Mobility Assistance
Test Plan and Report
Operations & Maintenance Plan
SPEAKERS

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TODAY’S AGENDA

01 | PURPOSE OF THIS WEBINAR
   • Share concept development activities from Smart Columbus with stakeholders

02 | WEBINAR CONTENT
   • Smart Columbus Program Overview
   • MAPCD Project Overview
   • MAPCD Project Test Plan and Report
   • Lessons Learned
   • MAPCD Operations & Maintenance Plan
   • Project Update
   • How to Stay Connected
   • Stakeholder Q&A

03 | WEBINAR PROTOCOL
   • All participant lines have been muted during the webinar in order to reduce background noise
   • Questions are welcome via chatbox during the Q&A Section
   • The webinar recording and presentation materials will be posted on the Smart Columbus website
$40 MILLION
78 APPLIED • COLUMBUS WON
MISSION

To demonstrate how an intelligent transportation system and equitable access to transportation can have positive impacts on every day challenges faced by cities.
MOBILITY ASSISTANCE FOR PEOPLE WITH COGNITIVE DISABILITIES

WALK TO CLEVELAND AVE THEN TURN LEFT
Objectives

- Improve mobility independence and confidence of travelers
- Move certain paratransit riders to fixed route bus service
- Reduce COTA expenditures

Solution

- An accessible smartphone program for providing multimedia prompts to individuals with cognitive disabilities for navigating public transit systems.
BACKGROUND

SMART Route Library

Cloud-based library with no stage limitations

SMART Route Builder & App Route Builder

WayFinder Travel App

Public

Agency

Source: COTA

SMART Route Library

Smart Route Builder & App Route Builder

WayFinder Travel App

Public

Agency
TEST PLAN AND REPORT
TEST PLAN IN THE DESIGN PROCESS

Phase I: Requirements
Product Goals & Objectives Established

Phase II: Product Solution
Detailed Specifications Developed

Phase III: Product Development
Detailed Product Design & Build Process

Phase IV: Testing & Validation
Product Tested to Specifications
TEST PLAN OBJECTIVES

Requirements Testing
• Individual requirements
• Integrated performance within the application
• Smart Columbus enhancements

Scenarios Testing
• Tested a variety of scenarios
• Incorporated different methods of travel and environments
• Used a diverse set of testers
Requirements testing evaluated requirements specified in:

• MAPCD trade study essential items
• MAPCD trade study desirable items
• OSU evaluation essential items
• ATTRI grant
STAGE 1: REQUIREMENTS TESTING

Essential Functions:

- System access
- Route creation via portal
- Route creation via app
- Tracking
- Accessibility
- App features and settings
- Alerts
- User communication and caregiver support
## REQUIREMENTS TESTING EXAMPLE

<table>
<thead>
<tr>
<th>Function Category</th>
<th>Function Title</th>
<th>Function Description</th>
<th>Metric</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF2</td>
<td>Route Creation</td>
<td>Ability to generate a route composed of individual waypoints, which includes at least a start and end point.</td>
<td>5 people will each create 3 roundtrips (a total of 6 routes per tester) with at least 5 waypoints on each route using the web portal.</td>
<td>Manual route function creation criteria will be considered met with 100% success rate. To be successful the route will be created on the portal without the site freezing, logging the individual out, the routes not being saved correctly. User will be able to successfully create a one way route or a roundtrip route. A roundtrip consists of two routes, the first route going from a starting point to a desired destination. The returning route will be from the desired destination back to the starting point.</td>
</tr>
<tr>
<td>EF2a</td>
<td>Route creation via web-based application</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EF2b</td>
<td>Waypoint content</td>
<td>Ability to add the following media types to each:</td>
<td>5 people will add text, audio, and photos to each waypoint in all 6 routes</td>
<td>Waypoint creation function criteria will be considered met with 100% accuracy and ability to add text, audio, and photos to all waypoints</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Text</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Audio</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Photos</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
STAGE 2: SCENARIO TESTING

Scenario testing evaluated several type of routes and scenarios:
- Walking routes
- COTA bus routes
- Open and obstructed spaces
- App-only and portal-only route creation and evaluation
- Route deviation
### Table 4: Walking Route Test Scenarios

<table>
<thead>
<tr>
<th>Test Number</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Title</strong></td>
<td>Walking route – open space (unobstructed GPS signal) – app only</td>
</tr>
<tr>
<td><strong>Function(s) Tested</strong></td>
<td>EF4 (a &amp; b), EF5 (a &amp; b), EF6 (a &amp; b), EF7(a, b, c, d, &amp; e)</td>
</tr>
<tr>
<td><strong>Test Objective</strong></td>
<td>Create route in open space (area without obstructions of GPS signal) using app only. Test route using app only.</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>○ Evaluate the effectiveness of the app in generating a pedestrian route on the OSU campus from one building to another building ○ Evaluate the effectiveness of the app when completing the pedestrian route. ○ Evaluate accessibility considerations when testing route ○ Evaluate alerts as appropriate and available when testing routes ○ Evaluate notifications and error response when testing routes</td>
</tr>
<tr>
<td><strong>Equipment &amp; Setting/Environment</strong></td>
<td>Route script information, Android device, access to Web Portal as needed</td>
</tr>
<tr>
<td><strong>Personnel Required</strong></td>
<td>Research personnel (x3). One researcher will generate route and then complete route. 2nd researcher will document visual observations. 3rd researcher will document observation from web-based portal.</td>
</tr>
<tr>
<td><strong>Procedure &amp; Evaluation Criteria</strong></td>
<td>○ Create route: record the number of waypoints, the location of waypoints and the WayFinder App settings ○ Initiate route: record the number of icon selections the individual takes to initiate the start of route ○ Navigate route: record the number of times the next waypoint doesn’t appear ○ Complete route: record the number of times the route doesn’t terminate when reaching destination ○ Web-based portal: record time and location of route initiation, navigation and completion. Record time and location of route deviation. Compare with real-world observations.</td>
</tr>
</tbody>
</table>
1/18/2019: Test plan finalized

1/22/2019: Pre-test training of OSU and CoC personnel

1/22/2019: Testing began

1/28/2019: Portal API testing completed (first test completion)

3/19/2019: Completed Stage 1 testing of all essential and desired functions (MAPCD trade study, OSU eval, ATTRI grant)

3/19/2019: Completed Stage 2 testing of all scenarios
TESTING RESULTS: STAGE 1

Stage 1 testing identified issues which were resolved by the development team before Stage 2.

Examples:
- Slow processing speed and freezing of the application
- Database record access permission issues
TESTING RESULTS: STAGE 1

- Developers modified and enhanced the system when testing identified issues.
- The interactive test and development approach allowed all features to be tested and re-tested as required.
- At the conclusion of the Stage 1 testing, all functions met the performance requirements.
TESTING RESULTS: STAGE 2

Walking Routes:

• Range of scenarios
• Testing included route creation and modification, accuracy of route cues, route deviation, alert functionality and monitoring caregiver notifications.
• Routes evaluated by a minimum of two testers
• Routes functioned with no reported issues
TESTING RESULTS: STAGE 2

COTA Routes:

- Range of scenarios
- Testing included route creation and modification, accuracy of cues, deviation, alert functionality and caregiver notifications
- Routes evaluated minimum of two times
- One test experienced inaccurate bus arrival time. Development team was notified, and then the issue was resolved
- All other routes functioned with no reported issues
• Document, document, document

• Switching engineering methodology presents challenges

• Recruit diverse testers
SMART COLUMBUS INITIATIVE 2019

PROGRESS REPORT
CURRENT ENROLLMENT

40 Active participants

1 Participant is in the assessment phase
6 Participants in Training
17 Participants in Implementation
17 Travel Partners
Self identified special needs: 36 users interviewed to date
<table>
<thead>
<tr>
<th>Reason</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Didn't know how</td>
<td>12</td>
</tr>
<tr>
<td>Crowds</td>
<td>13</td>
</tr>
<tr>
<td>Falling</td>
<td>6</td>
</tr>
<tr>
<td>Had other transportation</td>
<td>18</td>
</tr>
<tr>
<td>No money</td>
<td>10</td>
</tr>
<tr>
<td>Not being able to communicate</td>
<td>14</td>
</tr>
<tr>
<td>Fear of getting lost</td>
<td>11</td>
</tr>
<tr>
<td>Didn't feel able</td>
<td>5</td>
</tr>
<tr>
<td>Being injured</td>
<td>5</td>
</tr>
<tr>
<td>Was able to drive</td>
<td>2</td>
</tr>
<tr>
<td>Parents/Guardian/Family object</td>
<td>5</td>
</tr>
<tr>
<td>Forgetting route</td>
<td>7</td>
</tr>
<tr>
<td>Being Stranded</td>
<td>8</td>
</tr>
<tr>
<td>Inconvenient</td>
<td>9</td>
</tr>
<tr>
<td>Don't live near stop</td>
<td>10</td>
</tr>
<tr>
<td>Don't know how to use the lift</td>
<td>0</td>
</tr>
</tbody>
</table>
### CASE STUDY

<table>
<thead>
<tr>
<th>Problem/Issue:</th>
<th>Route Description:</th>
<th>Solution:</th>
<th>Benefits:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Had taken the wrong bus and gotten lost</td>
<td>• Constructed and supervised route with participant on COTA busses</td>
<td>• 2-3 practice routes allowed comfort and adjustment to real-world setting</td>
<td>• Allows participant to familiarize themselves with bussing system</td>
</tr>
<tr>
<td>• Created anxiety issues for bus travel</td>
<td>• Routes include work and social activities such as the North Market</td>
<td>• Created repetitive phone directions to reiterate that this is &quot;not your stop&quot;</td>
<td>• Eases and lessens anxiety of public transportation</td>
</tr>
</tbody>
</table>

**Current Update:** Traveler feels as if they no longer need to use the app since public transportation has become more natural and easier to them.
## CASE STUDY

<table>
<thead>
<tr>
<th>Problem/Issue:</th>
<th>Route Description:</th>
<th>Solution:</th>
<th>Benefits:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Difficulty with social cues and basic bus safety • Comprehension issues with the constructed trainings</td>
<td>• Utilized OSU Campus Area Bus Service (CABS) routes instead of COTA for practice</td>
<td>• Modifying trainings to suit her cognitive retention ability and create a more comfortable setting • Proposing to start off on OSU CABS as opposed to COTA buses</td>
<td>• Allows practice for her to adjust and become more comfortable with trainings before experiencing more real-world situations</td>
</tr>
</tbody>
</table>
# CASE STUDY

<table>
<thead>
<tr>
<th>Problem/Issue:</th>
<th>Route Description:</th>
<th>Solution:</th>
<th>Benefits:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lack of sidewalk accessibility to get to the bus stop</td>
<td>• Walk on Kenny Rd. to get to bus stop at Kenny Rd. and Fishinger Rd.</td>
<td>• Working to bring attention to lack of sidewalks on routes and ensure that bus stops are safe and accessible (in progress)</td>
<td>• Increased understanding of individualized challenges in the participants day-to-day context</td>
</tr>
</tbody>
</table>
ACCESSIBILITY AWARENESS
OPERATIONS AND MAINTENANCE (O&M) PLAN
The purpose of the O&M Plan is to provide a comprehensive view of the MAPCD operating environment, the elements that make it work, and the processes and procedures for maintaining optimum functionality.

The O&M Plan includes activities required to operate and maintain the system both during and after the Smart Columbus grant period.
O&M PLAN: GOALS

• To keep the WayFinder system operational and to provide optimal service to users
• To provide access to common troubleshooting and user issues and how to resolve them
• To facilitate communications between the support teams and developers
# O&M PLAN: ROLES AND RESPONSIBILITIES

<table>
<thead>
<tr>
<th>Role</th>
<th>Qualification</th>
<th>FTE (%)</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager</td>
<td>Smart Columbus Project Manager</td>
<td>10%</td>
<td>City of Columbus</td>
</tr>
<tr>
<td>Project Research and Outreach</td>
<td>Associate Professor – Clinical – Occupational Therapy Division Director of Rehabilitation Science and Technology - Assistive Technology Center</td>
<td>20%</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The Ohio State University Wexner Medical Center</td>
</tr>
<tr>
<td>Developer</td>
<td>Founder and President of AbleLink Smart Living Technologies</td>
<td>10%</td>
<td>AbleLink Smart Living Technologies</td>
</tr>
<tr>
<td>Project Engineer</td>
<td>Associate Professor - Practice – Department of Mechanical and Aerospace Engineering</td>
<td>10%</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td>Clinical Manager</td>
<td>Occupational Therapist and Doctoral Student – School of Health and Rehabilitation Science</td>
<td>50%</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td>Clinical Support</td>
<td>Occupational Therapist and Doctoral Student – School of Health and Rehabilitation Science</td>
<td>25%</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td>Research and Community Support</td>
<td>Health Science Student – School of Health and Rehabilitation Science</td>
<td>25%</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td>Research and Community Support</td>
<td>Health Science Student – School of Health and Rehabilitation Science</td>
<td>25%</td>
<td>The Ohio State University</td>
</tr>
</tbody>
</table>
### Route Creation Troubleshooting

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creating Routes Without Corridor Data Cannot Detect Off-Route Events</td>
<td>If a route is created with the WayFinder Route Editor (on the device) when the “Use Corridor Data” setting is turned off, then when travelers take those routes, the system will NOT be able to detect when individuals are off route. The use corridor data setting is turned on by default in WayFinder version 3.5 and higher. Page corridor data is required for a WayFinder route to be able to notify the traveler when he or she is off route and to send messages indicating that the traveler is off route.</td>
</tr>
<tr>
<td>Routes Created with Web-Based SMART Route Builder Do Not Include Corridor Data</td>
<td>Routes created with the online SMART Route Builder website require corridor data to be added to the route to be able to detect off route events for travelers. After a route is created online, it should then be downloaded to the WayFinder device. Before the route is used to track on-route/off-route events, corridor data needs to be added to the route. To add corridor data to a route, select the route in the route editor and ensure that the “Capture Corridor Data” setting is on. Then travel the route from beginning to end, being sure to stay in the normal travel corridor while traveling the route. This activity will capture and save corridor data for a previously created route. After corridor data has been added to a route in this way, on-route/off-route events will be able to be detected while the route is traveled.</td>
</tr>
<tr>
<td>GPS Signal Loss During Route Creation</td>
<td>WayFinder provides an icon indicating the strength of the GPS signal. If the GPS signal is lost during route creation, GPS coordinates may not be captured properly while the signal is low or lost. If GPS coordinates are not captured when the route is created, affected waypoints along the route will not play back correctly. To avoid this error, pay attention to the GPS signal icon to make sure there is sufficient GPS signal before creating the route. Use the route editor in WayFinder to recapture the GPS coordinates for any waypoints that do not appear at the location as expected.</td>
</tr>
</tbody>
</table>
### O&M Plan: Sample Preventative Maintenance

<table>
<thead>
<tr>
<th>Activities</th>
<th>Description</th>
<th>Frequency</th>
<th>Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check data availability in OS</td>
<td>Check the availability of data in the OS to ensure that services are up and running.</td>
<td>Weekly</td>
<td>0.5 hours</td>
</tr>
<tr>
<td>Wayfinder API availability check</td>
<td>Continuously monitor the availability of the Wayfinder Tracker API through an external monitor and notification service to ensure the service is available for use.</td>
<td>Continuous/Ongoing</td>
<td>N/A</td>
</tr>
<tr>
<td>Wayfinder Tracker website availability check</td>
<td>Continuously monitor the availability of the Wayfinder Tracker website through an external monitor and notification service to ensure the service is available for use.</td>
<td>Continuous/Ongoing</td>
<td>N/A</td>
</tr>
<tr>
<td>Wayfinder SMART API availability check</td>
<td>Continuously monitor the availability of the Wayfinder SMART API through an external monitor and notification service to ensure the service is available for use.</td>
<td>Continuous/Ongoing</td>
<td>N/A</td>
</tr>
<tr>
<td>Wayfinder SMART website availability check</td>
<td>Continuously monitor the availability of the Wayfinder SMART website through an external monitor and notification service to ensure the service is available for use.</td>
<td>Continuous/Ongoing</td>
<td>N/A</td>
</tr>
<tr>
<td>GTFS Real-Time Updates middleware API availability check</td>
<td>Continuously monitor the availability of the GTFS Real-Time middleware API through an external monitor and notification service to ensure the service is available for use.</td>
<td>Continuous/Ongoing</td>
<td>N/A</td>
</tr>
<tr>
<td>Server Operating System Upgrades</td>
<td>When new server operating system software and patches are released, upgrade and patch to keep current with the latest releases and security patches.</td>
<td>Semi-annually</td>
<td>2 hours</td>
</tr>
</tbody>
</table>

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**Note:** The Effort values for Continuous/Ongoing activities are not specified in the table. This information may be required to plan resource allocation and budgeting for these ongoing activities.
PUBLIC COMMENTS NEEDED

Public comment period open for the MAPCD Test Plan and Report and Operations & Maintenance Plan:

• October 4 - 14

Where to find it:

2. Click MOBILITY ASSISTANCE FOR PEOPLE WITH COGNITIVE DISABILITIES

How to comment:

1. Please email comments to: kdepenhart@columbus.gov
2. Subject line: MAPCD Comments
3. Include your contact information
4. State whether or not you represent a vendor interest
STAY CONNECTED

Webinar recording and materials will be available at ite.org and smart.columbus.gov

HOW TO STAY CONNECTED

USDOT SMART CITY CHALLENGE
PROGRAM INQUIRIES:
Kate Hartman, Chief - Research, Evaluation and Program Management Intelligent Transportation Systems Joint Program Office
Kate.Hartman@dot.gov

SMART COLUMBUS INQUIRIES:
Alyssa Chenault, Communications Project Manager anchenault@columbus.gov

Upcoming Smart Columbus Webinars:

<table>
<thead>
<tr>
<th>Title</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMTPA/CPS Test Plan and Project Update</td>
<td>10/28/2019</td>
</tr>
<tr>
<td>CVE - Interface Control and System Design Document</td>
<td>11/12/2019</td>
</tr>
<tr>
<td>Final Safety Management Plan</td>
<td>11/19/2019</td>
</tr>
<tr>
<td>CEAV - Presentation of Linden Deployment</td>
<td>12/3/2019</td>
</tr>
<tr>
<td>Final Demonstration Site Map and Installation Schedule</td>
<td>12/10/2019</td>
</tr>
</tbody>
</table>
QUESTIONS?
This material is based upon work supported by the U.S. Department of Transportation under Agreement No. DTFH6116H00013.

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the Author(s) and do not necessarily reflect the view of the U.S. Department of Transportation.