

login: User Authentication for Shiny Applications

ShinyConf

Jason Bryer, Ph.D.

CUNY SPS Data Science and Information Systems

April 18, 2024



Shiny authentication is not new...

- **shinymanager** - This is a great solution if you want to limit access to your entire Shiny application. This is accomplished by passing your UI (e.g. `fluidPage` object) to the `shinymanager::secure_app` function.
- **shinyauthr** - This is another nice solution if you have a pre-existing database of users.
- **Posit Connect** - This is a paid product and allows you to protect your entire Shiny application outside of your application code.
- **Standard and Professional plans on shinyapps.io** - Similar to Posit Connect, this is a paid hosting service.



Motivation for creating another authentication package

Two projects I am working on require user authentication:

- Master of Data Science (MSDS) at [CUNY School of Professional Studies](#) Bridge Tutorials - This is an assessment and feedback system for applications in our MSDS program. The goal is to bridge gaps in their mathematics and R programming skills before enrolling in coursework.
- [FutureMapping.org](#) is a project where young people in New York City can identify locations in their community that are assets, problems, or something else.

Both these projects require user authentication, but the current authentication frameworks did not have all the features we needed...



How is login different?

The `login` package provides some important features missing in the other Shiny authentication frameworks, namely:

- Users can create their own accounts. Optionally, you can require users to validate their email before creating the account.
- Users can reset their passwords via email.
- Allow user credentials to be stored in any `DBI` compatible database.
- Remember users by setting a cookie (this is optional both from the server and user point-of-view).
- Will log user activity for logging in and out.



Security

Disclaimer: I am not security researcher, but have attempted to implement the best practices to the best of my knowledge. If you have any suggestions feel free to open a [Github issue](#).

Here are some of the security features implemented by the `login` package:

- Passwords are encrypted client side (in the browser) using a [MD5](#) hash. There are a few advantages of doing this client side:
 - The password is never sent over the network in the clear. You *should still deploy your Shiny applications over https*. [Posit has instructions to do this](#).
 - The Shiny server never sees the unencrypted password.
- Salt - Salting is the processes of encrypting the password a second time before storing the password in the database. To enable set the `salt` parameter of `login::login_server()`. Additionally, you can specify the encryption algorithm to use (defaults to `sha512` but any algorithm supported by `digest::digest()` is valid).

Getting started

You can install the package from Github using the `remotes` package (should be on CRAN soon):

```
remotes::install_github('jbryer/login')
```

There are two example Shiny applications included in the package:

- https://github.com/jbryer/login/blob/main/inst/login_demo_simple/app.R
- https://github.com/jbryer/login/blob/main/inst/login_template/app.R
- https://github.com/jbryer/login/blob/main/inst/login_modal/app.R

I recommend putting this at the top of your `app.R` or `global.R` file:

```
library(login)
APP_ID <- 'my_login_app'
```



Server Side

```
USER <- login::login_server(  
  id = APP_ID,  
  db_conn = RSQLite::dbConnect(RSQLite::SQLite(),  
    'users.sqlite'),  
  users_table = "users",  
  emailer = emayili_emailer(  
    email_host = EMAIL_HOST,  
    email_port = EMAIL_PORT,  
    email_username = EMAIL_USERNAME,  
    email_password = EMAIL_PASSWORD,  
    from_email = RESET_PASSWORD_FROM_ADDRESS ),  
  additional_fields = c('first_name' = 'First Name',  
    'last_name' = 'Last Name'),  
  cookie_name = "loginusername",  
  cookie_expiration = 30,  
  salt = NULL  
)
```

The `login` package is implemented as a **Shiny module**. Within your server function you must call `login::login_server()`. The code on the left includes some of the basic features. The function will return a `reactiveValues` object with the following elements:

- `logged_in` - This is TRUE or FALSE.
- `username` - The username if they have successfully logged in (i.e. their email address).



Defining database connection

```
USER <- login::login_server(  
  id = APP_ID,  
  db_conn = RSQLite::dbConnect(RSQLite::SQLite(),  
    'users.sqlite'),  
  users_table = "users",  
  emailer = emayili_emailer(  
    email_host = EMAIL_HOST,  
    email_port = EMAIL_PORT,  
    email_username = EMAIL_USERNAME,  
    email_password = EMAIL_PASSWORD,  
    from_email = RESET_PASSWORD_FROM_ADDRESS ),  
  additional_fields = c('first_name' = 'First Name',  
    'last_name' = 'Last Name'),  
  cookie_name = "loginusername",  
  cookie_expiration = 30,  
  salt = NULL  
)
```

All the `login` credentials are stored using the `DBI` interface. `DBI` currently supports RSQLite, RMariaDB, odbc, and bigrquery natively, but there is an [extensive list of other backends](#) available.

The `users_table` parameter defines the table name in the database to store credentials. If the table doesn't exist, it will be created upon first run.



Email

```
USER <- login::login_server(  
  id = APP_ID,  
  db_conn = RSQLite::dbConnect(RSQLite::SQLite(),  
    'users.sqlite'),  
  users_table = "users",  
  emailer = emayili_emailer(  
    email_host = EMAIL_HOST,  
    email_port = EMAIL_PORT,  
    email_username = EMAIL_USERNAME,  
    email_password = EMAIL_PASSWORD,  
    from_email = RESET_PASSWORD_FROM_ADDRESS ),  
  additional_fields = c('first_name' = 'First Name',  
    'last_name' = 'Last Name'),  
  cookie_name = "loginusername",  
  cookie_expiration = 30,  
  salt = NULL  
)
```

An important feature of the `login` package is the ability to have users verify their email address when creating an account and for them to reset their passwords. The `emailer` parameter must define a function with three parameters: `to_email`, `subject`, and `message`. The package includes the `emayili_emailer()` function that uses the `emayili` package to send emails using SMTP. If you wish to implement your own emailer, use the following template:

```
my_emailer <- function(to_email, subject, message) {  
  # Implementation here  
}
```



Additional user information

```
USER <- login::login_server(  
  id = APP_ID,  
  db_conn = RSQLite::dbConnect(RSQLite::SQLite(),  
    'users.sqlite'),  
  users_table = "users",  
  emailer = emayili_emailer(  
    email_host = EMAIL_HOST,  
    email_port = EMAIL_PORT,  
    email_username = EMAIL_USERNAME,  
    email_password = EMAIL_PASSWORD,  
    from_email = RESET_PASSWORD_FROM_ADDRESS ),  
  additional_fields = c('first_name' = 'First Name',  
    'last_name' = 'Last Name'),  
  cookie_name = "loginusername",  
  cookie_expiration = 30,  
  salt = NULL  
)
```

At a minimum, the `login` package will capture the users' email address and (encrypted) password. If you wish to capture more information when the user creates an account, you can specify the desired fields with the `additional_fields` parameter. This is a character vector where the names are the database field names and the values are the labels users will see when creating an account. Also, the values will be available in the returned `reactiveValues`, that is `USER$first_name` and `USER$last_name` will be set.



Cookies

```
USER <- login::login_server(  
  id = APP_ID,  
  db_conn = RSQLite::dbConnect(RSQLite::SQLite(),  
    'users.sqlite'),  
  users_table = "users",  
  emailer = emayili_emailer(  
    email_host = EMAIL_HOST,  
    email_port = EMAIL_PORT,  
    email_username = EMAIL_USERNAME,  
    email_password = EMAIL_PASSWORD,  
    from_email = RESET_PASSWORD_FROM_ADDRESS ),  
  additional_fields = c('first_name' = 'First Name',  
    'last_name' = 'Last Name'),  
  cookie_name = "loginusername",  
  cookie_expiration = 30,  
  salt = NULL  
)
```

If you wish to allow users login state to be saved between sessions, set the `cookie_name` parameter. This will be the name of the cookie stored in their browser. The `cookie_expiration` is how long the cookie is valid in days. Set this parameter to `NULL` to disable cookies all together.

Note that if you have cookies enabled, users can still opt-out by unchecking the "remember me" check box.



Salting

```
USER <- login::login_server(  
  id = APP_ID,  
  db_conn = RSQLite::dbConnect(RSQLite::SQLite(),  
    'users.sqlite'),  
  users_table = "users",  
  emailer = emayili_emailer(  
    email_host = EMAIL_HOST,  
    email_port = EMAIL_PORT,  
    email_username = EMAIL_USERNAME,  
    email_password = EMAIL_PASSWORD,  
    from_email = RESET_PASSWORD_FROM_ADDRESS ),  
  additional_fields = c('first_name' = 'First Name',  
    'last_name' = 'Last Name'),  
  cookie_name = "loginusername",  
  cookie_expiration = 30,  
  salt = NULL  
)
```

To enable salting, set the `salt` parameter. Additionally, you can use a different algorithm (sha512 is the default) using the `salt_algo` parameter. This parameter is passed to the `digest::digest()` function.



Using the login state in the Shiny server

The `login:::login_server()` returns a `reactiveValues` object. Therefore you can use the `USER$logged_in` within your Shiny server to change the behavior of the application based upon the users' login state. Since this is reactive, if the user logs out, the code will be re-executed.

```
if(USER$logged_in) {  
  username <- USER$username  
  # The user is logged in, do something.  
} else {  
  # The user is not logged in.  
}
```



Shiny UI: Logging in and out

There are a number of functions included to provide the user interface elements for logging in, logging out, resetting password, and creating an account. The `login_ui()` function provides an interface for the user to login. Similarly, the `logout_button()` provides a button for the user to logout. These interface elements will only display if the user is logged out or logged in, respectively.

```
login::login_ui(id = APP_ID)
```



```
logout_button(  
  id = APP_ID,  
  label = "Logout",  
  icon = shiny::icon("right-from-bracket"))
```

 Logout



Shiny UI: Creating an account

The `new_user_ui()` function will provide the fields necessary to create a new account.

Note that there are additional text fields for the `additional_fields` parameter specified in the `login::login_server()` function earlier.

If the `verify_email = TRUE` in the `login::login_server()` then the user will be required to verify their email address before their account is created (and saved to the database). The interface is the same as steps 2 and 3 of the password reset process described on the next slide.

```
login::new_user_ui(id = APP_ID)
```

Email:

Password:

Confirm Password:

First Name

Last Name

Create Account



Shiny UI: Password reset

The `reset_password_ui()` function provides an interface to reset passwords. It will display differently depending on what step the user is on.

Step 1: Enter email address. If the email address is in the database then they will proceed to step 2.

Email address:

Send reset code

Step 2: Enter the code sent to the email address (the default is a random six digit code).

Enter the code from the email:

Resend Code Submit

Step 3: Enter a new password if the code in step 2 is entered correctly.

Enter new password:

Confirm new password:

Reset Password



Adapting your UI to login state

There are two functions to assist with adapting your user interface based upon the users' authentication state: `is_logged_in()` and `is_not_logged_in()`. The `id` parameter is required, all other parameters are displayed or not depending on the user state.

```
login:::is_logged_in(  
  id = APP_ID,  
  div("This only shows when you are logged in!")  
)
```

```
login:::is_not_logged_in(  
  id = APP_ID,  
  div("This only shows when you are NOT logged in!")  
)
```



Demos

This is the template included in the package:

```
shiny::runApp(paste0(find.package('login'),  
                      '/login_template/'), port = 2112)
```

Shiny Login Template

[Login](#) [Create Account](#) [Reset Password](#)

Email:

Password:

Remember me?

[Login](#)

Are you logged in?

FALSE

Username:

NA

This only shows when you are NOT logged in!

This example is from **CUNY School of Professional Studies** bridge tutorials for the Master in Data Science degree program.

CUNY MSDS Bridge Tutorials

[Login](#)



Welcome to the MSDS Applicant Virtual Bootcamp, an online mini-course of instructional aides and tutorials on key areas of Data Science – along with questions on those topics – to help you prepare and qualify for acceptance into the MS in Data Science degree program at the CUNY School of Professional Studies.

The purpose of this site is to assess your knowledge of these areas by providing feedback and resources on the prerequisite skills to be successful in the [Master of Data Science](#) program.

When creating an account you must USE THE SAME EMAIL ADDRESS you used for your MSDS application. Your results will not apply to your application if the email addresses do not match.

[Click here](#) to send an email with any questions or issues.

[Login](#)

[Create New Account](#)

[Forgot Password](#)

Email:

Password:

Remember me?

[Login](#)



Questions?



Thank You!

✉ jason.bryer@cuny.edu

⌚ @jbryer

Ⓜ️ @jbryer@vis.social

🔗 github.com/jbryer/login

