

Makerspace RFID Lock Management

Overview

This volunteer project is a collaboration with my local [Makerspace](#) to set up an RFID lock system for doors in the building that houses the Makerspace. My role included creating a Django web interface for staff users to manage lock users and locked spaces, which involves, for example, assigning/un-assigning RFID keycards; managing lock users' permissions for access to various spaces; viewing logs and stats about visitors. Apart from the interface, I worked with other volunteers on communication with the RFID lock system hardware to authenticate scanned cards.

Current project status

The project is currently functional, but is still under development. The master branch at <https://github.com/gnarlinsky/rfid-lock-admin> holds the latest stable version.

Much of the infrastructure for the project -- this includes electronic locks, dedicated RFID scanners, and Arduinos as well as the computer for serving the Django application outside the building -- has yet to be fully set up. Until that time, the application can be used locally, which of course is not a problem for tasks that require interfacing with the lock system hardware on the same network.

Quick start

Clone the repository.

```
$ git clone git@github.com:gnarlinsky/rfid-lock-admin.git
```

To avoid dependency issues, create a virtualenv and install the required packages.

```
$ cd rfid-lock-admin
$ virtualenv ve --no-site-packages
$ source ve/bin/activate      # activate the virtual environment
$ pip install -r requirements.txt
```

Create the database and load the initial data.

```
$ python manage.py syncdb
$ python manage.py loaddata rfid_lock_management/fixtures/initial.json
```

Run the Django development server.

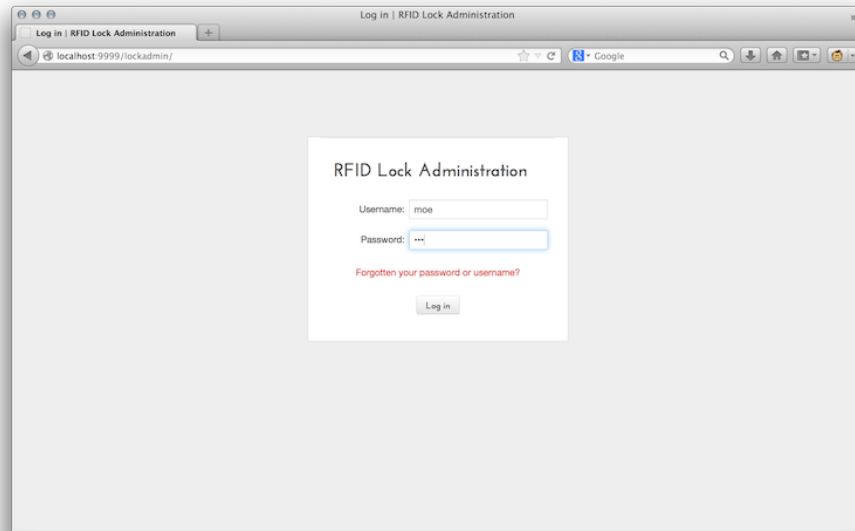
```
$ python manage.py runserver
```

Go to <http://localhost:8000/lockadmin> to see the application in action.

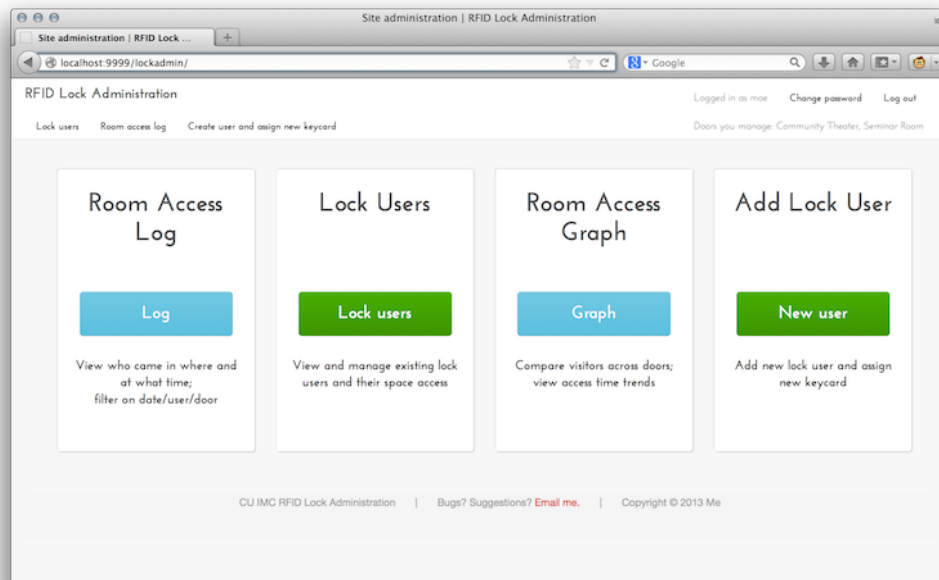
The interface for staff users

Logging in

If you used the fixture `initial.json` for the initial data as described in the Installation section, you can log in as 'moe', password 'moe'.

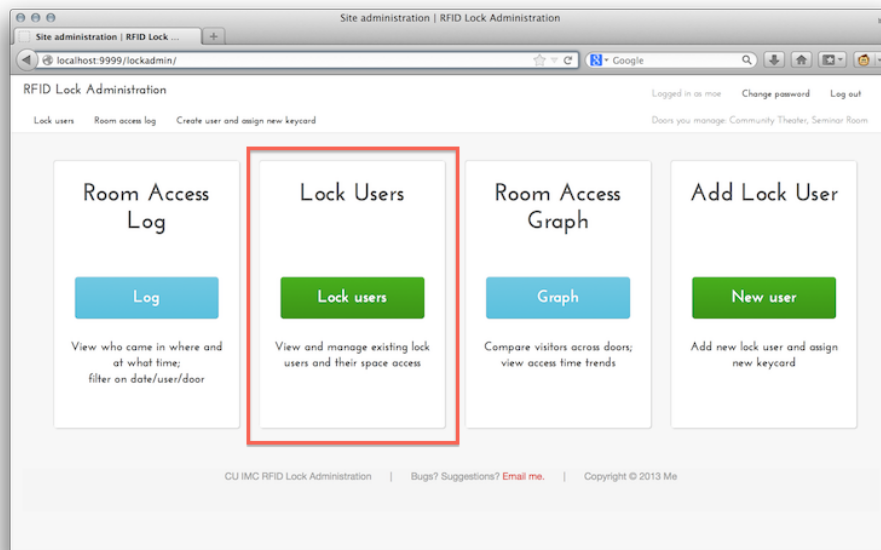


After logging in, you will see the index page, which summarizes the basic tasks a staff user can perform.

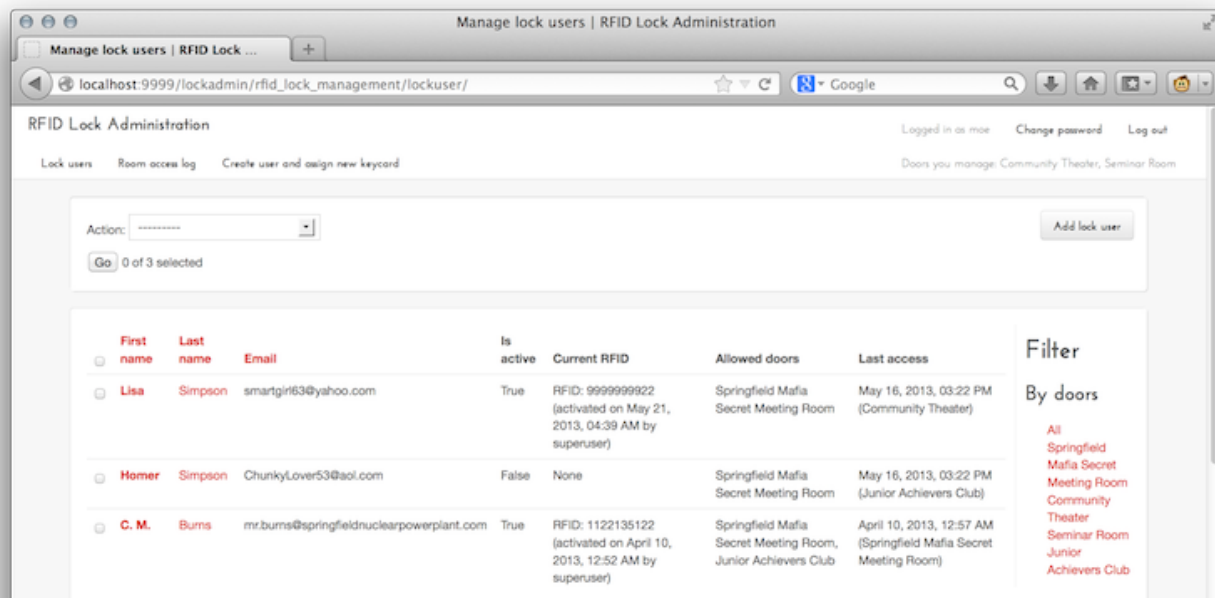


Managing lock users

Click on the “Lock users” button on the main page.



This takes you to the list of lock users. Here you can view, sort/filter, and apply batch actions to lock users.



You can also view/change an individual lock user's information. Clicking "Homer" should take you to a page containing his information:

Change lock user | RFID Lock Administration

localhost:9999/lockadmin/rfid_lock_management/lockuser/2/

RFID Lock Administration

Logged in as moe | Change password | Log out

Lock users | Room access log | Create user and assign new keycard

Doors you manage: Community Theater, Seminar Room

History

Lock user / keycard assignment

First name: Homer | Last name: Simpson

Email: ChunkyLover53@aol.com

Phone number: 2175553223

Address: 742 Evergreen Terrace, Springfield, IL

Current RFID: None

Last access: May 16, 2013, 03:22 PM (Junior Achievers Club) (View all access times)

Note: this lockuser also has permission to access the following door(s), that you, the staff user, do not have permission to manage:
Springfield Mafia Secret Meeting Room

Doors:

- ☐ Community Theater
- ☐ Seminar Room

Select at least one space to activate keycard. Hold down "Control", or "Command" on a Mac, to select more than one.

☐ Deactivate current keycard
Revoke keycard access and deactivate user.

Save | Save and add another | Save and continue editing

Assign keycard

A staff user may not be able to control access to all doors in the building. For example, staff user Moe can only manage access to the Community Theater and the Seminar Room (the top navbar lists the logged-in staff user's permitted spaces). Homer's keycard, however, can open two additional doors: Springfield Mafia Secret Meeting Room and the Junior Achievers Club. These are listed on the form in the Doors fieldset -- but Moe cannot interact with them.

RFID Lock Administration

Logged in as moe | Change password | Log out

Lock users | Room access log | Create user and assign new keycard

Doors you manage: Community Theater, Seminar Room

History

Lock user / keycard assignment

First name: Homer | Last name: Simpson

Email: ChunkyLover53@aol.com

Phone number: 2175553223

Address: 742 Evergreen Terrace, Springfield, IL

Current RFID: RFID: 1122135199 (activated on April 10, 2013, 12:53 AM by superuser)

Last access: April 10, 2013, 12:56 AM (Seminar Room) (View all access times)

Note: this lockuser also has permission to access the following door(s), that you, the staff user, do not have permission to manage:
Springfield Mafia Secret Meeting Room, Junior Achievers Club

Doors:

- ☒ Community Theater
- ☐ Seminar Room

Select at least one space to activate keycard. Hold down "Control", or "Command" on a Mac, to select more than one.

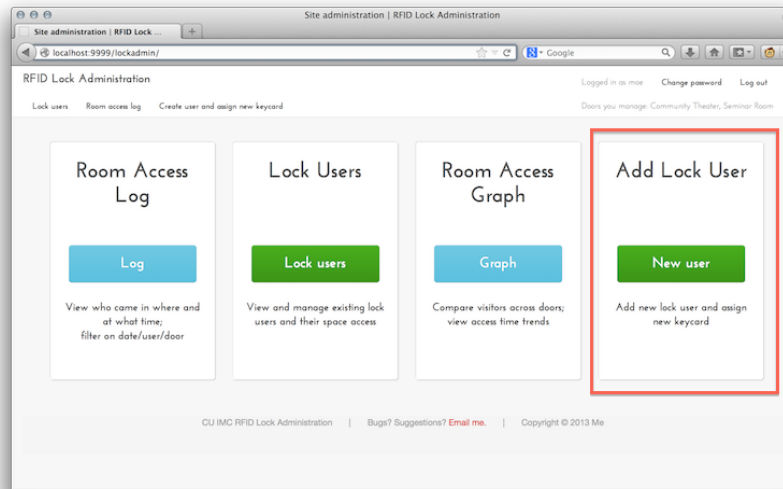
☐ Deactivate current keycard
Revoke keycard access and deactivate user.

Save | Save and add another | Save and continue editing

Assign keycard

Adding a new lock user and assigning a keycard

Click on the “New user” button on the main page.



This takes you to a blank form. Fill in the user’s information and check at least one door.

A screenshot of the 'Add lock user' form in the 'RFID Lock Administration' system. The browser address bar shows 'localhost:9999/lockadmin/rfid_lock_management/lockuser/add/'. The form is titled 'Lock user / keycard assignment' and contains the following fields and options:

- First name: Marge
- Last name: Simpson
- Email: marge@yahoo.com
- Phone number: 2175553223
- Address: 742 Evergreen Terrace, Springfield, IL
- Current RFID: None
- Last access: (None)
- Doors: ☒ Community Theater, ☐ Seminar Room
- Deactivate current keycard: ☐ (Revoke keycard access and deactivate user.)

At the bottom of the form, there are three buttons: 'Save', 'Save and add another', and 'Save and continue editing'. Below these buttons is a separate 'Assign keycard' button.

At this point you can save the new lock user without assigning a keycard. If you want to assign a keycard right away, click “Save and continue editing.” You should see a success message.

Change lock user | RFID Lock Administration

Change lock user | RFID Lock A...

localhost:9999/lockadmin/rfid_lock_management/lockuser/4/

RFID Lock Administration

Logged in as moe Change password Log out

Lock users Room access log Create user and assign new keycard

Doors you manage: Community Theater, Seminar Room

The lock user "Marge Simpson" was added successfully. You may edit it again below.

History

Lock user / keycard assignment

First name: Marge Last name: Simpson

Email: marge@yahoo.com

Phone number: 2175553223

Address: 742 Evergreen Terrace, Springfield, IL

Current RFID: RFID: 9999999923 (activated on May 30, 2013, 12:09 AM by moe)

Last access: (None)

Doors: ☒ Community Theater ☐ Seminar Room

Select at least one space to activate keycard. Hold down "Control", or "Command" on a Mac, to select more than one.

☐ Deactivate current keycard
Revoke keycard access and deactivate user.

Save Save and add another Save and continue editing

Assign keycard

Scroll down and click on “Assign keycard.”

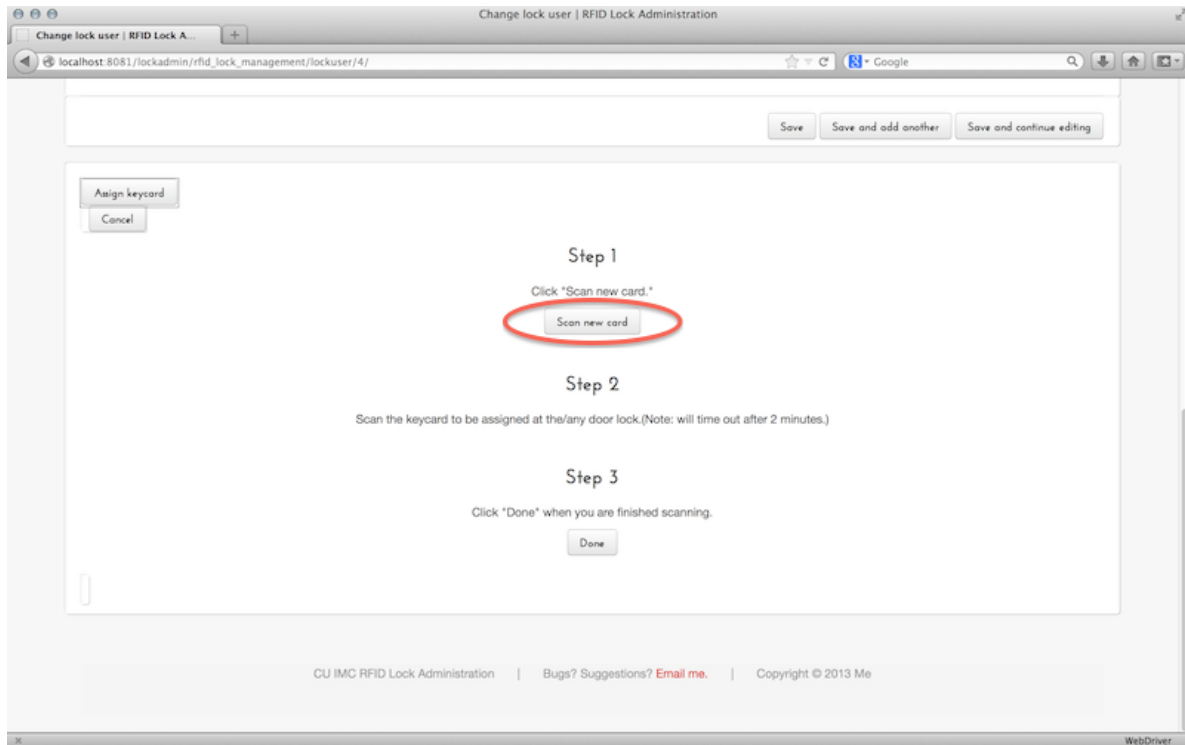
☐ Deactivate current keycard
Revoke keycard access and deactivate user.

Save Save and add another Save and continue editing

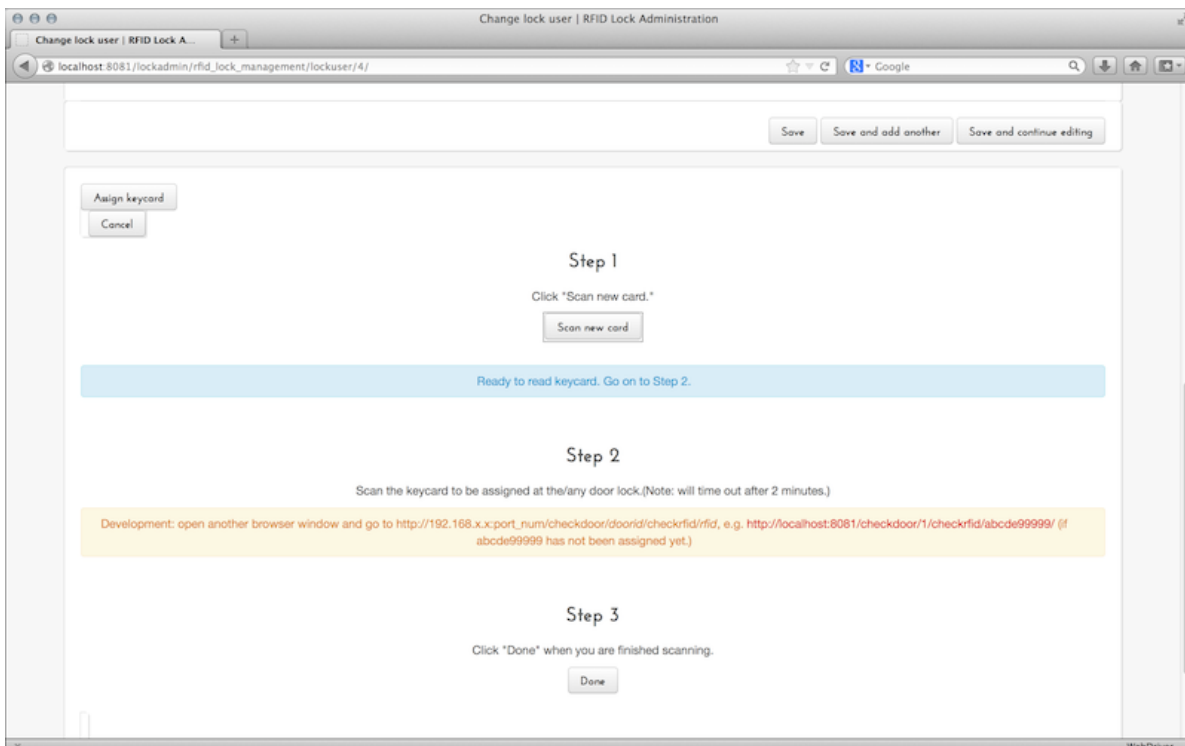
Assign keycard

CU IMC RFID Lock Administration | Bugs? Suggestions? Email me. | Copyright © 2013 Me

This will reveal the instructions for assigning a new keycard. Click on “Scan new card.”



At this point you will see a message telling you to go ahead and scan the card, along with additional instructions that describe how to simulate scanning a keycard through an RFID scanner dedicated to keycard assignment -- since for the purposes of this demo we cannot involve any external devices.



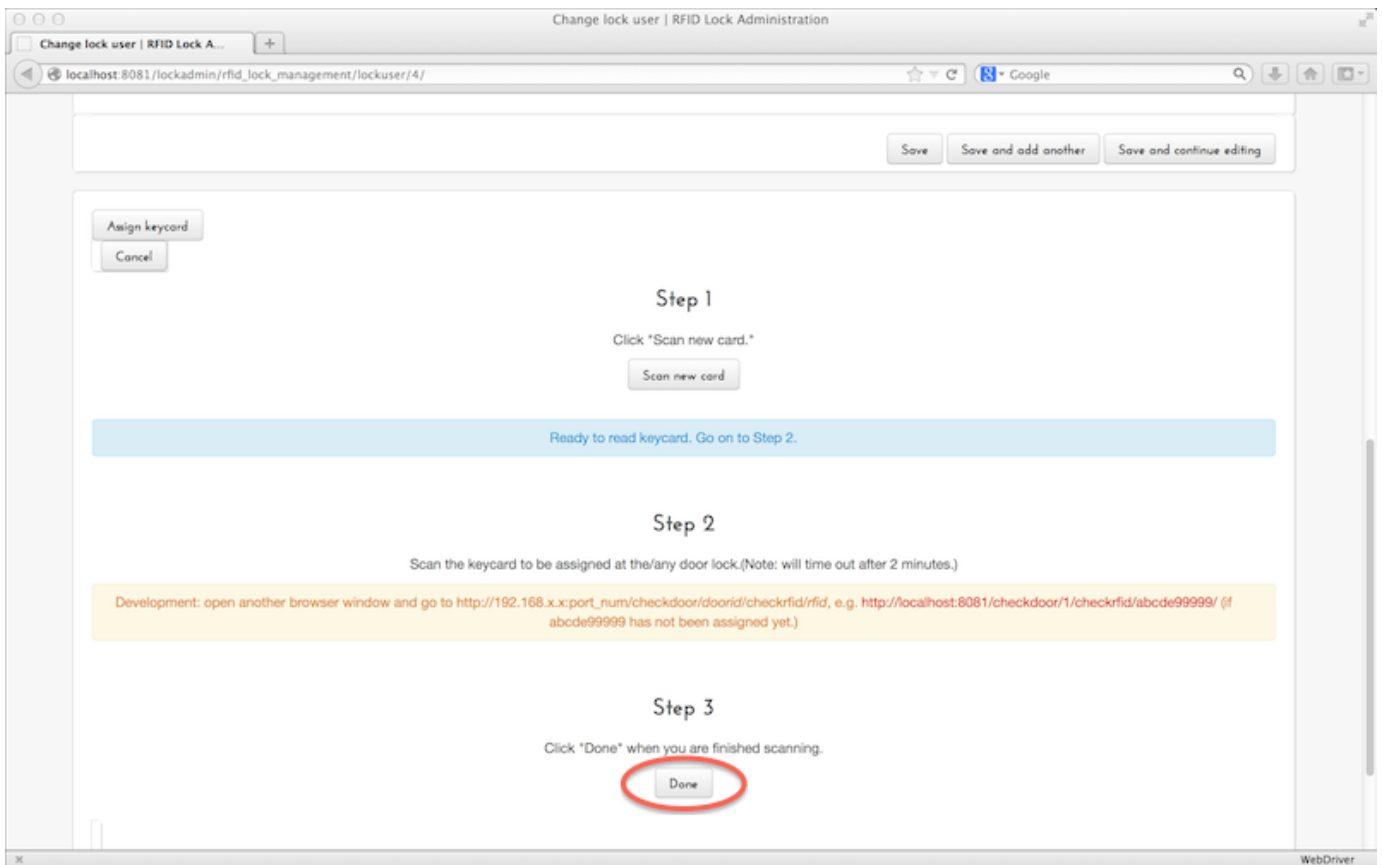
Follow the instructions in the yellow message box and visit the appropriate URL to simulate keycard scan. For example, if you are running the development server with the command

```
$ python manage.py runserver
```

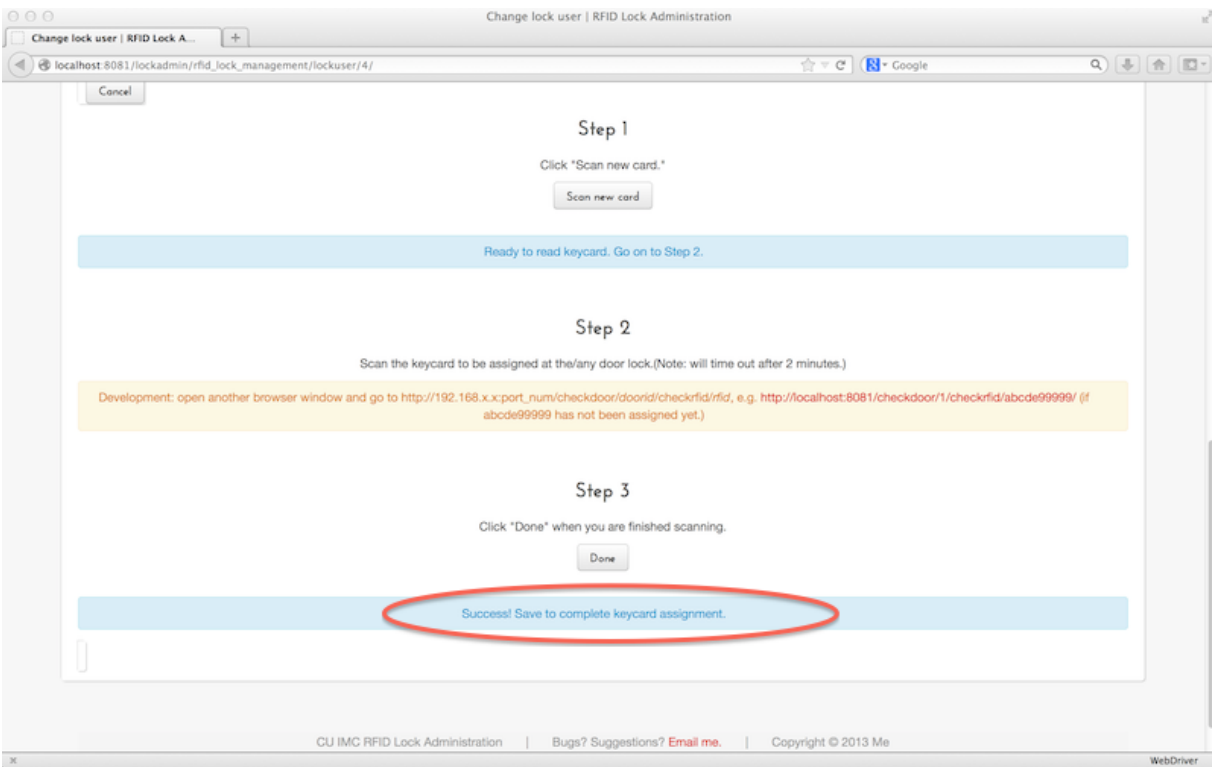
go to localhost:8000/checkdoor/1/checkrfid/abcde12345/.



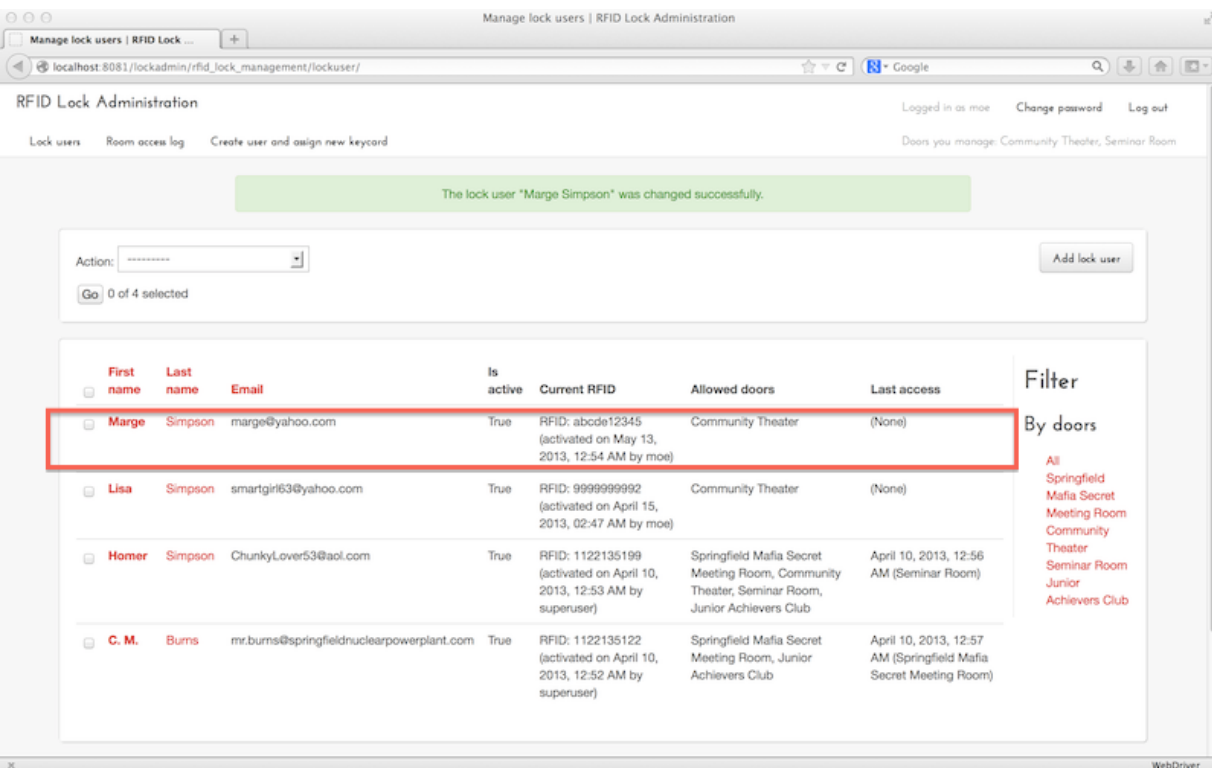
After “scanning” the card, click “Done.”



You should see a success message. Click “Save.”

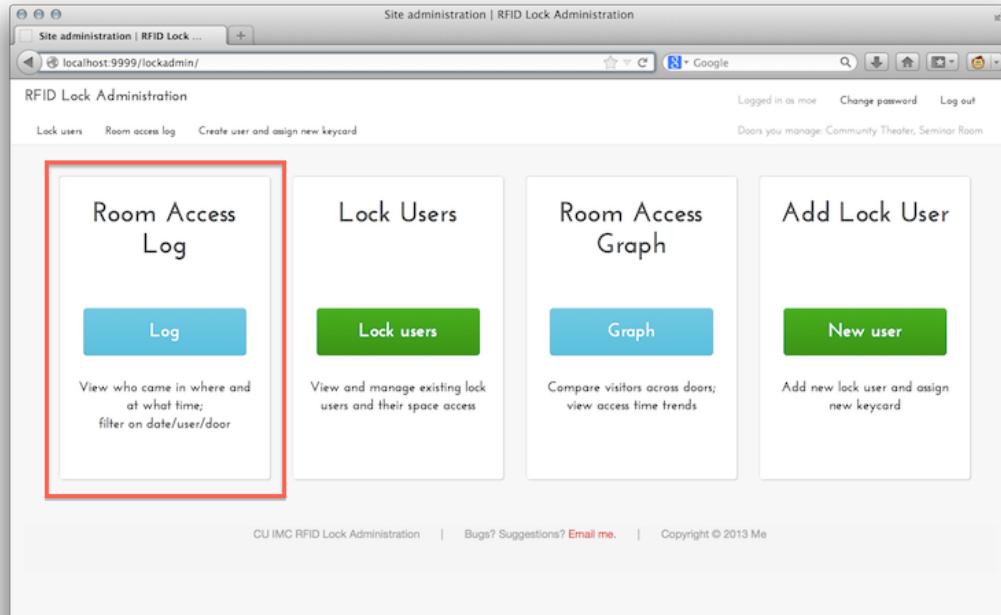


You'll be returned to the page listing all lock users. You should see the new lock user, with the RFID we just assigned:



Room access log

Click on the “Room access log” button on the main page.



This takes you to the list of access times for all doors. Here you can view and sort/filter by date, door, and lock user.

The screenshot shows the 'Room access log' page. It displays a table of access times with columns for 'Access time', 'User', and 'Door'. The table is filtered by date (2012) and user (Homer Simpson). The table is sorted by date in descending order. The 'Door' column lists various rooms like 'Community Theater', 'Springfield Mafia Secret Meeting Room', and 'Seminar Room'.

Access time	User	Door
Oct. 12, 2012, 10:38 p.m.	Homer Simpson	Community Theater
Oct. 14, 2012, 4:18 a.m.	C. M. Burns	Springfield Mafia Secret Meeting Room
Oct. 19, 2012, 3:41 a.m.	Homer Simpson	Community Theater
Oct. 20, 2012, 1:11 p.m.	Homer Simpson	Seminar Room
Oct. 20, 2012, 9:28 p.m.	Homer Simpson	Springfield Mafia Secret Meeting Room
Oct. 28, 2012, 1:12 p.m.	Homer Simpson	Seminar Room
Nov. 3, 2012, 8:23 a.m.	C. M. Burns	Springfield Mafia Secret Meeting Room
Nov. 4, 2012, 5:48 a.m.	C. M. Burns	Springfield Mafia Secret Meeting Room
Nov. 5, 2012, 11:01 a.m.	Homer Simpson	Seminar Room
Nov. 9, 2012, 12:22 p.m.	Homer Simpson	Seminar Room
Nov. 18, 2012, 2:46 a.m.	Homer Simpson	Community Theater
Nov. 18, 2012, 4:04 p.m.	Homer Simpson	Community Theater
Nov. 23, 2012, 8:26 a.m.	Homer Simpson	Community Theater
Nov. 30, 2012, 7:40 a.m.	C. M. Burns	Springfield Mafia Secret Meeting Room
Dec. 2, 2012, 5:11 p.m.	Homer Simpson	Community Theater
Dec. 2, 2012, 10:13 p.m.	Homer Simpson	Community Theater
Dec. 11, 2012, 12:48 p.m.	Homer Simpson	Community Theater
Dec. 16, 2012, 9:46 a.m.	Homer Simpson	Community Theater
Dec. 22, 2012, 7:30 a.m.	Homer Simpson	Community Theater
Dec. 24, 2012, 12:03 p.m.	Homer Simpson	Community Theater

Filter

By date

2012
2013

search

By lockuser

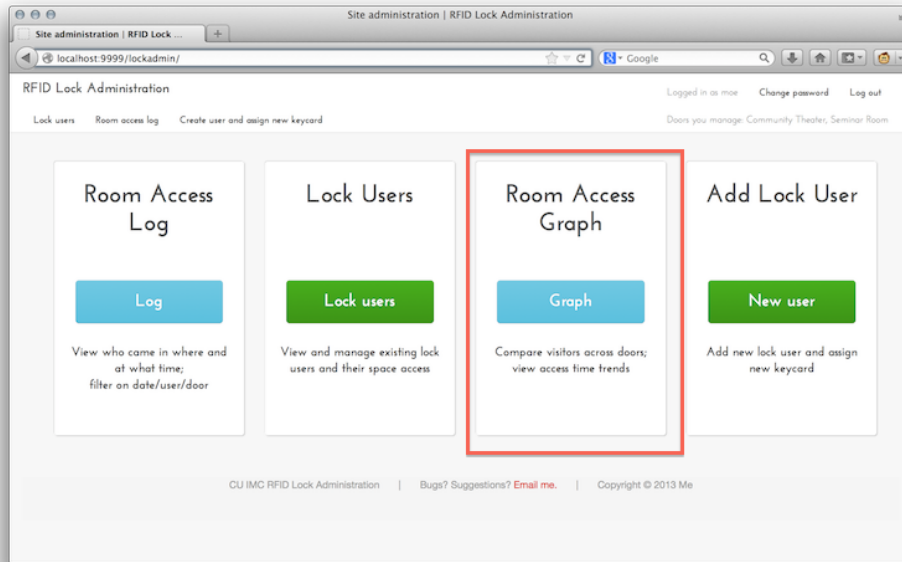
All
C. M. Burns
Homer Simpson
Lisa Simpson
(None)

By door

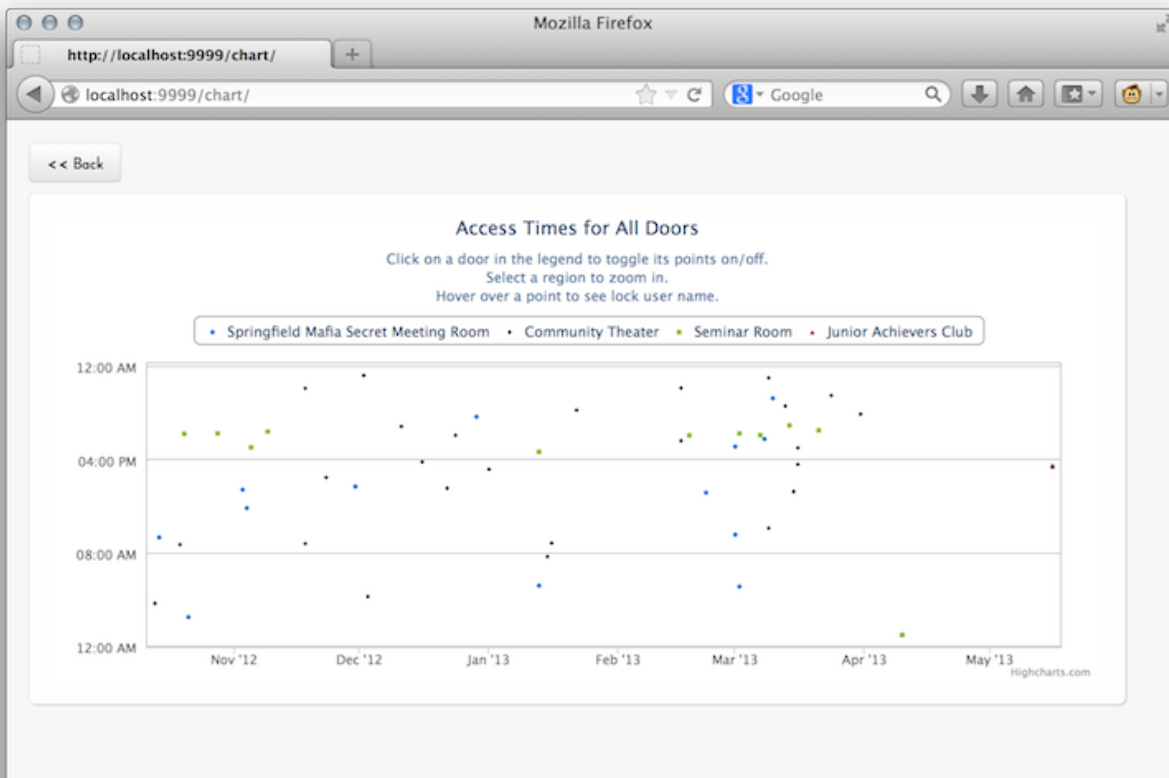
All
Springfield Mafia Secret Meeting Room
Community Theater
Seminar Room
Junior Achievers Club
(None)

Room access graph

Click on the “Graph” button on the main page.



This takes you to the interactive scatter plots showing all visits to every space in the building. The plot compares dates and time of day, which can reveal some interesting trends concerning room usage patterns, e.g. Space X is visited twice as much as Space Y. The plot is dynamically generated using the jQuery chart library [Highcharts](#).



RFID keycard authentication

In addition to the interface for staff users, the system also authenticates keycards and sends other information to the microcontroller (Arduino) that connects to the RFID scanner and operates the locking mechanism.

Simulating authenticating individual keycards

Keycards are authenticated like this:

- Lock user scans keycard at the RFID reader.
- The Arduino sends a request to the server hosting the lock management application.
 - The request URL identifies the door and the RFID, e.g. when a user scans a keycard with the RFID 9999999999 at a door with the id 1, the URL contains “/checkdoor/1/checkrfid/9999999999”.
- If the response content is “1,” the Arduino unlocks the door.

Since the lock management application is being developed independently of the lock hardware involved (not counting collaboration concerning communication for authentication, e.g. request URL syntax and response content format), we need a way to simulate keycard scanning without involving the Arduino.

So, to simulate the process, simply go to http://xx.xx.x.x:yyyy/checkdoor/<door_id>/checkrfid/<rfid_id>/ on the same network, where xx.xx.x.x is the ip of the computer running the development server; yyyy is the port; <door_id> is an integer denoting a particular door; and <rfid_id> is a 10-character string representing the RFID. For example, if you are running the development server with the command

```
$ ./manage.py runserver 11.11.1.242:9999
```

you can go to <http://11.11.1.242:9999/checkdoor/2/checkrfid/ABCDE12345/> from any device on the network to simulate a keycard (with RFID ABCDE12345) scan at door with the id 2.

(Note: this process is the same as simulating scanning a keycard for the purposes of assigning it, as described in the section “Adding a new lock user and assigning a keycard” above.)

Simulating retrieving *list* of permitted RFIDs

The Arduino periodically caches lists of authenticated users so that the lock can still function in case it can’t communicate with the Django application. Obtaining a list of authenticated users for a particular space is similar to the single keycard authentication process described above:

- The Arduino sends a request to the server hosting the lock management application.
 - The request URL identifies the door, e.g. when a user scans a keycard with the RFID 9999999999 at a door with the id 1, the URL contains “/door/1/getallowed”.
- The response contains the RFIDs allowed to access that particular space, in JSON format, e.g

```
{"doorid": 1, "allowed_rfids": ["1122135122", "9999999922"]}
```

To simulate this, go to http://xx.xx.x.x:yyyy/checkdoor/<door_id>/getallowed/ on the same network, where xx.xx.x.x is the ip of the computer running the development server; yyyy is the port; and <door_id> is an integer denoting a particular door. For example, if you are running the development server with the command

```
$ ./manage.py runserver 11.11.1.242:9999
```

you can go to <http://11.11.1.242:9999/door/2/getallowed/> from any device on the network to get all RFIDs allowed access to this door.