

UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

**Design Document for Dynamic Parking Project: User Manual Web Application**

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**ELEC 491**

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This document contains important information on how to use the application.

# 1. The Home Page

The homepage displays all key information necessary to monitor the stalls and gives easy access to all the system controls including editing/deleting existing stalls, viewing additional stall information, creating new stalls, and changing restrictions on stalls.

The screenshot shows the 'Home Page' with a navigation bar containing 'Home', 'About', and 'Contact'. Below the navigation bar is the 'Stall List' section. It features a 'Create New' button and a search/filter area with fields for 'Device Id', 'Status' (All), 'Restriction' (All), 'Location' (All), 'Group' (All), and 'Alerts' (All), along with 'Filter' and 'Clear' buttons. A table displays the following data:

Device Id	Last Check In	Status	Restriction	Location	Group	Alert
A8610A30372B6308	2019-03-31 2:21:54 PM	Empty	Handicap	Alumni Center	1	None
A8610A30372B6308	2019-03-31 2:21:54 PM	Empty	FN 9713	Alumni Center	1	None
A8610A30372B6308	2019-03-31 2:21:54 PM	Occupied	15 minute	Alumni Center	1	None

Below the table is a 'Return to Top' link and a footer with the text '2019 - PL063 Capstone'.

## Device Id:

Shows the unique ID used to establish a connection through the LoRa network with the sign.

## Last Check In:

Displays the last time the device sent an update to Eleven-X and the web application. This should update every 2-3 minutes. If this field is not changing there is a problem the device that is preventing it from sending uplink message through the LoRa Network.

## Status:

Shows if the stall is occupied or empty. Only empty stalls can have their restrictions changed.

## Restriction:

This column shows the restrictions displayed on the various signs. Restrictions can be changed manually using the change restriction link. The web application also uses logic to automatically change empty stalls to handicap only parking whenever there is only one empty stall left in a group.

**Location:**

Shows the parking lot where the stall is installed.

**Group:**

Within a parking lot, stalls can be grouped together. This is used in the automatic allocation of handicap stalls.

**Alert:**

Shows the user if there are any problems with the display. There are 3 different items that may appear in this section:

1) None:

This indicates there are no issues with the display

2) ALERT:

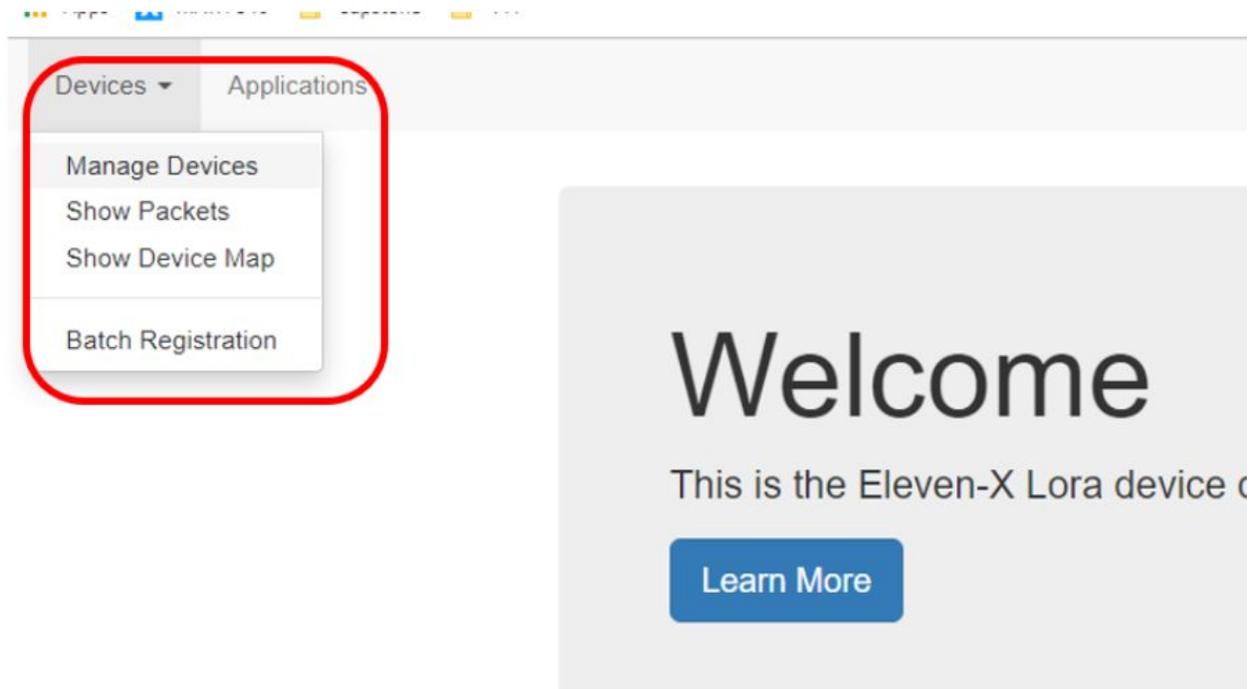
This indicates the sign may have been damaged in some way. If hit with enough force, or when moved this alert will appear.

3) No Data:

This indicates there is no data in the Eleven-X system for the web app to retrieve. This may occur when the device is first registered or if the device has not been transmitting data to Eleven-X for a long period of time.

## 2. Add a New Stall

To add a new stall to the management system the device must first be added to the Eleven-X network and then to the web application. To add the device to Eleven-X open <https://lora.eleven-x.com/welcome.html> and log in using the UBC parking account. Once signed in navigate to Devices > Manage devices



From there click on [+ Add Device](#) to open the add device form. This will open the following form. In this form you must fill out the DEVEUI for the sign and generate a 16-byte hexadecimal app key using <https://www.random.org/bytes/>.

## Add New Device

**DEVEUI**

The DevEUI is a 8-byte unique identified based on IEEE EUI-64. Mandatory.

**Comment**

The device comment is for convinience only. Optional.

Keys **QoS** Packet Storage LoRa Parameters Additional

**Activated**  Yes  No

Select Yes to allow the device to actively operate on the network. If a device is not activated, no data will be received from it and data cannot be sent to it.

**Downlink Enabled**  Yes  No

Select Yes to allow the network to send downlink on the network. If a not allowed, the network will not send any user payloads to the device

**Registration type**  OTAA  ABP

Personalised devices have pre-generated session keys and will not perform the JOIN procedure.

**App Key**

The App Key is a 16-byte encryption key used to encrypt the data payloads. If provided all encryption is managed by the network. If not provided, the payload encryption must be managed by the application. Optional.

 Edit device parameters

The DEVEUI allows to LoRa Network to communicate with the device and the app key allows for encryption/decryption of the data sent to and from the device.

Once the device has been successfully added to Eleven-X you will see it on the device list. From here you can also navigate to Action > View Data.

DEVEUI	Status	Comment	Groups	Apps	Last Seen	Bulk Action (0)
<input type="text" value="DEVEUI"/>		<input type="text" value="Comment"/>	<input type="button" value="Select"/>	<input type="button" value="Apps"/>	<input type="text" value="01/04/2019 - 01/04/2019"/>	
<input type="checkbox"/> 00-80-00-00-04-00-8C-6F		unit8C6F_ReplacementSensors		ubc_parking_app,mist...	01/04/2019 12:00:24 PM	Action
<input type="checkbox"/> 00-80-00-00-04-00-8C-42		PNI Parking Pod - 8C42		ubc_parking_app	01/04/2019 1:25:41 PM	Action
<input type="checkbox"/> 00-80-00-00-04-00-8B-AA		unit8BAA_TESTsensor			15/11/2018 10:08:55 AM	Action
<input type="checkbox"/> A8-61-0A-30-37-26-72-08		Arduino for Dynamic Parking			07/02/2019 3:43:22 PM	Action
<input type="checkbox"/> 00-80-00-00-04-00-8C-33		PNI Parking Pod - 8C33		ubc_parking_app	01/04/2019 1:26:50 PM	Action
<input type="checkbox"/> A8-61-0A-30-37-2B-63-08		Arduino - Dynamic Parking Controller (FINAL)			31/03/2019 2:45:58 PM	Action
<input type="checkbox"/> 00-80-00-00-04-00-8B-DA		unit8BDA_ReplacementSensors		ubc_parking_app,mist...	01/04/2019 2:13:31 PM	<ul style="list-style-type: none"> <li>Edit Device</li> <li>Send to device</li> <li><b>View Data</b></li> <li>Position on map</li> </ul>
<input type="checkbox"/> 00-80-00-00-04-00-8B-70		PNI Parking Pod - 8B70		ubc_parking_app	01/04/2019 12:28:00 PM	
<input type="checkbox"/> 00-80-00-00-04-00-8B-D7		PNI Parking Pod - 8BD7		ubc_parking_app	01/04/2019 2:08:32 PM	
<input type="checkbox"/> 00-80-00-00-04-00-8D-50		PNI Parking Pod - 8D50		ubc_parking_app	01/04/2019 2:04:01 PM	

If the data sent up from the Arduino is 00: 68 69 then it has been correctly connected and can now be added on the management application.

Devices ▾ Applications Language ▾ Signed in as ubc\_pt

There are 91 payloads in storage for device, 'A8-61-0A-30-37-2B-63-08':

First Previous **1** 2 3 4 Next Last

Direction	Time	FCNT	Port	Status	Data Rate	RSSI	Decrypted	Data
<input type="button" value="Uplink"/> <input type="button" value="Downlink"/>	<input type="text" value="2019-04-01 - 2019-04-1"/>	<input type="text"/>	<input type="text"/>	<input type="button" value="Any"/>	<input type="text"/>	<input type="text" value="From"/> <input type="text" value="To"/>		
Up	31/03/2019 2:45:58 PM	0	2		SF10BW125	-57dBm		00: 68 69
Up	31/03/2019 2:38:25 PM	16	2		SF7BW125	-57dBm		00: 68 69

From the homepage of the web application select  , this will take you to the following page. All fields in this form must be filled out.

## Add New Stall

Stall

---

**Device Id**

**Place Pod Id**

**Location**

**Group**

Create

[Back To List](#)

### **Device Id:**

This must match the DEVEUI of the device that was registered with Eleven-X. This ID will be an 8-byte string and should contain only capital letters and numbers. Space and special characters are not allowed. This value is used by the application to communicate with the device.

### **Place Pod Id:**

This value must match with the place pod vehicle detector present at the same stall as the device. This ID will be an 8-byte string and should contain only capital letters and numbers. Space and special characters are not allowed. This value is used by the application to communicate with the device.

### **Location:**

This is used to identify the parking lot in which the device is located. This value should be a string between 2 and 60 characters long.

**Group:**

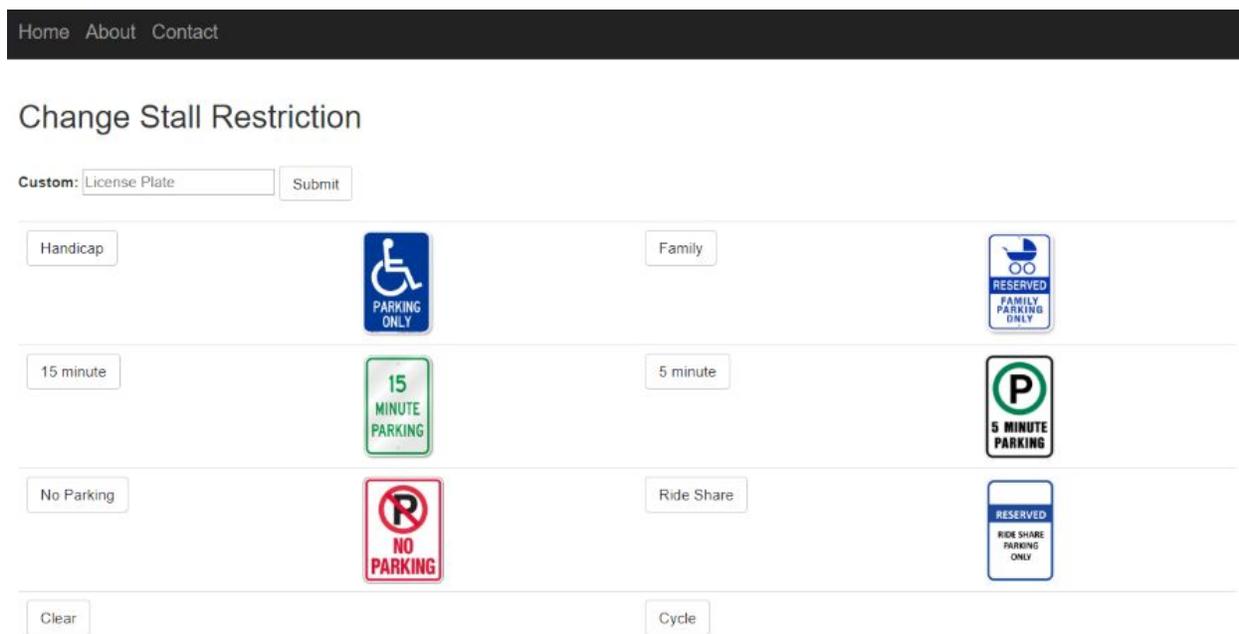
This is used to group stalls together within a parking lot and is used for automatic allocation of handicap stalls. This value should be a number.

### 3. Change Restrictions

There are two ways restrictions can be changed through the web application. The first way is done automatically by the application to ensure there is, whenever possible, an available handicap stall in every group, the second is to manually select the desired restriction.

For automatic allocation every minute the application will check to ensure there are available handicap stalls in each group. In the case there are nothing will change, in the case there are not the application will manually change the first empty stall in the group to be handicap. If there is only one available handicap stall in a group it cannot be change to a different restriction.

To manually change the restriction, from the homepage select “change restriction” for the stall you would like to edit. This will bring you to the following page. Here you have the option of selecting from one of the pre-loaded images or entering a custom license plate.



The restriction of an occupied stall cannot be changed. In addition, the restriction of the last available handicap stall cannot be changed. For the custom license plate the only acceptable characters are capital letters, numbers, and spaces. The license plate can at most be 8 characters.



statement change the `Restriction` value in the quotation marks to match the value attribute you gave to the button in step 3.

5. Now the `package` value must also be changed. To do this, take the number assigned to the restriction on the device (the numbers 0-8 are already in use) and change it to HEX using <https://www.online-toolz.com/tools/text-hex-convertor.php>. Then take the HEX value and change it to Base64 using <https://cryptii.com/pipes/base64-to-hex>. This Base64 value is the value that should be assigned to `package`. Save the file.
6. Run the program on your computer and check that the correct HEX value is being sent through to Eleven-X. To check the value, first change one of the stalls to the new restriction, then sign into <https://lora.eleven-x.com/welcome.html> and access the device (as described in section 2). The data enqueued by Eleven-X to the selected device should match the HEX value of the package.
7. Finally, re-publish the new code.