DRUCKER+FALK PROJECT DOCUMENTATION

TEAM MEMBER:

Tianrui Zhang, Yifan Xiao, Chong Xu,

Yueying Wu, Minghui Jiang, Steve Xian,

Yijie Yan, Frank Liang, Rui Sun, Ran Gu

DRUCKER+FALK

Contents

Revision Sheet

Tasks	Tasks	Reporting	Status	Date
Summary				
1	Initial documents from each non-programming team	version 1.0	Completed	02/01/19
2	version 1.0 update and wrap-up	version 1.1	Completed	02/05/19
3	Combined project documentation and revision	version 2.0	Completed	04/19/19
4	Final documentation	version 2.1	Completed	04/24/19

Requirements

I. Introduction

Our client Drucker & Falk LLC aims to build a strategic framework for sustainability investments in a fee-based real estate. Here are the existing functions so far - best practices guide and Excel model for retrofits, three-property selection, property audit and utility bill analysis, management/maintenance feedback, retrofit feasibility evaluation and providing recommendations. Based on this, the whole project target is to validate models, include landscaping, create training guide for self-audits, and develop business strategy based on sustainability practices cooperating with Duke Nicholas School of the Environment.

II. User Requirements

The overall product is one mobile (Android) application and one web application (portal), and has been divided into three parts - Inputs, Functionality and Cloud/database. See Figure 1 below.

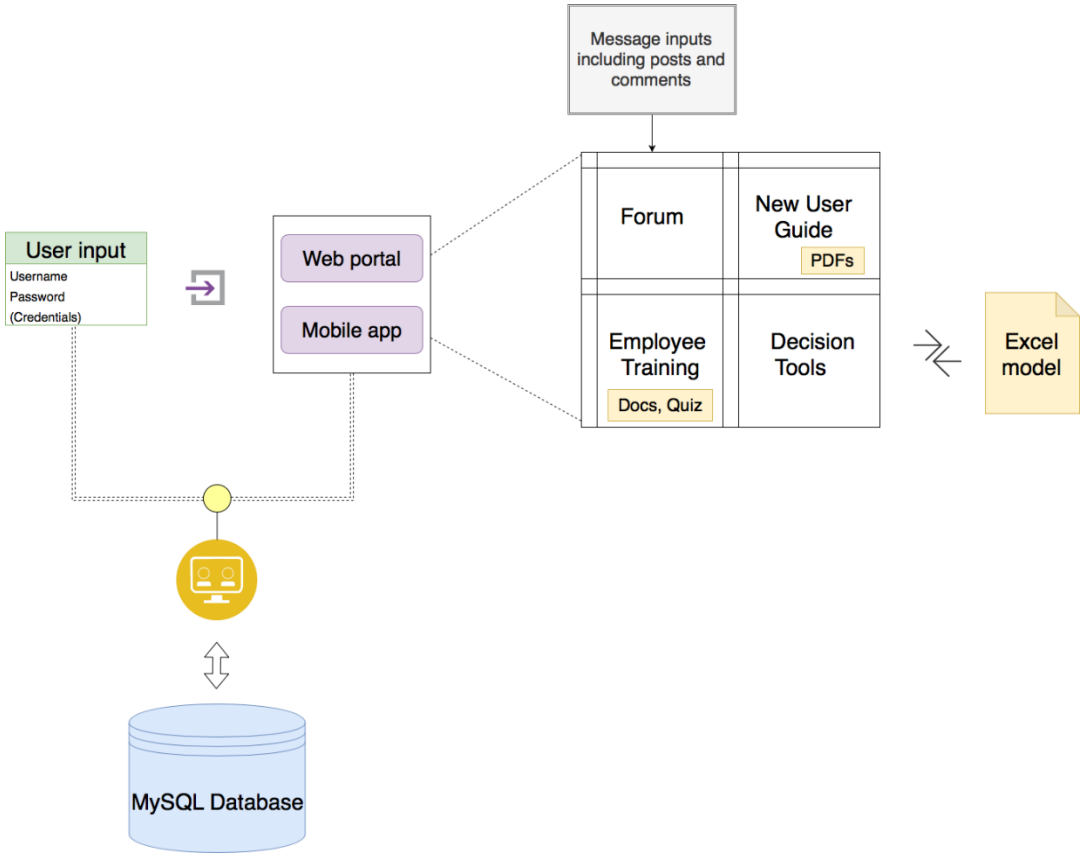


Figure 1. Project block diagram

So, either on the mobile phone or the web portal, the user credentials (username and password) are inputs to the basic login page. At least one type of user as the site managers should be able to operate with the specified functions. All functionalities are developed under tile block design and four tiles will be implemented. Tile 1 is the message board for posts and comments sharing for internal use in the form of a Q&A forum. Tile 2 is the new user guide module for easy-access of application introduction and user manual in PDF document form. Tile 3 is the employee training module including instructional documents and quizzes for employee onboarding and orientation. Tile 4 is the easy-to-do decision tool migrated and developed based on existing exported Excel models for providing recommendations and contributing to the maintainability of infrastructures including Lightning retrofit and water faucet retrofit models.

III. Functional Requirements

Server/database will be implemented for information storage and retrieval. The user will be able to access and retrieve information per request. Existing Excel models will be transferred to the decision model in software.

Basic functionality is to provide a platform for employees at Drucker + Falk to exchange information, access training documents and use strategic framework to make decisions.

1. Web Panel should load different interface to corresponding users.
    - 1.1 It should serve at least site managers for different tiles of functions.
        - 1.1.1 It should include New User Guide tile which contains a PDF document
            - 1.1.1.1 It should introduce the functionalities.
            - 1.1.1.2 It should describe how to use the web page or app.
        - 1.1.2 It should include Forum tile which is an interactive platform where any user can share articles via links and post messages.
        - 1.1.3 It should include Decision Tools tile which provides maintenance recommendations.
            - 1.1.3.1 One unit is called Lightning Retrofit.
            - 1.1.3.2 Another unit is called Water Faucet Retrofit.
        - 1.1.4 It should include Employee Training tile which offers trainings for onboarding.
    - 1.2 It should take credentials to redirect to different pages.
2. It should present the existing models developed by the Duke Nicholas School of Environment for Drucker.
    - 2.1 It should allow data input for the existing models.
    - 2.2 It shall include data visualization for easy-use of the framework.
    - 2.3 It should transfer data from Excel to executable model in the backend.
3. Two platforms should be developed.
    - 3.1 Mobile Application based on Android.
    - 3.2 Web Portal.

Login credentials:

For both mobile application and web portal, the user credentials (username and password) are the inputs to the basic login page. It should redirect to pages which manage, select, audit and analyze Drucker & Falk LLC's properties.

1. Basic login page should be included in both mobile application and web portal.
2. Input credentials should present.
   2.1 It should allow users to enter username and password.
   2.2 Inputs should be validated with records in the database to perform redirection.
   2.3 Data for validation should be real users in this project including our client.

User Interface - Four Tiles:

Four Tiles is the main interface once the corporate users log in to the system. It mainly consists of four functions, including Q&A forum that one can post and comment messages, document viewer that can access new user guide, employee training module to read all instrumental documentations for new-comers and provide follow-up quizzes and feedbacks, and finally decision tool to input lightning and water plumbing parameters and generate statistical results for reference.

1. Forum
   1.1 Different users should be able to freely interact with each other.
   1.2 A place to post and answer questions, where other people can easily view them too.
   1.3 Forum's potential functions are:
      1.3.1 Post questions or leave a message as an invoker.
      1.3.2 Leave comments under posts with no limitations.
      1.3.3 Each post or comment should display the post time and username.
      1.3.4 Modelized design and UI for easy-post.
2. New User Guide
   2.1 It should display documentation to employees for introduction purposes.
   2.2 It should provide easy-access to PDF file.
3. Employee Training
   3.1 It should present instructional documents for training purposes with provided links.
      3.1.1 Documents shall be uploaded or contained in the MySQL database.
   3.2 It should provide training quizzes provided by our client.
   3.3 It shall integrate Training Pages and Quiz Page.
   3.4 There are three documents to be presented.
      3.4.1 A sustainability guide in PDF format.
      3.4.2 A landscaping practices guide in PDF format.
      3.4.3 The quiz in webpage format to be provided.
   3.5 It shall show quiz feedback after the user completes the quiz.

4. Decision Tools
   4.1 It should visualize the Exported Excel Models, and transform into easy-to-use interface.
   4.2 There are two models to be constructed.
      4.2.1 Lightning Retrofit Model
      4.2.2 Water Faucet Retrofit Model
   4.3 It should guide users to input requested parameters and output the results.
   4.4 It should allow input data into the form and compute the result from the server.
   4.5 Each model should have a question mark besides the form linking to Lightning Retrofit Model Manual and Water Faucet Retrofit Model Manual to help users understand.
   4.6 It should visualize the result in a user-friendly way.

Server/database:

Server/database is implemented for information storage and retrieval in MySQL 5.7.25 on Duke Virtual Machine. The user should be able to access and retrieve information per request for each of the functional tiles. Existing PDF files, links, and Excel data should be managed by server and shall not be visible to the client side or Android app. All server APIs should be provided in Model under Spring framework and are ready to be called by controllers.

1. Relational database MySQL allows information storage.
   1.1 It should contain records of users and their passwords.
   1.2 It should store the posts and their metadata and corresponding comments.
   1.3 It should store the URLs for PDF files, and quizzes.
2. It allows interactions with Excel Models.
   2.1 It should allow input data to Lightning and Water Faucet Models.
   2.2 It should perform calculations in Excel file based on the input parameters.
   2.3 It should return and query back the results from Excel Model.
   2.4 Excel Models should be stored in the same level with the project.
3. Model and controller under Spring framework set up the APIs and allow information storage and retrieval through the database.
   3.1 Login model
      3.1.1 Login API receives username and password and sends to database for verification.
      3.1.2 Returned true or false from the database and send back to controller.
   3.2 URL model
      3.2.1 This model contains all the URL information involved in this project.
      3.2.2 It includes PDF for New User Guide and PDFs and quizzes for Employee Training.
      3.2.3 Server is responsible for returning all the URLs to the controller for parsing.
   3.3 Forum model including Posts and Messages
      3.3.1 Each post has a unique post id to distinguish itself from others.
      3.3.2 Each post has a list of comments (>=0).
      3.3.3 Server is responsible for querying the unique id of newly added posts.
      3.3.4 Forum API should be able to return a list of queried posts to controller.

IV. Non-functional Requirements

Maintainability:

NF1. There should be tile block design for easy use and access.

NF2. The platform should be managed internally.

NF3. It shall be maintained 24/7 if possible.

Sustainability:

NF4. This project should be sustainable as the company's culture supports.

Platform:

NF5. Mobile app shall be developed in Android.

NF6. Web application (online portal) shall be suitable for Chrome browser.

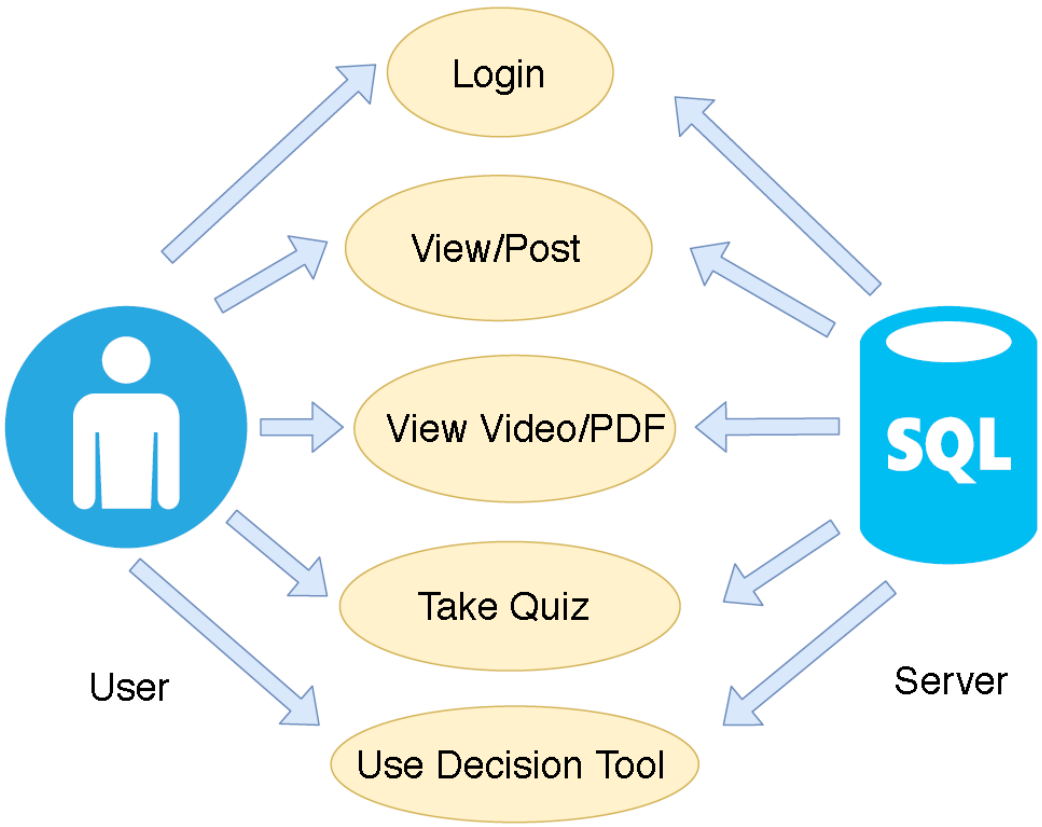
NF7. There should be a corresponding transfer of existing Excel Decision models.

Scalability:

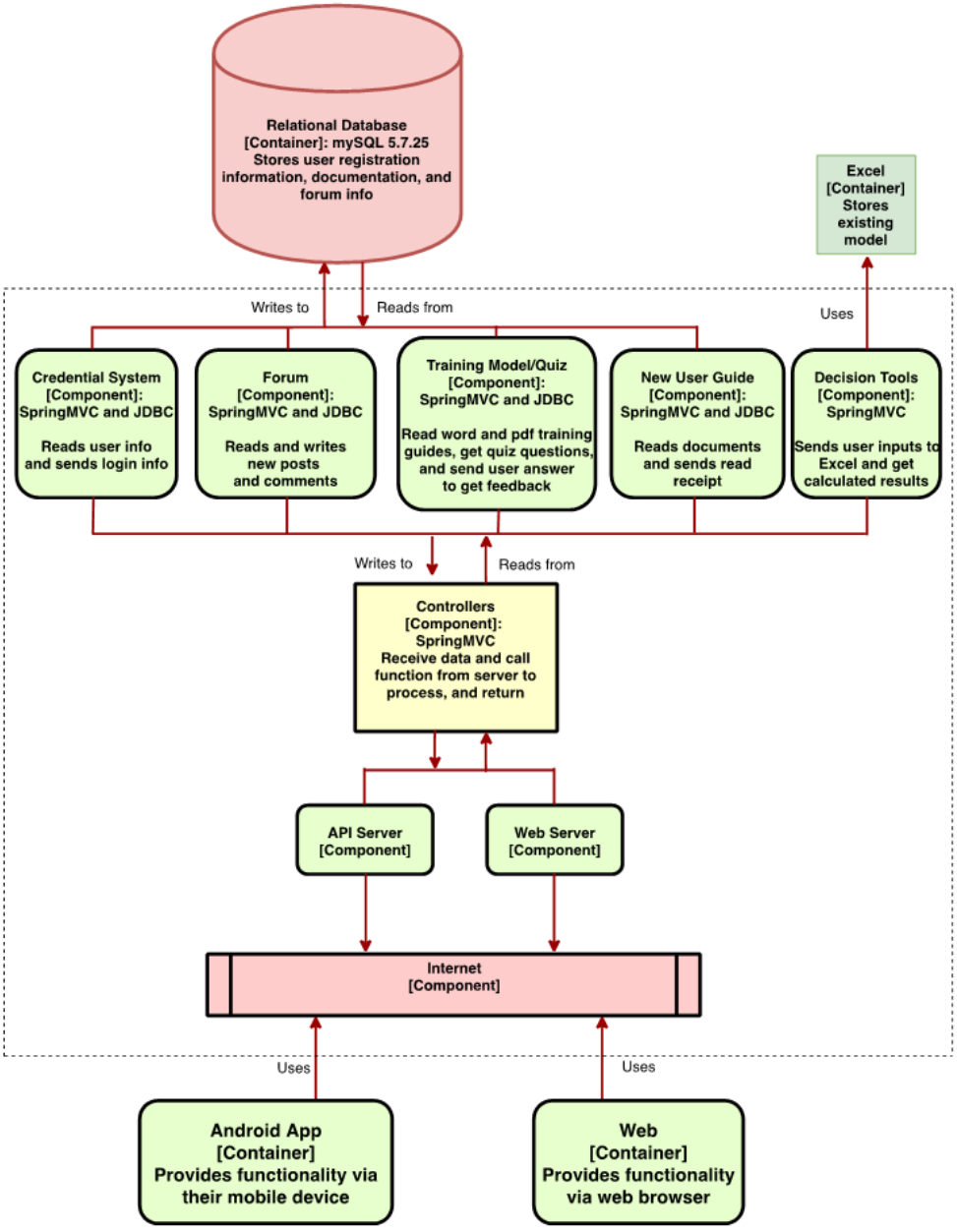
NF8. It should be modularized and allow future add-ons.

Architecture & Design

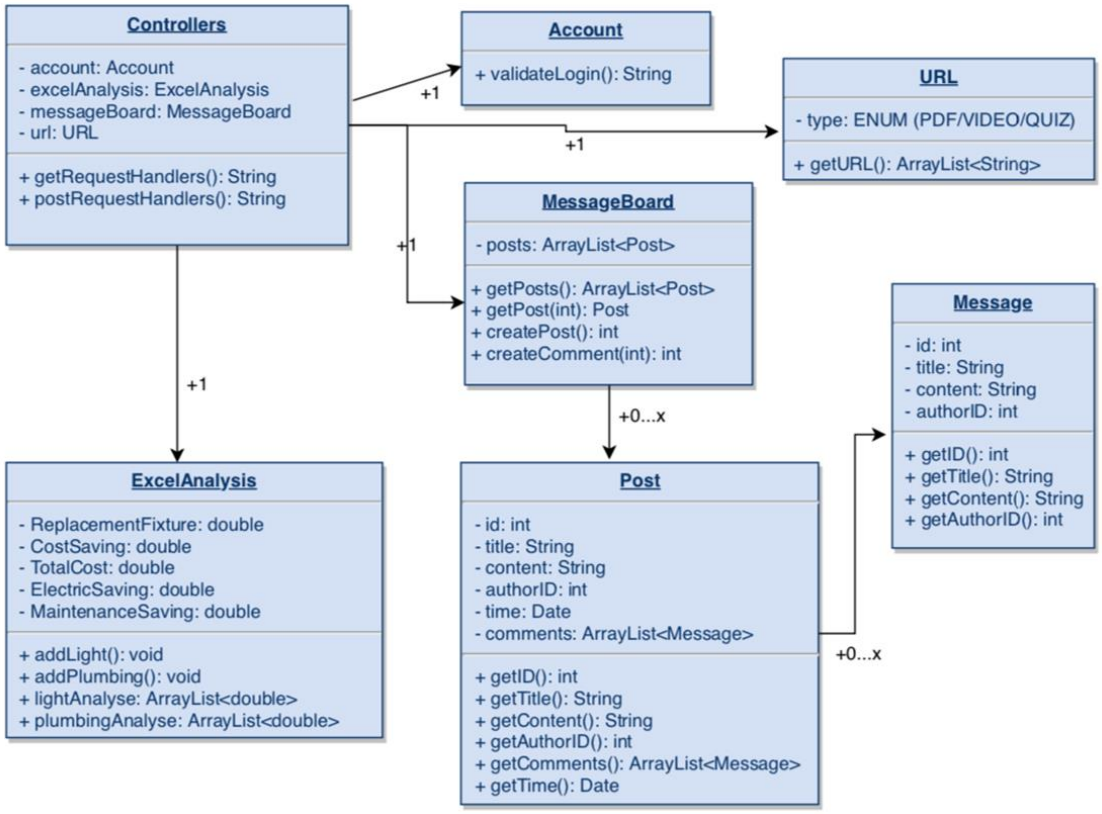
1. Use Cases



2. System Architecture and Component Diagram



3. Class Diagram



Test Cases

1. Test Overview

This document provides a test plan for Drucker project. For our project, we decide to adopt both component test as well as system test. Since our project is divided into three groups, which are client, Android and server/database, it's natural that each group can come up with their own component test. Then, after the system is integrated, test team can deploy the system test on the whole system.

Development test is tested during development to discover bugs and defects. Therefore, each group should test while they develop their part. Test team is responsible for the integration and overall performance as well as checking if it meets the customers' requirement.

2. Component test Cases

1. Android

1.0 Connection with server

- 1.0.1 Load user information from server
- 1.0.2 Load calculation results for decision tools from server
- 1.0.3 Save user data in server
- 1.0.4 Android front-end can obtain information from JSON
- 1.0.5 handle http request error if server failed to response data

Test Case(1.0.1-1.0.5)

Check if the information will be stored in server. Check if correct data can be retrieved from server; Check if all the data will be formatted in JSON to the destination URL; Check if Android front-end can receive fetched data through JSON. Check if the validation status effectively changed to "fail" if an error occurred when server searched for results.

Result:

After submitting the username and password through url, the information can be sent and stored in the server. The user information can then be retrived and validated.

By passing input parameters in decision tool through url directly, changes in data can be reflected in backend and correct results can be sent accordingly in JSON format.

The android app can parse JSON data to display calculation results.

The validation status successfully changed to “fail” when no matching results can be found be server.

Conclusion:

Passed.

1.1 Credential System

1.1.1 Using username and password to login

1.1.2 Retry page to handle validation error

Test Case(1.1.1-1.1.2)

Upon touching “login” to submit username and password to the destination url, the usename and password can be sent to server to validate the login activity. The user should not be able to access the four-tile function page if the validation failed.

Result:

By submitting the username and password in the app login page, the user information can be passed to server and validated accordingly. The four tile function homepage will be shown afterwards. A warning pop up window will block illegal users from entering the homepage and redirect them to login page through “retry”.

Conclusion:

Passed.

1.2 Forum

1.2.1 Save new post information in server

1.2.2 Save new comments to corresponding post

1.2.3 Load all posts with comments from server

1.2.4 New post/comment displays correct time, author, title and content information

1.2.5 New posts/comments posted by web client can be synchronized in Android

Test Case(1.2.1-1.2.5)

Check if the post/comment data can be sent and stored in server. Check if all posts published by multiple users from other platforms can be pulled from server upon refreshing. Check if the displayed timestamp has correct format.

Result:

Upon touching “view post”, the user can be direct to an editing page. After submitting the new post/comment, the user information will be sent to and stored in server. Then the page will return to the forum home page. New updates from web client can be synchronized and displayed with correct time and layout in android clients.

Conclusion:

Passed.

1.3 New User Guide

1.3.1 See if user guide pdf accessed through url can be shown

Test Case(1.3.1)

Check if the user guide pdf can be displayed normally.

Result:

User Guide PDF can be properly loaded on the screen.

Conclusion:

Passed.

1.4 Employee Training

1.4.1 Load training guide document from the Internet

1.4.2 Load quiz after completion of all training materials

Test Case(1.4.1-1.4.2)

Check if Training Guide pdf documents can be opened on screen and if the read status will be updated accordingly in record. Check if the quiz can be loaded before/after completion of all training guides.

Result:

By clicking the document respectively, the training material can be loaded from the Internet and the track record can successfully increase. The quiz will be blocked by a warning message to if the progress has not reached 100 percent.

Conclusion:

Passed.

1.5 Decision

1.5.1 Successfully operating on excel model when computing

1.5.2 Correct results(double precision) when pass back to Android

Test Case(1.5.1-1.5.2)

Check if the executing message inside excel api is properly generating tracking messages. Check if the results in JSON file match with original excel model.

Result:

By sending user input through http request, the data are intactly received by server and updated in backend. Excel API successfully generated executing log. The fetched results remain their precision and are correct.

Conclusion:

Passed.

2. Web

2.0 Interaction between Server

2.0.1 Load User Information from Server

2.0.2 Load Sets of Website Links from Server

2.0.3 Save User Information to Server

2.0.4 Submit the form to the Server

Test Case(2.0.1 - 2.0.4):

Check if the system can pull data from the server, including user information, and links; also the system can push data in the form to the server.

Result:

By submitting the user/password in the form of the login page, the user information can send to the back-end, and store in the database.

The front-end can load the sets of website links from the server, and display in the front-end.

Conclusion:

Passed.

2.1 Credential System

2.1.1 Login with username and password

2.1.2 Secure pages with credential system

Test Case(2.1.1 - 2.1.2):

By submitting the user information, users can log into the system, and access to the four function sections. User should not have access to the function page detail before logging in, and will be redirected to the login page.

Result:

By submitting the user/password in the form of the login page, the user information can send to the back-end, and validate the user information. User will then be redirected to home page. If users try to access the function pages, and will be redirected to login page.

Conclusion:

Passed.

2.2 Employee Training

2.2.1 Load Sets of Training Module Information from Server

2.2.2 Automatic Generate Card Component in the Front-end to Display the Data

Test Case(2.2.1 - 2.2.2):

Training Module page will load the data from the server, and loop through the sets of information to generate the info cards.

Result:

Training Module page will automatically generate and display the info cards in waterfall style, including the related links and pictures.

Conclusion:

Passed.

2.3 New User Guide

2.3.1 See if the PDF Stored in Static is Shown

Test Case(2.3.1):

Open the website module of New User Guide to see if PDF is shown normally.

Result:

New User Guide will successfully display the PDF in the website.

Conclusion:

Passed.

2.4 Decision Tool

2.4.1 Pass Front-end Input to Server End for Both Plumbing and Bulb Analysis

2.4.2 Utilization of Excel Results saved in Database

2.4.3 Excel is Utilized when Returning Computing Results

Test Case(2.4.1 - 2.4.3):

Decision Tool page will let the user input desired data in the form of front end and get corresponding results.

Result :

Decision Tool will return corresponding analysis for plumbing data and bulb data.

Conclusion:

Passed.

2.5 Message Board

2.5.1 Post New Message

2.5.2 Post New Comment of a Specific Message

2.5.3 See a List of All Messages

2.5.4 See Detail of a Specific Message

Test Case(2.5.1 - 2.5.2):

Enter the page to see the list of all messages, try to post a new message and a new comment and see details of a specific message.

Result :

When entering the page, we can see all messages. By clicking 'Create Post' we can successfully create a new message and see the message on the list of messages. By clicking one specific message, we can see details of this message and post comment for it.

Conclusion:

Passed.

3. Server
    - 3.1. Correct username and password combination
    - 3.2. Incorrect username or password
    - 3.3. Results from decision model
    - 3.4. URL of PDF and videos
    - 3.5. Message from forum

    Test 3.1, 3.2, 3.4, 3.5are basic inserting and querying operation of our database. We check if the results we got are correct based on our input.
    Results: if given the correct input, we can return the correct output. Otherwise, it will show error.
    Test 3.3 are the interaction of excel sheet and Apache POI. We check if we can successfully calculate the results.
    Results: Our results are correct as we are doing calculation in excel sheet.

    Conclusion: PASSED

Readme

1. Drucker Web General README

This directory (https://gitlab.oit.duke.edu/ECE651_S19/drucker/blob/master/drucker_web) is the web server and frontend for the Drucker tool implemented using Spring framework and managed by Gradle. The database is built in MySQL 5.7.25 on Duke Virtual Machine.

Getting Started

These instructions will get you a copy of the project up and running on your local machine for development and testing purposes. See deployment for notes on how to deploy the project on a live system.

Prerequisites

- JDK version 1.8
- IntelliJ IDEA (recommended)

Installing

If you are using IntelliJ IDEA, this guide should work for you regardless of your platform.

1. Clone the repository to local computer

   ```
   git clone git@gitlab.oit.duke.edu:ECE651_S19/drucker.git
   ```

2. Open IntelliJ and import project from:

   ```
   drucker/drucker_web
   ```

3. Follow through the instructions and add click **Import Gradle Project**, accept all default options and navigate to the Gradle window. In Tasks->Application, double click BootRun to start the server.

Test the App

Now that the web site is running, visit http://localhost:8080 where it shows the Drucker web homepage which requires user credential information to login.

Deployment

Currently, this application is bind to Duke Virtual Computing Manager for remote database access. It shall work normally 24-7. If not, please double check with Rui Sun - Email.

Built With

- Spring Framework- The web framework used
- Gradle- Dependency Management

2. Drucker Server/Database README

Below are the sample users we have in the database. This Account API will validate an incoming username and password pair with the stored values in the database and return a string containing the password validation result (either 'true' or 'false') to the front end and Android side.

username	password
testuser1	00000000
testuser2	11111111
testuser3	22222222
testuser4	33333333
testuser5	44444444

Below are the URLs we have in the database given by our client. This URL API will be given a type name (either 'pdf' or 'video') and return an arraylist consisting of all the pdf links or video links we have in the database for the use of decision model module and best practices module.

id	type	url
1	pdf	https://drive.google.com/file/d/18iGcdDR7IpSGe0ofKiPk_xgYuBvVY5ZZ/view?usp=sharing
3	pdf	https://drive.google.com/file/d/1Vii_EELBf_XG19S0RKlF1rqkzjTwSqSZ/view?usp=sharing
4	pdf	https://drive.google.com/file/d/11o4j2eP2jU6Oa6YDSBS8tJVn4ELuAn4A/view?usp=sharing

id	type	url
5	pdf	https://images.forrent.com/imgs/fr/propertyFiles/433/912/999/05_11710588780449818.pdf
6	quiz	https://duke.qualtrics.com/jfe/form/SV_a02p0vxoMZ7BknH
7	quiz	https://duke.qualtrics.com/jfe/form/SV_a02p0vxoMZ7BknH

Below is the decision model module. This Decision Model API will be given and return an arraylist consisting of all the output from the requested service model.

Sub-modules: Lightning Retrofit Model

Input parameters:

Name	Input parameter
ExcelAnalysis() xxx	new ExcelAnalysis()
Electricity Rate	x1
Tax Rate	x2
Minimum Acceptable Return	x3
- Current Bulb -	
Fixture Type	s1
Number of Bulbs	x4
Price	x5
Wattage	x6
Lumens	x7
Lifespan	x8
Hours used per day (Weekday)	x9
Hours used per day (Weekend)	x10
- Replacement Bulb -	
Fixture Type	s2
Number of Bulbs	x11
Price	x12
Wattage	x13
Lumens	x14
Lifespan	x15
Hours used per day (Weekday)	x16
Hours used per day (Weekend)	x17

Name	Input parameter
Rebates	x18

Outputs (in order):

Name	Output parameter
Escalting Rate:	3% (fixed)
NPV	arraylist[0]
IRR	arraylist[1]
Simple Payback period (year)	arraylist[2]

Sub-modules: Water Faucet Retrofit Model

Input parameters:

Name	Input parameter
Water Cost	y1
Tax Rate	y2
Minimum Acceptable Return	y3
- Current Fixture -	
Fixture Type	s1
Number of Fixture	y4
Price	y5
Flow Rate	y6
Estimated hours used per day	y7
- Replacement Fixture -	
Fixture Type	s2
Number of Fixtures	y8
Price	y9
Flow Rate	y10
Estimated hours used per day	y11
Rebates	y12

Outputs (in order):

Name	Output parameter
Escalating Rate:	3% (fixed)
NPV	arraylist[0]
IRR	arraylist[1]
Payback Period period (year)	arraylist[2]

Below are the message board attributes we have in the database. This forum is responsive for internal communications. It will display all the posts with comments and is supportive of adding new posts and comments.

Post details:

pID	username	time	cnum	title	content	shortcontent
1	Ric	2019-04-18 11:29:33	3	First post	Welcome to the first post of Drucker Message Board from Ric!	NULL
2	Ric	2019-04-18 11:29:38	5	New hire training guide	To all: please guide new hires through training guides and they shall be able to complete the quiz.	NULL
3	Mengting	2019-04-18 11:29:43	1	Working from home today	Bad weather. Feel free to work from home today.	NULL
4	Honglin	2019-04-18 11:23:52	0	Model updates	Lightning and water plumbing model need to be updated soon. Watch out for details.	NULL
5	Piyush	2019-04-18 11:29:49	2	Please help update documents	I have finalized all the documents for internal use. Calling tech team to add them.	NULL

Comment details:

postID	username	time	content	shortcontent
1	Rui	2019-04-16 19:41:48	Hello from Drucker server team!	NULL
1	Chong	2019-04-16 19:42:43	Hello from Drucker client team!	NULL

postID	username	time	content	shortcontent
1	Minghui	2019-04-16 19:43:20	Hello from Drucker Android team!	NULL
2	Tianrui	2019-04-16 19:56:17	Understood.	NULL
2	Yueying	2019-04-16 19:57:41	Sure. I'll keep track of that.	NULL
2	Yijie	2019-04-16 19:58:22	Well received. Thanks.	NULL
2	Yuqiao	2019-04-16 19:59:55	How do they feel about that?	NULL
2	Yijie	2019-04-16 20:00:26	They are doing really well.	NULL
3	Honglin	2019-04-16 20:04:27	Me too.	NULL
5	Yifan	2019-04-16 20:14:00	I will add the first part.	NULL
5	Xiaohuan	2019-04-16 20:14:22	I will add the second part.	NULL

3. Drucker Android General README

This directory (https://gitlab.oit.duke.edu/ECE651_S19/drucker/tree/master/drucker_android) is the android implemented using Spring framework and managed by Gradle.

Getting Started

These instructions will get you a copy of the project up and running on your local machine for development and testing purposes. See deployment for notes on how to deploy the project on a live system. Since some of our APIs are implemented in directory (https://gitlab.oit.duke.edu/ECE651_S19/drucker/blob/master/drucker_web), you also need to follow the instruction from Drucker web to install IntelliJ and run the program.

Prerequisites

- JDK version 1.8
- IntelliJ IDEA (recommended)

- Android Studio 3.3.2

Installing

If you are using IntelliJ IDEA, this guide should work for you regardless of your platform.

1. Clone the repository to local computer

git clone git@gitlab.oit.duke.edu:ECE651_S19/drucker.git

2. Open android studio and import project from:

drucker/drucker_android

3. Follow through the instructions and add click **Open an existing Android Studio project**, choose **build.gradle**file in your folder and click **Open**.After synchronizing, double click **Run 'app'**button in Run.

4. Then you will see the interface to select deploymenttarget like this:

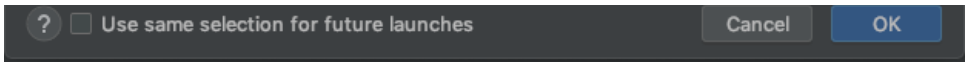


Figure. XX Select Deployment UI

You can create a new Virtual Device or use your own mobile phone. If you use your own mobile phone, connect you phone to your computer with USB cabler, switch your mobile phone to developer mode and set the purpose of USB "Input MIDI".

5. Finish your setting of deployment target and click OK, the app would successfully run on your mobile phone or virtual device.

Sprints

Details in Sprint Log.

Sprint 1

1. Communicate with project stakeholder regarding certain design decisions (e.g. UI, icon)
2. Construct general framework of Android App, creating placeholders for major components

3. Complete the design and implementation of login/logout page
4. Implement welcome page
5. Implement failed login response and feedback
6. Create json object file and test code with the URL link
7. Test credential system performance (UI performance)

Sprint 2

1. Construct the basic framework of Decision Tool model
2. Implement specific input boxes
3. Implement the interaction with back end
4. Test the function of decision tool model
5. Construct the general framework of Employee Training Model
6. Learn WebView and use it to implement pdf Viewer
7. Implement quiz model by using WebView
8. Implement the interaction with back end
9. Test the function of quiz
10. Test the function of pdf Viewer
11. Construct general framework of New User Guide module
12. Implement pdf viewer
13. Implement the prompt of invalid pdf
14. Test the function of New User Guide module

Sprint 3

1. Construct basic framework of forum
2. Implement view post function
3. Implement the new post function
4. Implement the comment function
5. Modify UI
6. Combine API to implement the interaction with back end
7. Test forum function

Deployment

Currently, this application is test with HUAWEI COL-AL10 (Android 8.1.0 API:27)

Built With

- Spring Framework- The Android API controller used
- Gradle- Dependency Management

User Documentation

1. System Overview

Our system provides both a website and an Android app for a strategic framework tailored for Drucker & Falk company. The system consists of the following functionality components for internal use within the company:

- New User Guide
- Employee Training
- Decision Tools
- Forum

2. Web Getting Started

2.1 Launching the Application

1. Test Run.

   Follow through the instructions and add click **Import Gradle Project**, accept all default options and navigate to the Gradle window. In Tasks->Application, double click BootRun to start the server. Then visit http://localhost:8080.

2. After Deployment

   Direct to the website in the computer browser.

2.2 Login in.

After launching into the website, users will be greeted by the home page, introducing all the functions the system offers, as shown in Figure. XX.

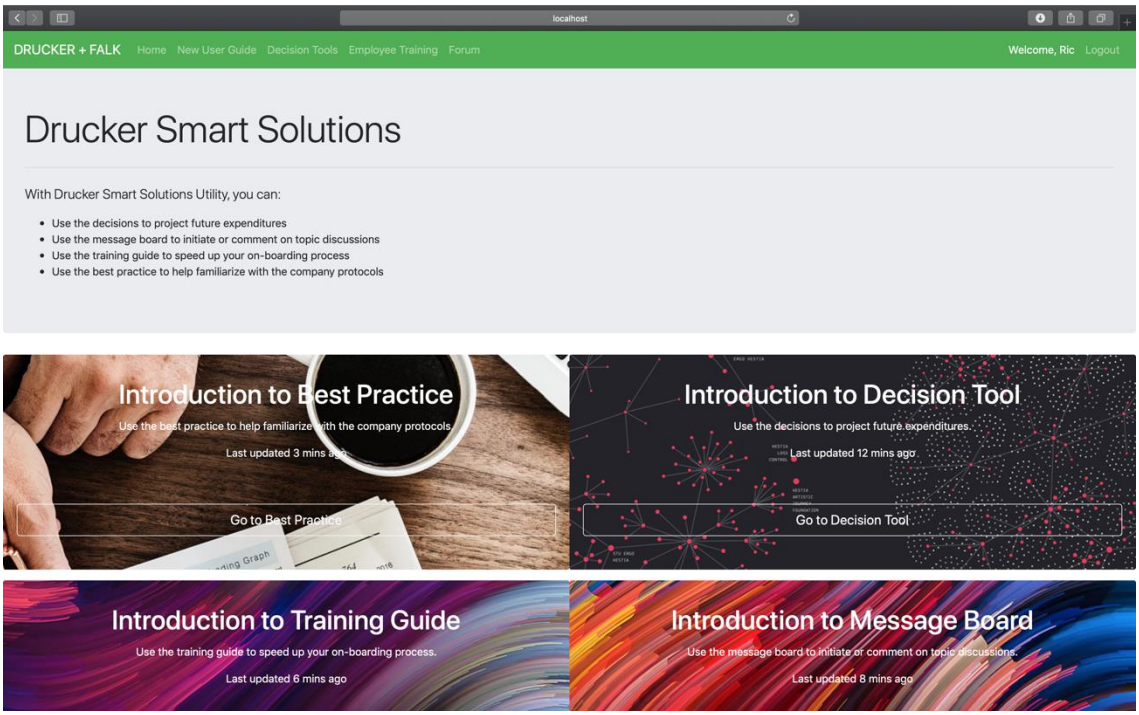


Figure. XX Home Page of the System after lauching the website

If the user is not logged in yet, the right up corner will show the log in button, and user can click the button to direct to the log in page. Or, if the users click on any function page, they will be automatically directed to the log in page, as shown in Figure. XX.

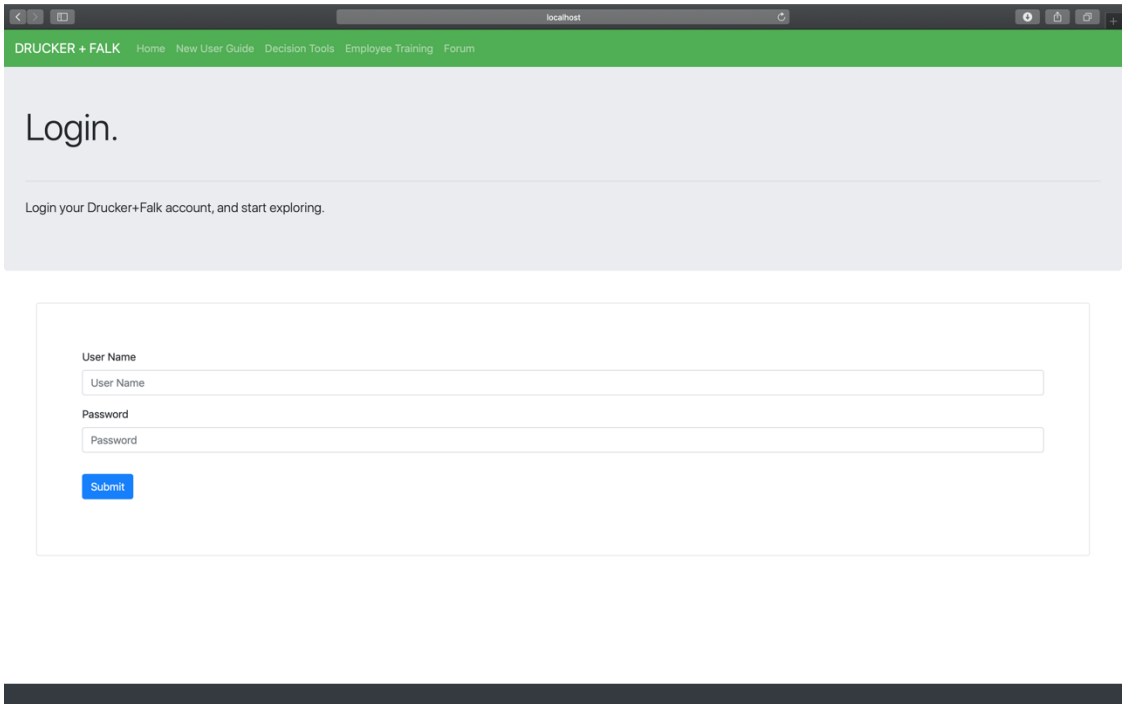


Figure. XX Login Page

After logging into the system, user will be redirected to the home page, from there the user can access all functions with no restriction.

2.3 New User Guide.

By clicking New User Guide button from home page or from Nav bar, user can access the New User Guide functionality. User will be greeted with a comprehensive document, introducing the basic steps to use and navigate in the system, as shown in Figure. XX.

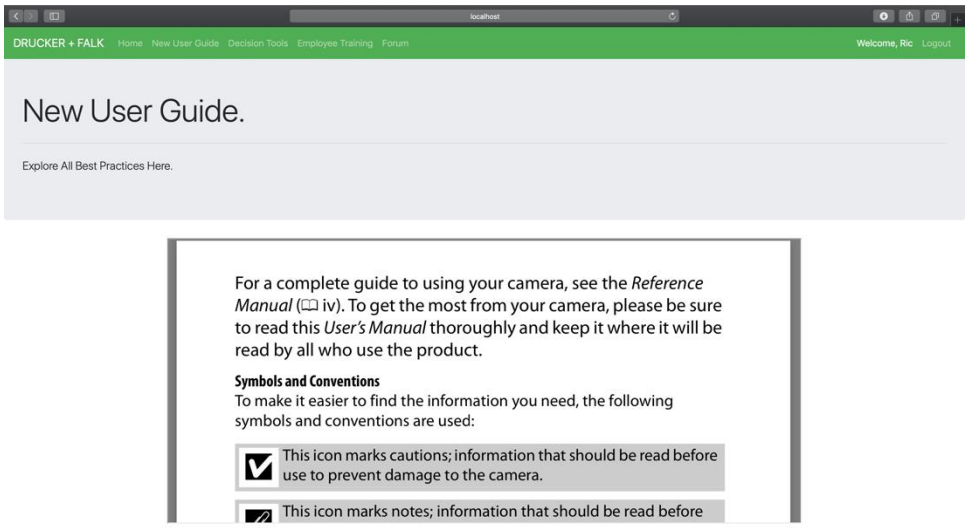


Figure. XX New User Guide Functionality

2.4 Decision Tool

By clicking Decision Tool button from home page or from Nav bar, user can access the Decision Tool functionality. User will be greeted with both lightning and plumbing forms, and can easily switch between the two forms using the toggle placed at the top of the forms, as shown in Figure. XX.

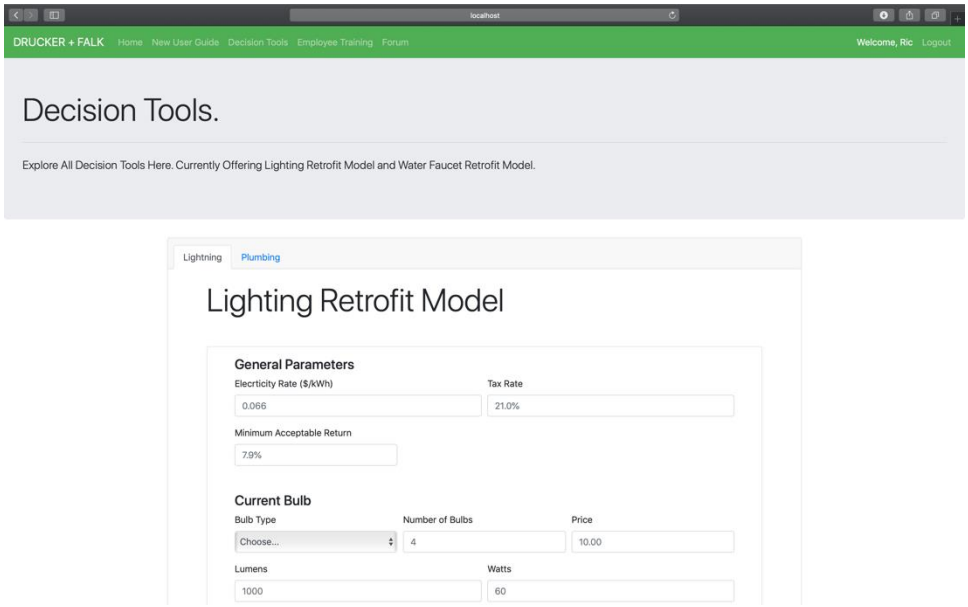


Figure. XX Decision Tool Functionality

All the required information that are needed to perform lighting model analysis, will be displayed as a field in the form presented. User will fill out the form accordingly to the indication above, if any field is left blank, the system will notify the user about which field is still required to be filled out before proceed.

Once all the fields are completed, user can click Add More button to submit current data to the system. Then the system will send the data over to the server, and redirect back to the form for user to add more information. After user finish adding all the information needed, user can then click the Get Analysis button to retrieve the analysis result, as shown in Figure. XX.

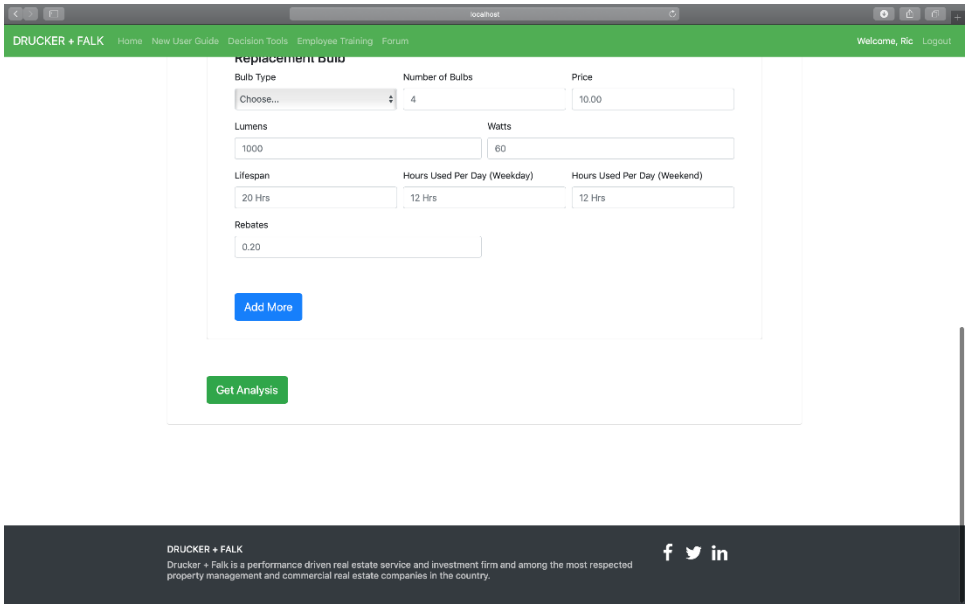


Figure. XX Interaction for Decision Tool Functionality

2.5 Forum

When entering the Forum page, the user can see all messages posted. By clicking ‘Create Post’ the user can create a new post of his or her own and enter the post detail of the new post. This page is shown in Figure. XX.

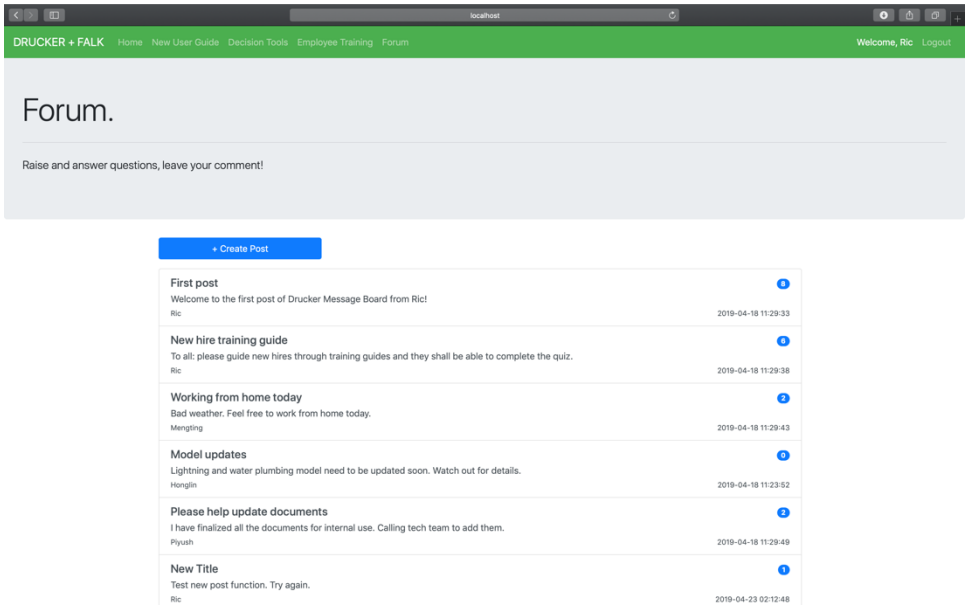


Figure. XX List of All Posts

As shown in Figure.XX and Figure.XX, when entering post detail page, the user can see title, author, content and other details of a post, and have the ability to create a comment for this post by clicking ‘Add Comment’ button. The comments of a particular post will also be shown on the detail page.

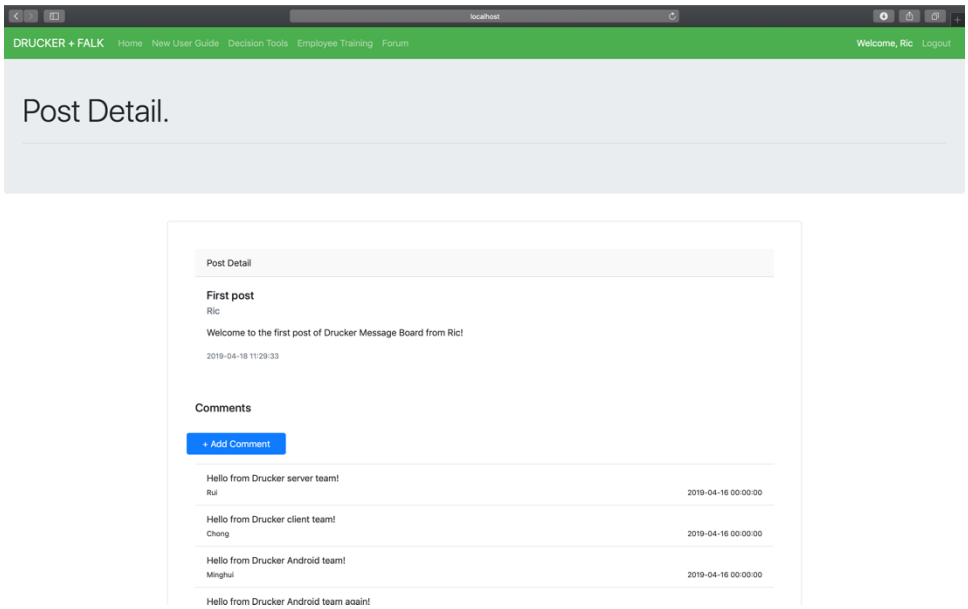


Figure. XX Post Detail Page

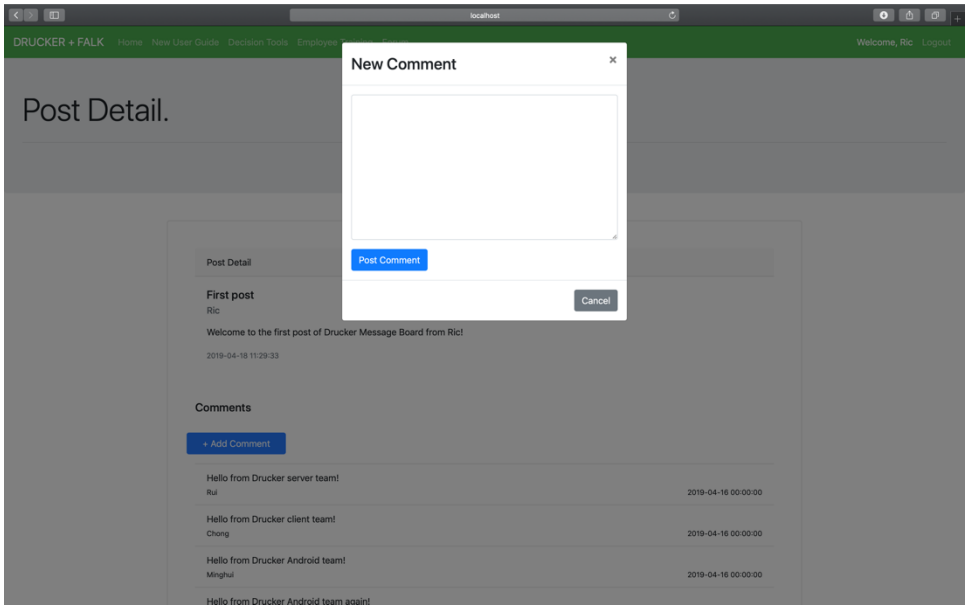


Figure. XX Creating Comment

2.6 Employee Training

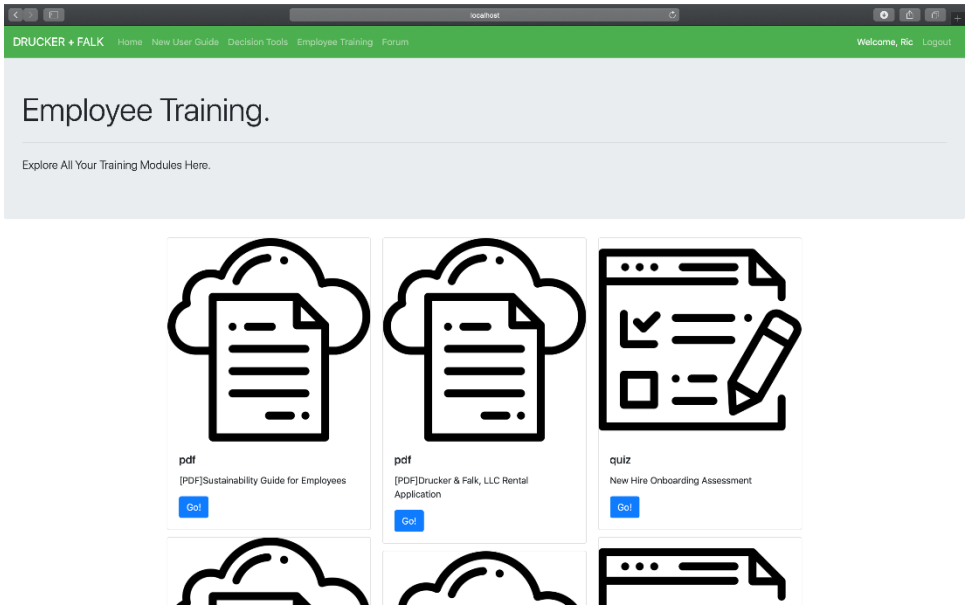


Figure.XX Employee Training page

When entering Employee Training page, there are several PDFs to read, after reading the PDFs by clicking ‘Go!’ button under PDFs, the user is allowed to answer questions in the quiz by clicking ‘Go!’ button under the quiz.

3. Android Getting Started

3.1 System Requirements

Android smart phone with Google play. When you upload an APK, it needs to meet Google Play’ s target API level requirements. Starting August 1, 2019, Google Play requires that new apps target at

least Android 9.0 (API level 28), and that app updates target Android 9.0 from November 1, 2019. Until these dates, new apps and app updates must target at least Android 8.0 (API level 26).

3.2 Launching Application

1.login

Upon opening the app, please enter your user name and password to login. If your username or password is wrong, click “RETRY” to re-enter your login information.

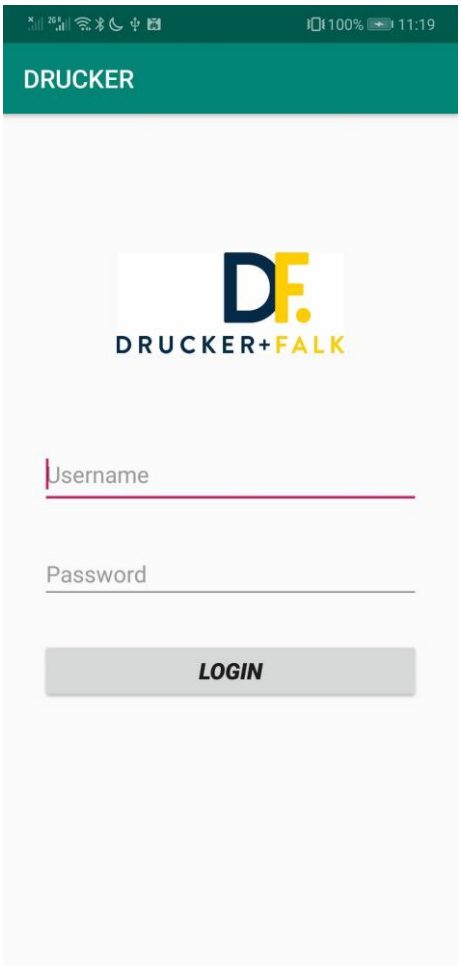


Figure. XX login page

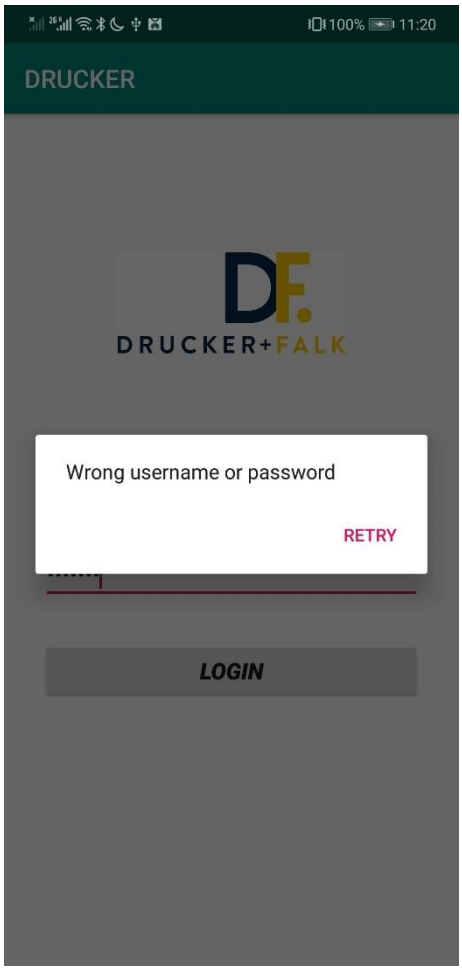


Figure. XX login Retry page

2.Main page

In the user main page, your user information will be shown in the screen. Below are the four tile functions buttons: “Forum”, “New User Guide”, “Employee Training”, “Decision”.

After using this app, click “LOGOUT” at the bottom of the main page to logout safely.

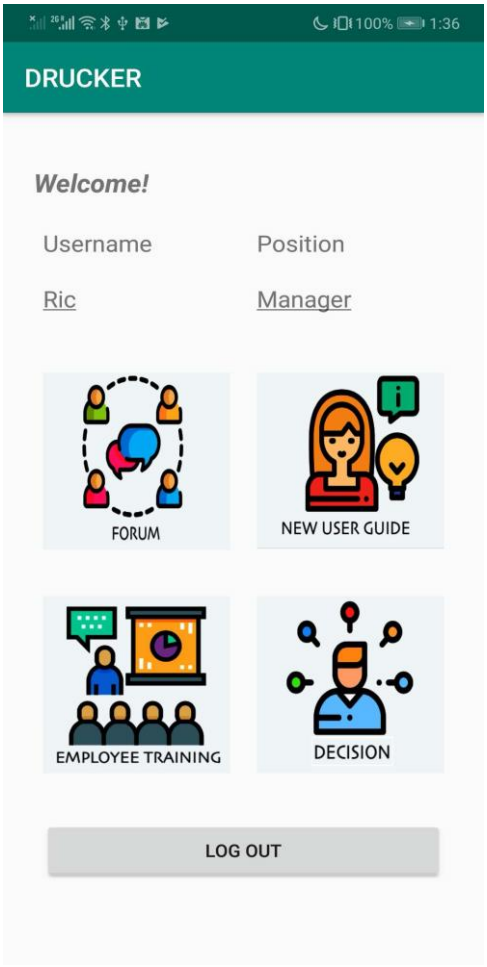


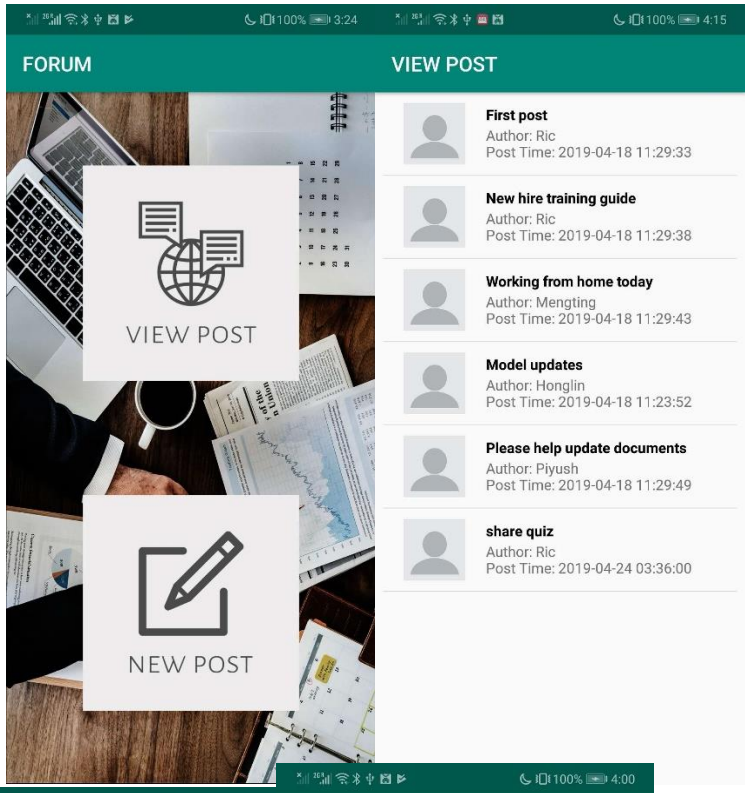
Figure. XX Main page

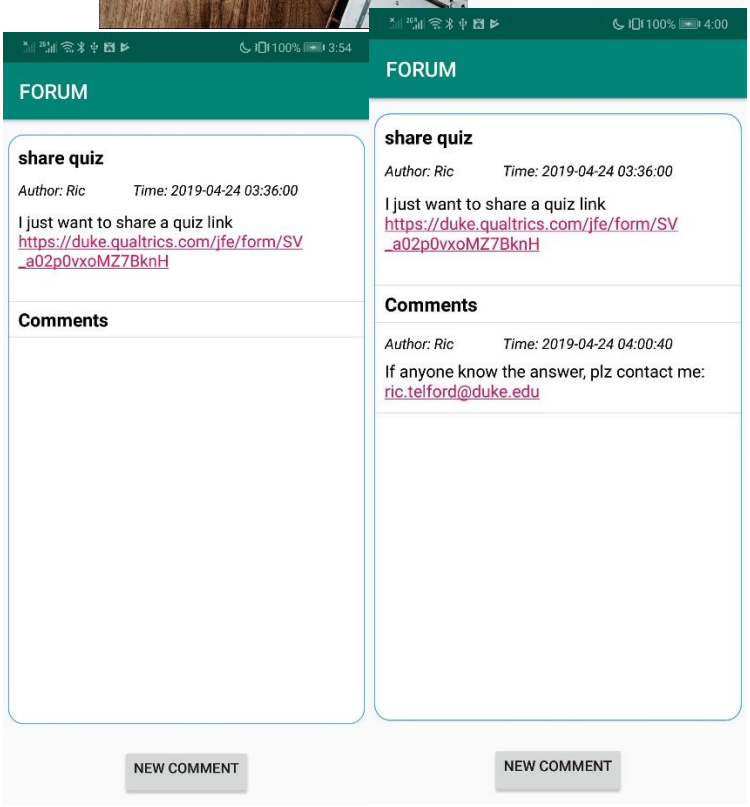
3.Forum

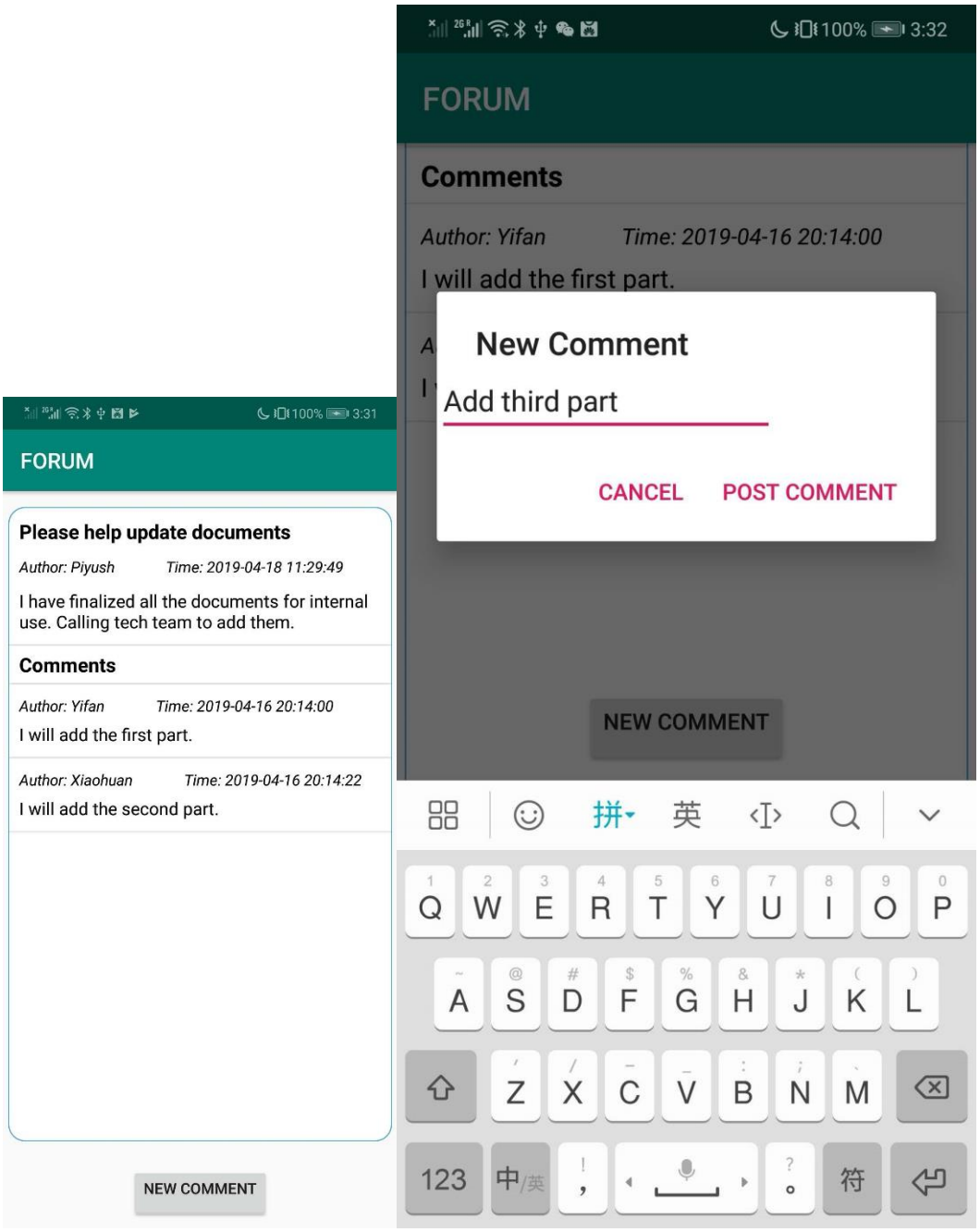
By touching Forum button from main page, users will be prompted to a page with two buttons: View Post and New Post.

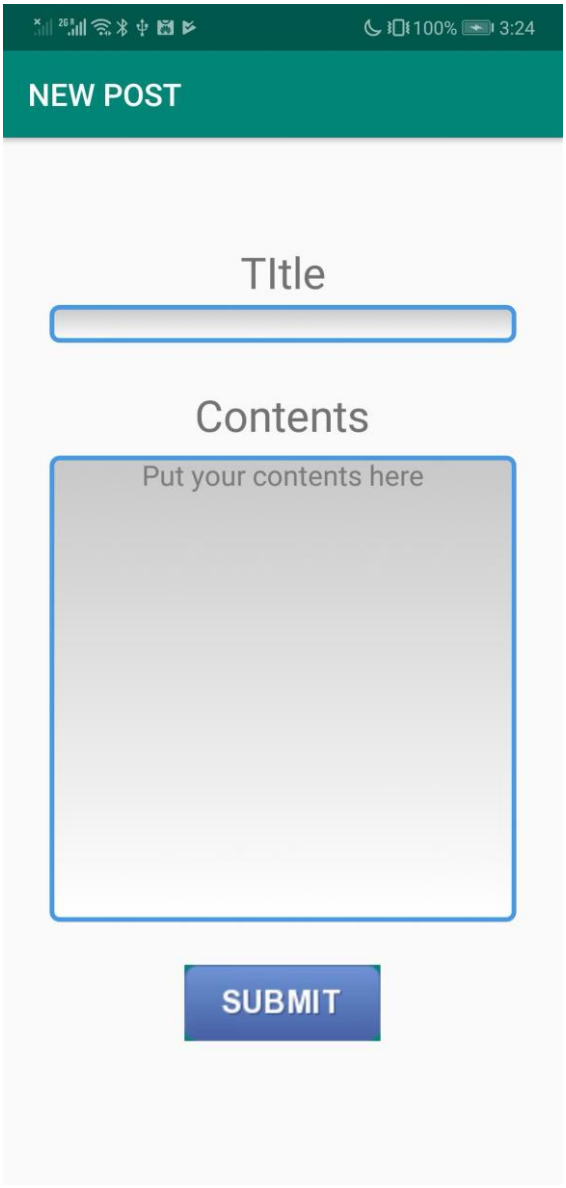
If the user wants to read existing posts, he or she can touch the View Post button, which prompts a page with a list of all post information, which includes post title, post author, and post time. User then can touch a post, and then the app will show a detailed information of the specific post, including post contents.

If the user wants to add a new post, he or she can touch the New Post button from the main page. Then there will be two textboxes with title and contents. After finishing typing, user touch submit to finish the post.


FORUM
VIEW POST
VIEW POST
NEW POST
First post
Author: Ric
Post Time: 2019-04-18 11:29:33
New hire training guide
Author: Ric
Post Time: 2019-04-18 11:29:38
Working from home today
Author: Mengting
Post Time: 2019-04-18 11:29:43
Model updates
Author: Honglin
Post Time: 2019-04-18 11:23:52
Please help update documents
Author: Piyush
Post Time: 2019-04-18 11:29:49
share quiz
Author: Ric
Post Time: 2019-04-24 03:36:00

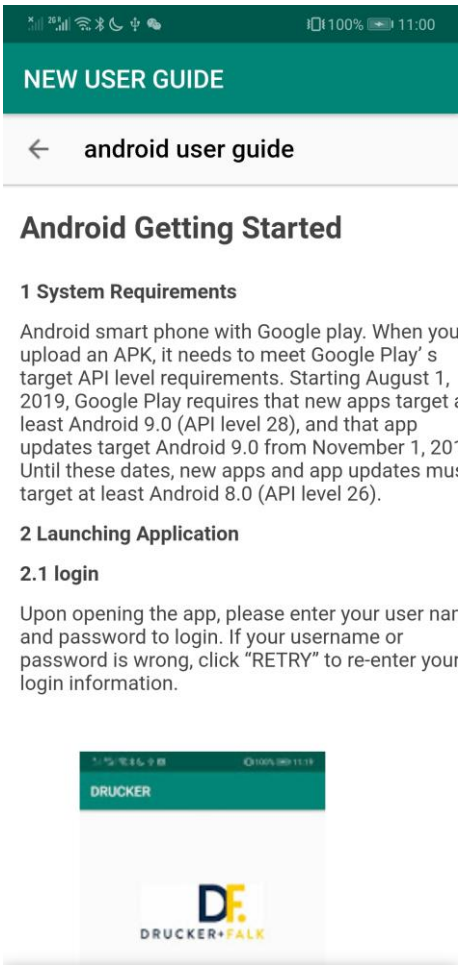

FORUM
share quiz
Author: Ric
Time: 2019-04-24 03:36:00
I just want to share a quiz link
https://duke.qualtrics.com/jfe/form/SV_a02p0vxoMZ7BknH
Comments
NEW COMMENT
FORUM
share quiz
Author: Ric
Time: 2019-04-24 03:36:00
I just want to share a quiz link
https://duke.qualtrics.com/jfe/form/SV_a02p0vxoMZ7BknH
Comments
Author: Ric
Time: 2019-04-24 04:00:40
If anyone know the answer, plz contact me:
ric.telford@duke.edu
NEW COMMENT


100% 3:31
FORUM
Please help update documents
Author: Piyush Time: 2019-04-18 11:29:49
I have finalized all the documents for internal use. Calling tech team to add them.
Comments
Author: Yifan Time: 2019-04-16 20:14:00
I will add the first part.
Author: Xiaohuan Time: 2019-04-16 20:14:22
I will add the second part.
NEW COMMENT
100% 3:32
FORUM
Comments
Author: Yifan Time: 2019-04-16 20:14:00
I will add the first part.
New Comment
Add third part
CANCEL
POST COMMENT
NEW COMMENT



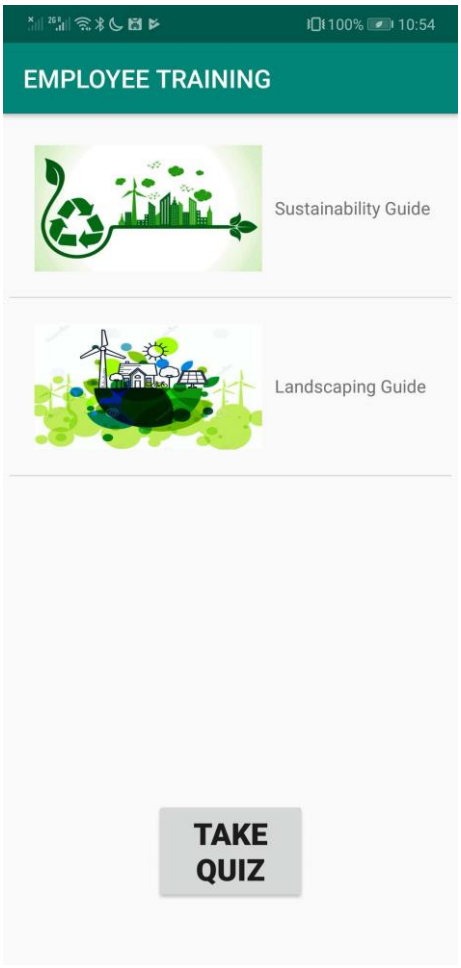
4.New User Guide

In the main page, click “NEW USER GUIDE” to access a PDF document introducing the app functions and how to use the app, as shown in Figure xx.



5.Employee Training

By touching the "Employee Training" button in the main page, you can enter the training module with PDF training guides and quiz system. Click each title to study the training material before taking the quiz.



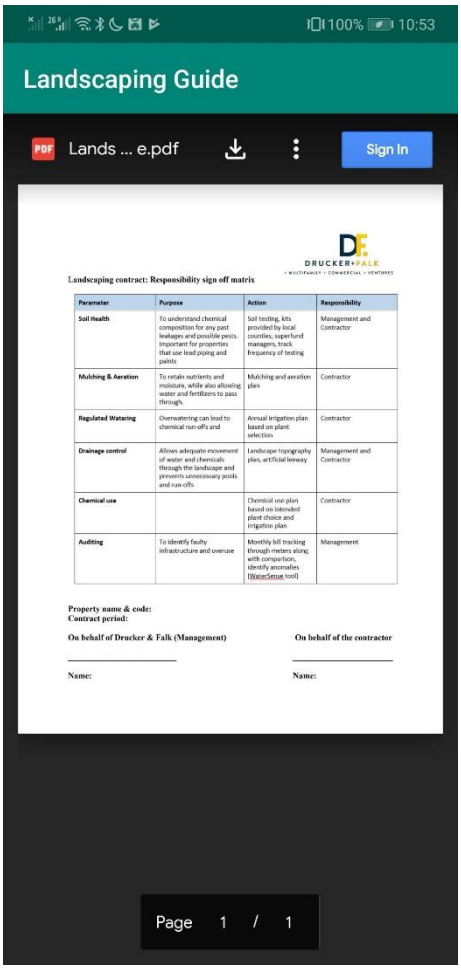


Figure. XX Employee Training page

The app oversees the user's training progress and the quiz cannot be open until the user read through all training materials. If the user attempts to take the quiz before full-completion of the training guide, a warning message will pop up. The user should click "KEEP TRAINING" to finish their training, as shown in Figure xx. The correct quiz page will be like Figure xx.

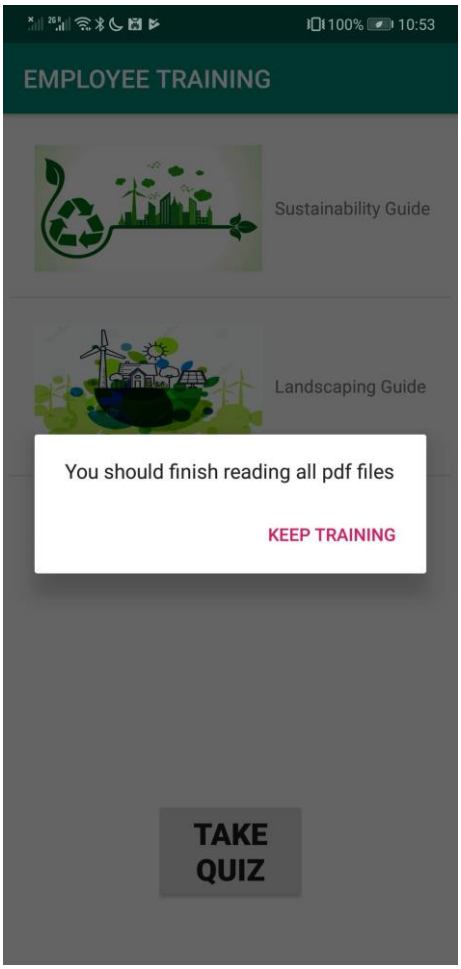


Figure. XX Quiz warning page

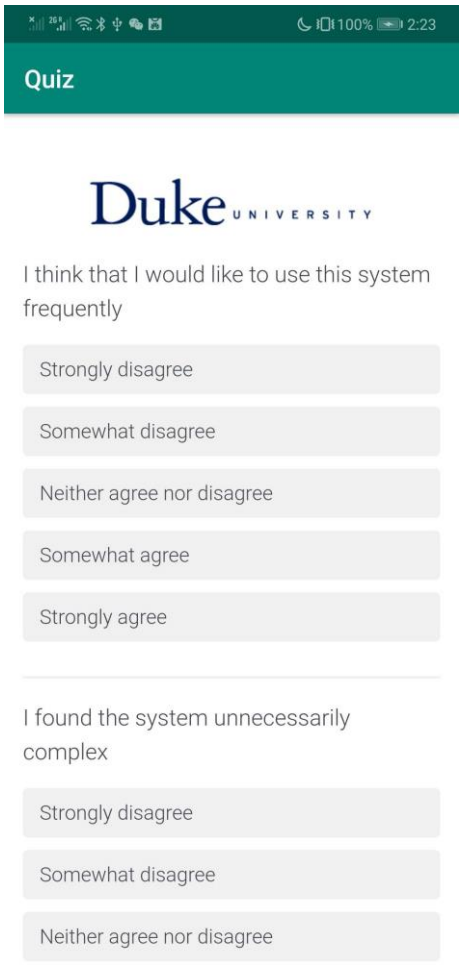
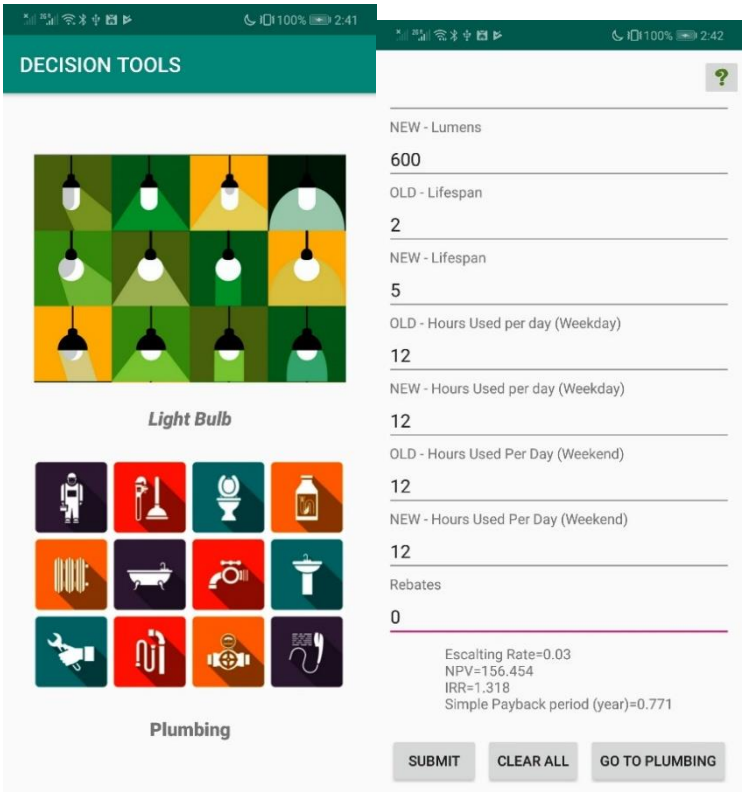
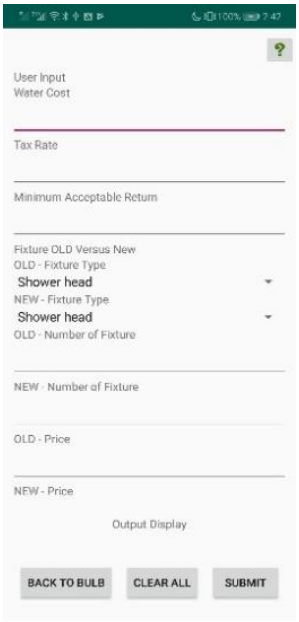


Figure. XX Quiz page

6.Decision

By touching Decision tool button, users will be prompted with two choices: Light Bulb and Plumbing, which represent two categories. By pushing one of the buttons, users will be displayed with various textboxes of input. Each input represents a single feature of either light bulb or plumbing. After typing in all the values, and touch SUBMIT, the lower part of the screen will show up the calculated result, which means the money saved by replacing old light bulb/plumbing with new one. Should the user only want to slightly adjust some input values, he or she can just go to the specific text box and change the value, and touch submit again to get the new result. Should the user need to input another set of data, he or she can touch Clear All button to refresh and clean the page.


DECISION TOOLS
Light Bulb
Plumbing
NEW - Lumens
600
OLD - Lifespan
2
NEW - Lifespan
5
OLD - Hours Used per day (Weekday)
12
NEW - Hours Used per day (Weekday)
12
OLD - Hours Used Per Day (Weekend)
12
NEW - Hours Used Per Day (Weekend)
12
Rebates
0
Escalting Rate=0.03
NPV=156.454
IRR=1.318
Simple Payback period (year)=0.771
SUBMIT
CLEAR ALL
GO TO PLUMBING


User Input
Water Cost
Tax Rate
Minimum Acceptable Return
Fixture OLD Versus New
OLD - Fixture Type
Shower head
NEW - Fixture Type
Shower head
OLD - Number of Fixture
NEW - Number of Fixture
OLD - Price
NEW - Price
Output Display
BACK TO BULB
CLEAR ALL
SUBMIT