NOT YOUR FATHER’S BUS ANYMORE: CURRENT TECHNOLOGY FOR IMPROVING MOBILITY

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President, Schweiger Consulting
Thursday, August 22, 2019

http://www.detroittransithistory.info/PhotoGalley/Photos1940sA.html
PRESENTATION OUTLINE

Federal View of Mobility Innovation

Transit Technology Menu

What is Mobility as a Service (MaaS)? What is Mobility on Demand (MOD)?

Key Enablers and Use Cases

Wrap-up and Resources
**Mobility Innovation Principles**

**Traveler-centric** – promotes choice in personal mobility driven by the specific needs of the traveler and utilizes universal design principles to capture the needs of all travelers.

**Mode-agnostic** – encourages multimodal connectivity and system interoperability where all modes of travel are considered and integrated seamlessly to achieve the complete trip vision.

**Technology-enabled** – leverages emerging and existing technologies, data connectivity, and standardization to support personal mobility choices.

**Partnership driven** – develop and leverage unique partnerships, both public and private, to accelerate deployment of emerging mobility options.
Between trip origin and departure location

Example: Crossing streets

Potential Transition Points

At Trip Origin:
- Pick-Up Point
- Station Platform
- Payment Location
- Docking station (bike/scooter share)
- Station entrance
- Terminal location (incl. ferry terminals)

Steps Prior to Departure:
- Boarding vehicle
- Paying once on-board
- Device securement

Potential Transition Points

At En-Route:
- On-board vehicle
- Inside tunnel
- Underground
- At street surface

Potential Transition Points

At Arrival:
- Paying before alighting vehicle ("Tap off")
- Disembarking

Potential Transition Points

Complete Trip

- The return trip circles back and repeats the steps like a separate trip.

Transition Points

- Between stop and transfer location
- Between the final stop and the trip destination

These trip aspects may be repeated for multi-modal trips.
TRANSIT TECHNOLOGY MENU

Fleet Operations and Management
Traveler Information
Safety and Security
Automated Fare Payment
Maintenance
Other
Dependencies Among Technologies
COMMUNICATIONS TECHNOLOGIES

• Depend on infrastructure and devices used to transmit **voice and data**
• Can transmit voice, text, data, and video over **radio, cellular, or other wireless networks**
• Types of wireless networks:
  • Wide area wireless (WAW)
  • Wireless local area network (WLAN)
  • Dedicated short-range communications (DSRC)
  • Land line and cellular telephone networks
  • Internet and intranet
AUTOMATIC VEHICLE LOCATION (AVL) & COMPUTER-AIDED DISPATCH (CAD)

• For operations management, periodically receives real-time updates on vehicle locations and schedule/route status

• Onboard computer with Global Positioning System (GPS) and mobile data communications

• Provides decision support tools used by dispatchers and supervisors, allowing proactive management of operations

• Allows for "single point" logon for all onboard systems
AUTOMATIC PASSENGER COUNTERS (APCS)

- Monitors passenger activity and uses algorithm to **count number of boarding and alighting passengers**
- Data can either be stored for downloading/uploading or transmitted in real-time
- Most common type is **infrared** technology
- Ability to "**stamp** data with exact bus stop location" and time of day through integration with AVL
- Transit operators typically deploy APC equipment on **12–25%** of their vehicles and then rotate the vehicles on different routes as needed
FIXED-ROUTE SCHEDULING SOFTWARE
PARATRANSIT SCHEDULING & DISPATCHING SOFTWARE

- Database
- Monitoring Unit
- PSDS
- Reservations Workstations
- Scheduler
- Mobile Data Terminal
- Data Modem
- Customer
- Vehicle

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TRANSIT SIGNAL PRIORITY (TSP)

• Give authorized transit vehicles ability to automatically change timing of traffic signals
• Can be limited to extending green cycle, but can result in red cycle truncation and phase insertion
• May be done “conditionally” based on passenger load, type of service (Bus Rapid Transit (BRT) vs. local), and schedule adherence

• Four major elements:
  • Transit vehicle
  • Transit fleet management
  • Traffic control
  • Traffic control management

• Enhanced with four functional applications:
  • Vehicle detection
  • Priority request generation (PRG)/PR server (PRS)
  • TSP control strategies
  • TSP system management
YARD MANAGEMENT

• Automatically locates vehicles within certain distance accuracy inside yard

• Allows yard attendants to adjust vehicle locations manually on yard map

• Provides interface with CAD/AVL system to record pull-in and pull-out time, and assigned vehicle operators

• Can be interfaced with fixed-route scheduling software to access vehicle operator information in real-time

Ubisense: https://www.ubisense.net/product/smart-transit
AUTOMATIC VOICE ANNOUNCEMENTS (AVA)

• Audio and visual announcements

• As fixed-route vehicle approaches stop or other designated location:
  • Digitally recorded announcement automatically made over onboard public address system speakers
  • Displayed on dynamic message signs inside vehicle to inform passengers about upcoming stops, major intersections landmarks
  • Can make time-based, location-based, and vehicle operator-initiated announcements/displays
EN-ROUTE/WAYSIDES TRAVELER INFORMATION
ONBOARD INTERNET ACCESS

• Being provided particularly on vehicles that service lengthy routes

• Some agencies leverage onboard communications hardware that provides both data communication for
  • Agency
  • Wi-Fi for passengers

Don Murphy, IBI Group, “Emerging On-board Transit Architectures & Implications: An Exciting Opportunity,” presentation at the 2018 ITS California Annual Meeting, Anaheim, CA, October 3, 2018
INTERACTIVE VOICE RESPONSE (IVR)

- IVR Platform (includes hardware and software)
  - Direct Access to CAD/AVL and RTIS
  - XML Interface
  - Direct Access to Scheduling Software
  - XML Interface

- Scheduling Software
- Transfer to Customer Service Representative
  - Direct Access to CAD/AVL and RTIS
  - XML Interface

- CAD/AVL and RTIS
  - XML Interface

- Telephone System
  - RT Information
  - Trip Notifications

- RT Information
- Trip Notifications
GOOGLE TRANSIT AND
OPENTRIPPLANNER

• Google Transit
  • General Transit Feed Specification (GTFS)
  • GTFS-realtime
  • GTFS-flex
  • GTFS-vehicles
  • GTFS-ride

• OpenTripPlanner
TRANSIT TECHNOLOGY MENU

- Fleet Operations and Management
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- Other
- Dependencies Among Technologies
MOBILE AND FIXED VIDEO SURVEILLANCE

- Review recorded images
- Potential crime prevention
- Identify criminal activity and perpetrator(s)
- Identify improper passenger and driver behavior
- Incident/insurance investigation
COVERT EMERGENCY ALARM AND COVERT LIVE AUDIO MONITORING

• Allows **dispatchers to listen in** on what is happening inside vehicle while an incident is taking place

• Covert microphones are **one-way communications** in order not to alert person responsible for incident that dispatcher/police are listening in

• **Driver in distress presses covert switch** that:
  • Activates covert microphone
  • Monitor in dispatcher’s office automatically displays information for that vehicle
  • Map display zooms in on that vehicle
ONBOARD DIGITAL VIDEO RECORDERS (DVRS)

• Connected to onboard cameras to record images from cameras
• Equipped with removable recording drive to allow playback of recorded video on centrally located playback system
• Able to store specific number of days of video, beyond which, previously recorded video will be overwritten
• May have capability to use Wi-Fi to upload video once vehicle enters yard or garage
**TRANSIT TECHNOLOGY MENU**

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AUTOMATED FARE MEDIA

• Magnetic stripe cards
• Smart cards - integrated circuit (or chip) card that has microprocessor and built-in logic: contact, contactless, and combi-card
• Mobile payment
  • Accommodate options such as stored value, stored trip, various lengths of passes, and fare capping
• Facilitates transfers
TRANSLIT TECHNOLOGY MENU

- Fleet Operations and Management
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MAINTENANCE: ENGINE AND DRIVETRAIN SYSTEMS MONITORING

• Sensors that **monitor various components** of vehicle and report back on components performance

• Maintenance supervisors can use this information to **perform preventive maintenance intervention** before minor problem becomes major and costly one

• Monitoring performed in **real-time** and problems are reported instantly
TRANSIT TECHNOLOGY MENU

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DATA MANAGEMENT AND REPORTING

- **Data generated** by transit ITS components installed in vehicles, and at central and other locations
- Data typically collected and archived in individual databases
- Once data archived, used for “after-the-fact” analyses and reporting by different business units within a public transport organization (e.g., planning, operations, customer service)
- Utilize true potential of data by consolidating in central repository to make process of data management, analysis, and reporting more efficient
AUTOMATED VEHICLES

- Michigan Mobility Challenge
- Strategic Transit Automation Research Plan from FTA
  - Framework to pursue transit bus automation
  - Activities identified in Enabling Research, Integrated Demonstrations, and Strategic Partnerships
- Minnesota Valley Transit Authority (MVTA) developed a lane guidance system for bus-on-shoulder operations along Cedar Avenue (Trunk Highway 77)
### SUMMARY OF TECHNOLOGY PACKAGES AND USE CASES

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AUTOMATED BRAKING

• Functional Description:
  • **Monitors vehicles, pedestrians, and objects** in the path based on distance, speed, and time
  • When potential for collision detected, **warning is sent to driver**
  • If driver does not react and distance or time-to-collision threshold is crossed, **brake system pressurizes brake lines** to reduce time it takes to apply brake torque if necessary
  • When the next distance or time threshold is crossed, the system applies a brake jerk
    • If driver still does not apply brakes, system **commands zero propulsion torque** and brake torque sufficient in time and magnitude to avoid collision
    • If driver does not apply sufficient brake force to avoid collision, system commands **additional brake torque** to avoid the collision
  • Most systems **operate above a minimum speed threshold** (e.g., 5 kph or 3.1 mph)
CORE TECHNOLOGY DEPENDENCIES

CAD: Computer-aided dispatch
AVL: Automatic vehicle location
APC: Automatic passenger counter
AVA: Automatic Voice Announcements
RSA: Route & schedule adherence
ETA: Estimated time of arrival
RTIS: Real-time information system
IVR: Interactive voice response

CAD/AVL & APCs

- Location, events, passenger counts, and voice and data communication management
- Interfaces with dissemination channels/media
- Geo-triggers and announcement files

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# MOBILITY ECOSYSTEM

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<td>???</td>
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EXAMPLES OF MOBILITY AS A SERVICE

• LA Metro - Equity
• Dallas Area Rapid Transit – P3
• Greater Dayton Regional Transit Authority – Agency provides MaaS
• Tompkins County, NY – Rural/Small Urban MaaS Framework
• Valley Flex – Rural MaaS Pilot
• AARP/FlexDanmark
Universal Mobility as a service

- A single, integrated network of traditional and non-traditional services that together serve EVERYONE
- Universal Design
- With or without AVs
- One stop shopping
  - Easy Discovery
  - Easy Booking
  - Easy Mode Transfers
  - Easy Payment

From Jana Lynott, AICP, Senior Policy Advisor, “Universal Mobility as a Service,” International Conference on Demand Responsive and Innovative Transportation Services, Tuesday, April 16, 2019, Baltimore, MD
FlexDanmark

- “On-demand" transportation for all citizens
- 5.7 million annual trips
  - 15,000 trips/day on average
  - Peak day at +24,000 trips
  - 250,000+ returning customers every year
- 95% on-time performance defined as 15 min window
- Portal used by hospitals, medical offices, and human service agencies to connect clients to transportation
- High level of institutional coordination
  - 5 public transit authorities
  - 1 Nationwide system
  - 550+ providers (all private sector)
- Cost allocation built into the software
- Cost savings of 20-40%
- Automated interface and common data format

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THANK YOU!

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