



Mobility Assistance for People with Cognitive Disabilities (MAPCD) Operations and Maintenance (O&M) Plan

for the Smart Columbus
Demonstration Program

DRAFT REPORT | August 23, 2019

Produced by City of Columbus

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Acknowledgment of Support

This material is based upon work supported by the U.S. Department of Transportation under Agreement No. DTFH6116H00013.

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Acknowledgments

The Smart Columbus Program would like to thank the following entities for their valuable contributions to the Mobility Assistance for People with Cognitive Disabilities (MAPCD) project and contributions to the Operations and Maintenance Plan.

The Ohio State University	The Central Ohio Transit Authority	AbleLink Smart Living Technologies, LLC
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Abstract

The purpose of this Operations and Maintenance (O&M) Plan is to explain operational and maintenance activities for the Mobility Assistance for People with Cognitive Disabilities (MAPCD) project both during and after the Smart Columbus grant period. This document provides a comprehensive view of the MAPCD environment, the roles and responsibilities that make it work, and the processes and procedures for maintaining optimum functionality.

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Executive Summary

Project Background

The Mobility Assistance for People with Cognitive Disabilities (MAPCD) project is one (1) of nine (9) projects in the Smart Columbus portfolio. The project is meant to enable people with cognitive disabilities to travel more independently on fixed-route bus service. The project team includes City of Columbus staff, subject matter experts with the Central Ohio Transit Authority (COTA) and The Ohio State University (OSU), and participating individuals with cognitive disabilities.

The goals of the MAPCD project are to:

- Allow travelers with cognitive disabilities to transition from using paratransit services to independent travel using fixed-route bus service;
- Provide caregivers with an interface to create individual routes for travelers and be able to view traveler's progress on a map, and
- Collect anonymized data on app usage and travel behavior in the Smart Columbus Operating System (OS) for performance measures and analytics.

Chapter 1. Introduction

1.1. SCOPE AND PURPOSE

This document identifies the scope and purpose of the Mobility Assistance for People with Cognitive Disabilities (MAPCD) Operations and Maintenance (O&M) Plan. It explains how operational and maintenance activities will be performed both during and after the Smart Columbus grant period. The following sections discuss in detail the materials and resources, operational activities, and maintenance tasks and routines taking place to operate and maintain the MAPCD program and other associated systems. This document also specifies the stakeholders, such as agencies and departments within agencies that rely on its successful operation. The purpose of this document is to provide a comprehensive view of the MAPCD environment, the elements that make it work, and the processes and procedures for maintaining optimum functionality.

The goals of the MAPCD project are to:

- Allow travelers with cognitive disabilities to transition from using paratransit services to independent travel using fixed-route bus service
- Provide caregivers with an interface to create individual routes for travelers and be able to view traveler's progress on a map
- Collect anonymized data on app usage and travel behavior in the Smart Columbus Operating System (OS) for performance measures and analytics

1.2. ORGANIZATION

The MAPCD O&M plan is organized into the following chapters:

- Introduction
- Material and Resources
- Training
- Operations
- Maintenance
- Appendix A: Stakeholders
- Appendix B: WayFinder Support Options
- Appendix C: Acronyms and Definitions
- Appendix D: Glossary

1.3. PROJECT DESCRIPTION

The MAPCD project consists of an innovative smartphone application (WayFinder) which is currently being piloted to a maximum of 30 individuals in the Columbus region in partnership with the Central Ohio Transit Authority (COTA) and The Ohio State University (OSU). WayFinder enables persons with cognitive disabilities to travel independently on the fixed-route bus system. Phone-based GPS tracking allows WayFinder to safely guide users with step-by-step visual and audio instructions. The WayFinder system was developed by AbleLink Smart Living Technologies, LLC through research funding from the United States Department of Education (USDOE) and the National Institutes of Health (NIH). Data generated by the system is transmitted to the Smart Columbus Operating System to support data analysis and performance measures during the grant period of the program.

The key components of the MAPCD project are:

- **WayFinder**
 - The WayFinder app is a mobile application which operates on iOS and Android smartphones, using the global positioning system (GPS) on the device to provide geolocation-based prompts to users of the system. The WayFinder app can have any number of routes setup for a person based on his or her typical travel destinations.
- **SMART Route Builder**
 - The SMART Route Builder is a web-based portal for simplifying the ability to create travel routes for various destinations. The SMART Route Builder gives caregivers the ability to create routes for WayFinder using a map-based interface and the ability to view real-time location tracking to show an individual’s progress on a map.
- **SMART Route Library**
 - The SMART Route Library is a cloud-based library of routes to specific destinations that will provide easy access to cloud-based routes for specific geographic areas which can be downloaded and used as is or modified to meet the needs of travelers with cognitive disabilities.
- **AbleLink Cloud Environment**
 - The AbleLink cloud environment hosts the SMART Route Library server application and SMART Route Builder website. The environment also hosts secure Application Programming Interfaces (APIs) to send de-identified travel information to the OS.
- **Smart Columbus Operating System**
 - De-identified travel information for Smart Columbus participants is ingested into the OS via a secure API, where it is available to City of Columbus users as a “restricted” dataset to support project analysis and performance measures.

1.4. SYSTEM COMPONENTS

Figure 1: Major System Components contains a high-level overview of the major system components of the MAPCD project. Each major system component is subsequently described in this section and includes screen captures to help describe key system functionality.

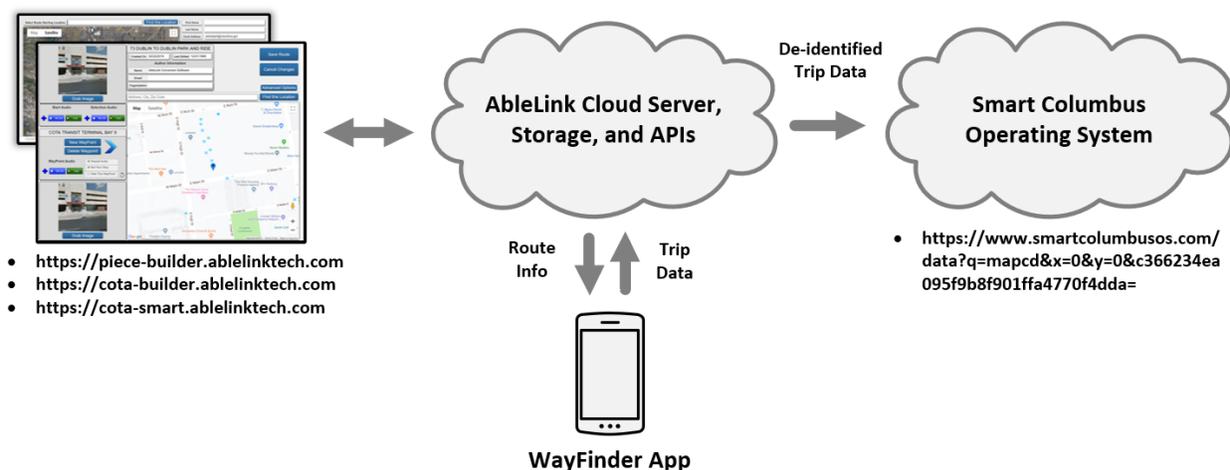


Figure 1: Major System Components

Source: City of Columbus

1.4.1. SMART Route Builder

To access the SMART Route Builder, enter <https://piece-builder.ablelinktech.com/> in an HTML-5 compliant web browser. This will display the login page (**Figure 2: SMART Route Builder Login Screen**) for the SMART Route Builder application.

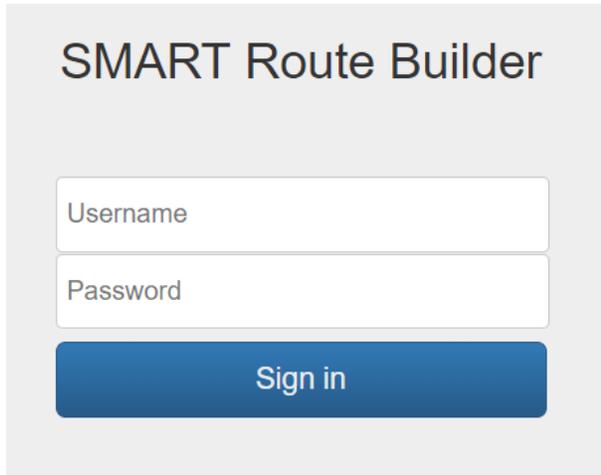
The image shows a login screen for the SMART Route Builder application. At the top, the text "SMART Route Builder" is displayed in a large, dark font. Below this, there are two input fields: the first is labeled "Username" and the second is labeled "Password". Both fields are white with a thin grey border. Below the password field is a blue button with the text "Sign in" in white.

Figure 2: SMART Route Builder Login Screen

Source: City of Columbus

Once logged in, users have access to existing routes and the ability to edit and make changes. Note that only a user with administrative permissions is able to manage accounts (refer to **Section 4.6.1.4**).

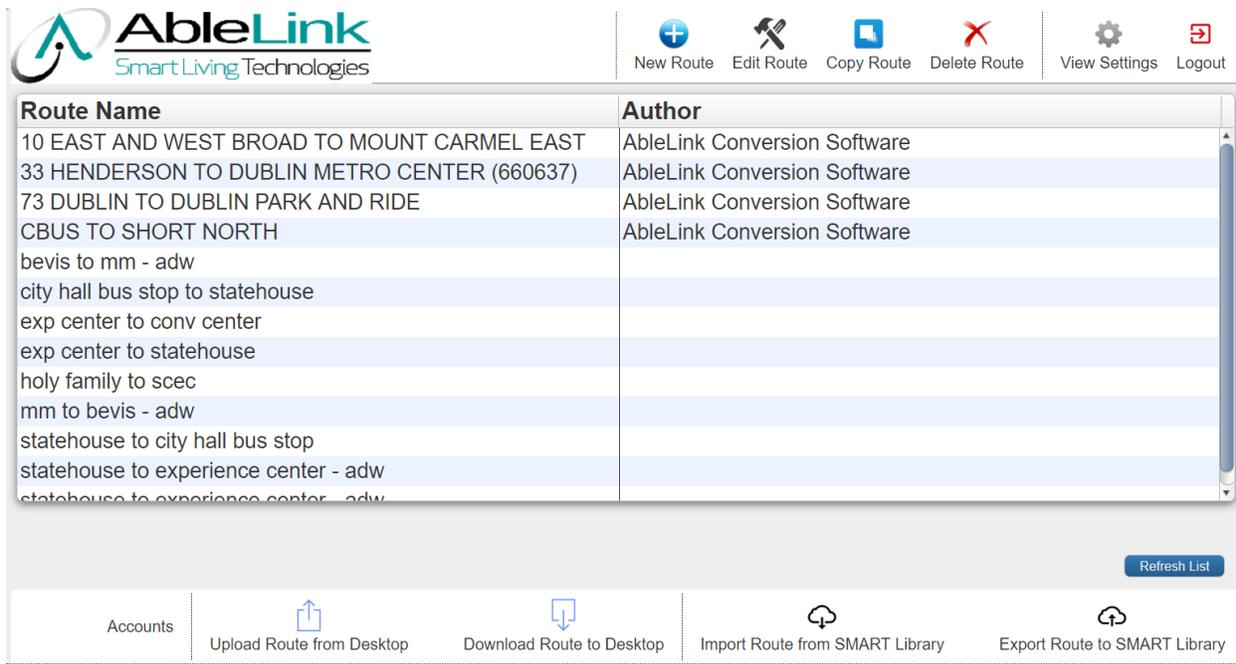


Figure 3: SMART Route Builder Main Menu Screen

Source: City of Columbus

Selecting the option for new route in the SMART Route Builder interface brings up a map-based editing screen. An existing route may be opened by selecting it in the table and selecting the option for edit route (refer to **Section 4.6.1.1** for more information).

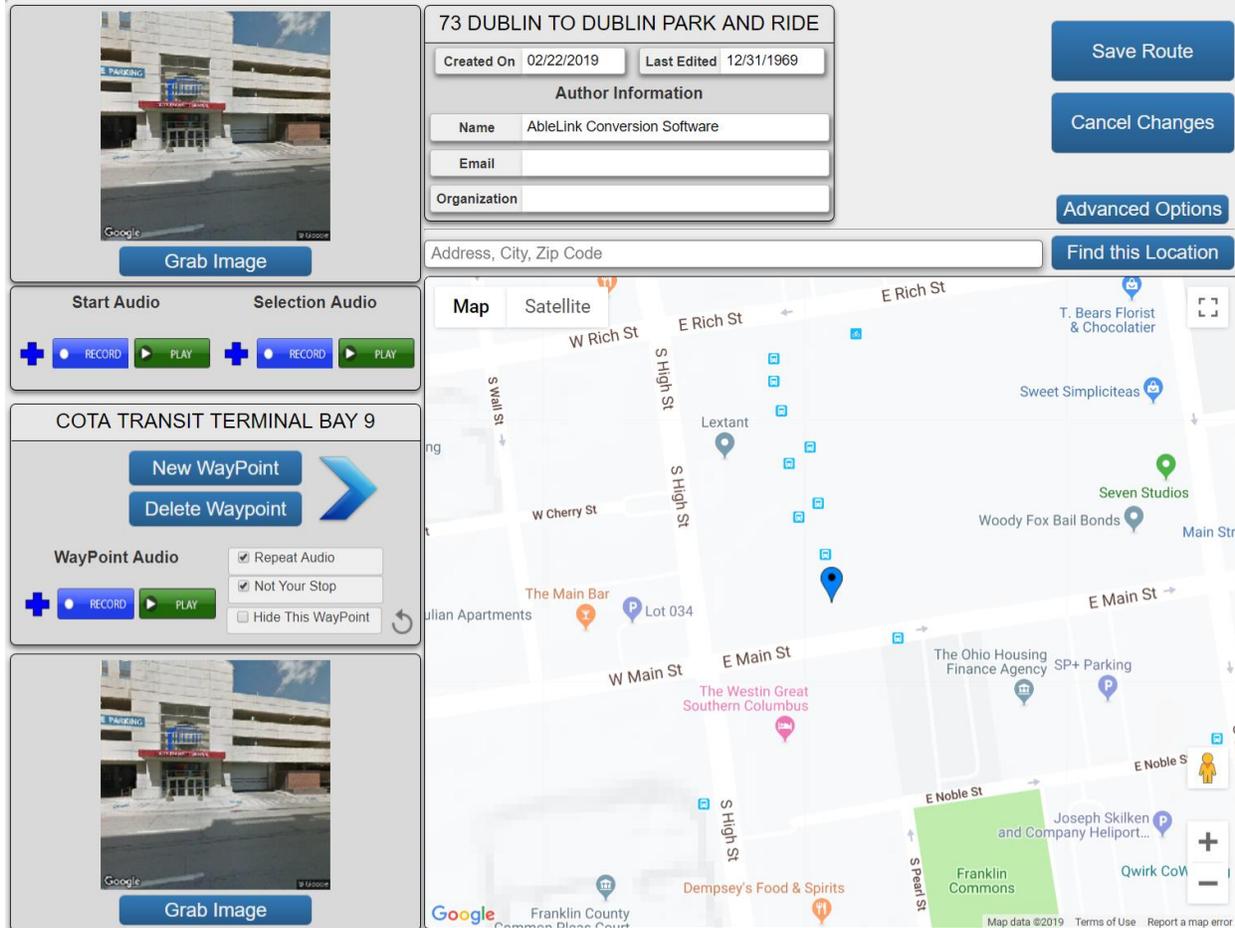


Figure 4: SMART Route Builder Edit Screen

Source: City of Columbus

1.4.2. SMART Route Library

After a route has been created using the SMART Route Builder, a user with administrative privileges can upload the route to a selected SMART Route Library. Once the route is uploaded, the SMART Route Library server application will open the route folder, condition all the media contained in the route, and reassemble it. The reason for this step is to ensure media playback compliance across multiple platforms due to the difference of supported file formats from one mobile operating system to the next. Once the route is reassembled it is categorized based on location and made available for download. Another user can then browse the SMART Route Library from his or her WayFinder app and select from routes available in the user's specific geographic area. When the user finds a route for a destination he or she is wanting to travel to, the route can be downloaded to his or her smartphone or tablet and used immediately to travel to the desired destination. Alternatively, the route instructions can be customized to meet the specific needs of a particular user, such as by adding in instructions for getting from the user's front door to a particular bus stop.

1.4.2.1. WAYFINDER TRACKER

The WayFinder Tracker provides caregivers with access to real-time traveler's information and the ability to view historic routes.

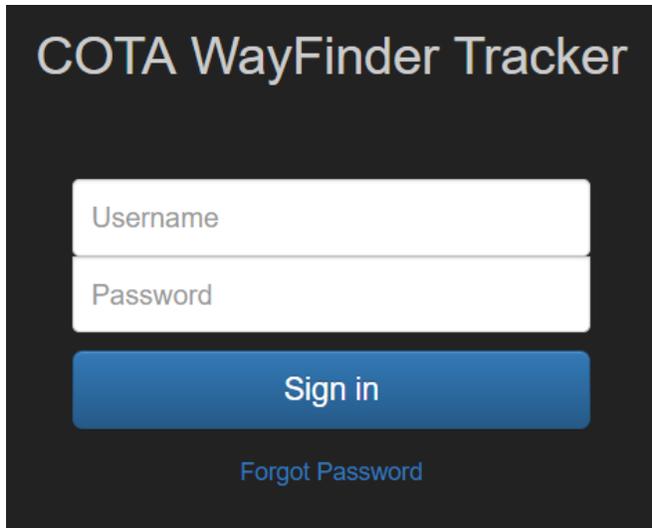


Figure 5: COTA WayFinder Tracker Login Screen

Source: City of Columbus

WayFinder Tracker Trips Account

COTA WayFinder Tracker - Trips

Trip ID	User Name/ID	Route Name	Start Time	Stop Time	End Type	Route Type	Trip Time (H:M)
<input type="checkbox"/> 15eb9214-9800-46...	COTA_3	Home to Henderso...	07/22/19 1:22 PM	07/22/19 1:22 PM	Canceled	PREVIEW	0:00
<input type="checkbox"/> 5f666c97-9f51-41d...	COTA_3	Kroger	07/22/19 12:31 PM	07/22/19 12:31 PM	Completed	PREVIEW	0:00
<input type="checkbox"/> 2d169b4a-2813-44...	COTA_3	Kroger	07/21/19 7:55 AM	07/21/19 7:55 AM	Completed	None	0:00
<input type="checkbox"/> 8a23d363-08a2-49...	COTA_30-i	Jazz and Rib Fest	07/19/19 10:22 AM	07/19/19 3:43 PM	Completed	PREVIEW	5:21
<input type="checkbox"/> bcb92d10-c7dc-4a...	COTA_06-t	Jazz and Rib Fest	07/19/19 10:21 AM	07/19/19 10:53 AM	Completed	PREVIEW	0:31
<input checked="" type="checkbox"/> 398d0201-f564-4c2...	COTA_01-i	Jazz and Rib Fest	07/19/19 10:12 AM		In Progress	Bus	4 days, 5:47
<input type="checkbox"/> 4d7838cf-1bc2-47f...	Dan Android	Trip to Work at Car...	07/18/19 7:48 PM	07/18/19 7:53 PM	Canceled	None	0:05
<input type="checkbox"/> 91a4d487-fed2-4d...	Dan Android	Trip to Work at Car...	07/18/19 7:46 PM	07/18/19 7:46 PM	Canceled	None	0:00
<input type="checkbox"/> 487f1383-d264-401...	COTA_30_J	Stadium	07/18/19 7:15 PM	07/18/19 7:16 PM	Canceled	None	0:00
<input type="checkbox"/> f977e289-a5c5-4ed...	COTA_30_T	Morehouse Bldg	07/18/19 6:14 PM	07/18/19 6:19 PM	Completed	None	0:05
<input type="checkbox"/> aff6cbec-2f7c-45ff...	COTA_30_T	Stadium	07/18/19 6:08 PM	07/18/19 6:13 PM	Completed	None	0:04
<input type="checkbox"/> c08eec0f-3818-462...	COTA_3	Kroger	07/18/19 2:00 PM	07/18/19 2:00 PM	Canceled	None	0:00
<input type="checkbox"/> d9a9534b-61b2-4d...	COTA_3	Kroger	07/17/19 9:33 PM	07/17/19 9:34 PM	Canceled	None	0:00
<input type="checkbox"/> e17a43a7-50bb-45...	COTA_3	Kroger	07/17/19 5:56 PM	07/17/19 5:56 PM	Completed	None	0:00
<input type="checkbox"/> cdc7bf3d-f7dc-4ed...	COTA_3	Kroger	07/17/19 3:54 PM	07/17/19 3:54 PM	Completed	None	0:00

Figure 6: COTA WayFinder Tracker Trips Screen

Source: City of Columbus

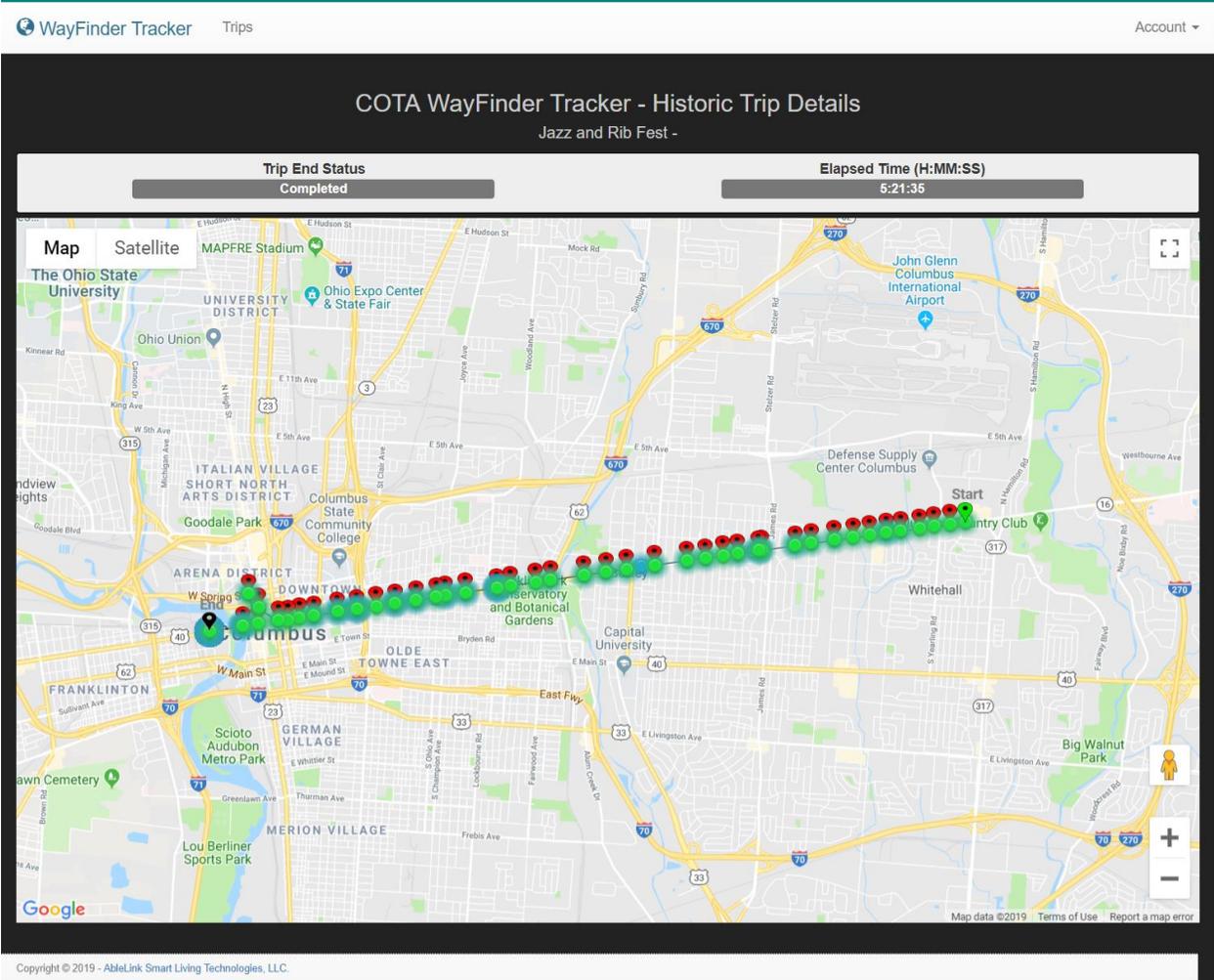


Figure 7: COTA WayFinder Tracker Historic Trip Details Screen

Source: City of Columbus

1.4.3. WayFinder

The WayFinder app presents travel instructions to users with special needs. WayFinder is designed to work with routes created with the SMART Route Builder application and interfaces with one or more SMART Route Libraries to download routes for immediate use.

For specific information on using WayFinder, refer to the WayFinder 3 user manual in **Table 1: References**.

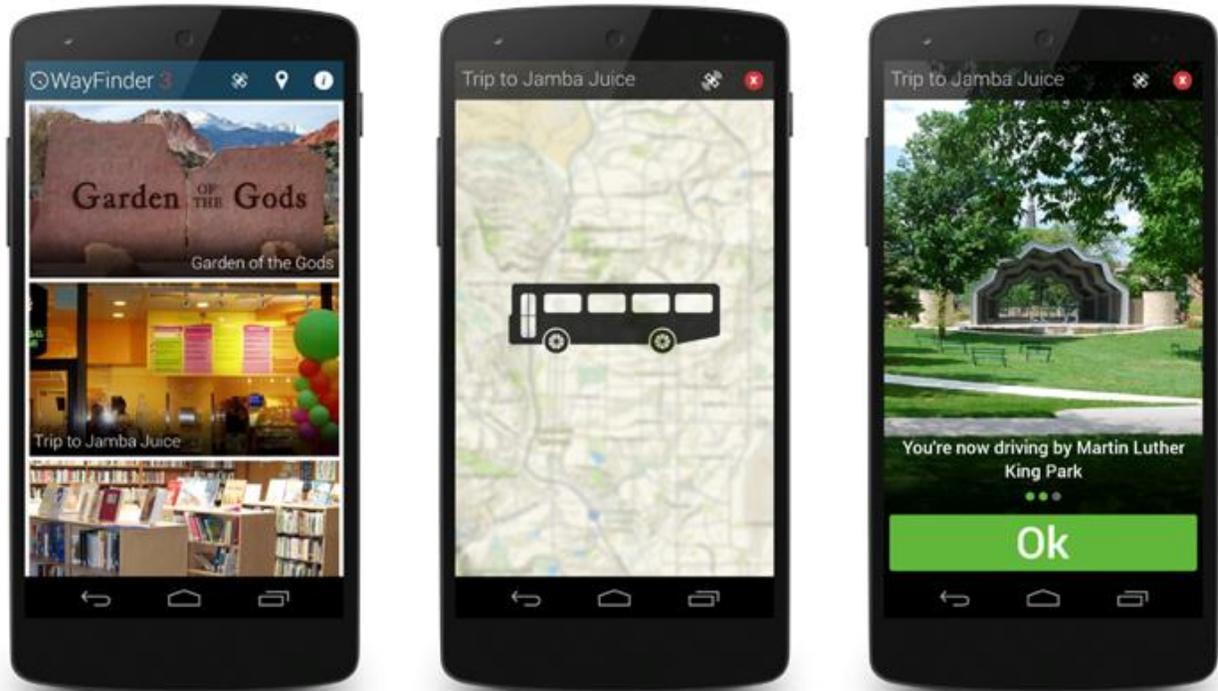


Figure 8: WayFinder Screens

Source: City of Columbus

1.5. SYSTEM USERS

The following are the main user types interacting with the MAPCD systems:

- Traveler
 - Has access to the WayFinder app on a smartphone; is connected to the SMART Route Library download route information
- OSU/OSUMC
 - Has read-write access to the SMART Route Builder for PIECE Program (<https://piece-builder.ablelinktech.com>)
 - Has read access to the SMART Tracker (<https://wftracker.ablelinktech.com/>)
 - Has read-write access to the private SMART Route Library (<https://piece-smart.ablelinktech.com>)
- COTA
 - Has read-write access to the SMART Route Builder for COTA (<https://cota-builder.ablelinktech.com/>)
 - Has read access to the SMART Tracker (<https://wftracker.ablelinktech.com/>)
 - Has read-write access to the public SMART Route Library (<https://cota-smart.ablelinktech.com>)
- City of Columbus
 - Has read-write access to all OSU/COTA resources
- Public
 - Has access to de-identified trip summary data in JSON format (<https://www.smartcolumbusos.com/data?q=mapcd&x=0&y=0&c366234ea095f9b8f901ffa4770f4dda=>)
- Independent Evaluators (IE)

- Has access to de-identified trip summary data in JSON format (<https://www.smartcolumbusos.com/data?q=mapcd&x=0&y=0&c366234ea095f9b8f901ffa4770f4dda=>)

1.6. STAKEHOLDERS

Appendix A contains a complete list of project stakeholders and their contact information. A summary of the stakeholders' roles and responsibilities is captured below:

- Product Owner
 - Responsible for working with stakeholders to determine what features and functionality are part of the WayFinder app
- Product Developer
 - Responsible for developing the features and functionality to meet the needs of stakeholders; responsible for maintenance of the WayFinder app
- Traveler
 - Person with cognitive disabilities who is the end user of the WayFinder app
- Caregiver
 - A guardian or family member who is responsible for creating and managing routes for the traveler
- City of Columbus
 - Representative of the Smart Columbus demonstration program
- The Ohio State University (OSU)
 - Subject matter experts and responsible for recruiting and training activities
- The Ohio State University Wexner Medical Center (OSUMC)
 - Subject matter experts and responsible for recruiting and training activities
- Central Ohio Transit Authority (COTA)
 - Subject matter experts and responsible for recruiting and training activities
- HNTB (Consultant)
 - Project coordinator and technical lead

1.7. REFERENCES

Table 1: References contains a list of all documents related to O&M of the MAPCD system.

Table 1: References

Document Number	Title	Author	Revision	Publication Date
N/A	Training Manual for Successful Use of Public Transportation Using the WayFinder App: Train the Traveler	Olivia Vega, OTS; Carmen Digiovine PhD, ATP/SMS, RET; Julie Faieta, OTR/L	Final	4/25/19
N/A	WayFinder Ecosystem - Training Manual	Dan Davies	Draft	July 2019

Document Number	Title	Author	Revision	Publication Date
N/A	<ul style="list-style-type: none"> Initial Assessment of Abilities Travel Training Intake Form - Individual with a disability Task Analysis Assessment of a Smartphone Task Analysis Assessment of the WayFinder App Public Transportation/COTA Training quiz 	Olivia Vega, OTS; Carmen Digiovine PhD, ATP/SMS, RET; Julie Faieta, OTR/L	Final	April 2019
N/A	Rehabilitation for Impairments of Executive Functions. In L. Trexler (Primary Ed) Cognitive rehabilitation Manual (pg. 12)	Haskins, E.	N/A	2012
N/A	Enabling occupation in children: The Cognitive Orientation to daily Occupational Performance (CO-OP) approach. Ottawa, ON: CAOT Publications ACE	Polatajko, H. J., & Mandich, A.	N/A	2004

Source: City of Columbus

Chapter 2. Materials and Resources

This section identifies the equipment/materials and personnel used in operations and maintenance of the MAPCD system. With respect to WayFinder physical facilities, the Amazon Web Services (AWS) cloud-based Platform-as-a-service (PaaS) is being used for hosting WayFinder operations. Since these elements are managed independently, only a high-level description is provided in this section; directly managed materials and resources are covered in greater detail.

2.1. PERSONNEL

This section includes personnel, including positions, general qualifications, and specialty skills needed, and a percentage of time dedicated to MAPCD operations or maintenance, if not full time.

Table 2: MAPCD Personnel

Name	Role	Qualification	Full Time Equivalent (%)	Organization
Andy Wolpert	Project Manager	Smart Columbus Project Manager	10%	Columbus
Carmen DiGiovine	Project Research and Outreach	Associate Professor – Clinical – Occupational Therapy Division Director of Rehabilitation Science and Technology - Assistive Technology Center	20%	The Ohio State University The Ohio State University Wexner Medical Center
Dan Davies	Developer	Founder and President of AbleLink Smart Living Technologies	10%	AbleLink Smart Living Technologies
Sandra A. Metzler	Project Engineer	Associate Professor - Practice – Department of Mechanical and Aerospace Engineering	10%	The Ohio State University
Julie Faieta	Clinical Manager	Occupational Therapist and Doctoral Student – School of Health and Rehabilitation Science	50%	The Ohio State University

Name	Role	Qualification	Full Time Equivalent (%)	Organization
Sarah Anderson	Clinical Support	Occupational Therapist and Doctoral Student – School of Health and Rehabilitation Science	25%	The Ohio State University
Keatlyn Culter	Research and Community Support	Health Science Student – School of Health and Rehabilitation Science	25%	The Ohio State University
Ashley Stojkov	Research and Community Support	Health Science Student – School of Health and Rehabilitation Science	25%	The Ohio State University

Source: City of Columbus

2.2. EQUIPMENT, SOFTWARE, AND MATERIALS

This section discusses the operating equipment, software, and other computing facilities used for operating the WayFinder and support options.

2.2.1. Equipment

WayFinder has been developed to run on any Android smartphone or tablet computer running Jelly Bean (OS 4.2) or newer and that has GPS capability. However, the Marshmallow 6.0+ OS is preferable. For Apple devices iOS 9.0 or better is required. Hardware devices do not require a calling plan or data plan unless the notification and real-time tracking features are going to be used. Field testing has shown that performance can vary from device to device, depending largely on the quality of the GPS technology in the device.

2.2.2. Software

Software licensing and support costs for the WayFinder app and support options are available in the tables below. A detailed description of all support options is available in **Appendix B**.

Table 3: Monthly/Yearly Recurring and Support Costs During Grant Period

Description	Quantity	Cost	Recurrence
WayFinder 3 Application/Licenses (includes Android smartphones)	30	\$29,970	One-time fee
Support Options for Columbus	-	\$0	No cost during grant period
<ol style="list-style-type: none"> 1. Travel Readiness Assessments 2. Self-Directed Travel Training Curriculum 3. SMART Route Library 4. SMART Route Builder 5. WayFinder Remote Tracker 			

Source: City of Columbus

Table 4: Monthly/Yearly Recurring and Support Costs After Grant Period

Description	Quantity	Cost	Recurrence
WayFinder 3 App/License – No Phone	1	\$349	One-time fee
WayFinder 3 Application/License – Android Phone	1	\$999	One-time fee
WayFinder 3 Application/License – iOS Phone	1	\$1,299	One-time fee
Support Options for Columbus <ol style="list-style-type: none"> 1. Travel Readiness Assessments 2. Self-Directed Travel Training Curriculum 3. SMART Route Library 4. SMART Route Builder 5. WayFinder Remote Tracker 	-	\$2,500 - \$25,000 ¹	Annual

Source: City of Columbus

2.2.3. Materials

AbleLink Smart Living Technologies, LLC has furnished 30 Android devices pre-configured with the WayFinder app. Additional pre-configured devices or separate licenses for existing devices can be purchased in accordance with **Table 4: Monthly/Yearly Recurring and Support Costs After Grant Period**.

2.3. DATA COLLECTION AND PRIVACY POLICIES

The following privacy policies govern use of the WayFinder app for mobile devices that was created by AbleLink Smart Living Technologies, LLC.

A copy of these policies can also be obtained at the following URL:

<https://www.ablelinktech.com/assets/downloads/AbleLink%20Privacy%20Policy%20-%20WayFinder%203.pdf>

2.3.1. Data Collection

2.3.1.1. WAYFINDER REGISTRATION INFORMATION

The WayFinder app obtains user information when it is downloaded and registered. Registration with AbleLink Smart Living Technologies, LLC is optional. However, not all of the features of WayFinder may be available unless registration is complete.

When registering the app with AbleLink Smart Living Technologies, LLC, a user must provide the following information:

- Name, email address, age, user name, password, and other registration information

¹ Subject to change depending on combination of services needed.

- Transaction-related information, such as when you make purchases, respond to any offers, or download or use applications from AbleLink
- Information a user provides when they contact AbleLink for help
- Credit card information for purchase and use of the app (if not supplied through the MAPCD project)
- Information a user enters into the system when using the app, such as contact information and route management information

AbleLink Smart Living Technologies, LLC may use the information provided to contact users from time to time to provide notices and marketing promotions.

2.3.1.2. WAYFINDER AUTOMATICALLY COLLECTED INFORMATION

WayFinder may collect certain types of information automatically, including, but not limited to:

- Type of mobile device
- Mobile device's unique device ID
- IP address of the mobile device
- Mobile device operating system
- Mobile internet browsers used
- Information about the way the app is used

WayFinder does not collect precise information about the location of a mobile device.

2.3.1.3. OPERATING SYSTEM

The OS ingests trip summary information, but not individual trip information with location (due to location information containing PII – Personally Identifiable Information). All data available in the OS is public and can be queried through an API and exported as JSON.

The data available in the OS includes:

- contactHelp - This is an indicator as to whether the user pressed the help button to be contacted anywhere in the trip
- elapsedTime - Time elapsed between startTime and stopTime of a trip (in seconds)
- endType - Status of the trip. Values include completed and canceled
- routeTitle - Title of the trip
- routeType - Type of travel mode chosen for a trip
- startTime - Timestamp at the start of a trip
- endTime - Timestamp at the end of a trip
- tripId - anonymized identification number of a trip
- userId - anonymized identification number of a user
- userName - Name of the user taking the trip

2.3.2. Access to WayFinder Data by Third Parties

Only aggregated, anonymized data is periodically transmitted to external services. AbleLink Smart Living Technologies, LLC may disclose user provided and automatically collected information in the following ways:

- As required by law, such as to comply with a subpoena, or similar legal process.
- When AbleLink Smart Living Technologies, LLC believes in good faith that disclosure is necessary to protect their rights, protect user safety or the safety of others, investigate fraud, or respond to a government request.

- With AbleLink Smart Living Technologies, LLC’s trusted services providers who do not have an independent use of the information disclosed to them and have agreed to adhere to the rules set forth in their privacy statement (refer to **Section 2.3**).
- If AbleLink Smart Living Technologies, LLC is involved in a merger, acquisition, or sale of all or a portion of its assets, users will be notified via email and/or a prominent notice on our website of any change in ownership or uses of this information, as well as any choices users may have regarding this information.

2.3.3. WayFinder Data Retention Policy

AbleLink Smart Living Technologies, LLC will retain user-provided data for as long as the WayFinder app is used and for a reasonable time thereafter. AbleLink will retain automatically collected information for up to 24 months and thereafter may store it in aggregate.

To request that user-provided data be deleted, contact info@ablelinktech.com. Note that some or all of the user-provided data may be required in order for the app to function properly.

2.3.4. WayFinder Security

AbleLink Smart Living Technologies, LLC provides physical, electronic, and procedural safeguards to protect information they process and maintain. Access to user information is limited to authorized employees and contractors who need the information in order to operate, develop, or improve the app.

Chapter 3. Training

This section provides an overview of the assessment and training process for individuals who will be utilizing smartphones and the WayFinder app to better access public transportation. The assessment and training processes described in this section were created by OSU and are presented here only in part; contact OSU for complete information or to request a copy of the individual training materials.

There are several phases involved in preparing an individual to use public transportation for independent wayfinding. This section details the necessary trainings required to support the individual when they are out in the community, such as reviewing important safety information, educating the individual on how to use a smartphone, how to use the WayFinder app, and finally putting all this information together while practicing using the COTA bus in a controlled setting.

Training may consist of one or many formats, such as PowerPoint presentations, interactive group discussions, online training programs (such as ones provided by AbleLink), and quizzes to test retention of the material presented.

Depending on the traveler's initial abilities and skill-level, training can be provided at varying paces. It is important to note that each traveler may come in with varying cognitive abilities and experiences. Repetition has been found to be beneficial to demonstrating skills required to be successful when utilizing public transportation; however, if a traveler is able to hear, understand and transfer the information to functional use after receiving the information once, this will suffice.

The following section discusses the initial steps of training which begins the assessment of the traveler's baseline skills and abilities.

3.1. DETERMINING LEVEL OF TRAINING

Prior to the start of training, each traveler must complete the COTA transportation skills assessment forms including the "Initial Assessment of Abilities" and the "Travel Training Intake Form - Individual with a disability" (refer to **Section 1.7**). This will provide baseline information on the travelers travel readiness.

Using the information collected from these assessments, the individuals may be assigned to either a Level 1 or Level 2 training program as described in the following sections.

3.1.1. Level 1 Training Program

Individuals who are placed in the Level 1 training program will be trained using a behavioral learning approach that has been found to be more effective with individuals who have very limited problem-solving abilities (Haskins, 2012). Some of these training strategies include errorless learning, task-specific learning, and chaining (Haskins, 2012).

Characteristics of individuals in Level 1 training program:

1. The participant is unaware of their deficits
2. The participant may have difficulty with problem-solving techniques even with assistance
3. The participant does not live independently and needs assistance with some daily tasks
4. The participant has difficulty with new or novel tasks even with assistance
5. Limited carry over even with repetition

3.1.2. Level 2 Training Program

Individuals who are placed in the Level 2 training program will be trained using an adapted model of the CO-OP which is a strategy that has been shown to be effective with individuals who have a mild to moderate levels of cognitive impairments (Polatajko, 2004). The decision-making model of assigning these individuals to their appropriate learning-style program has been adapted from the learning theory-based approach presented by Haskins (Haskins, 2012) (Wolf, 2018).

Characteristics of individuals in Level 2 training program:

1. The participant is aware of their deficits
2. The participant is able to perform some problem-solving techniques with minimal assistance
3. The participant may live independently or at least performs a large portion of their daily activities independently
4. The participant is able to navigate through new or novel tasks with minimal assistance
5. Fairly good carryover

3.2. SMARTPHONE TRAINING

For both the “Smartphone Training” and “WayFinder Training” it is important to split up travelers into their Level 1 and Level 2 training groups. During this training session it is important to have only two to three travelers in each group due to the complexity and novelty of these tasks. There should be one main trainer for each group and then however many additional trainers to have one-on-one assistance for each traveler in the group. If training is done individually, then only one trainer will be necessary. This training should take approximately one hour to complete.

Items necessary for this training include:

- At least one charged smartphone per traveler
- At least one trainer per traveler
- Task Analysis Assessment of a Smartphone (refer to **Section 1.7**)

3.3. WAYFINDER TRAINING

During this training session it is important to have only two to three travelers in each group due to the complexity and novelty of these tasks for some individuals. There should be one main trainer for each group and then however many additional trainers to have one-on-one assistance for each traveler in the group. If training is done individually, then only one trainer will be necessary.

This training should take approximately one hour to complete. Items necessary for this training include:

- At least one charged smartphone per traveler
- At least one trainer per traveler
- Task Analysis Assessment of the WayFinder App (refer to **Section 1.7**)

3.4. PUBLIC TRANSPORTATION/COTA TRAINING

The final training session involves practicing all the learned skills together in a controlled mock bus setting. The session can be done in a larger group of about four travelers and no longer needs to be divided by training level. There should be at least one main trainer and one to two additional trainers available for individual support. During this training session, the individual will learn the etiquette of how to ride a COTA bus.

This training session should take approximately one hour to an hour and 15 minutes to complete. Items necessary for this training include:

- Four tablets or computers for the individuals to perform the online sections (with sound)
- The AbleLink website (<https://stcs.ablelinktech.com/>) ***make sure using Google Chrome
- At least two trainers (one trainer for every individual)
- A bus pass
- The COTA transportation quiz (refer to **Section 1.7**)

Chapter 4. Operations

4.1. GOALS AND EXPECTATIONS

This section provides insight into the types of operational activities that are necessary to keep the MAPCD system operational and should serve as a guide for addressing and resolving issues that come up regarding the WayFinder suite of applications and integration with the Smart Columbus Operating System.

The primary goals and expectations of MAPCD operations and maintenance plan are as follows:

- To keep the WayFinder system operational and to provide optimal service to users
- To provide access to troubleshooting tips and common-user issues and how to resolve them
- To facilitate communications between the support teams and developers

4.2. HOURS OF OPERATION

The MAPCD system is expected to be operational continuously except for scheduled downtime for periodic maintenance. Technical support from AbleLink Smart Living Technologies, LLC is available during daytime hours.

4.3. WAYFINDER TECHNICAL SUPPORT

AbleLink Smart Living Technologies tech support can be contacted any of the following ways:

- Email: support@ablelinktech.com (preferred)
- Phone: 719-592-0347 (follow prompts for technical support)
- Fax: 719-592-0348

The following information should be included in the correspondence:

- Contact person's name and organization
- Number where contact person can be reached
- Contact person's email address
- The AbleLink Smart Living Technologies product in question (software and version)
- The type and model of the device and Operating System version the software is running on, if applicable
- A full description of the problem (including any error messages received)

Live support is generally available from 9 a.m. to 4 p.m., Mountain Standard Time, Monday-Friday.

4.4. OPERATING SYSTEM TECHNICAL SUPPORT

Smart Columbus Operating System tech support can be reached through the following URL:

<https://www.smartcolumbusos.com/contact-us>

The following information is required in the correspondence:

- Contact person's name and organization
- Email
- Subject (Tech Help/Request)
- Message

- Verification (reCAPTCHA)

4.5. INTERACTION AND COORDINATION

Table 5: MAPCD Responsibilities provides key resources for operations and maintenance of the MAPCD System.

Table 5: MAPCD Responsibilities

Individual	Role	Key Functions	Availability
Andy Wolpert	Project Manager, MAPCD Project	Product owner; project management	8 a.m. – 4 p.m. EST, Monday – Friday
Carmen DiGiovine, PhD, ATP/SMS, RET	Associate Professor – Clinical – Occupational Therapy Division – The Ohio State University Director of Rehabilitation Science and Technology - Assistive Technology Center – The Ohio State University Wexner Medical Center	Research, outreach, participant recruitment, and IRB	
Ram Boyapati	Data Curator, Smart Columbus Operating System	Responsible for creating the data structure/schema to import WayFinder data into the OS	8 a.m. – 4 p.m. EST, Monday – Friday
Dan Davies	Responsible for WayFinder product and maintenance of the AbleLink Cloud Server and related services.	WayFinder support and maintenance; licensing and hosting issues	9 a.m. – 4 p.m. MT, Monday – Friday

Source: City of Columbus

4.6. OPERATIONAL ACTIVITIES

4.6.1. SMART Route Builder

This section provides a description of common operational activities and troubleshooting activities related to the SMART Route Builder.

4.6.1.1. ADDING/REMOVING ROUTES

Table 6: SMART Route Builder Edit Options

Option	Description
 New Route	This button is used to create a new WayFinder route. The default starting location for each new route will be the location identified in the settings dialog.
 Edit Route	This button is used to edit the selected existing route in the route list. All aspects of a route can be edited by clicking on this button, including the name of the route. Canceling out of the editor before saving will discard all changes to a route being edited.
 Copy Route	This button is used to copy the selected route in the route list. The word “Copy” will be appended to the name of the copied route. Everything else in the route will be identical to the original route, with the exception of the route ID. A new route ID is created for the copy of the route to distinguish the copy from the original in the route list and when the routes(s) are uploaded to a SMART Route Library for use with WayFinder.
 Delete Route	This button is used to delete the selected route in the route list. A confirmation dialog will appear before the route is deleted. Once a route is deleted, it is permanently deleted in the Route Builder application and cannot be retrieved. Routes that have been uploaded to a SMART Route Library or downloaded to WayFinder will not be affected if the route is deleted in WayFinder. If you accidentally delete a route that has been previously uploaded to a SMART Route Library, you can import the route from the library if desired.
 View Settings	This button opens the settings page, where the user can enter his or her name for identifying as the author of new routes created by the user. In addition, this page is used to select which public SMART Route Library to connect to. In settings, the user can also set the default starting location for all new routes created while logged into the system.
 Logout	This button is used to exit from the SMART Route Builder web application. Please note that the site will log the user out after 20 minutes of inactivity for security purposes.
 Refresh List	This button is used to refresh the display of routes if a route that is imported from a SMART Route Library does not immediately appear in the list.

Source: City of Columbus

4.6.1.2. UPLOADING/DOWNLOADING ROUTES

Table 7: Uploading/Downloading Routes

Option	Description
 <p>Upload Route from Desktop</p>	<p>This button opens a file selection dialog so that a Zipped file of the route can be selected and uploaded to the route list. If the selected file is a properly formatted SMART route, it will be added to the route list and will be immediately available for review of editing.</p>
 <p>Download Route to Desktop</p>	<p>This button is used to download the selected route to the downloads location on the local computer. The route will be downloaded as a single Zip file and named with the title of the route.</p>

Source: City of Columbus

4.6.1.3. IMPORTING/EXPORTING ROUTES

Table 8: Importing/Exporting Routes

Option	Description
 <p>Import Route from SMART Library</p>	<p>This button is used to peruse the SMART Route Library so that a route can be selected from the library and imported into the SMART Route Builder application. If no public route library has been selected in settings, the default private route library for the user’s agency will be opened. If a public route library has been selected in settings, the user will be presented with the option to select routes from either the public library or the private library after clicking this button.</p>
 <p>Export Route to SMART Library</p>	<p>This button is used to contribute a route created in SMART Route Builder to the agency private route library. Select the category to store the route and press the upload button. Note: Only authorized parties are able to upload routes to a public SMART Route Library to ensure that no personally identifying information is added to a public library.</p>

Source: City of Columbus

4.6.1.4. ADDING/REMOVING USERS

The accounts button is used to access the account manager within the application to manage user accounts. This feature is only available to a user if the user level is set to staff or manager by the system administrator.

4.6.1.5. SMART ROUTE BUILDER TROUBLESHOOTING

Table 9: SMART Route Builder Troubleshooting provides recommendations to solve issues that may be encountered while using the SMART Route Builder or WayFinder app to create travel routes. This table is expected to be updated periodically as new issues are identified and appropriate recommendations for how to resolve are learned.

Table 9: SMART Route Builder Troubleshooting

Issue Type	Recommendation
Route Creation Errors	
Creating Routes Without Corridor Data Cannot Detect Off-Route Events	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.
Routes Created with Web-Based SMART Route Builder Do Not Include Corridor Data	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.
GPS Signal Loss During Route Creation	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.
Digital Photos Captured from Within WayFinder are not Available in the Photo Library	Digital photos obtained during route creation are not saved to the device’s photo library —The result is that users are unable to edit images (such as cropping) taken during route building. To avoid this situation, images may be obtained outside of the Route Builder application that can be edited if needed and integrated into the route using the route editor. Images captured during route creation can be copied to a connected computer, edited as needed, and then copied back over to the route folder on the mobile device. This is only recommended for users familiar with file transfer between Android devices and a desktop or notebook computer.

Issue Type	Recommendation
Walking vs. Vehicle Routes	WayFinder routes will typically involve both walking segments and segments traveling on public transit. It is good practice to create a single route for individuals for the entire route (including both walking segments and bus or train travel) so the individual can follow a single set of route instructions for his or her entire trip. For these types of routes, do not select the setting “On Foot Travel” in WayFinder, as this setting is not appropriate to use when a portion of the trip will be completed on a faster moving vehicle, such as a bus or train. The walking routes setting in WayFinder should only be selected when the ENTIRE route is a walking route.
Tips for Creating Waypoints for Walking vs. Vehicle Routes	For walking routes, waypoints should be set fairly closely to the intended action point (e.g., “you are at the corner of 4th and Elm, turn right and proceed down Elm Street”); for vehicle routes, waypoints should be set well in advance of an action point (e.g., “You are one block away from work, so pull the cord to indicate that you will be getting off the bus.”)
Failure to Provide Next-action Audio Prompts	Primarily on walking routes, the audio message should provide both information and direction (e.g., “you are at the corner of 4th and Elm, turn right and proceed down Elm Street.”). Information about where the individual is alone may be insufficient to direct a needed action by the traveler.
Audio Messages that are Excessive in Length	Primarily on vehicle routes, audio messages must be short enough to allow them to play completely before encountering the next waypoint; if audio messages are too long and waypoints are too close, the audio message may not play completely before the next waypoint message is triggered.
Route Playback Errors	
Failure to Provide Clear Direction at the End of a Route	Users may be unsure of what to do once they arrive at the end of a route; this can be addressed by adding walking route (i.e., last mile) waypoint directions; by adding a general end-of-route message (e.g., “You have reached the doctor’s office. Go in the glass doors and Dr. Smith’s office is on the right in office number 112”); or through training and practice.
Device Volume while in a Noisy Environment	Some buses, for example, can be very loud when crowded; the use of earbuds or Bluetooth headphones can alleviate loud environments and also serve to help users to focus on travel directions.
General Inattention to Waypoint Instructions	For users that may be more easily distracted, using WayFinder’s vibration setting on devices that support vibration provides a tactile cue to attend to the instruction. Earbud use can also help with distracted travelers. Another useful strategy is to include additional waypoint instructions throughout the route (“Out the window, you can see Washington Park now,” “You are about halfway to work now,” “You are doing great. Just a few more minutes and it will be time to get off the bus.”). These additional messages serve to help the traveler pay attention to the device to receive important instructions.

Issue Type	Recommendation
Understanding the Show Waypoint Preview Setting	Normally, the waypoint preview setting is turned off for most users. This is the default setting. Only turn on the waypoint preview feature for users that are needing a visual cue of what to look for NEXT when they are traveling, (i.e. before the traveler has arrived at the next waypoint location). When waypoint preview is turned on, a timer icon shows with a faded picture of the next waypoint for the user to know what to expect next. Turn waypoint preview off if this seems to be distracting and cause confusion to the traveler. When waypoint preview is turned off, the traveler will simply be notified when they reach the next waypoint and the picture and audio instructions associated with that waypoint will be presented at that time. Please note that when the waypoint preview feature is turned on, the system will show the not-your-stop image even if the bus does not stop (i.e., if no one is there); this may be confusing to some users.
Leaving WayFinder to Open a Text Messaging App	If the device has the feature that allows a text message to drop down and be responded to without fully going to the messaging app, WayFinder will continue to run even if the rider responds to the message in the dropdown interface. However, navigating to the full text message app will shut down WayFinder and the rider will have to manually return to it. If this happens, when restarting WayFinder the traveler will be provided the opportunity to continue the route he or she was on, or to quit the route and return to the route menu in WayFinder.
In-Range Distance Setting Too Small	The default in-range distance setting is 50 feet. This is a good value for traveling in a vehicle. The capability is available to reduce this value to as low as 10 feet. That is useful when walking routes are being used. If the waypoint instructions do not launch at the waypoint location as expected, this can be because this setting has been reduced below 50 and may be too low for the speed of vehicle travel. Waypoint instructions may be missed due to the speed the vehicle is traveling as the user enters and exits the region for the waypoint too quickly. To eliminate this potential problem, increase the in-range distance setting to 50 or higher. Faster traveling vehicles (such as a train) require this setting to be increase above the default of 50 to 75 or 100.

Source: City of Columbus

4.6.2. WayFinder

4.6.2.1. WAYFINDER TROUBLESHOOTING

Table 10: WayFinder Troubleshooting provides recommendations to solve issues that may be encountered while using the WayFinder app. This table is expected to be updated periodically as new issues are identified and appropriate recommendations for how to resolve them are learned.

Table 10: WayFinder Troubleshooting

Issue Type	Recommendation
WayFinder App Device Settings	
Unable to Record Audio or Use Camera Upon First Use	This issue is due to failure to give WayFinder permission to access the audio recorder or camera. When first starting WayFinder, it will ask for permission to access the audio recording and camera features on the device; failure to provide these permissions will prevent recording of audio prompts and obtaining image cues during route creation.
Device Not Receiving GPS Signals Frequently	For Android users, the default GPS setting is often set to a battery saving mode which often causes the device to lose GPS connectivity frequently. Be sure to set the device to high accuracy in settings to minimize loss of GPS signal during use. This setting is a location mode setting in Android and may have different specific wording depending upon the version of Android on the device.

Source: City of Columbus

4.6.3. Smart Columbus Operating System

4.6.3.1. ACCESS TO DATA

Users of the OS will consume data in multiple ways:

- Downloading a file that contains the dataset (various formats will be available depending on the dataset)
- Viewing structured data with an in-browser previewer/viewer
- Consuming the API to query the data
- Analyzing/visualizing data through analysis tools (currently in development)

Because all data is desired to be in a non-proprietary format, once retrieved, data will be able to be used within many different tools as needed. Users do not need to register a user account to interact with the data or API.

At this time, there is not a limit on the amount of data a given user can request through the website, but API requests will have request throttling set based on originating Internet Protocol (IP) address to prevent overloading the system with requests.

4.6.3.2. TROUBLESHOOTING

The OS generates statistics relative to the validity and completeness of the dataset as it is ingested. This will provide a score that will be appended to the data page. The data provider will be contacted and asked to remediate any anomalies detected. In the event of a data provider not abiding by the SLA, including irresponsible inclusion of restricted data, datasets may be frozen or deleted from the OS by the system administrator.

Chapter 5. Maintenance

The MAPCD solution is expected to be operational nearly 24 hours a day, seven days a week. Given that, maintenance activities are necessary to keep the system running. This section outlines various maintenance tasks, including preventive and corrective maintenance activities and other adjustments as needed.

5.1. PREVENTATIVE MAINTENANCE ACTIVITIES

Preventative maintenance is maintenance activity that is routinely performed to lessen the likelihood of failure and to discover issues in a proactive manner to lessen their impact. AbleLink is responsible for performing preventative maintenance on the WayFinder system (WayFinder app, SMART Route Builder, and SMART Route Library), however, AbleLink is not responsible for performing preventative maintenance on systems that are within the boundary of the Smart Columbus OS. Those preventative maintenance activities are documented here.

Table 11: Preventative Maintenance Activities

Activities	Description	Frequency	Effort
Check data availability in OS	Check the availability of data in the OS to ensure that services are up and running.	Weekly	0.5 hours
Wayfinder API availability check	Continuously monitor the availability of the Wayfinder Tracker API through an external monitor and notification service to ensure the service is available for use.	Continuous/Ongoing	N/A
Wayfinder Tracker website availability check	Continuously monitor the availability of the Wayfinder Tracker website through an external monitor and notification service to ensure the service is available for use.	Continuous/Ongoing	N/A
Wayfinder SMART API availability check	Continuously monitor the availability of the Wayfinder SMART API through an external monitor and notification service to ensure the service is available for use.	Continuous/Ongoing	N/A
Wayfinder SMART website availability check	Continuously monitor the availability of the Wayfinder SMART website through an external monitor and notification service to ensure the service is available for use.	Continuous/Ongoing	N/A
Wayfinder Builder website availability check	Continuously monitor the availability of the Wayfinder Builder website through an external monitor and notification service to ensure the service is available for use.	Continuous/Ongoing	N/A

Activities	Description	Frequency	Effort
GTFSS Real-Time Updates middleware API availability check	Continuously monitor the availability of the GTFSS Real-Time middleware API through an external monitor and notification service to ensure the service is available for use.	Continuous/Ongoing	N/A
Server Operating System Upgrades	When new server operating system software and patches are released, upgrade and patch to keep current with the latest releases and security patches.	Semi-annually	2 hours

Source: City of Columbus

5.2. DATA UPDATES

The following are activities associated with updating data that is collected into the OS.

Table 12: Data Update Activities

Activities	Description	Frequency	Effort
Update data structure/schema in OS	Data ingested into the OS has changed and requires updates to the existing data structure/schema.	Infrequent	1-2 days

Source: City of Columbus

5.3. CORRECTIVE MAINTENANCE ACTIVITIES

The following are corrective maintenance activities associated with addressing issues in the WayFinder system or OS.

Table 13: Corrective Maintenance Activities

Activities	Description	Frequency	Effort
Error in WayFinder app	Respond to error in the WayFinder app (refer to Section 4.6.2.1)	Infrequent	TBD
Error in SMART Route Builder	Respond to error in the SMART Route Builder (refer to Section 4.6.1.5)	Infrequent	TBD

Source: City of Columbus

5.4. DATA INGESTION WORKFLOW TO OPERATING SYSTEM

The OS uses Apache NiFi and KyoTM to ingest data from the AbleLink cloud server. The data is transformed and stored in a Hadoop data lake, where it is searchable utilizing Apache Hive to end users of the system through publicly accessible APIs.

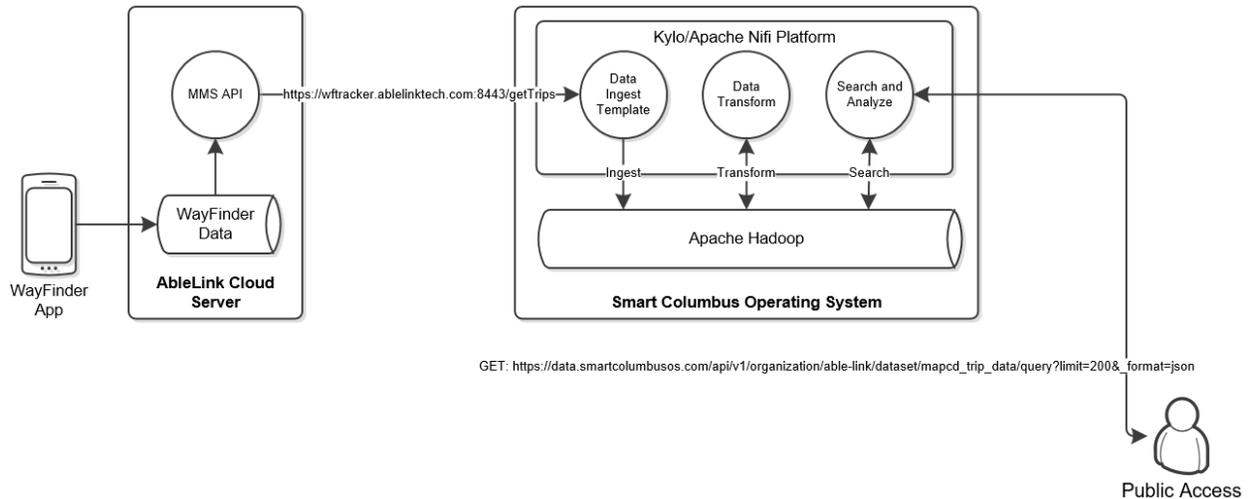


Figure 9: Data Ingestion Workflow to Operating System

Source: City of Columbus

5.4.1. Data Ingest Template

The OS development team is responsible for creating the template (data structure/schema) to import WayFinder data (trip data) from the AbleLink Cloud Server into the Hadoop Distributed File System (HDFS) tables. Apache Hive is a data warehousing application that provides logical access to data being stored in the Apache Hadoop infrastructure.

5.4.2. Data Transform

Once imported, WayFinder data is prepared for analytics using transformation features provided by Kylo. The OS development team is responsible for data transformation that will be achieved in the Kylo front end.

5.4.3. Search and Analyze

Users can search the trip data in Hadoop and build Hive queries to support analysis. The OS development team is responsible for maintaining the search and query interface to allow end users of the system to analyze the data.

5.5. APPLICATION PROGRAMMING INTERFACES (APIS)

5.5.1. Introduction

The WayFinder TrackerTripInfo REST API is an HTTP server. It is accessed using standard HTTP[S] and all HTTP[S] transactions that transmit data to the application must use the POST method.

Usage Example: `https://wftracker.ablelinktech.com:8443/<action>`

Where `<action>` is the action to be performed. The various actions and their parameters are described below.

5.5.2. Actions

All of the actions require an API key.

5.5.3. Return Messages

After submitting an action, the application should return a JSON formatted message with the requested information. The action may also return an error. See below for an example of an error.

Error Return Message Example:

```
{
  "error": "Invalid tripId."
}
```

If the client does not authenticate properly with a valid API key, the system will return an HTTP 401 (access denied) with the string "Access denied."

5.5.4. Client Actions

5.5.4.1. GETTRIPS

Get a list of trip IDs available in the system. Get either all trips or, optionally, those specified within a date range.

5.5.4.1.1 cURL Example:

```
# curl -k -d \  
> 'apiKey=XXXXXXXXXX&start=1539807000&end=1539807005' \  
> https://wftracker.ablelinktech.com:8443/getTrips
```

5.5.4.1.2 Parameters:

- **apiKey**: The API key is required in order to authenticate. Required: yes
 - **start**: Specify the start date/time of the time range in epoch format for which to get a list of trips. Required: no
- **end**: Specify the end date/time of the time range in epoch format for which to get a list of trips. Even if a 'start' time is specified, the end time is still optional and will default to the current time.
 - Required: no
- **includePreview**: A true/false value that indicates if trips with a 'preview' route type should be included. Defaults to 'false' if not specified.
 - Required: no
- **deIdentify**: A true/false value that indicates if the trip data should de-identified. Defaults to 'false' if not specified.
 - Required: no
- **imp**: Specify 'true' to only return COTA 'implementation' trips with a '-I' suffix. Required: no

5.5.4.1.3 De-Identification Notes

The de-identification process, if used, will remove the route name and the user's name from the trip summary data.

5.5.4.1.4 Return Value

List of trip IDs and other information in JSON format or an error message.

5.5.4.1.5 Return Example

```
[
  {
    "elapsedTime": 29731,
    "endType": null,
    "routeType": "Car",
    "startTime":
    1548100715, "stopTime":
    null,
    "tripId": "df1f3347-f4f9-425a-8acc-
    WFe24b72b38b", "tripTitle": "Home to the BF Post
    Office", "userId": "Dan - MotoG 6"
  },
  {
    "elapsedTime": 27,
    "endType": "canceled",
    "routeType": "Car",
    "startTime":
    1548100798,
    "stopTime": 1548100825,
    "tripId": "44bf25e3-862c-4e8e-9d59-
    WfB89dbdaf4c", "tripTitle": "Home from Pies and
    Grinders", "userId": "Dan - MotoG 6"
  }
]
```

5.5.4.2. GETTRIP

Get the details for a specific trip. If de-identification parameters are specified, the location data will be replaced with skewed data within the location's US census block. See de-identification notes.

5.5.4.2.1 cURL Example:

```
# curl -k -d \
> 'apiKey=XXXXXXXXXX&tripId= f85d3682-e226-4267-9686-WF0e09abc836' \
> https://wftracker.ablelinktech.com:8443/getTrip
```

5.5.4.2.2 Parameters:

- **apiKey**: The API key is required in order to authenticate.
 - Required: yes
- **tripId**: A unique ID representing a WayFinder trip.
 - Required: yes
- **deldentify**: A true/false value that indicates if the location data should de-identified. Defaults to 'false' if not specified.
 - Required: no
- **deldentifyStyle**: A string of either 'center' or 'edge' to indicate if the de-identified location will use the nearest edge or the center of the census block. Defaults to 'center' if not specified. This parameter is ignored if the 'deldentify' parameter is omitted or is set to 'false.'

- Required: no

5.5.4.2.3 De-Identification Notes

The de-identification process, if used, will attempt to “skew” the latitude and longitude within the location’s U.S. census block. If enabled, each location event will have a dictionary entry to indicate if that location event is de-identified as well as an entry to list the style of de-identification (see example).

When the de-identification process uses the ‘center’ style, the original latitude and longitude will be replaced with the center latitude and longitude of the census block.

When the de-identification process uses the ‘edge’ style, the original latitude and longitude will be replaced with the latitude or longitude of the nearest edge. The other non-edge value will be randomized between the two perpendicular edges of the block.

Since the census block data is read in real-time from a backend API provided by the U.S. government, it is possible for there to be a communication error that does not allow for de-identification. In this case a de-identification error entry will appear in the location event dictionary and the latitude and longitude data will be omitted (see example).

As an added precaution the de-identification process also removes the first and last location from the data as well as any point within 0.5 miles of the first and last points.

5.5.4.2.4 Return Value:

Normal success or error message.

5.5.4.2.5 Return Example:

```
{
  "assistanceRequested":
  0, "locationEvents": [
    {
      "batteryLevel": 9,
      "cellCoverage": 50,
      "eventTime": 1548101317,
      "gpsAccuracy": 0,
      "locationEvent":
      "waypointResponded", "locationLat":
      38.984946534,
      "locationLong": -
      104.700396106, "onRoute":
      "true"
    },
    {
      "batteryLevel": 9,
      "cellCoverage": 50,
      "eventTime": 1548101337,
      "gpsAccuracy": 0,
      "locationEvent": "none",
      "locationLat":
      38.988233746,
      "locationLong": -
      104.700376476, "onRoute":
      "true"
    }
  ],
}
```

```

    {
      "batteryLevel": 9,
      "cellCoverage": 50,
      "eventTime": 1548101357,
      "gpsAccuracy": 0,
      "locationEvent": "none",
      "locationLat":
      38.992232116,
      "locationLong": -
      104.70038326, "onRoute":
      "true"
    },
    {
      "batteryLevel": 9,
      "cellCoverage": 50,
      "eventTime": 1548101377,
      "gpsAccuracy": 0,
      "locationEvent": "none",
      "locationLat":
      38.996089556,
      "locationLong": -
      104.70038712, "onRoute":
      "true"
    }
  ],
  "routeDownloaded":
  "", "routeType": [
    "Car"
  ],
  "startTime": 1548101317,
  "stopTime": 1548101380,
  "tripEndType":
  "canceled",
  "tripId": "f85d3682-e226-4267-9686-WF0e09abc836",
  "tripTitle": "Home to the BF Post
  Office", "userId": "Dan - MotoG
  6", "wayfinderVersion": "1.0"
}

```

5.5.4.3. DELETETRIP

Delete a specific trip.

5.5.4.3.1 cURL Example:

```

# curl -k -d \
> 'apiKey=XXXXXXXXXX&tripId= f85d3682-e226-4267-9686-WF0e09abc836' \
> https://wftracker.ablelinktech.com:8443/deleteTrip

```

5.5.4.3.2 Parameters:

- **apiKey:** The API key is required in order to authenticate.
 - Required: yes
- **start:** Specify the start date/time of the time range in epoch format for which to get a list of trips.
 - Required: no

- **end:** Specify the end date/time of the time range in epoch format for which to get a list of trips. Even if a 'start' time is specified, the end time is still optional and will default to the current time.
 - Required: no

5.5.4.3.3 Return Value

List of trip IDs and other information in JSON format or an error message.

5.5.4.3.4 Return Example:

```
{ "status": "success" }
```

Appendix A. Stakeholders

A.1 STAKEHOLDERS

Table 14: Stakeholders includes a list of stakeholders and contact information for the MAPCD project.

Table 14: Stakeholders

Name	Role/Organization	Email
Mandy K. Bishop	City of Columbus, Smart Columbus Program Manager	MKBishop@columbus.gov
Andrew Wolpert	City of Columbus, Product Owner	ADWolpert@columbus.gov
Alyssa N. Chenault	City of Columbus, Smart Columbus Communications Project Manager	ANChenault@columbus.gov
Sandra Metzler	OSU	metzler.136@osu.edu
Katie M. White	OSU	white.3073@osu.edu
Carmen Digiovine	OSU/OSUWMC	Carmen.Digiovine@osumc.edu
Julie Faieta	OSU	Julie.Faieta@osumc.edu
Amy N. Hockman	COTA	HockmanAN@cota.com
Alex Kavanagh	HNTB	AKavanagh@HNTB.com
Diane Newton	HNTB	dnewton@HNTB.com
Dan Davies	AbleLink Smart Living Technologies, LLC., WayFinder Developer	dan@ablelinktech.com

Source: City of Columbus

Appendix B. WayFinder Support Options

The WayFinder system includes multiple levels of service options for individuals, human service agencies, and public transit systems, which taken together comprise the WayFinder SMART Travel Ecosystem. This document provides a description of these service options. Specific cost information included in this document is subject to change. Hardware/software bundles do not include Wi-Fi or data services.

B.1 APP OPTIONS FOR INDIVIDUAL TRAVELERS

B.1.1 WayFinder App (Android or iOS Software)

The WayFinder app is available for purchase by specific individuals from the Google Play/ Apple App stores. The version of the app available in these app stores allows routes to be created with the WayFinder device that are compliant with the SMART Wayfinding Specification and used as desired to support travel in the Columbus metro area. This version also allows routes to be downloaded from a local SMART Route Library populated with routes for a local transit agency which has made a Public SMART Route Library available for transit customers. Routes downloaded from the library can be used as is or customized with personalized travel instructions on the device once the route has been downloaded.

App Cost: \$349

B.1.1.1 WAYFINDER BUNDLE (ANDROID OR IOS SOFTWARE/HARDWARE)

The WayFinder app can be purchased directly from AbleLink Smart Living Technologies (www.ablelinktech.com) as a bundled solution with an Android phone/tablet or an Apple iPhone/iPad. Android bundles include pre-installation of the software on the device. Apple bundles are shipped with the selected device and app codes for the user to install the app after receiving the device.

Bundle Cost: \$999 (Android phone), \$1,299 (iPhone)

B.1.1.2 COMMUNITY ACCESS SUITE

The Community Access Suite provides a bundled solution for WayFinder users which includes an accessible personal scheduling app (AbleLink Endeavor) and step-by-step prompting app (AbleLink Visual Impact), which can work seamlessly with the included WayFinder app. Personal schedules can be created and customized directly on the device to provide the user with time-sensitive reminders for any activity as well as for specific WayFinder routes at a desired time. This helps users who have difficulty with time management to know when it is time to leave home to catch the bus and to automatically launch the WayFinder app with a specific route needed for a particular time. In addition, the software can be used to assist users with completing pre-trip checklists containing specific step-by-step instructions (using pictures, audio and video) for accomplishing activities in preparation for a trip. The Community Access Suite turnkey system includes the suite of applications mentioned above and a mobile device (either Android or Apple tablet or smartphone).

Bundle Cost: \$1,299 (Android tablet), \$1,399 (Apple iPad)

\$1,399 (Android phone), \$1,499 (Apple iPhone)

Expected Outcomes for Individual WayFinder App Users

- Increased independence in accessing the community as a result of using public transportation

- Decreased dependency on agency staff and paratransit to meet travel needs
- Increased frequency of engagement in community activities
- Increased social connectedness for individuals with cognitive disabilities and others with special needs
- Increased variety of travel destinations (work, friends, activities, etc.) as a result of individuals having much more personal control over transportation

B.2 SERVICE OPTIONS FOR HUMAN SERVICE AGENCIES

The WayFinder ecosystem includes a suite of services which provide the human services agency with assessment, training, and productivity tools for supporting the travel needs of all the individuals served by their agency in a specific metropolitan area. This section provides a summary description of each of the services included.

B.2.1 Travel Readiness Assessments

The travel readiness assessments provide the agency a suite of travel readiness assessments which can be used to identify travel training needs for individuals with cognitive disabilities and special needs served by the agency. The assessments are web based, cognitively accessible assessments based on AbleLink's ATLAS technology which address five topics, including: travel skills and experience, light rail skills and experience, street crossing skills, social skills, and vehicle identification skills.

B.2.2 Self-Directed Travel Training Curriculum

The self-directed travel training curriculum allows individuals with cognitive disabilities and others with special needs to complete training sessions designed to teach important travel skills in a self-paced, self-directed manner. There are 22 training sessions that correspond with the content included in the travel readiness assessments. Tools are also provided to allow agency travel trainers to create custom training modules and add them to the online library to provide location or agency specific training sessions.

B.2.3 Agency SMART Route Library

An Agency SMART Route Library is a private route library that interfaces directly with the agency's SMART Route Builder application and WayFinder users that are configured to access routes created by the agency. This library is used by the agency to store routes created for individuals they serve. Routes added to the agency's private SMART Route Library typically include customized routes that include a combination of local metro system transit waypoints and personalized waypoints that provide very detailed instructions for travelers to travel from their own homes to desired destinations.

B.2.4 SMART Route Builder

SMART Route Builder is a web-based application that allows agency staff to create custom routes for use with WayFinder to meet the travel needs of individuals served by the agency. The system allows new routes to be created by dropping pins on a map and adding the specialized multimedia used to provide accessible instructions to travelers with cognitive disabilities and others with special needs. The system interfaces with any available public SMART Route Libraries and also includes a private SMART Route Library that is only available to agency staff. Routes created with the SMART Route Builder can then be contributed to the online library so that they can be downloaded directly by the WayFinder app user.

B.2.5 WayFinder Remote Support System

The WayFinder Remote Support System (i.e. tracker) provides trip management tools to agencies, including the ability to view real-time trip updates and historical trip data for individual WayFinder users participating in their travel support program. Live trip data allows agency staff to receive location data and user interaction updates as the trip progresses (updates provided every 30 seconds). This allows agency staff to be alerted to travelers that go off route, user-initiated messages or requests for assistance, and battery level of the device (with alerts for low-battery conditions). Historical trip data includes all of this same information for completed or aborted trips, as well as filters for selecting all trips by a particular individual, all trips taken for a particular route, as well as several other filters for trip end type and route type.

Cost for services described in B.2.1 – B.2.5: Varies depending on the number of individuals using the WayFinder system within the agency to travel more independently. Estimated cost for a typical agency - \$2,500-\$5,000/year.

Expected Outcomes for Human Service Agencies

- Reduction in staff-related costs for providing transportation (staff time, mileage for personal vehicles, etc.).
- Reduction in costs (fuel costs, service, driver time, etc.) related to providing agency-based travel support due to fewer requirements for staff-driven trips.
- Staff time can be shifted to higher-quality interactions with individuals, rather than having to spend time driving people around town.

B.3 SERVICE OPTIONS FOR PUBLIC TRANSIT AGENCIES

A city's transit system can employ a range of WayFinder services to support individuals with cognitive disabilities and others with special needs starting with a basic set of WayFinder services (e.g. public SMART Route Library) to a comprehensive set of services which can even include a branded custom WayFinder app pre-set to connect to the agency's local public SMART Route Library which can be offered for free to all customers in the local region. Service options include initial population and regular updates of GTFS-based routes for the entire metro system and other specialized routes, such as routes for local attractions (e.g. walking tour of the city zoo, historical walking tour of downtown, etc.). Other services can include access to de-identified trip data for use by the transit agency to analyze system usage and identify transit needs for customers with disabilities. Additional service options can include online training resources, live periodic training webinars, premium tech support, on-site evaluation and training, future recommendations and identification of expansion opportunities.

Cost: Varies depending on size of the metropolitan area and the specific suite of services desired by the transit agency. A customized proposal is developed for each transit agency which addresses the specific services, support, and training options which will best enable the agency to support customers with cognitive disabilities and others with special needs.

Expected Outcomes for Human Service Agencies:

1. Reduction in paratransit costs.
2. Increased ridership on public transit system.
3. Better compliance with federal regulations/laws regarding accessible transportation by serving cognitive disability population more effectively.
4. Increased accessibility to city services and public recreational and tourist attractions.
5. Improved ability to meet travel needs of customers with cognitive disabilities and others with special needs in areas not specifically served by existing transit routes.

Appendix C. Acronyms and Definitions

Table 15: Acronym List contains project specific acronyms used throughout this document.

Table 15: Acronym List

Abbreviation/Acronym	Definition
App	Application
API	Application Programming Interface
AWS	Amazon Web Services
CO-OP	Cognitive Orientation to daily Occupational Performance
COTA	Central Ohio Transit Authority
cURL	Client URL
e.g.	For example
ID	Identifier
i.e.	In other words
IE	Independent Evaluators
GPS	Global Positioning System
GTFS	General Transit Feed Specification
HDFS	Hadoop Distributed File System
HTTPS	Hypertext Transfer Protocol Secure
IP	Internet Protocol
JSON	JavaScript Object Notation
LLC	Limited Liability Company
MAPCD	Mobility Assistance for People with Cognitive Disabilities
NIH	National Institutes of Health
O&M	Operations & Maintenance
OS	Operating System
OSU	The Ohio State University
OSUMC	The Ohio State University Wexner Medical Center
PII	Personally Identifiable Information
PaaS	Platform-as-a-service
SLA	Service Level Agreement
URL	Universal Resource Locator
USDOE	United States Department of Education

Appendix C. Acronyms and Definitions

Abbreviation/Acronym	Definition
USDOT	U.S. Department of Transportation

Source: City of Columbus

Appendix D. Glossary

Table 16: Glossary contains project specific terms used throughout this document.

Table 16: Glossary

Term	Definition
Android	An open-source operating system used for smartphones and tablet computers.
App	A software application.
Caregiver	Family member, guardian, or support person for person with cognitive disabilities. A caregiver is responsible for creating and managing routes for use by individual users of the WayFinder application.
iOS	An operating system used for mobile devices manufactured by Apple Inc.
Multimodal Transportation	Travel done via more than one mode of transportation.
Real-Time Data	Information that is delivered immediately after collection.
reCAPTCHA	reCAPTCHA is a free service from Google that helps protect websites from spam and abuse.
Third Party	Organizations not affiliated with the Smart Columbus Program.
Travelers	Travelers are users of the WayFinder application.

Source: City of Columbus



THE CITY OF
COLUMBUS^{*}
ANDREW J. GINTHER, MAYOR