

FoodChain

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Introduction

The idea of FoodChain application system is to provide a secure tracking system of food produce or product from its source (farm or factory) to the consumer. It should allow easy tracking for producers and will be easy for consumers to independent verified. The tracking data is too be entered to the blockchain as the product flows through the supply chain. The use of blockchain makes the data immutable and unfalsifiable after it has been lodged into it.

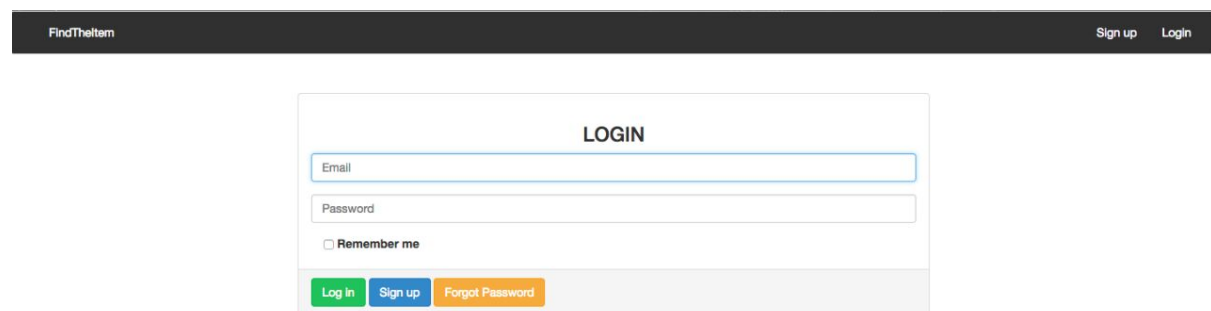
However, the most important part of the system is that the system must not be open to falsifying and collusion at the point of input. This requires careful implementation and establishment of proper security protocols. We need proof-of-location security protocols and will implement it along the lines of Zhu and Cao (2011). We need other analysis tools to set red flags for suspicious movements. We are in the process of researching the best means to do so.

Implementation

We have implemented a preliminary small scale prototype website to test the ideas. This is not a complete website as it does not yet have integration with blockchain nor are the security protocols ready. It is just a prototype to spark further discussion and research. The prototype is developed using Ruby and Rails. A client app is also developed in Android for query and QR scanning.

Prototype Screens

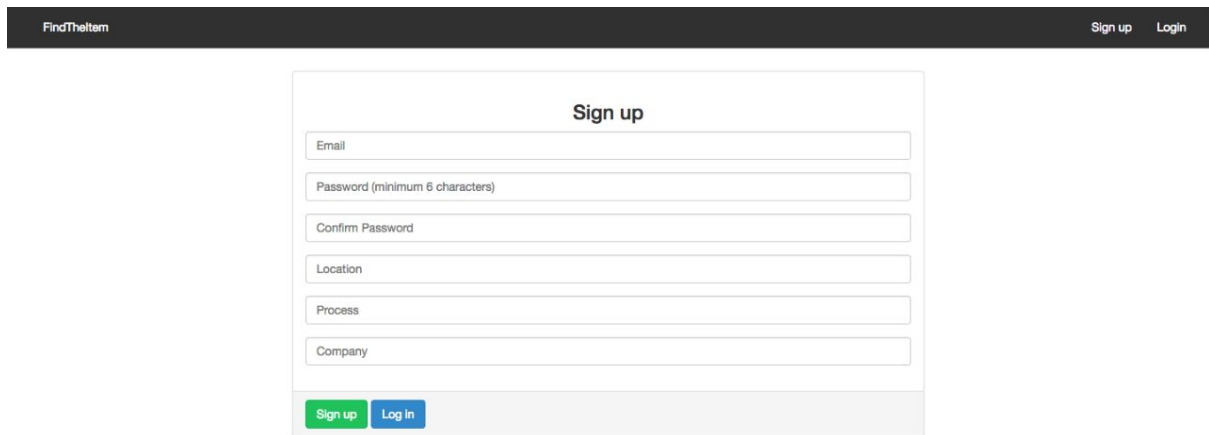
First we have the login screen for normal users and suppliers. Those without a sign in will need to Sign-up (or register).



The screenshot shows the login interface of the FoodChain application. At the top, a dark navigation bar contains the text 'FindTheItem' on the left and 'Sign up' and 'Login' on the right. The main content area is white and features a 'LOGIN' form. The form includes an 'Email' input field, a 'Password' input field, and a 'Remember me' checkbox. Below the form, there are three buttons: 'Log in' (green), 'Sign up' (blue), and 'Forgot Password' (orange).

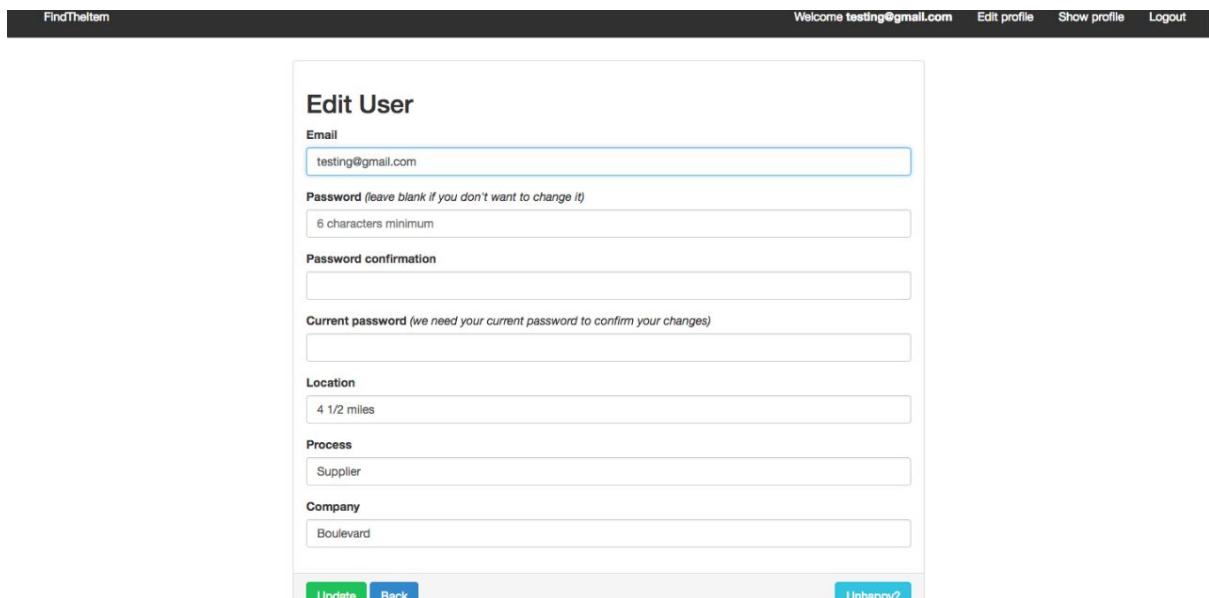
Figure 1. Login Screen.

Next we have the sign up screen for users and suppliers.



The sign-up screen features a dark header with the text "FindTheItem" on the left and "Sign up" and "Login" on the right. The main content area is a white box with the title "Sign up" centered at the top. Below the title are six input fields: "Email", "Password (minimum 6 characters)", "Confirm Password", "Location", "Process", and "Company". At the bottom of the box are two buttons: a green "Sign up" button and a blue "Log In" button.

Figure 2. Sign-up Screen



The edit user screen has a dark header with "FindTheItem" on the left and "Welcome testing@gmail.com", "Edit profile", "Show profile", and "Logout" on the right. The main content area is a white box with the title "Edit User" at the top. Below the title are several input fields: "Email" (containing "testing@gmail.com"), "Password" (with a note "leave blank if you don't want to change it" and "6 characters minimum"), "Password confirmation", "Current password" (with a note "we need your current password to confirm your changes"), "Location" (containing "4 1/2 miles"), "Process" (containing "Supplier"), and "Company" (containing "Boulevard"). At the bottom are three buttons: a green "Update" button, a blue "Back" button, and a light blue "Unhappy?" button.

Figure 3. Edit User screen

At sign up or after login the profile can be updated (Fig 3). After login in the user can see a list of items available (Fig 4), and click on that. Alternatively the user with Android app can scan the QR code at the retailers or place of purchase or online website. Figure 4 shows a simplified screen. In practise the list of items should be searchable. Figure 5 shows the origin of the product requested. The screen currently only shows the source not the entire supply chain as it may not be necessary, though at a later stage there may be a toggle for the user/consumer to see the detail trail. This data item will be pulled from the blockchain. The user should also see flagged items that are deemed suspicious, e.g. the timing of movement

The supplier can add items into the local database (Fig 6). Once the movement are scanned (Fig 7), that data will go to blockchain. The movement of the items are added in Fig 8.

FindTheItem

Welcome testing@gmail.com

Edit profile

Show profile

Logout

List of Items

Image	ID	Name	Date	Owner
	1	Apple	2016-11-21 07:26:49 UTC	Mulder
	18	Orange	2016-11-27 06:43:53 UTC	testing@gmail.com
	19	Watermelon	2016-11-28 06:32:51 UTC	testing@gmail.com
	20	Apple	2016-11-28 14:46:49 UTC	testing@gmail.com

Figure 4. List of products available for tracking information on the blockchain.

FindTheItem

Welcome testing@gmail.com

Edit profile

Show profile

Logout

ITEM CHAIN

Location	Process	Company	Timestamp
Stutong Market	Seller	MAMAK	2016-11-28 06:33:11 UTC
4 1/2 mile	Supplier	The Happy Supply	2016-11-28 07:18:20 UTC
4 1/2 mile	Retailer	Boulevard	2016-11-29 16:04:26 UTC

ITEM

ITEM

Watermelon

TIMESTAMP

2016-11-28 06:32:51 UTC

DESCRIPTION

FROM YUZRIE

OWNER

testing@gmail.com

Add Chain

Figure 5. Source of product display

FindTheItem		Welcome testing@gmail.com Edit profile Show profile Logout					
ADD NEW ITEM							
Name							
Description							
Choose file No file chosen							
Add Back							

Figure 6. Supplier user can add new items. Fi

FindTheItem		Welcome testing@gmail.com Edit profile Show profile Logout					
New Chain							
Location							
Process							
Company							
Save Chain Back							

Figure 7. Start a new supply movement chain for the item.

USER INFO				
Email: testing@gmail.com				
Company: Boulevard				
Location: 4 1/2 miles				
Process: Supplier				

CHAIN INFO				
ID	Name	Date	Owner	Chain
18	Orange	2016-11-27 06:43:53 UTC	testing@gmail.com	5 hours 24 hours Add Chain QR Code Delete
19	Watermelon	2016-11-28 06:32:51 UTC	testing@gmail.com	44 33 hours Add Chain QR Code Delete
20	Apple	2016-11-28 14:46:49 UTC	testing@gmail.com	26 hours Add Chain QR Code Delete

Add new item

Figure 8 Supply chain movement data for the items.

Currently the Add Chain is done by manual input or by QR code that is attached to the produce. In this prototype the QR code is generated by the website and to be scanned by an Android device without security protocols (yet to be implemented).

Android App Prototype

The Android app have the usual user sign in and registration (Fig 9).

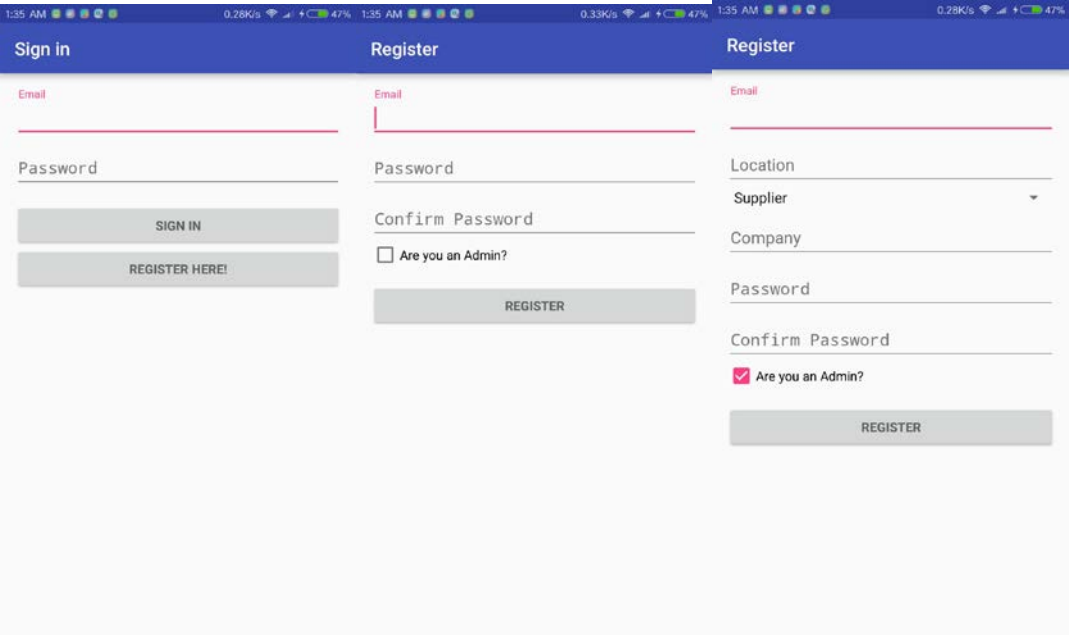


Figure 9. User Sign-in and registration Screen



Figure 10. QR code generation from the website

When the QR code generation is selected (Fig 8), the QR will be displayed (Fig 10). The user then can scan with the Android device and the QR code item will be displayed.

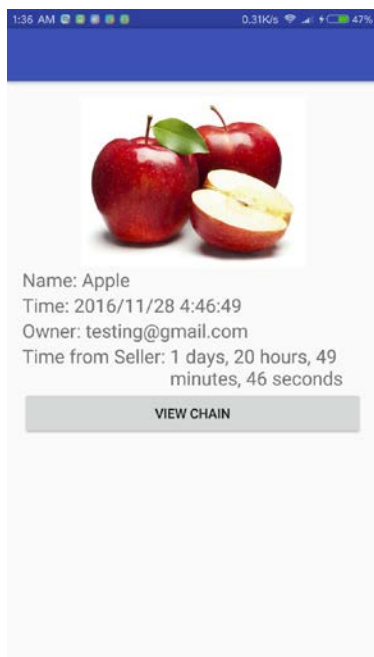


Figure 11. Presentation of Item from QR Code.

Once the QR code have been scanned the item will be displayed on the Android screen (Fig 11). Selecting “View Chain” will result in the values being pulled in from the blockchain (actual from blockchain not implemented yet). Results are as in Figure 12. The information provided are mostly place holders, the actual data to be used has not been decided yet. It is assumed here that the proof-of-location (e.g. Zhu & Cao, 2011) security protocol will be activated here. The Android device that is scanning in the data to the blockchain needs to prove its actual physical location.

The consumer (non-supplier) login will only be able to view the food chain without being able to update the food blockchain.

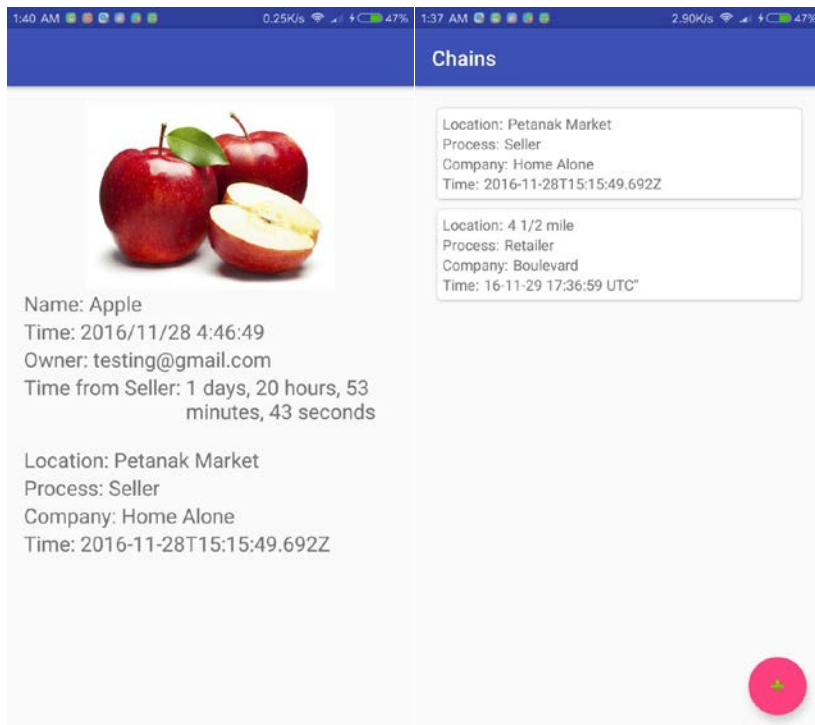


Figure 12. Supply Chain data (to be pulled in from blockchain) for Apple. Information showed are just sample, not actual to be implemented.

References

- Giacomo Brambilla and Michele Amoretti and Francesco Zanichelli, "Using Block Chain for Peer-to-Peer Proof-of-Location, " CoRR abs/1607.00174, 2016.
- Zhichao Zhu and Guohong Cao, "APPLAUS: A Privacy-Preserving Location Proof Updating System for Location-based Services," IEEE Infocom, 2011.