

Smart Columbus

Interface Control Document for the Mobility Assistance for People with Cognitive Disabilities Project for the Smart Columbus Demonstration Program

www.its.dot.gov/index.htm

Final Report – July 26, 2018



Source: City of Columbus – November 2015



U.S. Department of Transportation

Produced by City of Columbus
U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

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Acknowledgement of Support

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

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Technical Report Documentation Page

1. Report No. N/A		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Interface Control Document (ICD) for the Mobility Assistance for People with Cognitive Disabilities (MAPCD) Project for the Smart Columbus Demonstration Program				5. Report Date 07-26-2018	
				6. Performing Organization Code	
7. Author(s) Andy Wolpert (City of Columbus), Alex Kavanagh (HNTB)				8. Performing Organization Report No.	
9. Performing Organization Name and Address City of Columbus 90 West Broad Street Columbus, OH 43215-9004				10. Work Unit No. (TRAIS)	
				11. Contract or Grant No. DTFH6116G00013	
12. Sponsoring Agency Name and Address U.S. Department of Transportation (USDOT) Federal Highway Administration (FHWA) Office of Acquisition and Grants Management 1200 New Jersey Avenue, SE Mail Drop: E62-204 Washington, DC 20590				13. Type of Report and Period Covered Interface Control Document	
				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract					
17. Keywords Smart Columbus, Mobility Assistance for People with Cognitive Disabilities (MAPCD) Interface Control Document (ICD)			18. Distribution Statement		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 22	22. Price

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Chapter 1. Introduction

Purpose

The purpose of this Interface Control Document (ICD) is to document the information required to effectively define the systems interfaces for the Mobility Assistance for People with Cognitive Disabilities (MAPCD) project. The intended audience for this document is the City of Columbus project team, the vendor development team, United States Department of Transportation (USDOT), and project stakeholders interested in understanding the system interfaces for the MAPCD project.

Background

The Mobility Assistance for People with Cognitive Disabilities (MAPCD) project consists of an innovative smartphone application (WayFinder) which will be piloted for between 15 to 30 individuals in the Columbus region in partnership with the Central Ohio Transit Authority (COTA) and Ohio State University (OSU). WayFinder will enable persons with cognitive disabilities to transition off costly paratransit services and 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 through research funding from the United States Department of Education (USDOE) and the National Institutes of Health (NIH). Data generated by the application will be written to the Smart Columbus Operating System (Operating System) to support data analysis and performance measures. For more information on the WayFinder system refer to <https://www.ablelinktech.com/>.

Introduction

This ICD describes the interchange of data between the Mobility Management Server (MMS) (source system) and the Operating System (target system), including relevant message structure and protocols that govern the interchange of data between these two systems. An estimate of the size and frequency of data exchange is provided as appropriate.

Assumptions

AbleLink Smart Living Technologies, the WayFinder vendor, will provide the MMS. The MMS will be a cloud-based application server that will provide real-time data to the Operating System. The data connection will be secured through an encrypted point-to-point virtual private network (VPN) tunnel between the MMS and the Operating System. AbleLink Smart Living Technologies will provide a RESTful interface to allow the data to be extracted in real-time.

Constraints

N/A

Risks

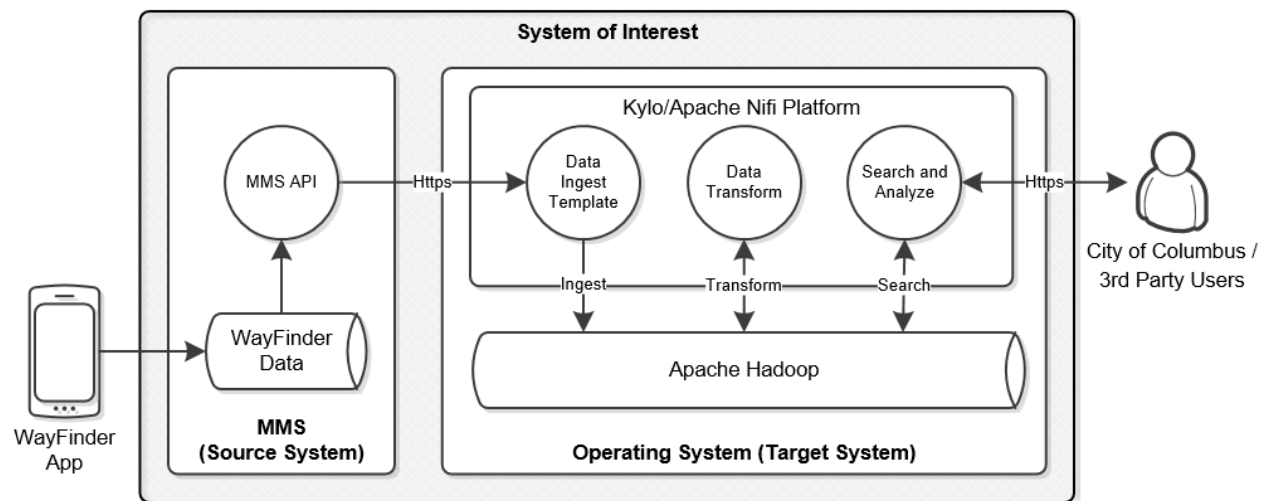
The MMS is currently in development by AbleLink Smart Living Technologies. As a result, the message structure for the various data elements of a trip (**Trip Data**) may continue to change as AbleLink Smart Living Technologies continues to develop and implement new features within the MMS. Agile development of the source system and target system will help to mitigate risks.

Chapter 2. Interface Requirements

Operating System Overview

The Operating System will utilize Apache NiFi and Kylo™ to ingest data from the MMS interface. The data will be transformed and stored in a Hadoop data lake, where it will be searchable utilizing Apache Hive to end-users of the system (City of Columbus and third-party users) through MMS Application Programming Interfaces (APIs).

Figure 1: High-Level System Overview describes the ingestion process at a high-level.



Source: City of Columbus

Figure 1: High-Level System Overview

Data Ingest Template

The Operating System development team will be responsible for creating the template (data structure/schema) to import data (**Trip Data**) from the MMS 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.

Data Transform

Once imported, trip data will be prepared for analytics using transformation features provided by Kylo. The Operating System development team will be responsible for data transformation that will be achieved in the Kylo front-end.

Search and Analyze

End-users of the system will be able to search the trip data in Hadoop and build Hive queries to support analysis. The Operating System development team will be responsible for establishing a search and query interface to allow end-users of the system to analyze the data.

Mobility Management Server (MMS) Overview

The MMS provides cloud-based storage for trip data generated by the mobile app. The mobile app provides geo-location-based multimedia instructions to individuals with cognitive disabilities to facilitate independent travel. Trip data generated by the mobile app is transmitted to the MMS in near-real time. This data is accessible to developers through a secure API.

Trip Data

Trip data is the information that is created by the WayFinder app while a user is in route from an origin to a destination. Trip data is transmitted from the WayFinder app to the MMS. The following data elements may be requested from the MMS via the MMS API. Detailed documentation on the following data elements is provided in **Table 1: Data Dictionary**.

Data elements:

- Starting a particular route
- Completing a route
- Canceling a route before completion
- Pausing a route
- Resuming a route
- Loss of GPS connection
- Reacquisition of GPS connection
- Leaving the travel corridor for the route
- Reentering the travel corridor for the route
- Requests for assistance by the traveler
- Downloading a route with mode of travel used
- Caregiver updates and communications

Communication Protocol

HTTPS will be the mandated protocol to protect the data in transit.

Authentication

The vendor will provide authentication credentials to the Operating System team to be used in all API calls. The MMS will not accept any API commands from a client without a proper authentication token, unless a particular API endpoint allows anonymous access.

Format

JSON will be the mandated format for the payload in the requests and responses from the MMS.

Personally Identifiable Information (PII)

PII will not be requested.

JSON Tags

Table 1: Data Dictionary describes the JSON tags available from the MMS API.

Table 1: Data Dictionary

Tag	Description	Type	Specific Values	Unique	Required	Example
Trip Data						
#mmsapi_version#	Field identifying the version of MMS API that the current trip was completed with.	String	n/a	No	Yes	"#mmsapi_version#": "1.0"
trip_id	Unique identifier for the trip.	String	n/a	Yes	Yes	"trip_id": "acda1fc0130b4f99f1e577bf822"
user_id	Unique identifier for the traveler.	String	n/a	Yes	Yes	"user_id": "acda1fc0130b4f99f1e577bf822"
title	Descriptive title of the route.	String	n/a	No	Yes	"title": "Bus 25 - Center Mall to North Transfer Station"
routeddownloaded	Date and time route was downloaded.	Unix epoch date value	Valid epoch date value, which represents the number of seconds that have elapsed since January 1, 1970.	No	Yes	"routeddownloaded": 2522562400
starttime	Start date and time for the current trip.	Unix epoch date value	Valid epoch date value, which represents the number of seconds that have elapsed since January 1, 1970.	No	Yes	"starttime": 4522562400

Tag	Description	Type	Specific Values	Unique	Required	Example
completetime	Date/ time trip was completed.	Unix epoch date value	Valid epoch date value, which represents the number of seconds that have elapsed since January 1, 1970.	No	No	"completetime": 8522562400
canceltime	Date/time the trip was cancelled.	Unix epoch date value	Valid epoch date value, which represents the number of seconds that have elapsed since January 1, 1970.	No	No	"canceltime": 1522562400
assistancerequested	Value indicating the number of times assistance was requested during the trip.	Integer	n/a	No	No	"assistancerequested": 0
caregiverrequest	Value indicating the number of times caregiver was contacted during the trip.	Integer	n/a	No	No	"caregiveralertrequest": 0

Tag	Description	Type	Specific Values	Unique	Required	Example
Diagnostics Data						
batterylevel	Value indicating the percentage value of battery power on the device at the time the data was posted to the MMS during the trip.	Integer	0 - 100	No	No	"batterylevel": 85
gpsaccuracy	Relative value indicating the accuracy level of the GPS signal at the time the data was posted to the MMS during the trip.	Integer	0 – 9 (9 represents the highest value)	No	No	"gpsaccuracy": 9
routetype	Text description of the type(s) of travel included in the route, used in the Route Library to identify the route type. This value corresponds with the routetype value in the MMS Standard.	Comma-delimited string	autonomous vehicle, bus, bike, cable car, ferry, funicular, gondola, light rail, metro, rail, ride share, streetcar, subway, tram, walking, other	No	No	"routetype": "walking, bus"
cellnetworkcoverage	String value indicating the cell network coverage at the time the data was posted to the MMS during the trip.	String	excellent, very good, good, fair, poor, no signal	No	No	"cellnetworkcoverage": "excellent"

Tag	Description	Type	Specific Values	Unique	Required	Example
Performance Data						
trippaused	Specific date/time(s) route was paused during trip.	Unix epoch date value in comma-delimited string	Valid epoch date value, which represents the number of seconds that have elapsed since January 1, 1970.	No	No	"trippaused": "1507827232, 1507837819, 1507849123"
tripresumed	Specific date/time(s) route was resumed during trip.	Unix epoch date value in comma-delimited string.	Valid epoch date value, which represents the number of seconds that have elapsed since January 1, 1970.	No	No	"tripresumed": "1507827232, 1507837819, 1507849123"
gpssignalloss	Specific date/time(s) gps signal was lost during trip.	Unix epoch date value in comma-delimited string	Valid epoch date value, which represents the number of seconds that have elapsed since January 1, 1970.	No	No	"gpssignalloss": "1507827232, 1507837819, 1507849123"
gpssignalreaquired	Specific date/time(s) gps signal was re-acquired during trip.	Unix epoch date value in comma-delimited string	Valid epoch date value, which represents the number of seconds that have elapsed since January 1, 1970.	No	No	"gpssignalreaquired": "1507827232, 1507837819, 1507849123"

Tag	Description	Type	Specific Values	Unique	Required	Example
Off-Route/Return to Route Data						
offroutetime	Specific date/time(s) representing the time the traveler exited the travel corridor.	Unix epoch date value in comma-delimited string	Valid epoch date value, which represents the number of seconds that have elapsed since January 1, 1970.	No	No	"offroutetime": "1507827232, 1507837819, 1507849123"
offroutelat	Numeric value representing the latitude of the current specific location when the traveler left the travel corridor.	Real number in comma delimited string	Valid latitude in signed degrees format	No	Yes	"offroutelat": -104.845149625467
offroutelong	Numeric value representing the longitude of the current specific location when the traveler left the travel corridor.	Real number in comma delimited string	Valid longitude in signed degrees format	No	Yes	"offroutelong": -104.845149625467
returntoroutetime	Date/time(s) representing when the traveler returned to the route after being off route.	Real number in comma-delimited string	Unix epoch date value.	No	Yes	"returntoroutetime": 1507837819

Tag	Description	Type	Specific Values	Unique	Required	Example
returntoroutelat	Numeric value representing the latitude of the current specific location the traveler returned to the route after being off route.	Real number	Valid latitude in signed degrees format	No	Yes	"returntoroutelat": -104.845149625467
returntoroutelong	Numeric value representing the longitude of the current specific location the traveler returned to the route after being off route.	Real number	Valid longitude in signed degrees format	No	Yes	"returntoroutelong": -104.845149625467

Source: City of Columbus

Appendix A. Title

Table 2: Acronym List contains project specific acronyms used throughout this document.

Table 2: Acronym List

Acronym / Abbreviation	Definition
API	Application Programming Interface
HDFS	Hadoop Distributed File System
HTTPS	Hypertext Transfer Protocol Secure
ICD	Interface Control Document
JSON	JavaScript Object Notation
MAPCD	Mobility Assistance for People with Cognitive Disabilities
MMS	Mobility Management Server
N/A	Not Applicable
NIH	National Institutes of Health
OSU	Ohio State University
PII	Personally Identifiable Information
USDOE	United States Department of Education
USDOT	United States Department of Transportation
VPN	Virtual Private Network

Source: City of Columbus

Appendix B. Glossary

Table 3: Glossary contains project specific terms used throughout this document.

Table 3: Glossary

Term	Definition
Authentication	The process or action of verifying the identity of a user or process.
Communication Protocol	A system of rules that allow two or more entities of a communications system to transmit information.
End-Users	City of Columbus and third-party users who will connect to the Operating System for trip data.
Operating System	The Smart Columbus Operating System is a cloud-based platform designed to ingest and disseminate data from external systems for processing via a microservices architecture.

Source: City of Columbus

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