

NDOT Research Report

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**Development of Software Tools for ADA
Compliance Data Collection, Management, and
Inquiry**

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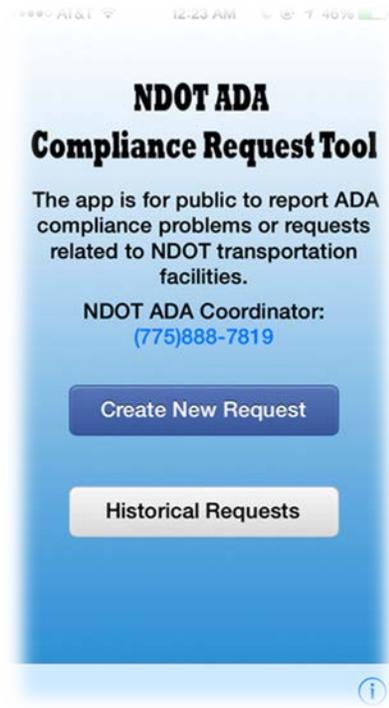
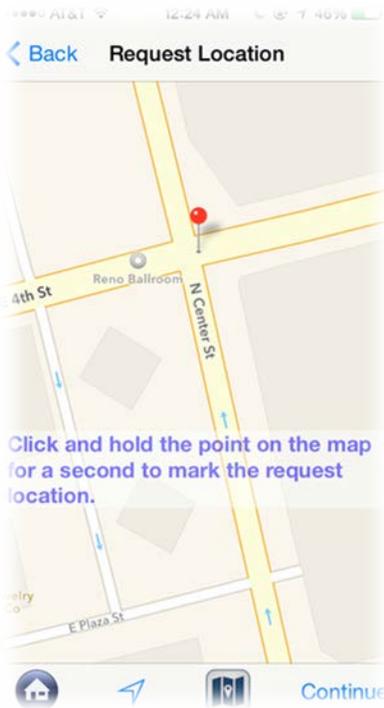


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Development Of Software Tools For ADA Compliance Data Collection, Management, And Inquiry

5TH YEAR NUTC PROJECT REPORT



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1 EXECUTIVE SUMMARY

In this NUTC research project, the UNR research team developed an iOS application (named “**NDOT ADA Data**”) to efficiently and intuitively collect ADA inventory data with iPhones or iPads. This tool was developed to facilitate NDOT ADA data collection process for the Department’s ADA Transition Plan. During the development, it was found that NDOT GIS Division could not provide a public data interface an application to communicate with the NDOT GIS Database, which is caused by a data security concern. The NDOT GIS Division has been working on the connection interface for users outside NDOT to access the GIS database, but it was not available during the time frame of this project. Therefore, the research team completed a pilot version of this application with all the proposed functions except data communication between the application and the data server. Since NDOT engineers could not really use this pilot application for ADA data collection without the communication to the GIS data server, it was developed to demonstrate the major functions and prepare for a full version application in the future when the GIS data interface is available for users outside NDOT. The pilot version of NDOT ADA Data was not published to the Apple Store, but it can be installed to iPhone or iPad devices for testing by the research team.

With approval of the ADA Coordinator, the research team developed a second iOS application for the iPhone and iPad devices. The second application was named as “**NDOT ADA Request**”. It is for the general public to submit ADA compliance requests to NDOT. Major functions of the NDOT ADA Request (the second application) are similar as the functions of NDOT ADA Data (the first application). However, functions and user interface were adjusted to meet requirements of general public users. The NDOT ADA Data is for NDOT engineers to collect detailed ADA data, NDOT ADA Request application was designed to be simple and intuitive for the general public. The NDOT ADA Request application allows public users to locate the compliance request on a map view and select brief descriptions of issues or problems. Public users can also take field pictures by using this application. The application then automatically generates an ADA compliance request email including the request location, description, field pictures and submitter contact information. The public users can submit the request email by a button-click. The NDOT ADA Request application has been verified by Apple Inc. and is now available as a free application at the Apple Store.

ADA data collection can be classified into two types based on who collect and submit the data. One is conducted by NDOT engineers or contractors, who collect the detailed ADA inventory data following a data collection plan. The second one is by the general public, who sees deficiency or problems with existing transportation ADA facilities and submits ADA compliance complaints or requests to NDOT. Both data collection approaches are limited by lack of efficient tools. This issue exists not only with the NDOT ADA Program but ADA programs in most states and cities. The two application tools developed in this project can benefit the two types of data collection by employing the new information technologies. They will greatly improve the efficiency and accuracy of data collection. The success of this project will also put NDOT in the forefront of ADA compliance initiatives. It’s very possible that the tools developed in this study can be extended and used by other ADA programs.

2 INTRODUCTION

2.1 BACKGROUND SUMMARY

The Americans with Disabilities Act (ADA) of 1990 prohibits discrimination on the basis of disability within the U.S. It requires state and local governments and public entities/agencies to perform Self-Evaluations of their current facilities relative to the accessibility requirements of the ADA. Agencies are then required to develop a program access plan – otherwise referred to as a Transition Plan – to address deficiencies identified in their Self- Evaluations. The Nevada Department of Transportation (NDOT) needs to ensure that qualified disabled individuals shall not, solely on the basis of their disability, be excluded from the participation in, denied the benefits of, or subjected to discrimination under any of its programs, services or activities. Consequently, NDOT is tasked by the Federal Highway Administration (FHWA) to provide an ADA Transition Plan. The Transition Plan needs to describe NDOT’s current access facilities to disabled persons as determined through self-assessment and NDOT’s progress and necessary future steps. The development of a Transition Plan first begins with a Self-Evaluation, or inventory, of existing physical barriers in all the facilities managed by NDOT, and a listing of all barriers that limit accessibility. When NDOT is taking the leadership role in making Nevada’s public road rights-of-way accessible for people with disabilities, ADA inventory data of roads in Nevada need to be collected periodically for ADA compliance self-evaluation and transition plan.

Limitations found in preparation of the transition plan are gaps in information and aggregate data from which a baseline inventory can be established. Existing approaches for conducting this inventory include on-site surveys, windshield surveys, aerial photo studies, and drawing reviews. NDOT has begun this process by conducting a limited windshield survey of major public rights-of-way facilities in Las Vegas. Much more, of course, remains to be done. The geographic extent of State DOT facilities can easily span thousands of miles of public rights-of-way, which significantly magnify the complexity and cost of efforts to achieve, maintain, and track compliance over time. ADA data collection can be classified into two types based on who collect and submit ADA data. One type is conducted by NDOT engineers or contractors, who collect detailed ADA data following a data collection plan. The second type is by the general public who may be the ADA facility users or just normal people finding ADA compliance problems. When facility users see deficiency or problems with existing ADA transportation facilities, they submit the complaints or requests to NDOT. The data collected by NDOT engineers or contractors are the major data source for ADA inventory and they are in unit formats and posted in well-organized formats. The data submitted by the public are often poorly described and are confusing. However, complains and requests from the public normally a have higher priority for the NDOT ADA Program to take care of, and which is to meet the urgent requirement of facility users. NDOT engineers know data collection forms or tools well as their professional work. However, a general public user may come across problems to find the right contact information, obtain a paper form for the request, describe the problems as required and submit all the documents. Therefore, data collection tools for ADA inventory leveraging the latest information technologies can greatly benefit the two types of data collection for the NDOT ADA Program.

2.2 LITERATURE REVIEW

A preliminary literature review found that some advanced data collection tools for engineers or contractors to collect ADA inventory data had been developed. In 2008, the City of Bellevue undertook an ADA sidewalk and curb ramp self-evaluation update. The city adapted the profiler technology to the task of inventorying and mapping the city's ADA inventory data. Profilers are typically mounted on motor vehicles and used in both the aerospace and roadway construction industries for measuring smoothness of pavement surfaces on airplane landing strips and the highway system. The problem with the profiler data collection system is that it is expensive. Operation of the device requires specialized training and the devices are difficult to maintain. The system helps measure and collect some geometric design data of ADA inventories but is not easy to use for adding other data. With the rapid development of information technology, smart phones and mobile computers (also called Tablets) are widely used in data collection processes. Especially iPhones and iPads, products from Apple Inc., have been applied in data collection in many different engineering and research domains, because of its reliable operation system and data security capability. Recently, iPad devices were employed for ADA inventory data collection in Mishawaka, Indiana by using an application developed by DLZ Corporation. However, the application used in Mishawaka has limited functions compared to the requirements of ADA inventory data collection in Nevada. New ADA data collection tools need to be specially designed and implemented for NDOT ADA Program. After review of ADA data collection tools, the research team did not find any one applicable for the general public to submit ADA complains and requests to DOTs.

2.3 ADJUSTMENT TO PROPOSED RESEARCH

The originally proposed research is to develop a smart data collection tool for ADA inventory data collection, which will be running on iPad devices as an application. Data collectors can use the tool efficiently and intuitively input the ADA inventory data in office or in field. The tool was designed to collect and synchronize geo-location data automatically. The tool should also provide convenient data sync function to transfer data between the iPad device and data server via wireless or Wi-Fi connection. Users could submit their collected data to a server or download the ADA inventory information from the server with only a few clicks on the device's screen. Thus, the tool was also expected to provide data management in inquiry functions.

When the UNR team was working on the demo version for the app demonstration, it was found that the NDOT GIS Division could not provide data interface for the application to communicate with the NDOT GIS Database. The NDOT GIS Division has been working on data connection for users outside NDOT to access the GIS database, but it was not available during the project term. The GIS Division also proposed to test a few existing data collection tools and see whether they could meet the ADA Program's requirements. The study team was suggested to suspend the original tool development to avoid the duplicated effort, and the ADA Program Coordinator suggested turning the completed application design and functions into an iPhone/iPad application for the general public to report ADA noncompliance problems of NDOT facilities. The new application has similar functions as the original design and is still an ADA data collection tool. However the users will be ADA facility users or the general public rather than engineers, so the application interface and functions are adjusted to meet the new requirements. The adjusted application allows public to report existing ADA problems with GIS location,

description and field pictures, the tool automatically generates a request email to the ADA Program Coordinator. Then the submitter can expect response from the ADA Coordinator.

This report is to summarize the work effort and products of this project, and is organized like this. The first section is the Executive Summary to summarize the contents of this report. Project background, literature review and adjustments to the originally proposed research were introduced in the second section for readers to understand why this research was conducted. The third section describes the design, development, implemented functions and user interface of the NDOT ADA Data tool (a pilot version) for NDOT engineers or contractors. Similar information related to the NDOT ADA Request tool for the general public was documented in the fourth section. Section Five is the summary and recommendation of this report. Reports and research papers found in the literature review are listed in the Reference section.

3 DESIGN AND IMPLEMENTATION OF ADA DATA COLLECTION TOOL

The research team completed a pilot version of this application with all the proposed functions except data communication between the application and the data server, because the current NDOT GIS data server was not open to users outside NDOT. Engineers could not really use this pilot application for ADA data collection without the communication to the GIS data server, so it was developed to demonstrate the major functions. The effort also prepared for a full version application in the future when the GIS data interface is available for users outside NDOT. The pilot version of NDOT ADA Data application was not published to the Apple Store, but it can be installed to iPhone or iPad devices for testing by the research team.

3.1 FUNCTION DESIGN

The original tool function design is demonstrated by the use case diagram of Figure 3-1. The application was originally designed to assist the ADA data collector to collect the field ADA inventory data through an iPhone/iPad. The raw data will be combined and organized in the smart phone, and then transferred to a data server through wireless connection or cable connection. Server side software reads all the data and transfers the raw data into GIS format following NDOT GIS data protocols. Then the information could be imported into or exported out of the NDOT GIS server. The designed system components and data flows are presented in Figure 3-2.

After the adjustment to the originally proposed objectives, the study team developed the demo version of the ADA data collection application at the iPhone side, including the functions of:

- 1) Project management,
- 2) Creating new data record on the map interface,
- 3) Viewing the existing data records on the map interface,
- 4) Moving the existing data records on the map,
- 5) Reading the detailed information of each data record,
- 6) Editing the content of the data recorded by using option list or text view input,
- 7) Taking field pictures,
- 8) Viewing and managing pictures.

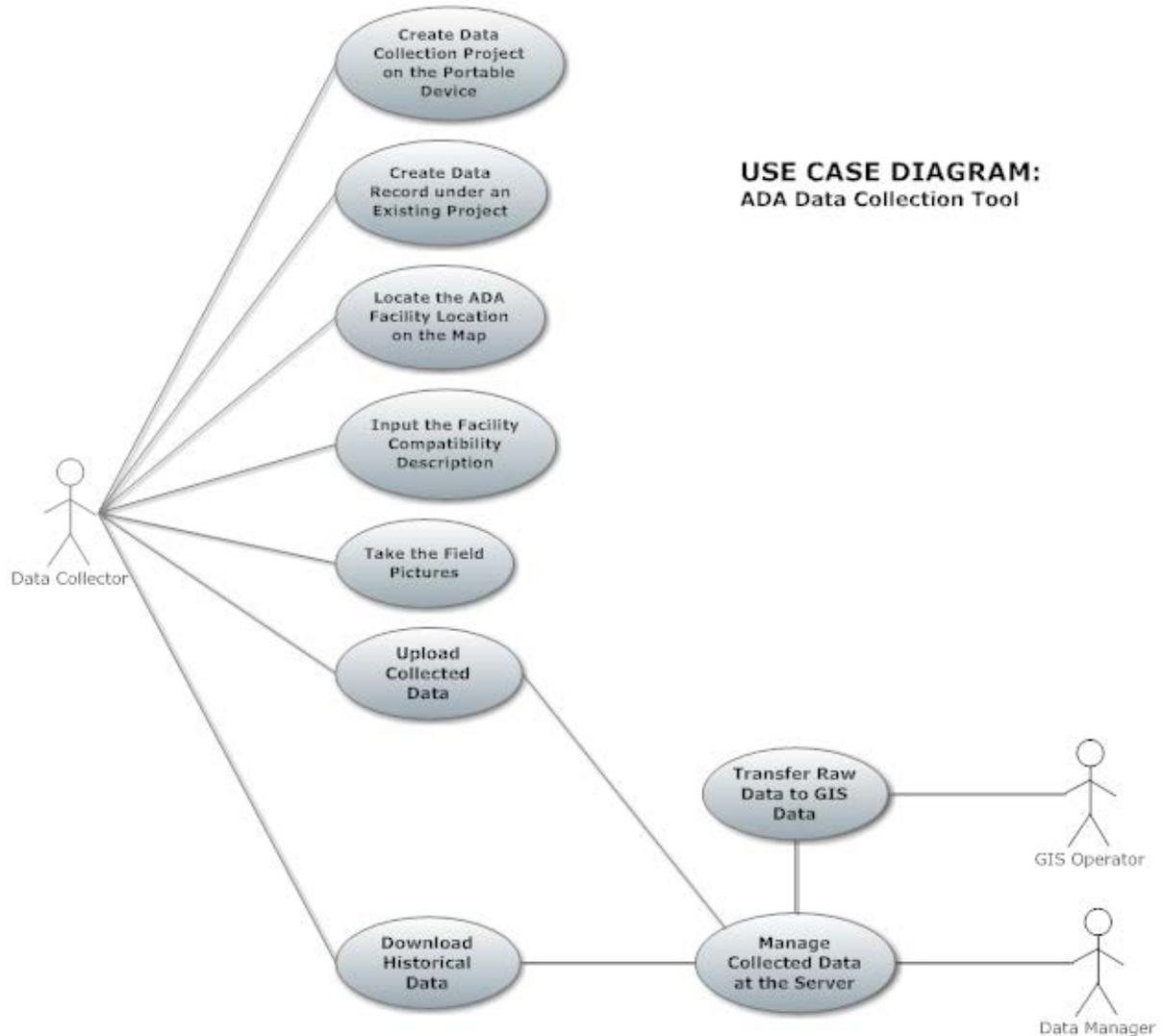


Figure 3-1 ADA Data Collection Tool Use Case Diagram - Original Design

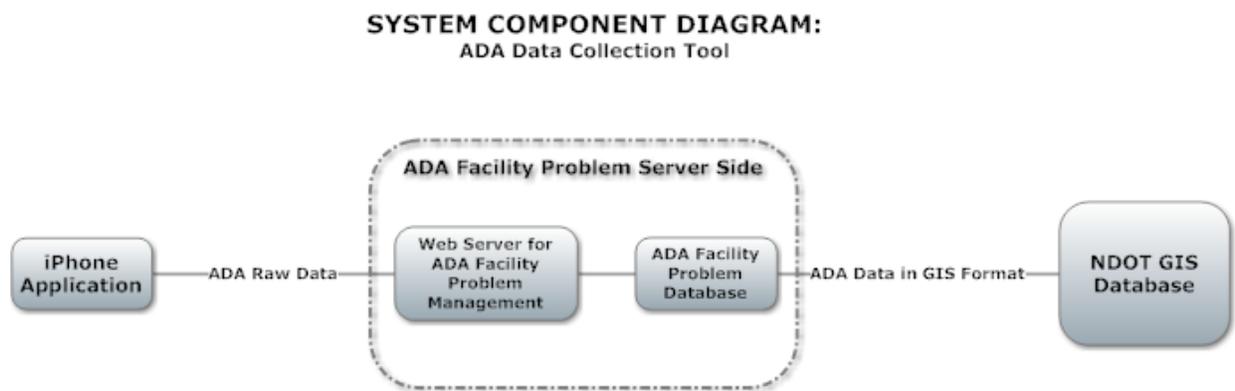


Figure 3-2 ADA Data Collection System Components

3.2 DEVELOPMENT OF THE PILOT APPLICATION

The application was developed on the iOS platform supported by Apple Inc., because of the stability and safety of the iOS platform compared to other mobile operation systems. iOS is a mobile operating system developed by Apple Inc. and distributed exclusively for Apple hardware. It is the operating system that powers many of the company's iDevices. The research team employed the Integrated Development Environment software of Xcode for the application development. Xcode contains a suite of software development tools developed by Apple for developing software for OS X and iOS. The programming language of Objective C was used for program coding.

An Extensible Markup Language (XML) database was integrated in the application. The lightweight database follows the standard data format required by XML. With the consideration of the data collection which may involve huge data records, different projects and their data records are managed by different XML data files. One example is shown in Figure 3-3. The developed demo application was demonstrated to the ADA Coordinator for any future application or extension.

Name
ADA_App_Data_Abstract.xml
dataRecord_20140806083941_20140806085351.xml
dataRecord_20140806083941_20140806085355.xml
dataRecord_20140806083941_20140806085359.xml
dataRecord_20140806083941_20140806085418.xml
dataRecord_20140806083941_20140806085422.xml
dataRecord_20140806083941_20140806085432.xml
dataRecord_20140806083941_20140806085437.xml
dataRecord_20140806083941_20140806085447.xml
project_20140806083941.xml

Figure 3-3 An XML Data File Organization Example

3.3 DESCRIPTION OF THE DEMO ADA DATA COLLECTION TOOL

Picture 3-4 through **Picture 3-19** demonstrate the application user interface and related functions.

3.3.1 Project management page

When NDOT engineers collect ADA data, the data collection may be for different tasks or organized by different zones. Therefore, the data collection project management page was recommended and implemented in the demo application, as shown in Figure 3-4. It is also the home page of this application. This application page shows the project list and provides functions of adding, deleting and listing ADA data collection projects.

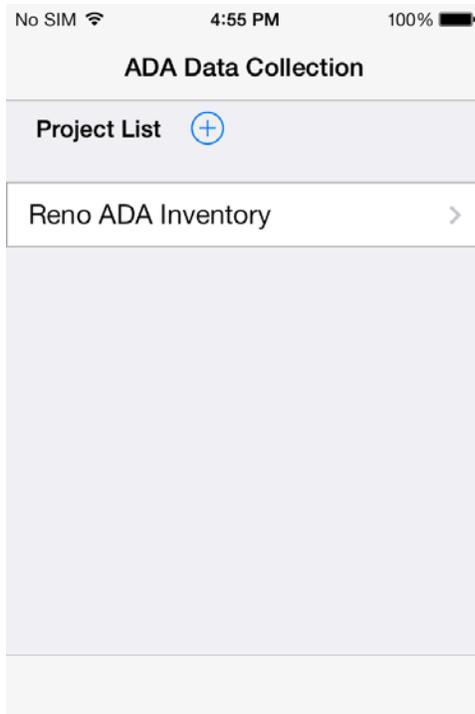


Figure 3-4 Project Management Page

3.3.1.1 Adding a new project

When a user clicks the blue “plus” icon, a new data collection project is added with the default project name of “New Project”. The name can be edited.

3.3.1.2 Deleting an existing project

When a user slide left on a project name in the list, a red “Delete” button will be shown, as in Figure 3-5. If the user clicks the red “Delete” button, a pop-up window will ask the user’s a confirmation of deleting the project record and its data, shown in Figure 3-6.

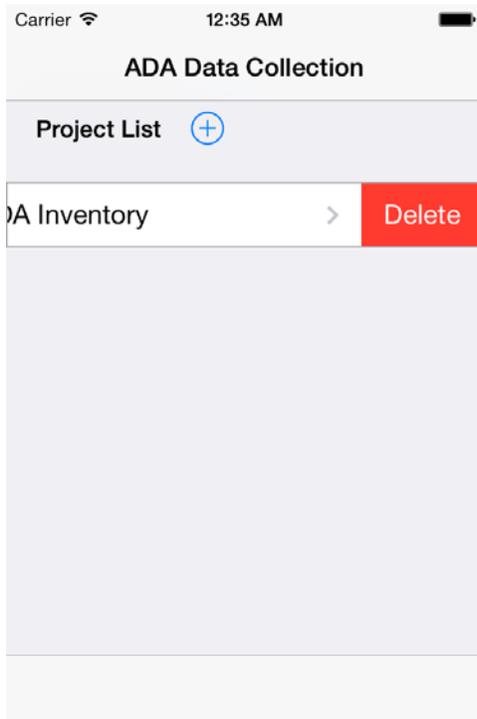


Figure 3-5 Function of Deleting a Project

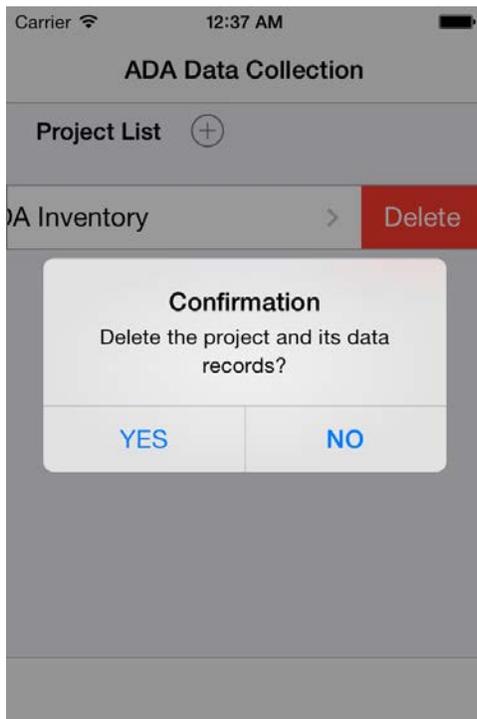


Figure 3-6 The Alert Dialog for Deleting a Project Record and Its Data

3.3.1.3 Selecting a project record

When a user click a project record, the application shows the project information page for the user to view, add, edit or delete data records in this project.

3.3.2 Project View Page (GIS-Based)

After selecting a project record from the project list on the project management page, the application shows the project view page, which is a GIS-Based map view. When a user enters this page for the first time, the application will pop up a window for the user's authorization to allow the use of determining their current location, as shown in Figure 3-7. This page shows the data collection project name on top bar, a map view with all data records and a bottom tool bar with three function buttons, as shown in Figure 3-8.

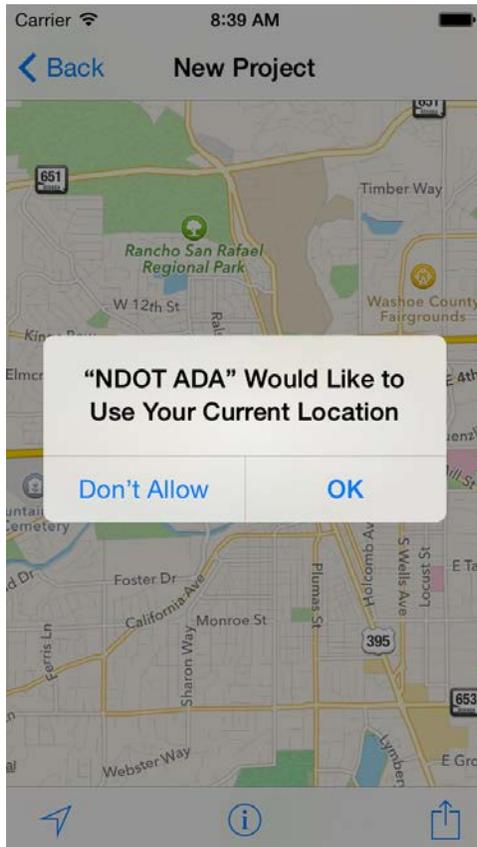


Figure 3-7 Confirmation Window of Using Locating Function

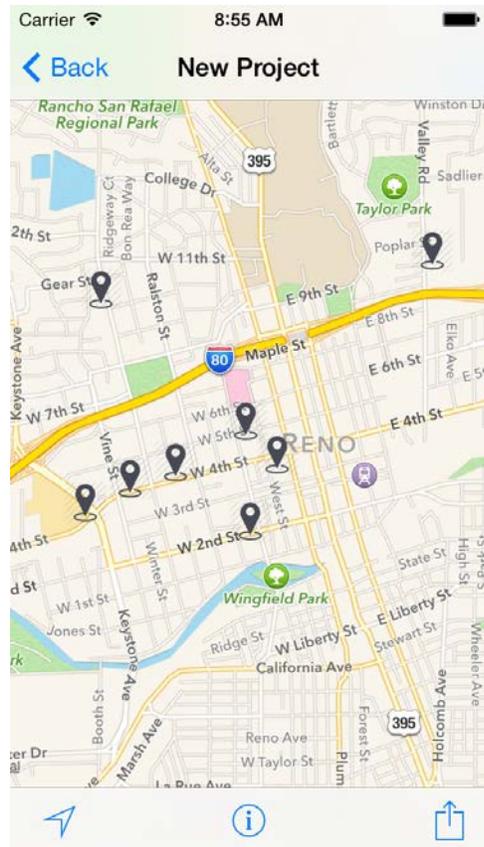


Figure 3-8 Data Records on the Project Map View

3.3.2.1 *Operating the map view*

A user can operate the map view with their fingers to pan, zoom in and zoom out the map. The most right function button on the bottom bar is to switch the map view between modes of Satellite Map and Road Map.

3.3.2.2 *Adding a new ADA data record*

A user can add a new ADA inventory data record by clicking and holding a finger on the map for one second, and then a new record is added onto the pointed location. The application automatically creates a blank new data record with the coordinate information (longitude and latitude values) and a data record ID generated by the current date and time. The newly added data record is then automatically shown on the map interface.

3.3.2.3 *Changing a data record location*

A user can change location of an existing ADA inventory data record by clicking and holding the record icon for one second, then the record icon can be moved with fingers. The application automatically records the new record location coordinate and updates it in the database.

3.3.2.4 *Viewing an ADA data record*

A user can view an ADA data record by clicking its icon on the map. The record ID will be shown in the pop up window, as shown in Figure 3-9. When the user click the information button on the right of the

popup window, the application will show the data record details for the user to view and edit record details.

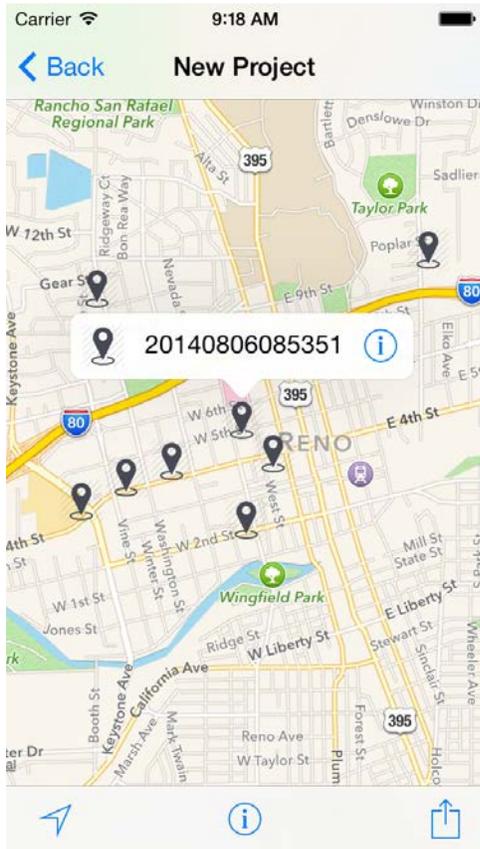


Figure 3-9 Data Record Popup Window

3.3.2.5 *Locating a user's current location*

The most left button on the bottom tool bar can show the user's current location, which assists the user to input inventory records around his/her location, as shown in Figure 3-10.

3.3.2.6 *Switching to the table view of the project view page*

The middle function button on the bottom tool bar can switch the project view page to a table view, which shows the project name and records as table lists.

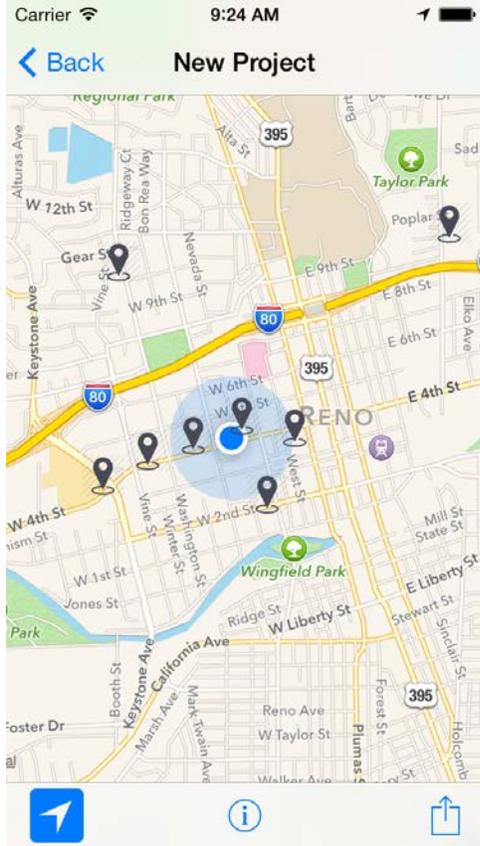


Figure 3-10 Showing the User's Current Location

3.3.2.7 Going back to the Project Management Page

The application can go back to the Project Management Page by clicking the Back button on the top bar.

3.3.3 Project View Page (Table-Based)

When a user switches the project view page from GIS-Based to Table-Based, the project information and its records change to a list view, shown as Figure 3-11.

3.3.3.1 Editing the project name

The project name can be edited by clicking the name text field, as shown in Figure 3-12. A user can exit the editing mode by touching any area other than the project name text field and the keyboard.

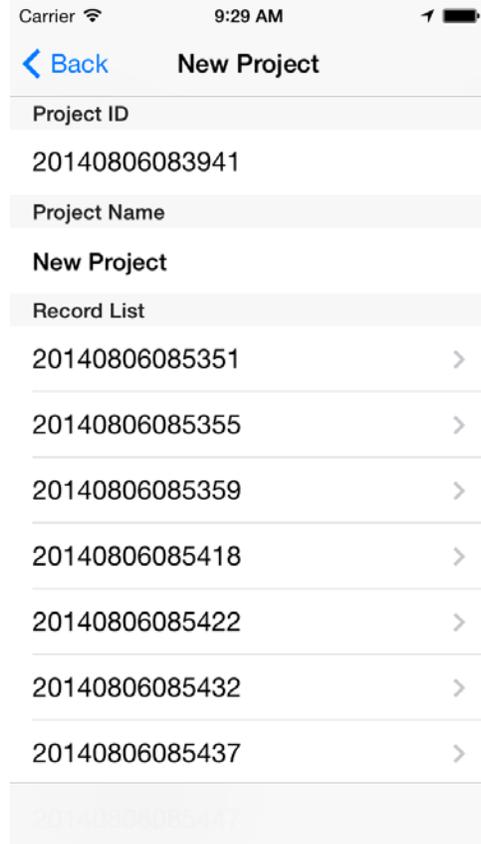


Figure 11 Table-Based Project View

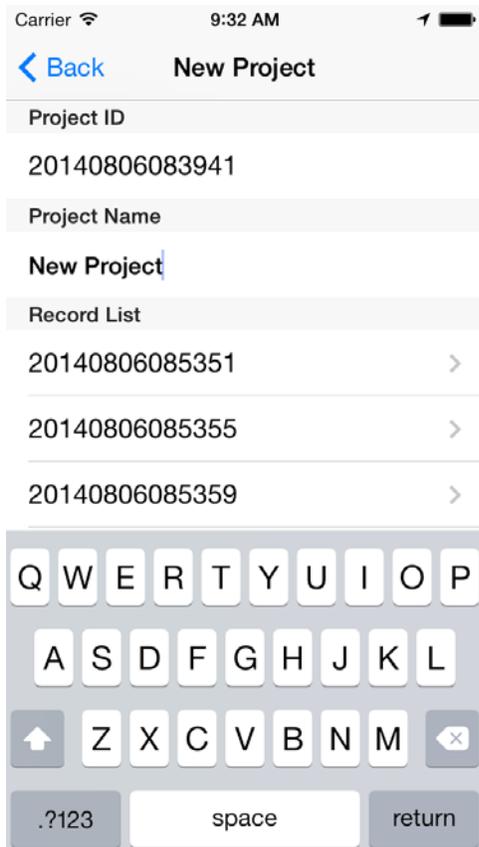


Figure 3-12 Editing Mode to Input or Edit Project Name

3.3.3.2 Selecting a data record

A user can select a data record by clicking the record in the data list. The application will show the data record details view for the user to view and edit record details.

3.3.3.3 Going back to the GIS-Based Project View Page

The application can go back to the GIS-Based Project View Page by clicking the Back button on the top bar.

3.3.4 ADA Data Record View Page

A user can turn to the ADA Data Record View Page, as shown in Figure 3-13 (a) and Figure 3-13 (b), by selecting a data record on the GIS-Based Project View Page or on the Table-Based Project View Page. The page includes information of data record ID, coordinate information, field picture list and ADA compliance description. The compliance description includes “Ramp Compliance”, “Slope Compliance”, “Detectable Warning”, “Narrow Access”, “Noncompliant Driveway” and “Note”.

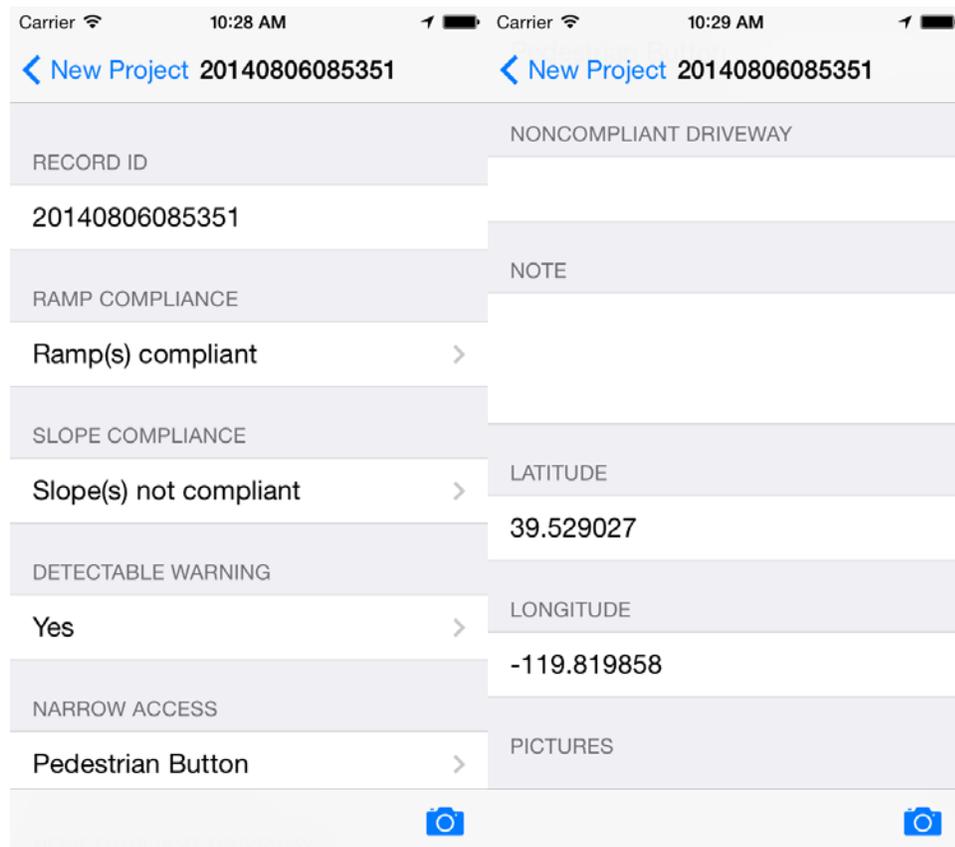


Figure 3-13 Data Record View

3.3.4.1 Entering or Editing Ramp Compliance

A user can enter or edit Ramp Compliance information by clicking its text field area, the application will show a selection page, as shown in Figure 3-14 for users to select Ramp Compliance description from pre-defined options. The available options for Ramp Compliance were recommended by the NDOT ADA Coordinator based on existing data collection forms.

Ramp Compliance

- Null
- Missing ramp(s) – see notes
- Ramp(s) compliant
- Ramp(s) not compliant – see notes

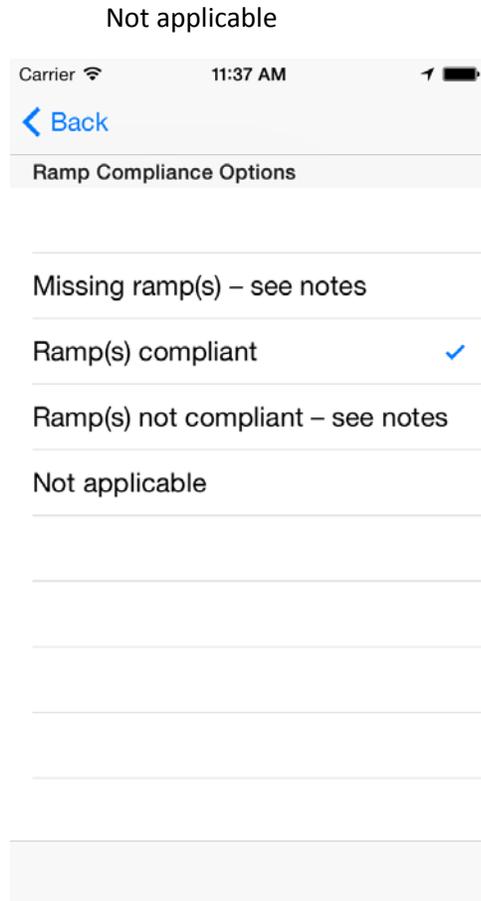


Figure 3-14 Page for Users to Select Ramp Compliance Options

3.3.4.2 *Entering or Editing Slope Compliance*

A user can enter or edit Slope Compliance information by clicking its text field area, the application will show a selection page, shown in Figure 3-15 for user to select Slope Compliance description from pre-defined options. The available options for Slope Compliance were recommended by the NDOT ADA Coordinator based on existing data collection forms.

Slope Compliance

Null

Slope(s) not compliant

Slope(s) compliant

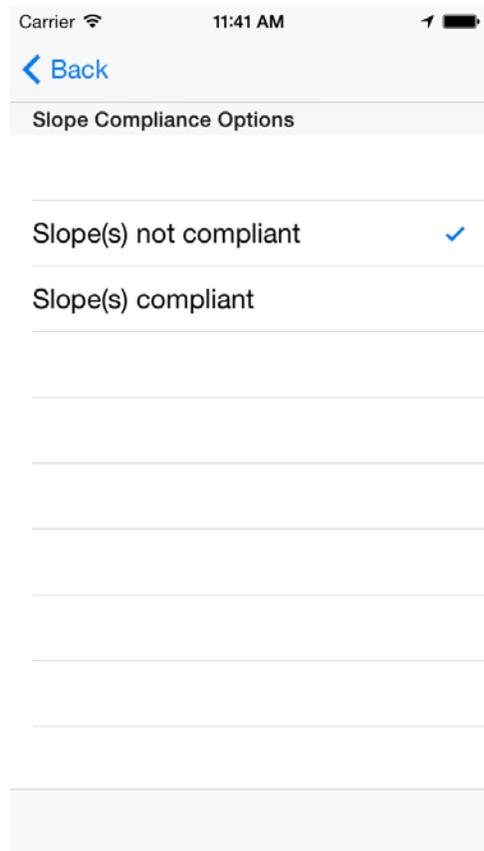


Figure 3-15 Page for Users to Select Slope Compliance Options

3.3.4.3 *Entering or Editing Detectable Warning*

A user can enter or edit Detectable Warning information by clicking its text field area, the application will show a selection page, shown in Figure 3-16 for user to select Detectable Warning description from pre-defined options. The available options for Detectable Warning were recommended by the NDOT ADA Coordinator based on existing data collection forms.

Detectable Warning

Null

Yes

No

Unknown

See Notes

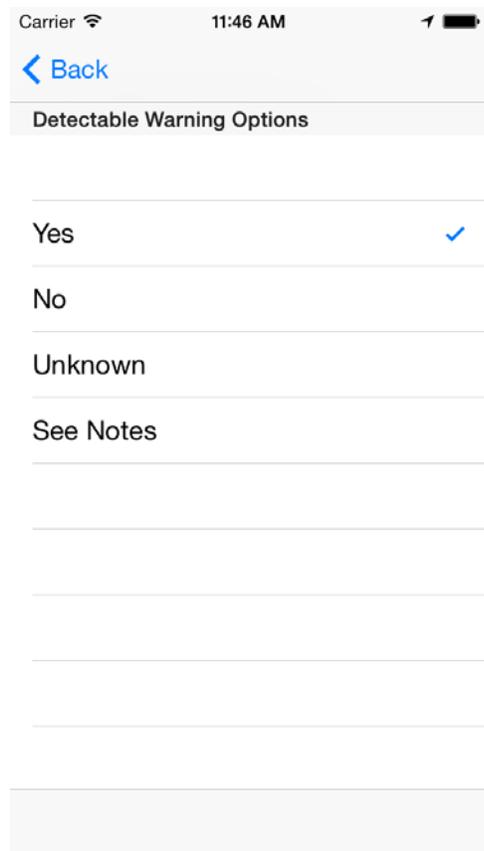


Figure 3-16 Page for Users to Select Detectable Warning Options

3.3.4.4 Entering or Editing Narrow Access

A user can enter or edit Narrow Access information by clicking its text field area, the application will show a selection page, shown in Figure 3-17 for user to select Narrow Access description from pre-defined options. The available options for Narrow Access were recommended by the NDOT ADA Coordinator based on existing data collection forms.

Narrow Access

- Null
- Pedestrian Button
- Power Pole
- Fire Hydrant
- Signal Pole
- Manhole
- Emergency Signal
- Bus Stop

- Mailbox
- Signal Cabinet
- Street Light
- Signpost
- Multiple obstructions, see notes for details
- Newspaper Stand
- Not Applicable

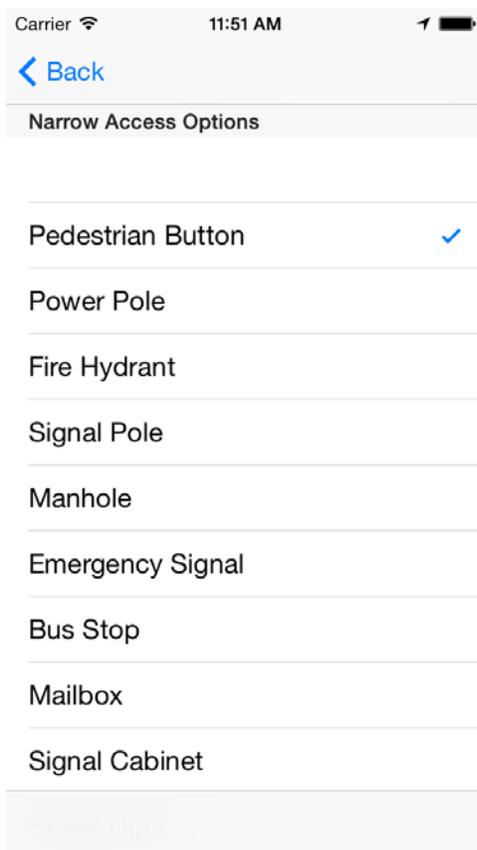


Figure 3-17 Page for Users to Select Narrow Access Options

3.3.4.5 Entering or Editing Noncompliant Driveway

A user can enter or edit Noncompliant Driveway information by clicking its text field area, the application turns to editing mode and showing the keyboard for the user to enter the problem description, as shown in Figure 3-18. The user can exit the editing mode by touching any area other than the Noncompliant Driveway text field and the keyboard.

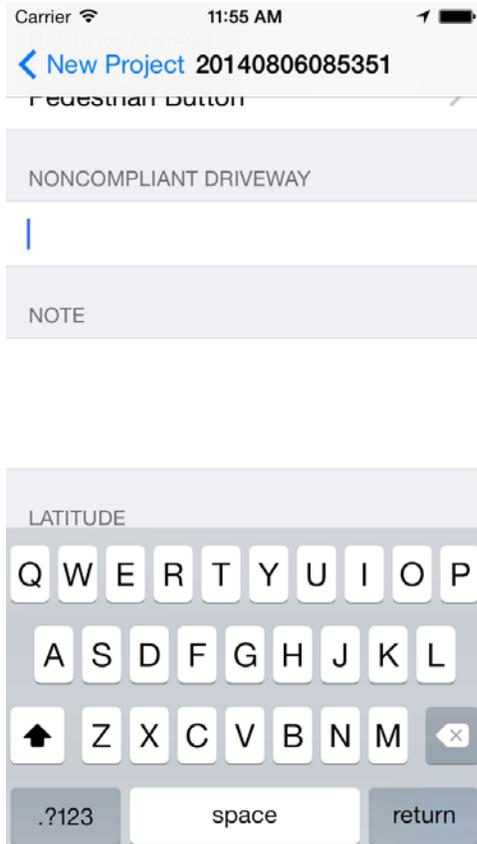


Figure 3-18 Editing Mode for Users to Input Noncompliant Driveway

3.3.4.6 Entering or Editing Note Information

Some supplementary information can be input into the Note by clicking its text field area, the application turns to editing mode and showing the keyboard for the user to enter the extra description. The user can exit the editing mode by touching any area other than the Note text field and the keyboard.

3.3.4.7 Taking pictures of ADA facilities

The right camera button on the bottom allows the user to take pictures of the field investigation, as shown in Figure 3-19; the pictures are integrated with other information related to the data record.

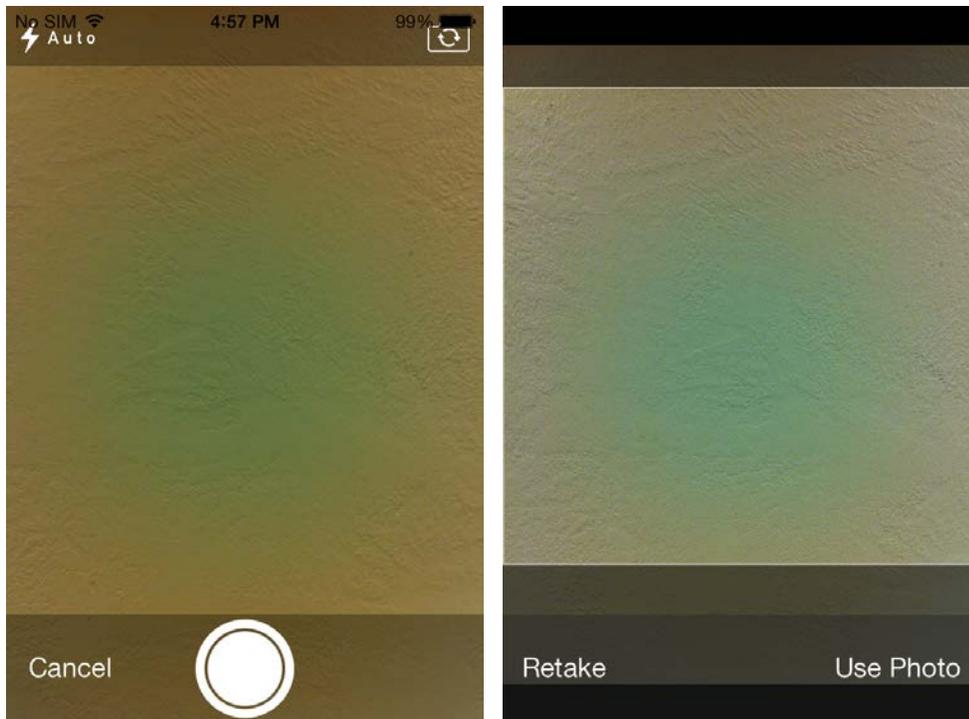


Figure 3-19 Camera View for Users to Take Field Pictures

3.3.4.8 *Viewing pictures*

The user can view pictures taken by this application by selecting a picture from the picture list.

3.3.5 Data Transition

The data collected by using this application can be exported through a computer with iTunes software installed. Because the connection interface to the NDOT GIS server is not available, wireless data uploading was not implemented in this demo version.

4 DESIGN AND IMPLEMENTATION OF ADA TOOL FOR PUBLIC TO SUBMIT COMPLIANCE REQUEST

When knowing it is not possible to connect to the NDOT GIS server at this stage and ArcGIS provides integrated tools for simple smart phone applications of data collection, the study team was suggested to suspend the original tool development to avoid the duplicated effort. The ADA Program Coordinator agreed and suggested the UNR research team to turn the completed application design and functions into an application for the public to report any ADA compliance problems of existing ADA facilities. The new application will have similar functions as the original design. However the users will be the ADA inventory users or the common public rather than the ADA data collectors, so the application interface and functions will be adjusted to meet the new requirements. The adjusted application allows public to report existing ADA problems with GIS location, description and field pictures, the tool will generate an email to the ADA Program Coordinator. Then request submitter will receive confirmation of the Coordinator receiving the problem report and also all the follow-up updates for fixing the problem.

4.1 FUNCTION DESIGN

The new application function design led to a new use case diagram as shown in Figure 4-1.

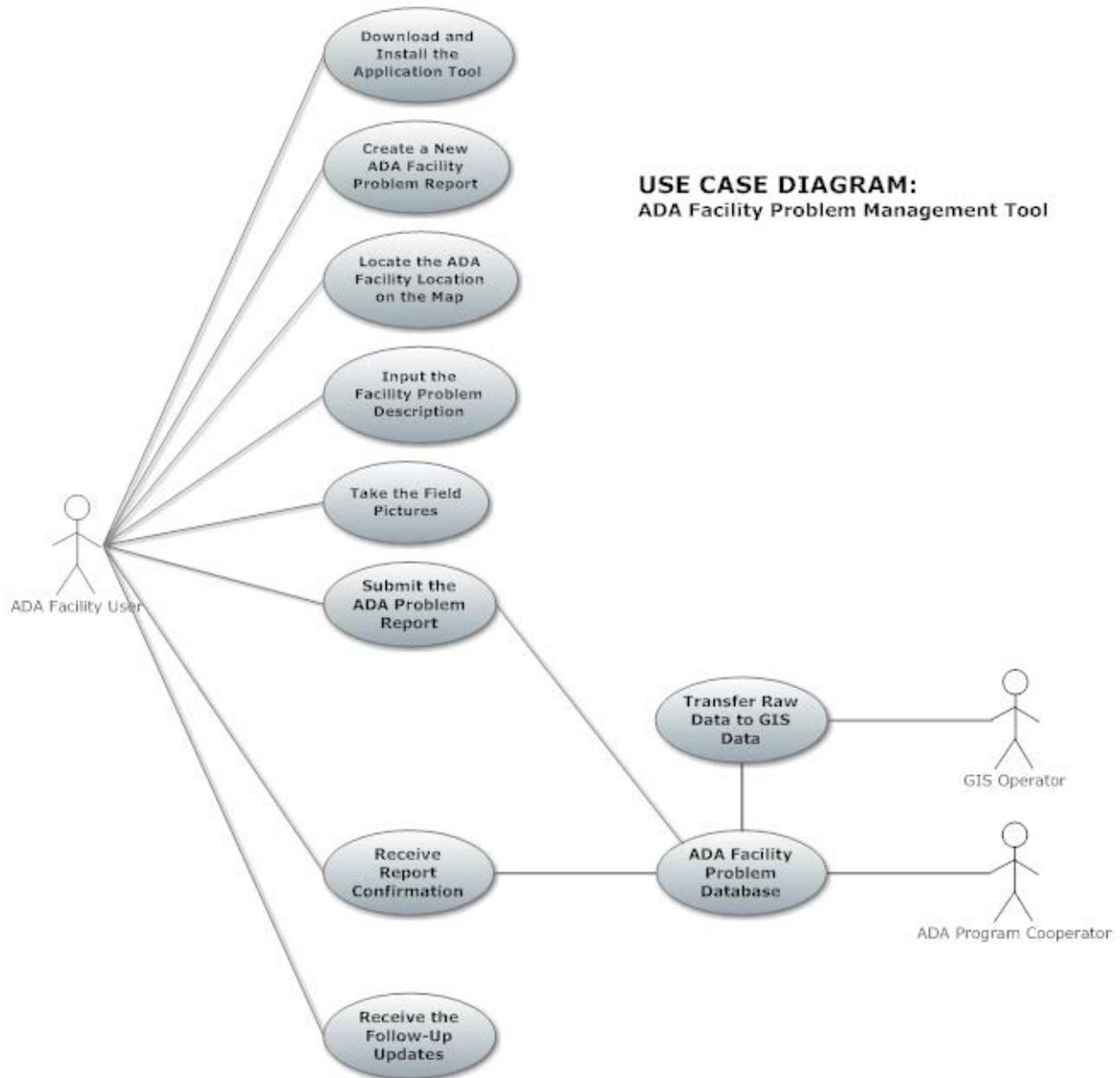


Figure 4-1 ADA Facility Problem Management Tool Use Case Diagram

4.2 DEVELOPMENT OF THE NDOT ADA APPLICATION FOR PUBLIC

This application was also developed for iPhone/iPad devices running iOS operation system. The Xcode Integrated Development Environment is also necessary for the application development. The application has been verified by Apple and is now available at the Apple Store. The application name at the store is “NDOT ADA Request” - <https://itunes.apple.com/us/app/ndot-ada-request/id888208268?ls=1&mt=8>.

An Extensible Markup Language database was also integrated in the application. The lightweight database follows the standard data format required by XML. Since ADA compliance requests are submitted by a general person, it cannot be huge dataset, the organization of the XML database for this

application is different from the data organization of the first application. All the data are stored and managed in one XML data file. An example of the XML data file content is demonstrated in Figure 4-2.

```
<?xml version="1.0" encoding="UTF-8"?>
<unr_cater>
  <NDOTADAPublic>
    <ADAaccommodationRequestList>
      <Request>
        <RequestID>20140806044155</RequestID>
        <RequestName>2014-08-06 04:41:55</RequestName>
        <RequestStatus>Submitted</RequestStatus>
        <RequestDescription>
          <Nosidewalk>1</Nosidewalk>
          <Noramp>0</Noramp>
          <Steepsidewalksorramps>0</Steepsidewalksorramps>
          <Narrowsidewalksorramps>1</Narrowsidewalksorramps>
          <Blockedsidewalksorramps>0</Blockedsidewalksorramps>
          <Roughsurface>0</Roughsurface>
          <Other>1</Other>
          <OtherDescription>TEST</OtherDescription>
        </RequestDescription>
        <Requestor>
          <RequestorName>Hao Xu</RequestorName>
          <RequestorAddressLine1 />
          <RequestorAddressLine2 />
          <RequestorAddressCity />
          <RequestorAddressState />
          <RequestorAddressZipCode />
          <RequestorPhone>775-784-6909</RequestorPhone>
          <RequestorEmail>Haox@unr.edu</RequestorEmail>
        </Requestor>
        <RequestCoordinate>
          <RequestCoordinateX>-119.804176</RequestCoordinateX>
          <RequestCoordinateY>39.527326</RequestCoordinateY>
        </RequestCoordinate>
        <RequestPictureList />
      </Request>
    </ADAaccommodationRequestList>
  </NDOTADAPublic>
</unr_cater>
```

Figure 4-2 An XML Data File Example

4.3 DESCRIPTION OF THE NDOT ADA APPLICATION FOR PUBLIC

The application pages and related functions are demonstrated in Figure 4-3 to Figure 4-14.

4.3.1 Application Home Page

When a user opens the NDOT ADA Request application, the application shows the home page, as shown in Figure 4-3. The home page shows the full name of this application – NDOT ADA Compliance Request Tool. It shows a brief description of the application tool – “the app is for the public to report ADA compliance problems or requests related to NDOT transportation facilities”. This page also provides the contact phone number of the NDOT ADA Coordinator for the users to directly contact the coordinator for ADA related questions.

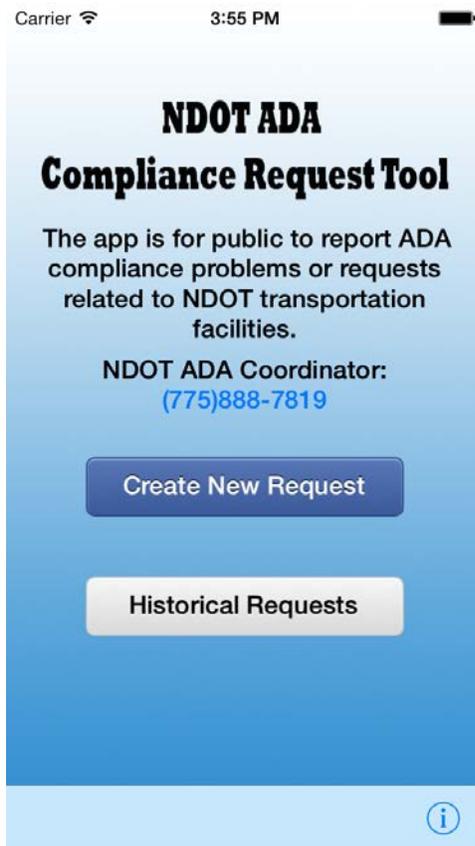


Figure 4-3 Home Page

4.3.1.1 Calling the NDOT ADA Coordinator

When a user clicks the NDOT ADA Coordinator phone number on the home page, the application can automatically trigger the calling function of iPhone to call the coordinator.

4.3.1.2 Creating a new ADA compliance request

A user can create a new ADA compliance request by clicking the blue button named “Create New Request” on the home page.

4.3.1.3 Viewing historical requests

A user can view historical compliance requests created and submitted by the user.

4.3.1.4 Viewing information of the application

When a user clicks the information icon button on the bottom bar, it will show an information page as Figure 4-4.

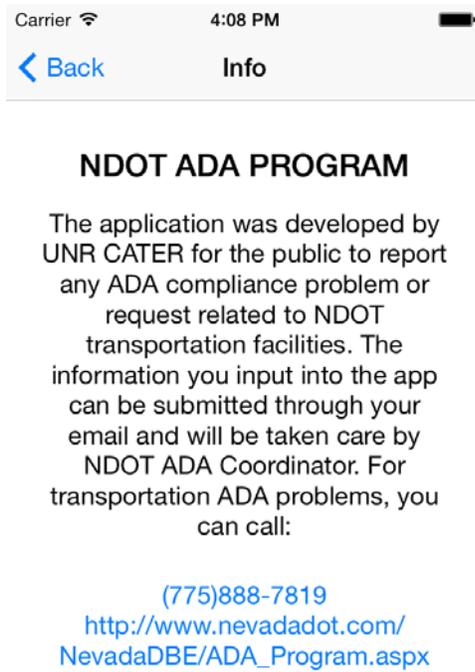


Figure 4-4 Application Information Page

4.3.2 Request Location Map Page

The Request Location Map Page is for the user to input or change the facility location related to the request. The page is shown in Figure 4-5. The top bar has a button backing to the home page and the page name. The major page view is a map and has the same functions just like with any other common map applications with the functions of zooming in, zooming out and panning around. The bottom tool bar has four function buttons.

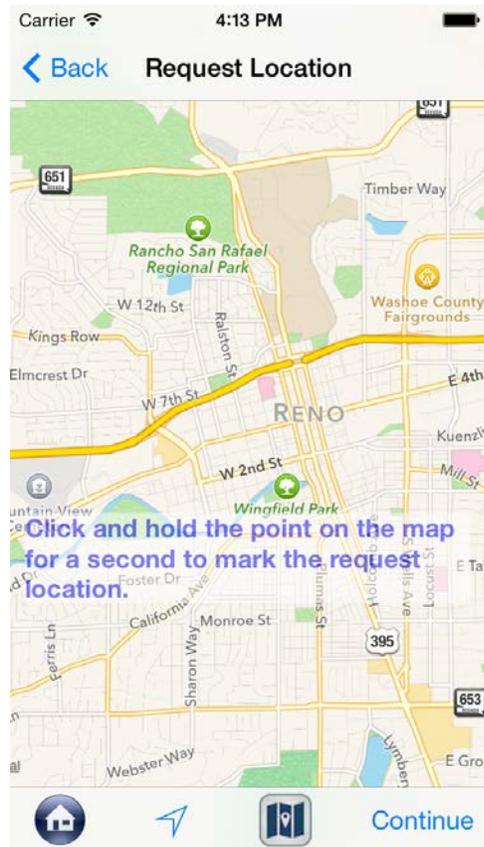


Figure 4-5 Request Location Map View

4.3.2.1 *Inputting the request location*

A user can input the request location for a new request by clicking the location on the map, as shown in Figure 4-6.

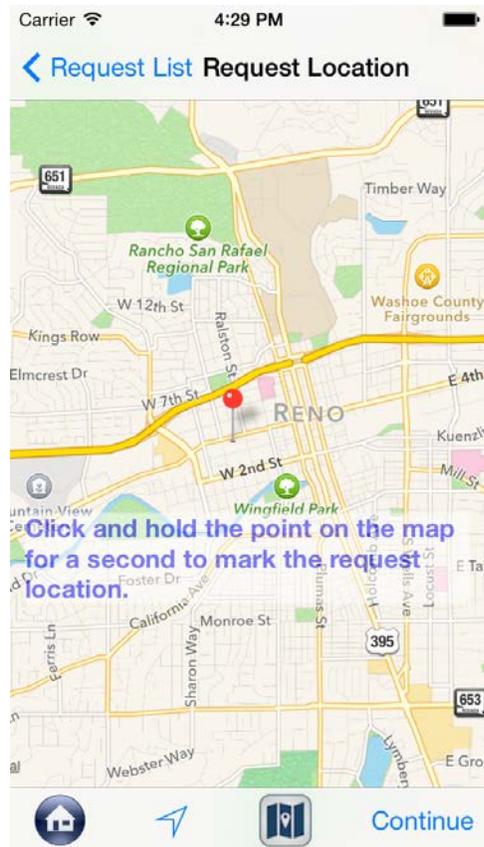


Figure 4-6 Request Location Map View with a Request Location

4.3.2.2 *Changing the request location*

A user can change the location of an existing request by clicking the new location for the request. The changed location is saved to the application database.

4.3.2.3 *Operating the map view*

A user can operate the map view with their fingers to pan, zoom in and zoom out the map. The second most right function button on the bottom bar is to switch the map view between modes of Satellite Map and Road Map.

4.3.2.4 *Locating a user's current location*

The second most left button on the bottom tool bar can show the user's current location, which assists the user to input inventory records around his/her location, as shown in Figure 4-7.

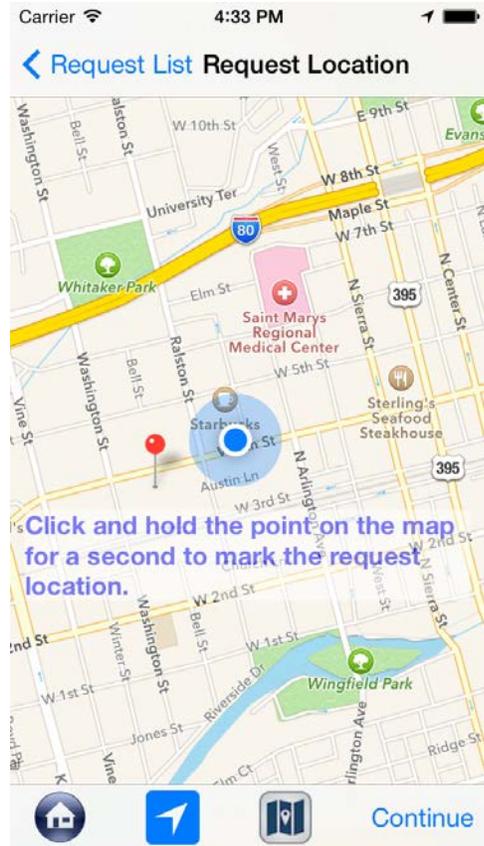


Figure 4-7 Showing the User's Current Location

4.3.2.5 *Going back to the Home Page*

A user can go back to the application Home Page by clicking the "Back" button on the top bar or click the most left button on the bottom tool bar.

4.3.2.6 *Continuing to input request information*

A user can continue to input other request information by clicking the most right button "Continue" on the bottom tool bar.

4.3.3 Request Description Page

When a user clicks the continue button on the Request Location Map Page, the application turns to the Request Description Page, as shown in Figure 4-8.

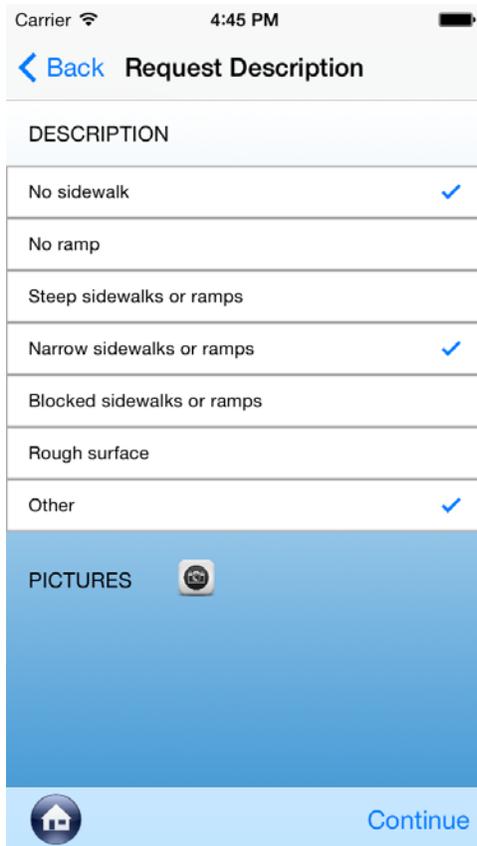


Figure 4-8 Request Description View

The page lists the common descriptions of an ADA compliance request as options for users to select. The user can select multiple options for one request. When the listed options cannot cover all problems or requests. The “Other” option allows users to input other words. This page also lists pictures taken in the field for this request.

4.3.3.1 *Selecting/unselecting description options*

A user can select or unselect a description options by clicking it. The selected options have check marks.

4.3.3.2 *Inputting Other descriptions*

When a user selects the other option, the application will show the user a page to input other information, as shown in Figure 4-9.

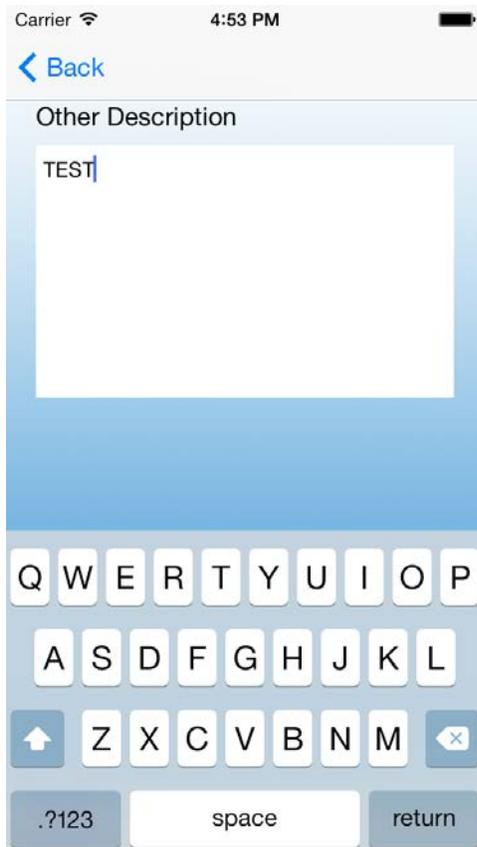


Figure 4-9 Input Description in “Other”

4.3.3.3 Taking field pictures for the request

A user can click the camera button besides the “Pictures” section name. The user can take multiple pictures for one request.

4.3.3.4 Viewing pictures

A user can view pictures taken by this application by selecting a picture from the picture list.

4.3.3.5 Going back to the Home Page

A user can go back to the application Home Page by clicking the most left button on the bottom tool bar.

4.3.3.6 Going back to the Request Location Map Page

A user can go back to the Request Location Map Page by clicking the “Back” button on the top bar.

4.3.3.7 Continuing to the Submitter Contact Information Page

A user can continue to input the submitter contact information by click the most right button “Continue” on the bottom tool bar.

4.3.4 Submitter Contact Information Page

When A user clicks the “Continue” button on the Request Description Page, the application turns to the Submitter Contact Information Page, as shown in Figure 4-10.



Figure 4-10 Contact Information of the Submitter

4.3.4.1 *Inputting/Editing the submitter’s name*

When a user clicks the name text field area, the application enters editing mode and shows the virtual keyboard allowing the user to input his/her name, as shown in Figure 4-11. When the user clicks page areas other than the text field and keyboard, the application exits editing mode and automatically save the input or edited information.

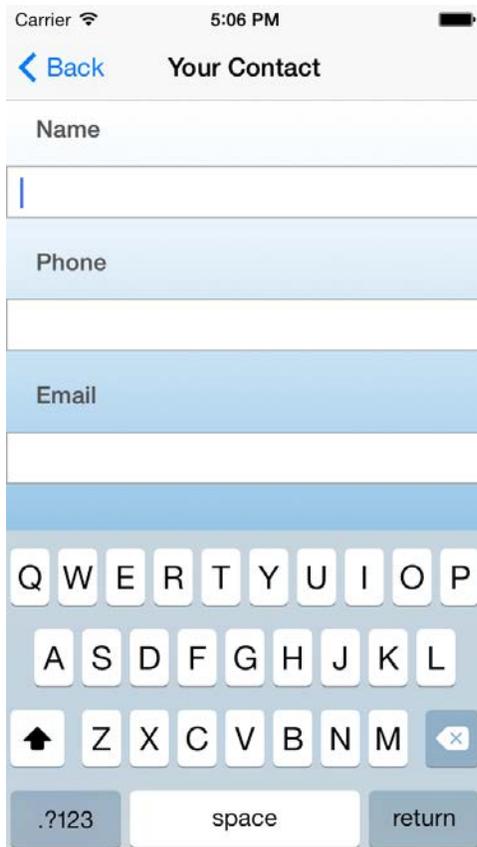


Figure 4-11 Inputting or Editing Contact Information

4.3.4.2 Inputting/Editing the submitter's phone

When a user clicks the phone text field area, the application enters editing mode and shows the virtual keyboard allowing the user to input his/her name, as shown in Figure 4-10. When the user clicks page areas other than the text field and keyboard, the application exits editing mode and automatically save the input or edited information.

4.3.4.3 Inputting/Editing the submitter's email

When a user clicks the email text field area, the application enters editing mode and shows the virtual keyboard allowing the user to input his/her name, as shown in Figure 4-10. When the user clicks page areas other than the text field and keyboard, the application exits editing mode and automatically save the input or edited information.

4.3.4.4 Going back to the Home Page

A user can go back to the application Home Page by clicking the most left button on the bottom tool bar.

4.3.4.5 Going back to the Request Description Page

A user can go back to the Request Description Page by clicking the “Back” button on the top bar.

4.3.4.6 Continuing to the Submitting Page

A user can continue to the Submitting Page by click the most right button “Submit” on the bottom tool bar.

4.3.5 Request Submitting Page

The Request Submitting Page automatically generates and shows an email containing the information inputted by the user and pictures taken for the request, as shown in Figure 4-12.

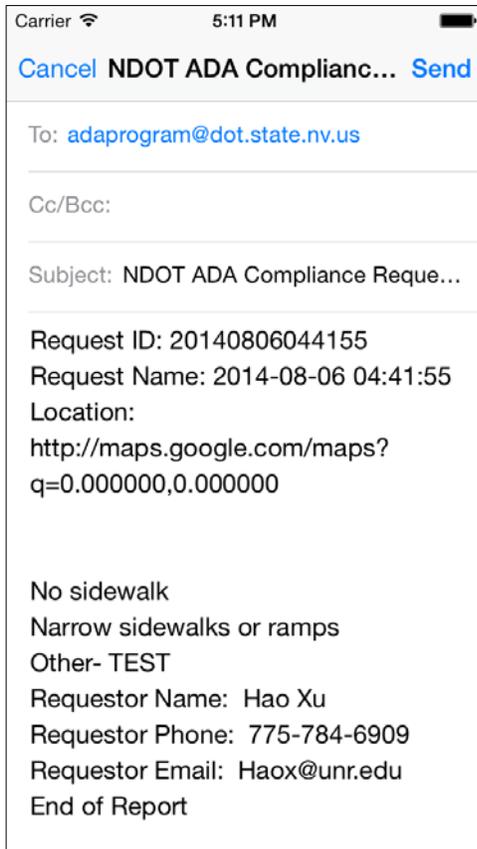


Figure 4-12 Automatically Generated Request Email including All Information Input

4.3.5.1 Sending the request email

A user can send the request email to the NDOT ADA Coordinator by clicking the “Send” button on the top bar.

4.3.5.2 Canceling the request email

A user can also cancel the request email by clicking the “Cancel” button on the top bar.

4.3.6 Historical Request List Page

On the Home Page of the NDOT ADA Request application, one button is named as “Historical Requests”. When a user clicks this button, the Historical Request List Page is shown, as Figure 4-13. This page shows all the records (stored in this device) created by the user, including unfinished requests (not being submitted) and submitted requests. The two types of historical requests are in two separate lists. Unfinished requests can be viewed, edited and submitted to the NDOT ADA Coordinator, but submitted requests can only be viewed. The application does not allow editing or re-submitting the submitted requests.

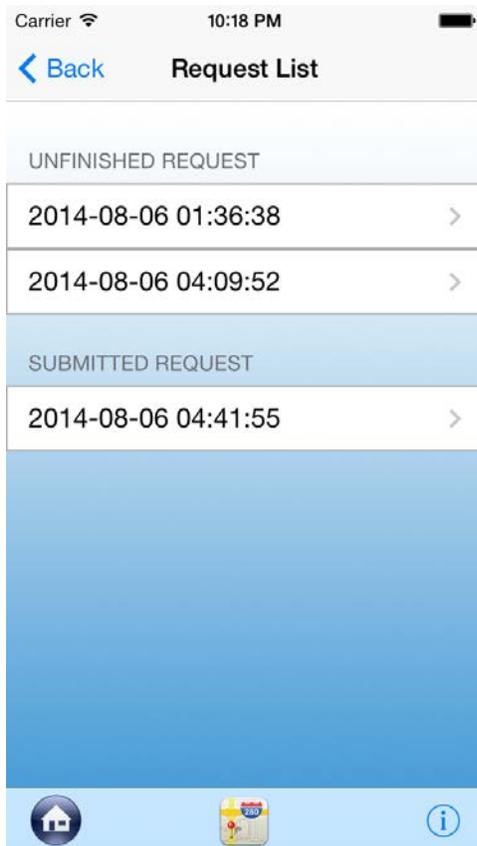


Figure 4-13 Historical Request View

4.3.6.1 *Selecting a historical request*

If a user clicks a historical request in the two lists, the request is selected and its location map page is shown.

4.3.6.2 *Switching to GIS Map View*

When a user clicks the middle button on the bottom tool bar, the application switches to the GIS Map View of the historical requests, shown as Figure 4-14. Red icons mean unfinished requests and green icons mean submitted requests.

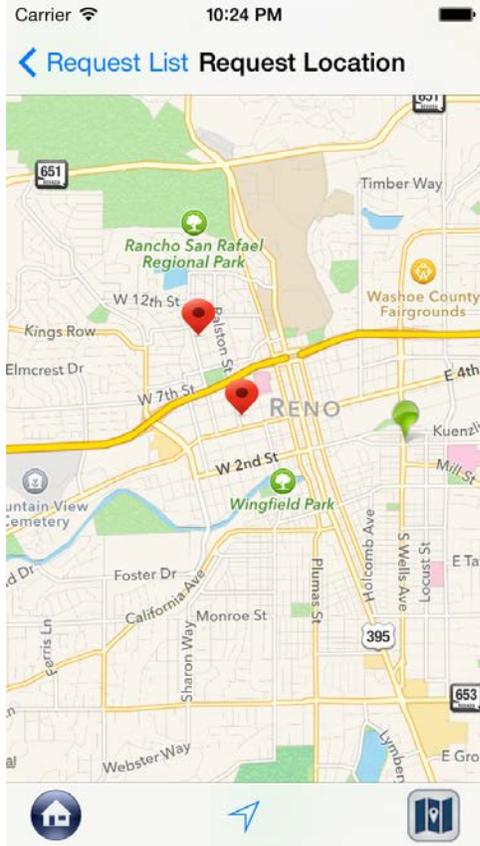


Figure 4-14 Historical Request Map View with Historical Requests on the Map

4.3.6.3 *Going back to the Home Page*

A user can go back to the application Home Page by clicking the most left button on the bottom tool bar.

4.3.6.4 *Going back to the Home Page*

A user can go back to the application Home Page by clicking the “Back” button on the top bar or click the most left button on the bottom tool bar.

4.3.6.5 *Viewing information of the application*

When a user clicks the information icon button on the bottom bar, it will show an information page as Figure 4-3.

5 PROJECT SUMMARY

The UNR research team conducted a literature and technology review of existing tools for ADA data collection, and found that advanced tools for ADA data collection are needed. ADA requires state and local governments and public entities/agencies to perform Self-Evaluations of their current facilities relative to the accessibility requirements of the ADA. Therefore, a research to develop tools for ADA data collection by leveraging new information technologies is significant not only for the NDOT ADA Program but also for ADA programs of most DOTs and Cities.

This project developed two iOS applications for ADA data collection, being able to operate on both iPhones and iPads. The first applications was for engineers to collect detailed ADA facility data. Because of unexpected GIS data server connection issues, only a pilot version of this application was completed as advised by the ADA Coordinator. The pilot version includes the major functions of collecting ADA data and taking field pictures, but not the function of data communication with the NDOT GIS data server. It was not uploaded to the Apple Store, because it cannot really be used for the field data collection without the data communication function. The pilot version can be easily extended to a full version when NDOT open the GIS data server connection interface to users outside NDOT. The second application developed in this project is a completed full version application, which has been verified by Apple and is now available at the Apple Store. The second application is for the general public to submit ADA Noncompliance Request when they see any ADA problems. This tool greatly facilities general public to report ADA problems compared to the existing paper form data submission.

The two application tools developed in this project can benefit the two types of data collection by employing the new information technologies. They will greatly improve the efficiency and accuracy of data collection. The success of this project will also put NDOT in the forefront of ADA compliance initiatives. It's very possible that the tools developed in this study can be extended and used by other ADA programs.

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