was to improve the customer’s experience with the Portland, Oregon public transportation system by providing accurate and timely information. The goal was to provide customers with better information in order to make transit a more attractive choice, which in turn can increase ridership and improve customer perception of the service quality.

The internal agency goals for Transit Tracker were to maximize the use of existing infrastructure and resources. Therefore, it was built on systems already in place for bus and rail and was integrated into those systems.

Description

By 1997 TriMet had successfully implemented their comprehensive Bus Dispatch System (BDS) that included the installation of GPS-based Automatic Vehicle Location (AVL) devices on-board the entire fleet of buses.

Around the same time, a TriMet employee working on the implementation of AVL at TriMet visited London, England and was able to view the new “Countdown” system that had been in use since 1992. The London transit system had implemented a pilot program with 480 display signs on one bus route and the evaluation of the system showed that customers valued the service. Results from a pilot survey by Transport for London found that Countdown has generated a minimum of a 1.5% increase in new revenue.1 Riders also found that they depended less on the scheduled time point information which reduced anxiety about whether the bus had just passed. Before and after surveys also found that people were able to more accurately perceive their wait

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time and thought that the buses had a higher on-time arrival rate than the actual on-time arrival rate.²

Around the same time, a new TriMet General Manager, Fred Hansen, was focusing the agency on customer service. Mr. Hansen read a news story about the “Countdown” system and asked staff to prepare a proposal to implement a similar system for TriMet. Soon afterward, staff proposed a phased program with the following customer service oriented goals:

- Reduce perceived waiting times at bus stops and light rail platforms,
- Help reduce passenger uncertainty, and
- Allow passengers to make informed decisions about they will use their time.

Staff proposed the following three phases³.

**Phase I:** Deploy real-time customer information displays at two bus stop locations that represent two different types of bus stops; a major bus facility (SW Salmon/5th Ave) and a standard bus stop in inner NE Portland (NE Martin Luther King Jr. Blvd/NE Killingsworth).

**Phase II:** Conduct an evaluation of the traveler information displays to determine user acceptance of the system as well as site selection for expansion of the system.

**Phase III:** Complete deployment of the operational system on the street as well as add new technologies to decrease long-term operations and maintenance costs.

**System Architecture**

Before placing the displays out on the street, staff prepared a list of system architecture goals. The new system should:

- Provide an architecture that will operate with the existing Bus Dispatch System (BDS) and be ready to upgrade with improvements in the BDS.
- Bus stop signs should display predicted arrival times for ten routes for either the next half hour or the next three buses (whichever is least) and provide the bus route number, destination of the bus, and predicted arrival time in increments of whole minutes.
- The bus stop signs shall be capable of displaying messages 200 characters long and be able to cycle through three sets of messages.
- The architecture will allow for estimated arrival time solely based on deviation data provided by the vehicle. The system would also need to accommodate future new information such as traffic, road and weather conditions or historical data.

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² Transit Cooperative Research Program, Strategies for Improved Traveler Information, Project A-20A(1), FY 1997
³ TriMet 5-year ITS Plan, 1999
• The accuracy should be +/- 60 seconds when the bus is 15 minutes away.

There were three specific issues with the implementation of the pilot program:

• Software - for running the new system
• Communication protocol to be used between the new system and the signs
• Hardware – the signs themselves

All of the issues above revolved around open vs. proprietary interfaces. TriMet seriously considered using third-party companies to provide the Transit Tracker software and hardware such as a company called Nextbus. However, the use of another company’s technology meant that TriMet would be paying annually for the use of a communication system and technology owned by a third party and that integration with existing software would not be feasible.

The company Orbital TMS had developed the software for the existing Bus Dispatch System which was to be the foundation for the new system. BDS communicates between the buses and BDS by Radio Frequency (RF) data channels.

The decision was made to work with Orbital TMS to create software, called InfoTrack, that would take the information from the Bus Dispatch System and relay it to the bus stop displays. The only change necessary to the old BDS was to update the frequency of messaging from every 3 minutes to every 90 seconds.

Instead of relaying this information using the existing Radio Frequency data channels, the decision was made to use Cellular Digital Packet Data (CDPD) due to ease of integrating with Orbital’s standard products use CDPD modems. The monthly charge for the CDPD service was a minimal $50. This monthly charge has significantly increased with the addition of more signs. TriMet applied and was granted greater bandwidth for their RF recently and they will be looking to place new signs on this system in the future.

Finally, the bus stop displays were designed in-house by TriMet staff and built by a company in the Portland, Oregon area. This decision was made based on costs and control of the system by TriMet rather than relying on a third party.

Implementation

After the system architecture was designed and tested in-house, the first two bus stop locations and one light rail station were chosen to deploy the technology in May of 2000:

• High capacity transit shelter downtown Portland on the transit mall at SW Salmon and 5th Avenue,
• Standard bus stop shelter on NE Martin Luther King Jr. Blvd at NE Killingsworth, and
• Gateway Light Rail Station (a transfer point between two light rail lines and bus routes).

The pilot program was underway for several months when the decision was made to skip Phase II, the in-depth evaluation, and proceed to Phase III. The main reason for skipping Phase II was to coordinate with a new Ad Shelter Program. This new marketing program placed back-lit advertisements in bus stops with high passenger volumes. Coordination with program meant that significant costs of providing power to the signs could be drastically reduced.

The decision was made to move to Phase III. By the end of July, 2003 TriMet had increased the total number of bus displays to 18 and the number of light rail station signs to 33.

After working on the program for 3 years, customer and system evaluation was completed. Internally, TriMet staff evaluated the system and found that they were accurate to within one minute 91% of the time. In addition, there had been no graffiti or vandalism.

Users Assessment

Customers

A customer evaluation of the system was done through a U.S. Department of Transportation Intelligent Transportation Systems grant. The study completed surveys at bus stops and an on-line survey to assess the following about bus riders:

• Use of trip planning information
• Perceptions of transit efficiency
• Perceptions of personal safety
• Perceptions of Transit Tracker
• Overall perception of transit system

The results of the surveys showed that repeatedly riders were happy with their use of Transit Tracker. Interestingly, the hypothesis that riders have more accurate information on their trips, that TT was easy to use and that riders are overall happy with transit service was supported by the data. The perceptions of transit efficiency and personal safety depended on the location of the bus stop. The surveys showed that if people were happy with service and safety before TT, there was no statistically significant change.

Agency

TriMet is a municipal corporation providing public transportation for much of the three counties in the Portland, Oregon region. TriMet operates a comprehensive transit network including a 44-mile, 64-station light rail system, 93 bus lines, service for seniors
and people with disabilities and enhanced amenities and information. The population of the Portland region is about 1.8 million.

TriMet provides service in order to provide transportation choices and maintain clean air. More importantly, the region expects that TriMet will assist in implementing the 2040 Growth Concept that decreases non-single occupant vehicle trips by concentrating residential and employment growth in transit-oriented centers throughout the region.

TriMet is a leader in providing innovative transit service. TriMet’s has demonstrated an ability to evaluate and change direction, if necessary. This ability to roll out new exciting initiatives, gain media attention and then ask for their feedback is why TriMet has helped result in very little negative media attention.

Potential users of this technology are transit companies that have already introduced some type of vehicle tracking system and wishes to move away from the need for riders to use schedules with time points. In attempting to communicate transit arrival times with their customers it will be necessary to have this important element already in place.

Technology Assessment

Benefits

In order to attract and retain customers, transit agencies must provide easy and accurate methods of determining when the next bus will arrive. To keep up with societal technology trends, these methods must be on-site or in the “palm of their hand” with a cell phone or personal digital assistant (PDA). Moving arrival time information to the user, in Portland, has had the benefit of increasing riders’ satisfaction with the overall transit system and easing their anxiety about using the system.

Complexity

The complexity of the system depends on the decision to use open or proprietary systems. In order for the system to be open and integrated with existing systems within the agency, the complexity increases due to coordination with these existing systems. However, in the long run the agency trades off independency and possible cost savings if a proprietary system is chosen.

Cost

One of the unforeseen costs was the provision of power to the bus stops. The cost to add electric service to a bus stop is about $5,000 plus another $5,000 for hardware. One idea to cut costs was to coordinate transit tracker implementation with the Ad Shelter Program. Unfortunately, the Ad Shelter program has not proven to be that successful.
Observability

The survey of customers that was completed for TriMet found that this method was helpful for communicating with the customer for emergencies and that the customers generally valued the product as seen in the customer evaluation surveys.

Consequence of Failure

If Transit Tracker had failed significantly in its accuracy or in its ability to provide information in emergency situations, there would have been a questioning of how to make the system more accurate or more reliable for emergency situations. If reliability had been an issue and the customers were placing a value on the system, TriMet would have either found partners to share the cost or found a way to provide the information through a different medium such as they did with a decrease in revenue.

Implementation Issues

From the perspective of TriMet, the two implementation issues that had to be overcome were system architecture for long term growth of the system and the cost of providing power to the bus shelters.

The monthly charge for CDPD service was a minimal $50 when the program began. This monthly charge has significantly increased with the addition of more signs. TriMet applied and was granted greater bandwidth for their RF recently and they will be looking to place new signs on this system in the future.

The capital cost of installation became the issue to implementation of the hardware. With the flexibility of staff and the increasing use of cell phones, PDAs and the web by customers, the agency moved on to a new phase until capital costs can be reduced.

Project Status

The initial plan for Transit Tracker called for 25 new signs per year until 2006. Currently, Transit Tracker has taken a new direction. Due to a downturn of the Portland and national economy, TriMet has faced large losses in revenue from decreases in the payroll tax. Staff are currently working on new, less expensive ways to use the Transit Tracker technology to interface with PDAs and cell phones. This type of interface means less hardware costs for the agency by using personal hardware. Currently, the Transit Tracker is available via the Internet, for desktop trip planning. In addition, a rider can use the TriMet website to determine their bus stop number (a four digit number) and then call a specific number to find out the arrival of the next buses to that bus stop.

Staff is also looking to add wireless internet capability to the light rail stations and trains in order for people to be productive en-route as well as access information on the next train arriving. This technology will not be available to bus and bus stops in the near future.
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