

CmpE 451  
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Final Milestone

Group 4

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## 1 Project Assessment

As a Group4, it was teaching, enjoyable but sometimes tiring experience for us in a one year period. Most of the team members did not know each other at the beginning of CmpE352, however the members met quickly and adapted to working as a team. Moreover, there were individuals leaving and joining at the beginning of CmpE451, but the team handled the adaptation very gracefully. To sum up, Group4 succeeded in teamwork.

At the beginning of CmpE352, there were few members who had development experience from previous internships etc. Also, there even existed member who did not know the difference between client side and server side. Through the project, with different ways such as following guide, asking other team members, watching tutorials, everyone contributed to the application. More importantly, every group member became better, experienced in development at some aspects of project.

At the end of the CmpE451, with the help of teamwork through the semester and the experience we had previously, we implemented our investment platform, Arkenstone. Our project Arkenstone's aim is to establish an environment that users can socialize with each other, get information about any trading equipment, read articles and find out about economic events and also share their ideas about economic events and articles. We implemented all the functionalities that being asked as requirements from our customer. Users can make investments, track their investments, set alarms for certain level of parities, observe current values of parities, predict future values of parities, read comments and articles, interact with other users by following them. The system, which is running on a different server, also supports text to text, image annotations, which is using the W3C protocol.

We can conclude that time management has crucial role while implementing the product. So, we need to design our project plan in a reasonable way, and share workloads of a implementation equally among team members. We were have limited time, and in each milestone we were expected to show progress of our development to our customer. Also, we have to satisfy our customer's expectations. Beside of those, by just taking into account of customer's feed-backs can lead to great pleasure. As Group4 with the help of teamwork and friendship, we are very happy with the final product that we have.

## 2 List and status of deliverables

Deliverable	Status
Trading Equipment	Done
Comment	Done
Search	Done
Article	Done
User Profile	Done
User Follow	Done
Trading Equipment Follow	Done
Trading Equipment Prediction	Done
Investment	Done
Portfolio	Done
Notification	Done
Recommendation	Done
Annotation	Done

Table 1: List and status of the deliverable in Mobile

Deliverable	Status
Trading Equipment	Done
Comment	Done
Search	Done
Article	Done
User Profile	Done
User Follow	Done
Trading Equipment Follow	Done
Trading Equipment Prediction	Done
Deployment	Done
Investment	Done
Portfolio	Done
Notification	Done
Recommendation	Done
Annotation Server	Done

Table 2: List and status of the deliverable in Backend

<b>Deliverable</b>	<b>Status</b>
Trading Equipment	Done
Comment	Done
Search	Done
Article	Done
User Profile	Done
User Follow	Done
Trading Equipment Follow	Done
Trading Equipment Prediction	Done
Deployment	Done
Investment	Done
Portfolio	Done
Notification	Done
Recommendation	Done
Annotation	Done

Table 3: List and status of the deliverable in Frontend

### 3 Summary of coding work done

<b>Member Name</b>	<b>Work Done</b>
Bahadır Hocamoğlu	Enhanced our search functionality with semantic search, as it was using fuzzy search only. Implemented annotation server completely separate from our API. Fixed several bugs related to the endpoints about portfolio and events. Added pseudo-images to articles for annotation purposes.
Baturalp Yörük	Made search results of events, articles and trading equipment clickable. Implemented notification feature which enables users to see if they have a follow request, prediction is true or not. Also, I implemented recommendation feature which recommends some top rated articles and some users with high prediction rate. Additionally, I added icons for notifications according to its category. For example, if the notification is about a true prediction, it corresponds to green tick.

Cemal Aytekin	Implemented fetching additional trading equipment part. Also implemented scheduler function for those additional stocks. Organized currencies, coins and stocks in order to comply with daily request constraints. Fix current stock value database operations bugs. Enhanced edit part of the portfolio in order to provide an easier api to frontend and mobile teams. Fixed bugs on portfolio response. Enhanced get profile response and provide all the details of followed portfolios including authors' information. Add trading equipment information of portfolios to get profile response.
Elif Çalışkan	Designed and implemented trading equipment add and delete alert functionality in mobile team. Also there is a "Show all" button which shows all alerts of that user. Created portfolio page and implemented add, delete and update portfolio functionalities. Each user has a portfolio page and public ones can be seen by other users and they can be followed. A user can see his/her all following portfolios. Added comments to article page. Added images to articles and implemented image annotation by following W3C standards. Created another Retrofit client for annotation.
Ege Başural	Implemented investments page for frontend. Created backend connection for investment endpoints. Initialized text annotation for frontend, which was later modified and finalized by Bera Kaya. I also made image annotation, implemented a library for it. Backend connection was established together with Bera Kaya.

Emre Demircioğlu	Implemented my investment page design and investment related functionalities such as deposit EUR to account, Buy/Sell different trading equipment via spending/gaining EUR and giving Buy/Sell order according to a certain trading equipment rate is reached. Also implemented view of profit/loss and transactions of a user. Implemented remaining article features edit and delete. Implemented text annotation feature on articles. Implemented annotation models for communication with API. Helped portfolio, notification and recommendation implementation via resolving bugs. Changed prediction view according to feedback. The whole implementation that I mentioned is on android.
Gürkan Demir	Implemented endpoint for canceling follow request, and for comment functionality to articles. Implemented investment service, add deposit money, buy, sell, make order functionalities. Calculate total profit/loss according to user's investment history. Implemented endpoint for setting an alarm for specific rate of parity. Implemented scheduler for handle investment orders and trading equipment alarms. Implemented notification functionality, where users are informed about follow status, alert status, order status, prediction status etc. Implemented recommendation system, where system recommends users and articles to logged in user according to their previous interactions. Fixed some bugs, and also changed cronjob timers. Implemented tests for trading equipments, global endpoints and comment endpoints.
Levent Baş	Enhanced and updated the design of remaining layouts of our mobile application. Started learning ReactJS to help frontend team to redesign our entire web application. Worked with Taha and Bera to kick-start the re-design process. Changed web homepage design to its latest version. Changed comment feature design in web. Updated the design of profile, trading equipment and article features in web application. Added new version of our logo and new images to frontend to enhance the design.

Muhammed Bera Kaya	Implemented alert feature.Added creating and deleting alert functionalities, created dropdowns for these and added to "Trading Equipment" page.Implemented "Articles" page where all articles in the system are listed and can be filtered by author,article name and date. Implemented real time notification feature.Created dropdown for notifications and added to the website header. Implemented recommendation feature.Created table for recommended articles and added to the "Articles" page. Created dropdown for recommended users and added to the website header. Implemented the profile editing feature.Implemented text annotation feature with Ege.Created the pop-ups for text annotations and added creating,editing and deleting text annotations functionalities. Implemented portfolio details page where users can see the details of a portfolio (his/hers or another users) and edit or delete his/her own portfolios. Worked with Levent and Taha to change website design to be in harmony with mobile application design.Added profit/loss information to "My Investments" page.Added "comments" feature to "Article Details" page.Changed trading equipment chart to demonstrate daily values.Fixed multiple bugs and did major styling.
Taha Eyup Korkmaz	Implemented the portfolio pages that was left from the second milestone. Create edit portfolio and the portfolios that will be showed in the profile page itself like one person's own portfolios and the following portfolios. Also implemented the homepage with sliders using Levent's designed colors and new logo. It gave the whole site a good look. Also done some bug fixing that was requested from our customer, like showing the correct following trading equipment adding the profile missing stuff etc.

Table 4: Summary of work done by each team member

## 4 Annotation Implementation & W3C Standard Compliance

Our annotation server implementation almost fully complies with the W3C Annotation Protocol specifications. Container retrieval is partially supported. Beside that, all other endpoints are fully implemented according to the standard. Example requests for annotation retrieval, creation, deletion and update are provided below.

Annotation server root address is <https://anno.arkenstone.ml/>. For more information, check our API Document.

### 4.1 Annotation Creation

#### Request:

POST /annotations/ HTTP/1.1  
Content-Type: application/ld+json; profile="http://www.w3.org/ns/anno.jsonld"

```
{  
  "@context": "http://www.w3.org/ns/anno.jsonld",  
  "type": "Annotation",  
  "body": {  
    "annotationText": "spelling mistake",  
    "articleId": "5dfa3d8b5ffcd23ef3b0b5ec",  
    "finishIndex": 158,  
    "h": 0,  
    "startIndex": 142,  
    "type": "Text",  
    "userId": "5dd776b0192f9d13dc38e847",  
    "w": 0,  
    "x": 0,  
    "y": 0  
  },  
  "target": "http://www.example.com/index.htm"  
}
```

#### Response:

HTTP/1.1 201 CREATED  
Content-Type: application/ld+json; profile="http://www.w3.org/ns/anno.jsonld"  
ETag: W/"1eb-QNkfybThWy9yX19rjlmdrfYxMCA"

```
{
    "_id": "5e0d24bc5a85d73739ec5820",
    "@context": "http://www.w3.org/ns/anno.jsonld",
    "type": "Annotation",
    "body": {
        "annotationText": "spelling mistake",
        "articleId": "5dfa3d8b5ffcd23ef3b0b5ec",
        "finishIndex": 158,
        "h": 0,
        "startIndex": 142,
        "type": "Text",
        "userId": "5dd776b0192f9d13dc38e847",
        "w": 0,
        "x": 0,
        "y": 0
    },
    "target": "http://www.example.com/index.htm",
    "created": "2020-01-01T23:01:16.477Z",
    "modified": "2020-01-01T23:01:16.479Z",
    "__v": 0,
    "id": "https://anno.arkenstone.ml/annotations/
      5e0d24bc5a85d73739ec5820"
}
```

## 4.2 Annotation Retrieval

Annotation details can be retrieved by supplying its instance ID.

**Request:**

```
GET /annotations/5e00f61adbb4463d9c543cf HTTP/1.1
Content-Type: application/ld+json; profile="http://www.w3.org/ns/anno.jsonld"
```

**Response:**

HTTP/1.1 200 OK  
Content-Type: application/ld+json; profile="http://www.w3.org/ns/anno.jsonld"  
ETag: W/"1eb-QNkfybThWy9yX19rjlmdrfYxMCA"

```
{  
    "_id": "5e0d23f35a85d73739ec581f",  
    "@context": "http://www.w3.org/ns/anno.jsonld",  
    "type": "Annotation",  
    "body": {  
        "annotationText": "spelling mistake",  
        "articleId": "5dfa3d8b5ffcd23ef3b0b5ec",  
        "finishIndex": 158,  
        "h": 0,  
        "startIndex": 142,  
        "type": "Text",  
        "userId": "5dd776b0192f9d13dc38e847",  
        "w": 0,  
        "x": 0,  
        "y": 0  
    },  
    "target": "http://www.example.com/index.htm",  
    "created": "2020-01-01T22:57:55.343Z",  
    "modified": "2020-01-01T22:57:55.345Z",  
    "__v": 0,  
    "id": "https://anno.arkenstone.ml/annotations/  
          5e0d23f35a85d73739ec581f"  
}
```

### 4.3 Annotation Update

The ETag supplied in the request header 'If-Match' is the one received after creating/updating/retrieving the same annotation before.

#### Request:

POST /annotations/ HTTP/1.1  
Content-Type: application/ld+json; profile="http://www.w3.org/ns/anno.jsonld"

if-Match: W/"20f-S9K93IejDDRpkJZWFBNtt5Q"

```
{  
    "_id": "5e0d23f35a85d73739ec581f",  
    "@context": "http://www.w3.org/ns/anno.jsonld",  
    "type": "Annotation",  
    "body": {  
        "annotationText": "spelling mistake fixed",  
        "articleId": "5dfa3d8b5ffcd23ef3b0b5ec",  
        "finishIndex": 160,  
        "h": 0,  
        "startIndex": 142,  
        "type": "Text",  
        "userId": "5dd776b0192f9d13dc38e847",  
        "w": 0,  
        "x": 0,  
        "y": 0  
    },  
    "target": "http://www.example.com/index.htm",  
    "id": "https://anno.arkenstone.ml/annotations  
/5e0d23f35a85d73739ec581f"  
}
```

**Response:**

HTTP/1.1 200 OK

Content-Type: application/ld+json; profile="http://www.w3.org/ns/anno.jsonld"

ETag: W/"1eb-QNkfzbThWy9yX19rjlmdrfYxMCA"

```
{
    "_id": "5e0d24bc5a85d73739ec5820",
    "@context": "http://www.w3.org/ns/anno.jsonld",
    "type": "Annotation",
    "body": {
        "annotationText": "spelling mistake",
        "articleId": "5dfa3d8b5ffcd23ef3b0b5ec",
        "finishIndex": 158,
        "h": 0,
        "startIndex": 142,
        "type": "Text",
        "userId": "5dd776b0192f9d13dc38e847",
        "w": 0,
        "x": 0,
        "y": 0
    },
    "target": "http://www.example.com/index.htm",
    "created": "2020-01-01T23:01:16.477Z",
    "modified": "2020-01-01T23:01:16.479Z",
    "__v": 0,
    "id": "https://anno.arkenstone.ml/annotations/
      5e0d24bc5a85d73739ec5820"
}
```

#### 4.4 Annotation Deletion

**Request:**

```
DELETE /annotations/ HTTP/1.1
if-Match: W/"20f-S9K93IejDDRpkJZWFBNtt5Q"
```

**Response:**

```
HTTP/1.1 204 NO CONTENT
```

## 5 API Documentation

The domain of our API is [api.dev.arkenstone.ml](http://api.dev.arkenstone.ml).

Latest version of our API documentation prepared using Postman can be found [here](#), and in our repository.

## 6 Requirements

### 6.1 Glossary

- **Application:** The whole project as seen by guests, members and users.
- **Article:** Text written by user about trading equipment.
- **Basic User:** Signed up user who can't perform investments inside the application, can be chosen during sign up.
- **Comment:** A body of text, image or links shared in response to an article.
- **Database:** An organized collection of data.
- **Day's Range:** The range in which a trading equipment traded. For example, a day's range that reads "48.50-51.25" means that the lowest price the trading equipment reached that day was \$48.50/share and the highest price was \$51.25.
- **Event:** Events about economy that occurred and posted inside the application, will have a numeric result.
- **Followed User:** A user who accepted other users following request.
- **Following User:** A user who's following request has been accepted by other user.
- **Guest:** Unregistered person.
- **Moving Average:** A succession of averages derived from successive segments (typically of constant size and overlapping) of a series of values.
- **Profile Page:** A page where user can see information about user and additionally change the information if it's their own profile page.
- **Prediction Rate:** A rate showed on user's profile page, calculated by their past predictions.
- **Previous Close:** What the price of a trading equipment was when the market closed on the previous trading day.

- **Semantic Search:** A prediction system to improve search accuracy by understanding the searcher's intent and the contextual meaning of terms as they appear in the searchable dataspace.
- **Significance Level:** A rating system that describes the importance of an event.
- **System:** The whole project, including design and functionalities.
- **Trading Equipment:** Indices, stocks, ETFs, commodities, currencies, funds, bonds and cryptocurrencies.
- **Trading User:** Signed up user who can make investments inside the application, can be chosen during sign up.
- **User:** Registered basic user or trading user.

## 6.2 Functional Requirements

### 6.2.1 User Requirements

#### 6.2.1.1 Guests

- **5.2.1.1.1** Guests shall be able to search economic events, articles and trading equipment.
- **5.2.1.1.2** Guests shall view the price of trading equipment.
- **5.2.1.1.3** Guests shall read comments about trading equipment.
- **5.2.1.1.4 Registration**
  - **5.2.1.1.4.1** User shall be able to choose between basic user and trading user.
  - **5.2.1.1.4.2** Basic user shall provide name, surname, email and password.
  - **5.2.1.1.4.3** Trading user shall additionally provide IBAN and TC identification number.
  - **5.2.1.1.4.4** User shall provide location with Google Maps.
  - **5.2.1.1.4.5** User shall validate account via e-mail.
  - **5.2.1.1.4.6** Users shall be able to register via their Google accounts.

#### 6.2.1.2 Registered Users

#### **6.2.1.2.1 Login**

- **5.2.1.2.1.1** User shall login via email and password provided upon registration.
- **5.2.1.2.1.2** User shall login via Google account.
- **5.2.1.2.1.3** User shall be able to reset password if they forget it, by clicking "Forget password?" button. An email containing the link for resetting password is sent. User resets its password by using the link that can be used only once.
- **5.2.1.2.1.4** Users shall be able to logout.

#### **6.2.1.2.2 User Follow System**

- **5.2.1.2.2.1** User shall be able to follow other users.
- **5.2.1.2.2.2** User shall be able to send following request to other users who have private profile.
- **5.2.1.2.2.3** Users shall be able to accept or reject following requests.
- **5.2.1.2.2.4** User shall be able to be followed by another user upon accepting their follow request.

#### **6.2.1.2.3 Trading Equipment**

- **5.2.1.2.3.1** User shall be able to follow trading equipment.
- **5.2.1.2.3.2** User shall be able to set alerts for certain levels and certain percentage change of trading equipment.
- **5.2.1.2.3.3** User shall be able to comment on trading equipment.
- **5.2.1.2.3.4** Trading user shall be able to invest in trading equipment.
- **5.2.1.2.3.5** User shall be able to make prediction on trading equipment details page.

#### **6.2.1.2.4 Profile**

- **5.2.1.2.4.1** User shall have a profile page.
- **5.2.1.2.4.2** Profile page shall have the general prediction rate of the user.
- **5.2.1.2.4.3** User shall be able to choose to be public user or private user.
- **5.2.1.2.4.4** Private users profile page content other than prediction rate shall be seen only by following users.

- **5.2.1.2.4.5** Public users profile page content including name, surname, location, articles and portfolios shall be able to be seen by all other users.
- **5.2.1.2.4.6** Users shall see and edit their personal information including name, surname, location, IBAN, TC identification number and password in profile page.
- **5.2.1.2.4.7** Users shall view their old actions including portfolios and articles on their profile page.
- **5.2.1.2.4.8** Users shall be able to reach their own followers and followings list in their profile page.

#### **6.2.1.2.5 Articles**

- **5.2.1.2.5.1** User shall be able to share ideas only in text based about trading equipment as articles.
- **5.2.1.2.5.2** User shall be able to comment on articles.
- **5.2.1.2.5.3** User shall be able to rate articles, from 1(worst) to 5(best).

#### **6.2.1.2.6 Portfolio**

- **5.2.1.2.6.1** User shall have at least one portfolio.
- **5.2.1.2.6.2** User shall be able to have different portfolios.
- **5.2.1.2.6.3** User shall be able to rename portfolio.
- **5.2.1.2.6.4** Users shall be able to add trading equipment to portfolio.
- **5.2.1.2.6.5** Users shall be able to remove trading equipment from portfolio.
- **5.2.1.2.6.6** User shall be able to share portfolio in profile page.
- **5.2.1.2.6.7** Other users shall be able to follow other public user's portfolio.
- **5.2.1.2.6.8** Users shall be able to create their portfolios.
- **5.2.1.2.6.9** Users shall be able to delete their portfolios.

#### **6.2.1.2.7 My Investments Page**

- **5.2.1.2.7.1** Trading users shall have "My Investments" page.
- **5.2.1.2.7.2** Trading users shall be able to invest on trading equipment in "My Investments" page.
- **5.2.1.2.7.3** Trading users shall be able to create a buy order for a trading equipment for a specified rate in "My Investments" page.
- **5.2.1.2.7.4** Trading users shall be able to set stop/loss limits on trading equipment in "My Investments".

#### **6.2.1.2.8 Profit/Loss Section**

- **5.2.1.2.8.1** Users shall have a profit/loss section.
- **5.2.1.2.8.2** Profit/loss section shall be private to each user.
- **5.2.1.2.8.3** User shall be able to see profit/loss in terms of currency chosen by user.
- **5.2.1.2.8.4** Users shall be able to manually enter investments to see calculated profit/loss.
- **5.2.1.2.8.5** Profit/loss section should include investments made in the platform by a trading user when calculating profit/loss.

#### **6.2.1.2.9 Events**

- **5.2.1.2.9.1** Users shall be able to see events fetched from third parties.
- **5.2.1.2.9.2** Users shall be able to comment on events.
- **5.2.1.2.9.3** Users shall be able to filter events by its currency, significance level.
- **5.2.1.2.9.4** Users shall be able to set an alarm to a specific event

### **6.2.2 System Requirements**

#### **6.2.2.1 Trading Equipment**

- **5.2.2.1.1** System shall provide following functionalities for a trading equipment:
  - **5.2.2.1.1.1** Previous close
  - **5.2.2.1.1.2** Percentage change compared to the previous close
  - **5.2.2.1.1.3** Amount change compared to the previous close
  - **5.2.2.1.1.4** Day's range
  - **5.2.2.1.1.5** Moving averages

#### **6.2.2.2 Recommendation & Notification**

- **5.2.2.2.1** System shall recommend users, portfolios, articles and trading equipment to users based on their history of search, trading equipment interactions and follows in the system.
- **5.2.2.2.2** System shall provide a notification mechanism which lets traders to get notified (or alerted) about certain levels of trading equipment.

- **5.2.2.2.3** System shall provide a notification settings interface that lets traders set their notifications about certain levels of trading equipment and success of their buy/sell orders.
- **5.2.2.2.4** System shall notify trading users according to a transaction that is made because of the stop/loss limit.

#### **6.2.2.3 Search**

- **5.2.2.3.1** System shall provide searching for users, trading equipment, articles, and economic events.
- **5.2.2.3.2** System shall support semantic search.
- **5.2.2.3.3** System shall sort events in search results by their significance level.
- **5.2.2.3.4** System shall also sort users according to their general prediction success rate.

#### **6.2.2.4 Events**

- **5.2.2.4.1** System shall have events page which contains economic events.
- **5.2.2.4.2** System shall be able to provide different significance levels for events. The assignment of significance levels might be done by an external API.
- **5.2.2.4.3** Events shall have numerical results.

#### **6.2.2.5 User Authentication**

- **5.2.2.5.1** An email verification link shall be sent to the users' email address for verification. After clicking the link, users' email address shall be verified.

### **6.3 Nonfunctional Requirements**

#### **6.3.1 Security and Reliability**

- **5.3.1.1** User data shall be processed according to 'Law on the Protection of Personal Data (KVKK)'.
- **5.3.1.2** User's password shall be stored with encryption in the database.
- **5.3.1.3** User shall get notification emails when changing their password.
- **5.3.1.4** Weekly backups of every table in the database shall be taken in order to ensure data is safe and sound.

- **5.3.1.5** In case of server failure or any other need, the system shall be restored with the latest backup. Also, the data of the financial transactions that occurred after the time that backup is taken shall be recollected from the financial institutions involved.

#### 6.3.2 Performance

- **5.3.2.1** The system should be able to respond to requests within 3 seconds.
- **5.3.2.2** At least 150 requests per second should be responded.
- **5.3.2.3** The system shall be able to serve at least 100000 members.

#### 6.3.3 Availability

- **5.3.3.1** The system shall be accessible on both native Android and web platforms, including Google Chrome v60, Mozilla Firefox v57 and Microsoft Edge v18.
- **5.3.3.2** The system shall support English language.
- **5.3.3.3** The system should be available 99% of the time.
- **5.3.3.4** In the case of failure, the system should recover in at most 30 minutes.
- **5.3.3.5** The system shall support Turkish characters.

#### 6.3.4 Annotations

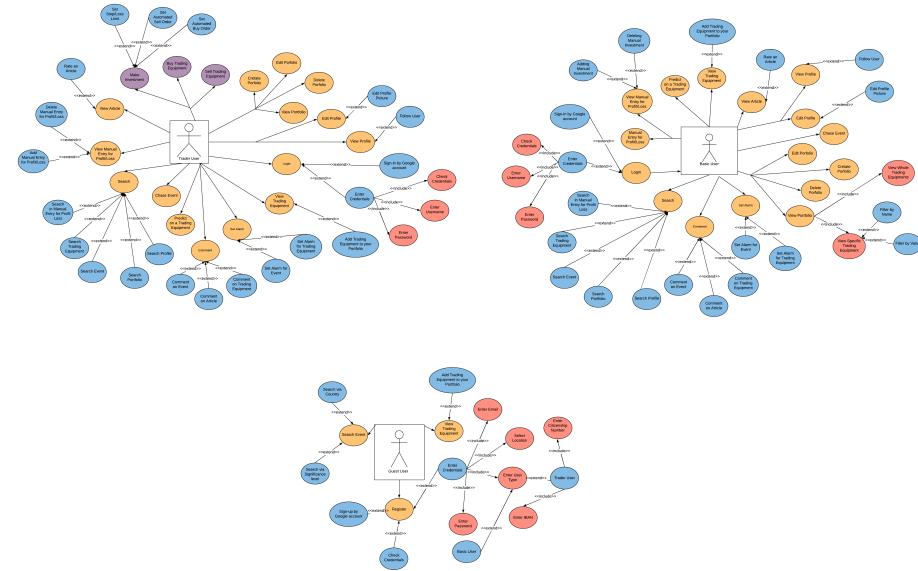
- **5.3.4.1** The annotations shall be designed according to W3C web annotation data model.
- **5.3.4.2** The annotations shall be tested by the test team to ensure that they work correctly.

#### 6.3.5 Database

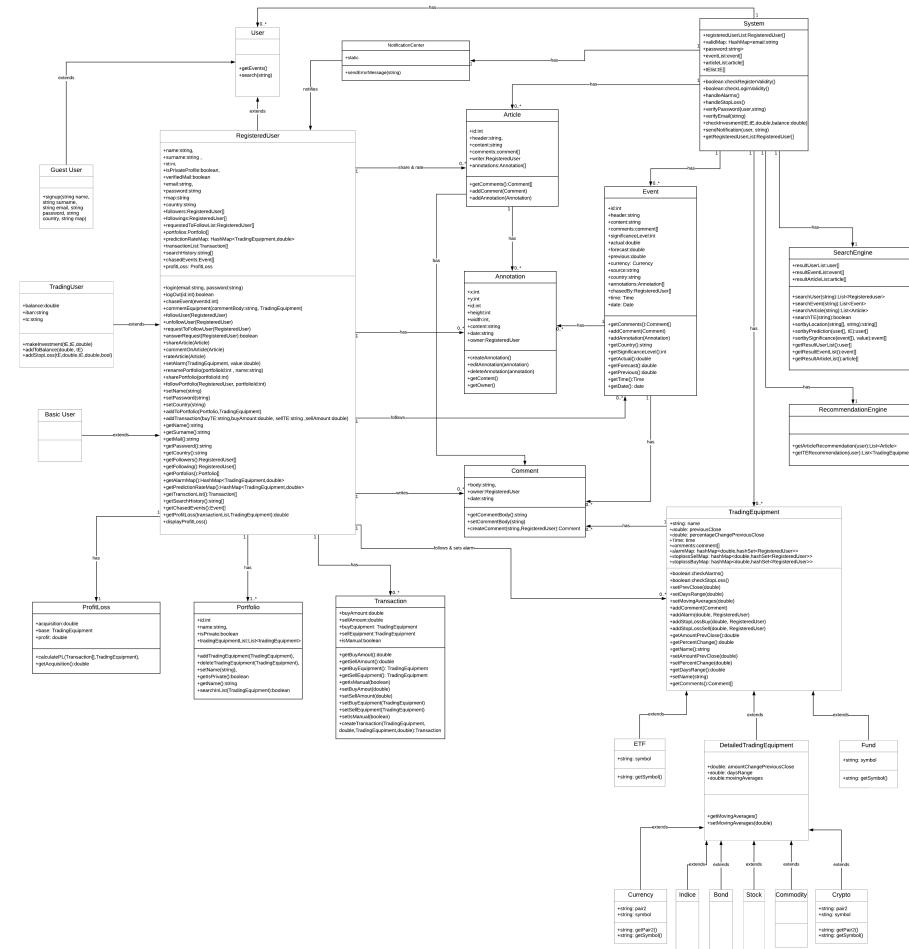
- **5.3.5.1** User data shall be held in a secure database.
- **5.3.5.2** Database hierarchy shall be well-constructed so that it shall be efficient and protect the user's privacy.
- **5.3.5.3** All changes shall be logged in a database.

## 7 Design Documents

### 7.1 Use Case Diagram

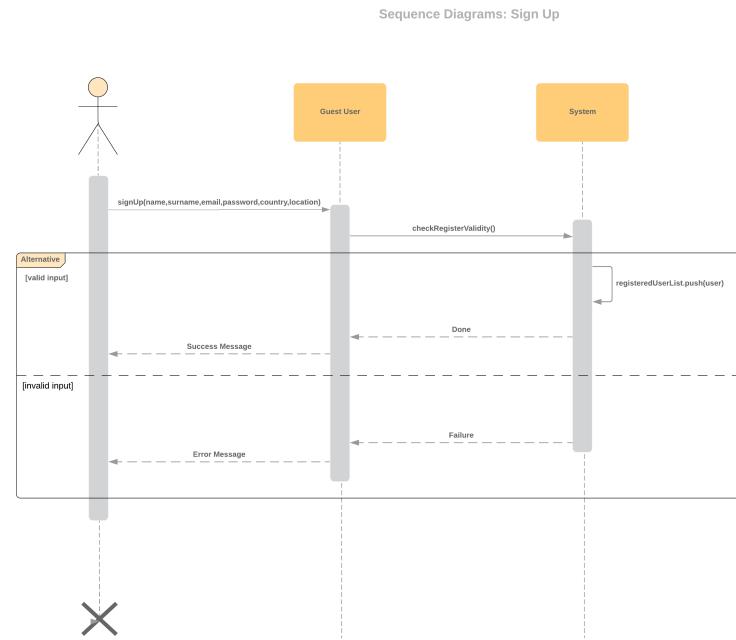


## 7.2 Class Diagram



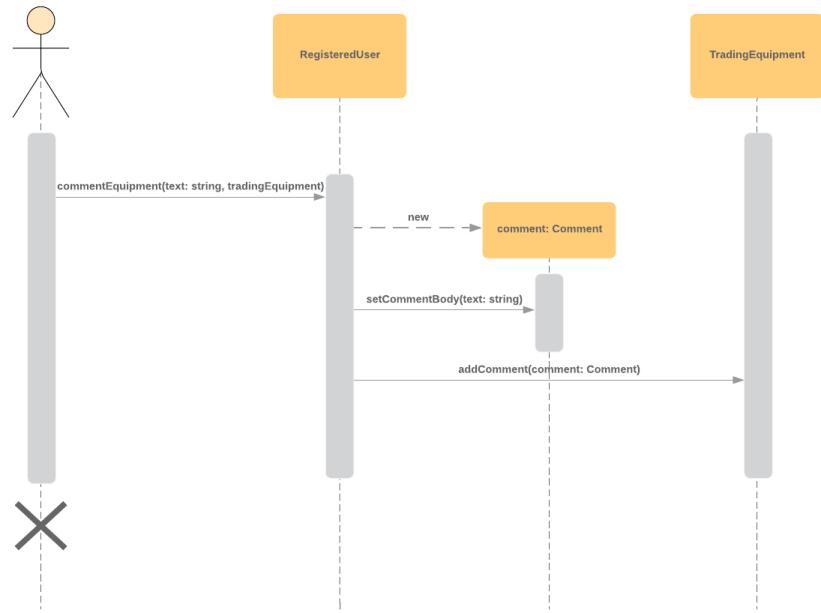
### 7.3 Sequence Diagrams

- Signup

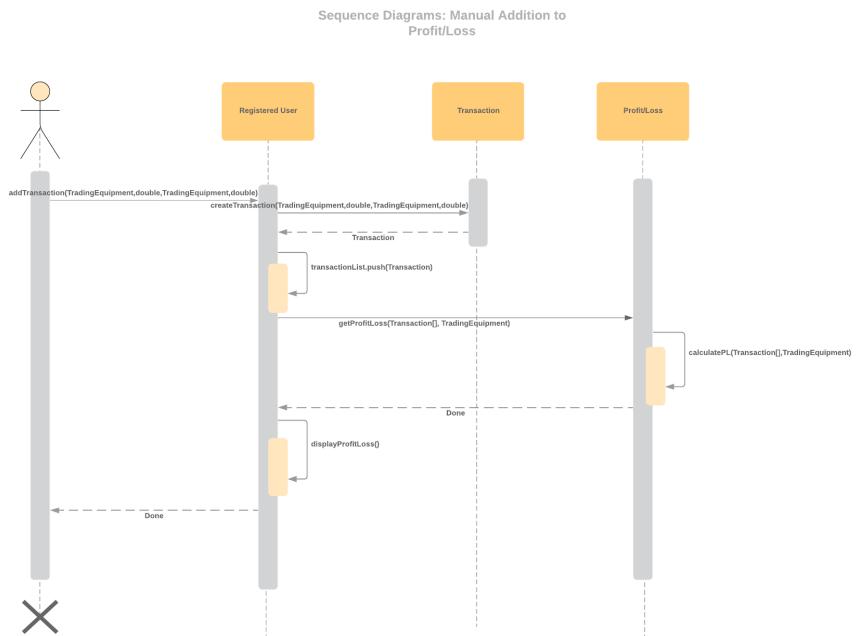


- Comment on a trading equipment

Sequence Diagrams: Comment on Trading Equipment

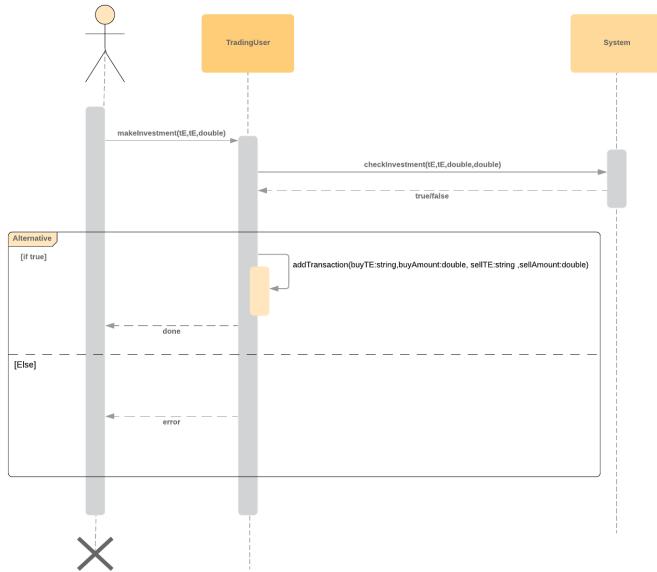


- Manual addition to profit/loss

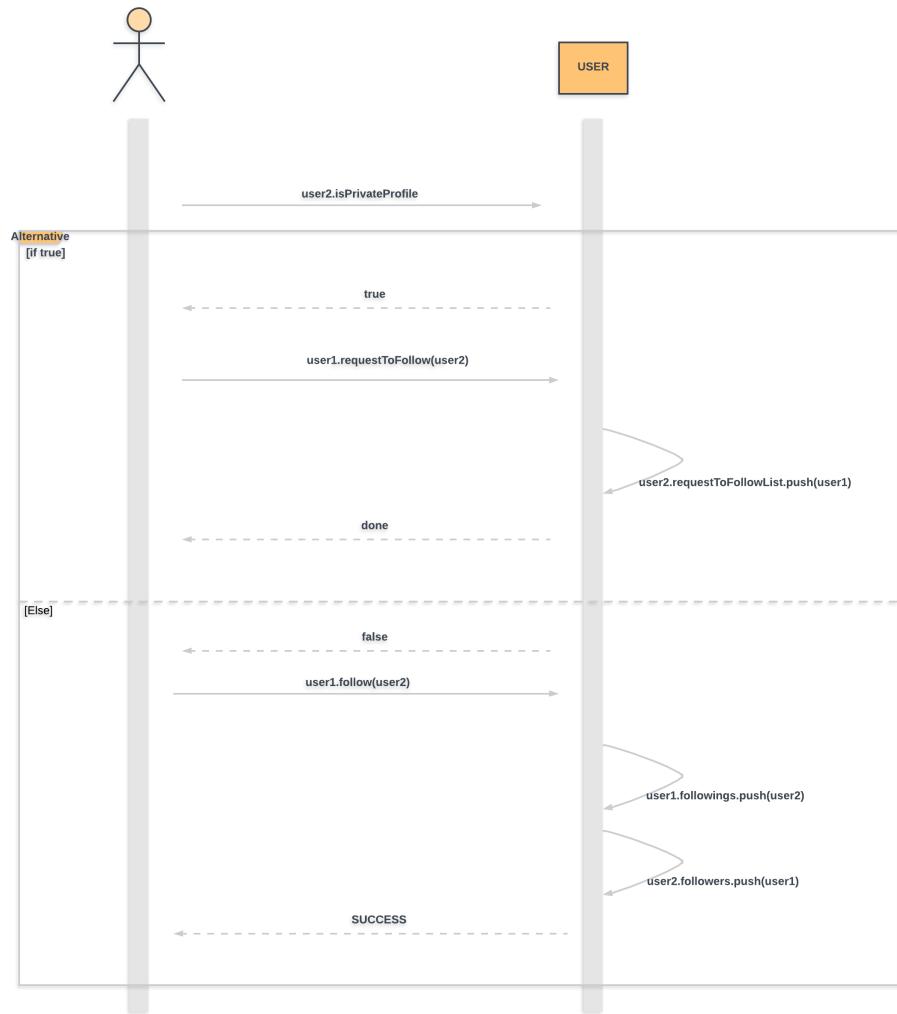


- Add stop/loss

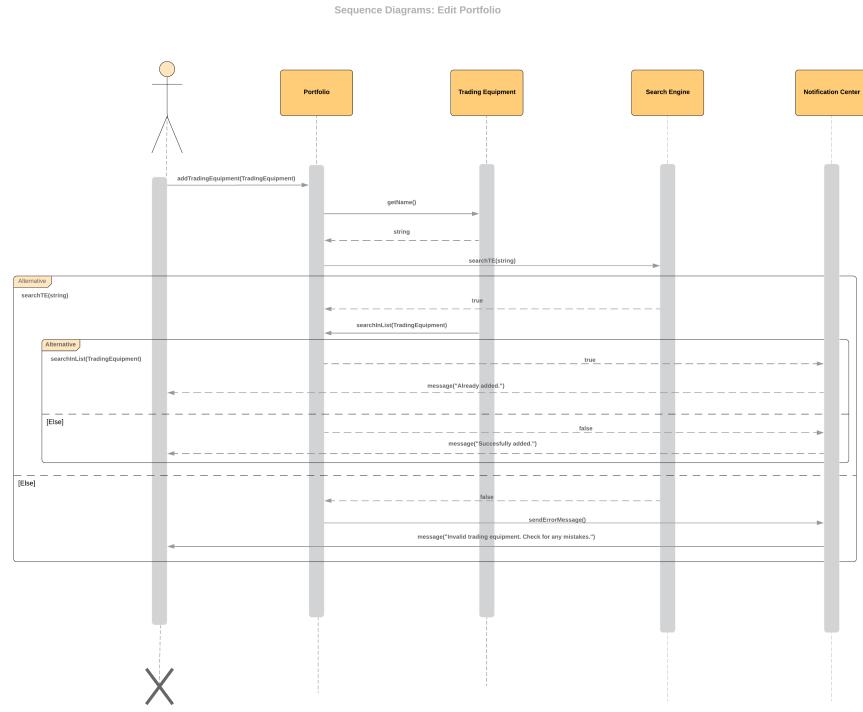
Sequence Diagrams: Make Investment



- Follow other users

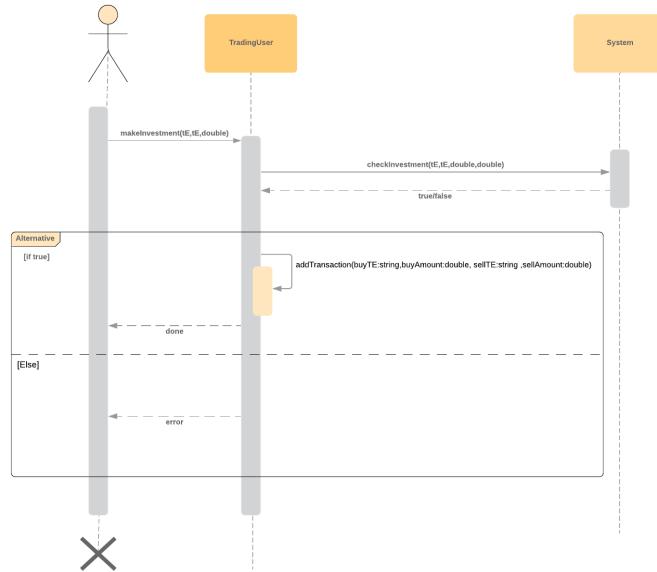


- Edit portfolio

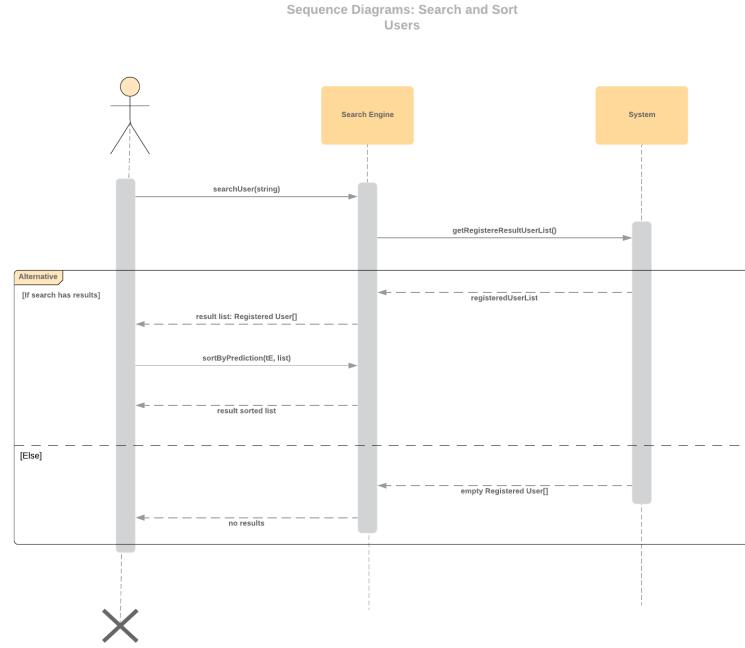


- Make investment

Sequence Diagrams: Make Investment



- Search and sort users

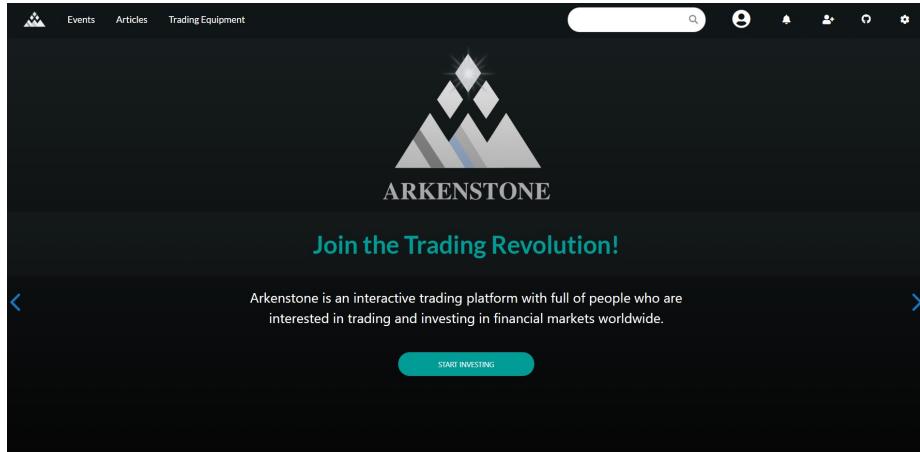


## 8 User Manual

### 8.1 Frontend

#### Homepage

Here's our homepage of our web page. You can see a brief explanation of what you can do in Arkenstone. If you haven't logged in, you'll be redirected to sign up page if you're logged in you'll be directed to trading equipments page.



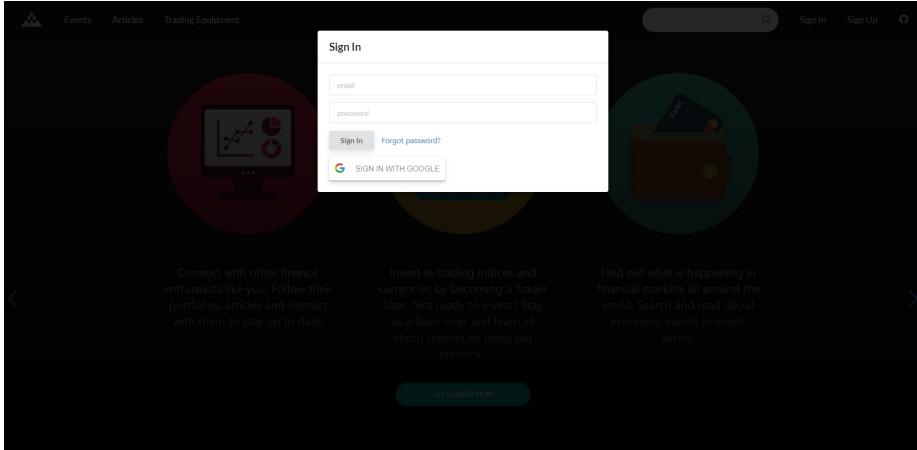
### Sign Up

This is the sign up page. You can register here as a Normal User or a Trader User with additional TCKN number and your IBAN. You can select your location from the map. A user can also make their profile public or private due to their interest of use. If user's passwords are matching to our criterias and email is an actual email; we'll send a verification email to verify the account. User can also choose to just visit the site without signing in.

The sign up form is divided into two main sections. The left section is titled "Sign Up Right Now!" and contains fields for Name (name and surname), Email (email), Password (password and confirm password), and Location (a map of Istanbul with a red marker indicating the user's location). The right section is titled "Join today and get rich!" and lists benefits such as "Sign up easily!", "Become a basic user and follow the leading minds in the area!", "Become a trader and start getting into it.", and "See what others think, do and suggest!". Below these sections is a promotional message: "Arkenstone. It's time for you to find your gem!"

### Login

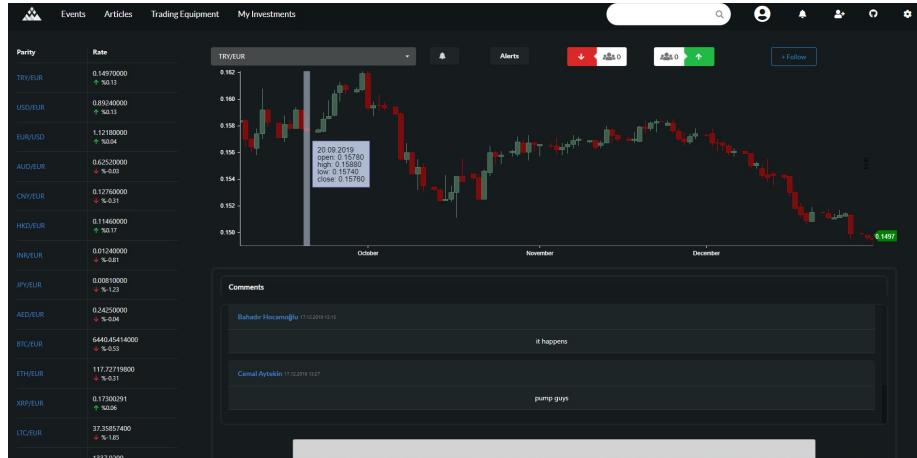
This is where a user logs into the trading world. If user's input of email and password's matches to our database they'll be able login.



### User Profile

After logging in, user can view their profile and do a bunch of things here. User can create new articles, portfolios. User can edit their profile and also accept or reject their follow requests if it's a private account. User can also view the portfolios and the trading equipments that they are following. The followers and the followed people are also shown so user can socialize with them by checking out their profiles.

### Trading Equipment



This is the trading equipments page where all kinds of users including the guests can enter and see the general outlook of the trading equipments. Our base currency is EUR but only for EUR itself we check for the EUR/USD graph. Other than that we also have the crypto-currencies like Ethereum and Bitcoin and some tech company stocks like Apple, Microsoft and Amazon etc. Logged in user can follow these trading equipments and set alarms for certain levels. Also they can do prediction up or down while also being able to see how many users made which prediction. Predictions are checked after 24 hours if it was correct or not and the prediction rates of the users can be viewed at their profile. Logged users also can make and view comments about the trading equipment.

### Articles

This is the articles page, everyone can see all the articles unless it was written by a private user. Logged in users can see the recommended articles as well. If they want to read one they can enter the article page and see the whole article with the annotations that made from the other users as well as the rating of the article. Logged in users can rate the article and comment on it and add more annotations too.

Article	All	Author	All	Date	T	Rating
Most Innovative Companies: Microsoft	Thomas Mac	24.12.2019 17:00	5	ab:1		
Alphabet: To Protect And Grow Your Capital	Giuseppe Montemurro	24.12.2019 15:09	3	ab:1		
HOW TO INVEST IN LITECOIN (AND SHOULD YOU DO IT)	Albert Costa Ruiz	24.12.2019 14:45	4.5	ab:2		
Litecoin is the new Bitcoin	Albert Costa Ruiz	24.12.2019 14:43	3.8	ab:1		
Facebook Is Hiring On All Cylinders And Is A Conviction Buy	Albert Costa Ruiz	24.12.2019 14:42	3.8	ab:4		
Facebook's Total Yield From Its Buyback Program Will Push Its Stock Higher	Albert Costa Ruiz	24.12.2019 14:41	4.6	ab:5		
Use Indicators into a Great Trading Strategy	Hans Muller	24.12.2019 14:24	4.5	ab:2		
Italian Politics Soon To Weigh On The EUR	Danilo Medici	23.12.2019 22:55	3.8	ab:4		
JPY: Why the yen's at a crossroads	Yoshiko Akemi	23.12.2019 22:15	3.5	ab:3		
How I got into the crypto world	Bahadir Hocamoğlu	19.12.2019 18:09	3	ab:3		

### Annotation

On the articles page, logged in users can create annotations for the article's text or the photo itself. Everyone can see the annotations and the user who created it too.

The screenshot shows a detailed view of an article about Microsoft. On the left, there's a circular profile picture of Thomas Mac, the author, with a blue background and a white icon. Below it, his name, the date (12/24/2019, 17:00), and a rating of 5.0/4.4 are displayed. On the right, the main content area features a chart with red annotations. A tooltip shows two annotations: "Current CEO Albert Costa Ruiz in 24.12.2019 17:05" and "Indian Cloud architect Albert Costa Ruiz in 24.12.2019 17:05". Below the chart, a text block reads: "Under CEO Satya Nadella, who succeeded Steve Ballmer in February 2014, Microsoft has re-engaged itself in multiple ways to ensure that decades-old cash cows such as Windows and Office are part of technology's future rather than legacies of a more PC-centric past. The company has invested in AI, championed bots as a new computing paradigm, and developed ambitious apps for platforms such as iOS and Android rather than trying to weaken the competition by tying its core assets directly to Windows." At the bottom, there's a "Comments" section with a message: "No comments yet".

### Investment

The screenshot shows the 'My Investments' section of a trading platform. At the top left, it displays the 'Current Balance' as €114.67, with a green button labeled 'Edit Profile & Deposit'. To the right, a 'My Assets' summary shows holdings in various currencies and tokens. Below this, an 'Invest' section allows users to 'SELL' or 'BUY' ETH, with a form to enter an amount and a 'BUY NOW for 117.72€' button. A 'Orders' section indicates 'No current order.' On the right, an 'Action History' log tracks recent deposits and purchases, such as '1 ETH bought' and '1 EUR deposited to account'.

This is the my investment page. This page is only available for trader users. In this page you can see your balance such that the amount of the assets you are holding and the profit you gain from previous investment. In addition, you can see your action history of deposit and Buy/sell. At top left (under the total profit) there is a deposit button which is used for deposit EUR to your account. In this version only EUR deposit is available. In the middle there is a Invest box for you to invest in a particular trading equipment or to give buy/sell order. You can enter the amount and select buy or sell and click buy now for instant investment. Also you can select above or below and enter a comparison value so that you can give buy/sell order.

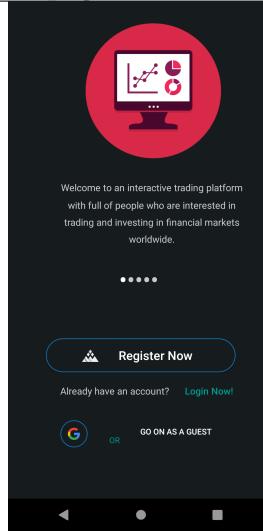
#### Notification

Logged in users can also see the notifications from the header as well. They'll be notified when there's a new follower or a following request, when their alerts are triggered or when their predictions are resulted.

The screenshot shows the user profile page for 'Levent Baş'. It includes a bio section with a prediction rate of 9/12, a 'Private Profile' button, and a 'Trading User' badge. Below this is a 'Pending Requests' section with a pending follow request from 'Baturalp yoruk'. The main area features an article titled 'BIST 100 Hareketleri Borsaya Bomba Gibi Düşebilir' with a vote count of 30 by 1 voter. On the right, a sidebar displays a list of notifications: 'Your prediction is false for TRY.', 'Juho Toro wants to follow you.', 'Emre Demircioğlu wants to follow you.', 'bera kaya wants to follow you.', 'Baturalp yoruk wants to follow you.', and 'Cemal Aytetkin wants to follow you.'. At the bottom, a 'Crypto Currencies' section lists held cryptocurrencies.

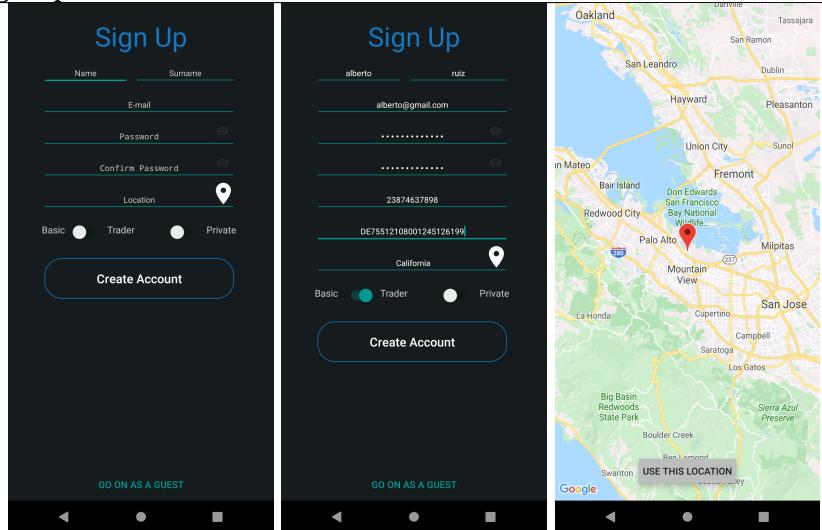
## 8.2 Android

### Homepage



This is the homepage of our application. You can get some information about our app by using the sliding images. If you wish to create an account, you can click on "Register Now" button. If you already have an account, you can click on "Login Now!" link. You can use your Google Account for signing in. You can still use our app with limited functionalities without an account by clicking "Go on as a Guest" button.

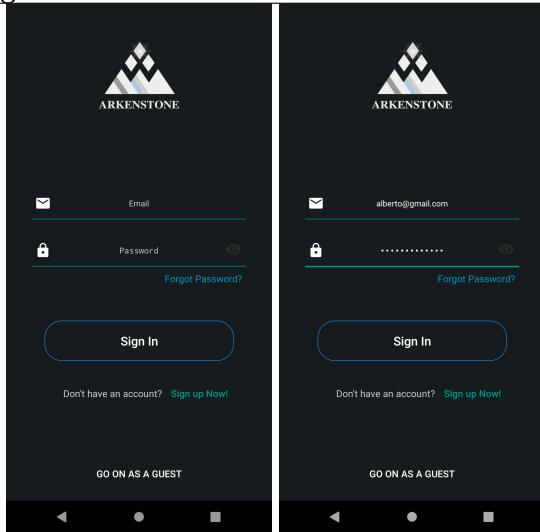
### Sign up



You can register by using this page. After filling the necessary information, you can create your account. You can check your password by pressing the eye

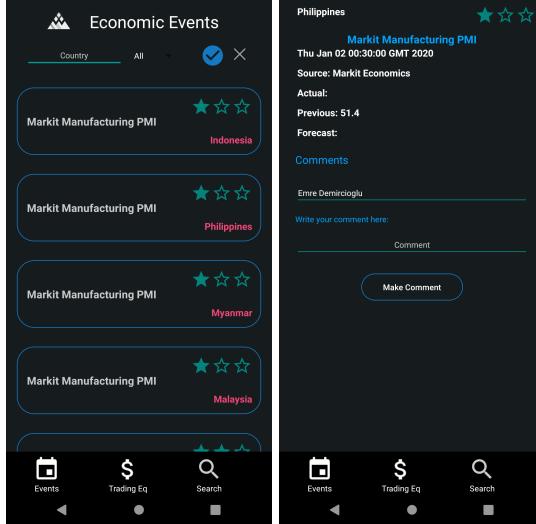
icon. You can use Google Maps in order to add your location. But you can choose to write manually. You can choose to become trader or basic user. If you choose trader, you should also write your id and IBAN number. You can make your account private if you don't want everyone to see your actions such as portfolios, articles etc. Each answer is checked before registering, please don't give incorrect information. In order to complete the registering process, you should click on the link that was sent to your mail address.

### Log in



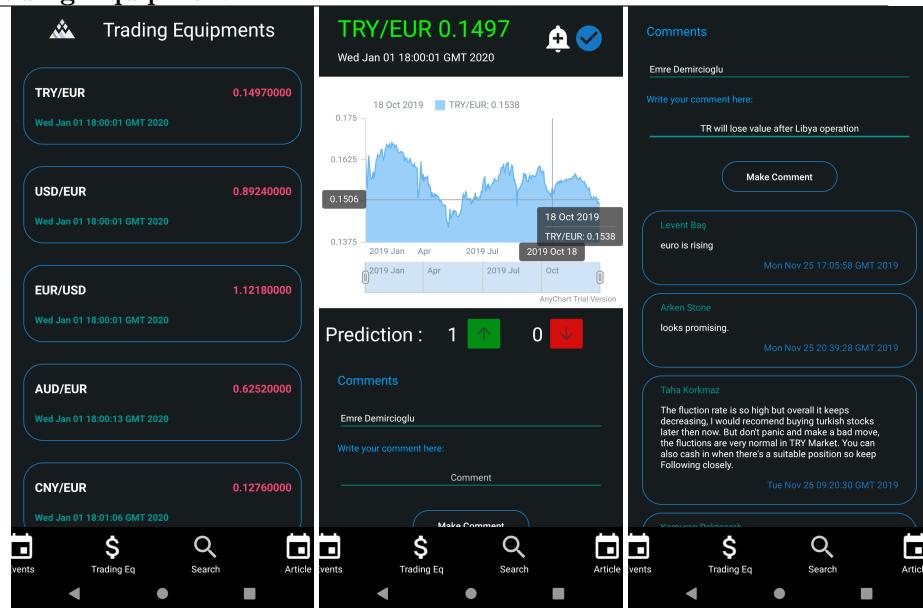
You can log in by using this page. If the registration process is completed and your email and password matches, you can log in. If you forget your password, you can reset your password by clicking on "Forgot Password" text.

### Events



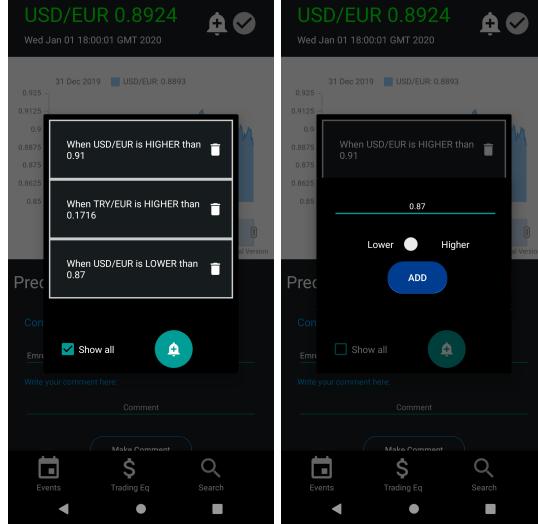
If you sign in or choose to go on as a guest, events page is the first page you will see. Using the menu below the page, you can go to trading equipment page, search, article, profile and portfolio page. Each event has a country and an importance level. Using the header at the top, you can filter the events by their country or importance level. The filter is applied with blue check icon and cancelled with cross icon. If you click on any event, you can see the details of that specific event. Also, you can make a comment if you are interested. If you don't like your comment, you can click on delete icon at the right of your comment.

## Trading Equipment



If you click on "Trading Eq" button at the menu, you will see a list of trading equipment. Each trading equipment is shown as a parity and has a value which was acquired at a specific time. If you click any parity, you can see the details of that trading equipment. You can see the value of that parity at the top of the detail page. If the value has increased based on the last acquired value, the text is green, otherwise red. You can create an alert if you want to get notifications if this parity hits a specific value by clicking bell icon. You can follow that trading equipment by clicking blue check icon. You can see the trends of the parity and change the intervals of the graph. You can make prediction (up if you think the value will increase or down otherwise). Also, you can make a comment if you are interested. If you don't like your comment, you can click on delete icon at the right of your comment.

## Alarm



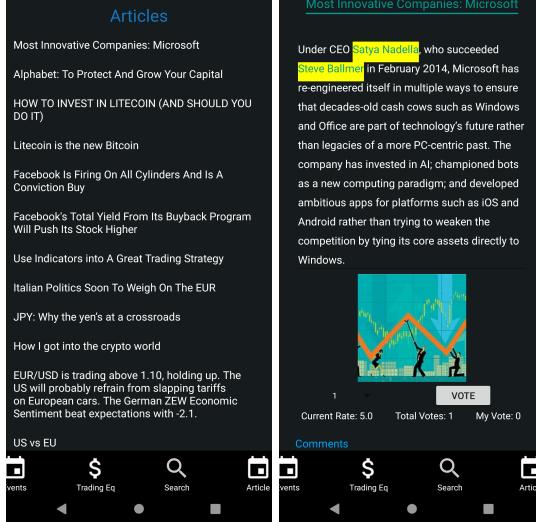
If you want to set an alarm to a trading equipment, you can click on bell icon. This will bring you the alarms that were set before. If you wish to add a new alert. You can write the amount and set higher or lower flag. If you want to set an alarm which was already correct, this will give an error. If you want to delete an alert, you can click on delete icon at the right of the alert. You can see all of your alerts by clicking "Show all" checkbox.

## Search



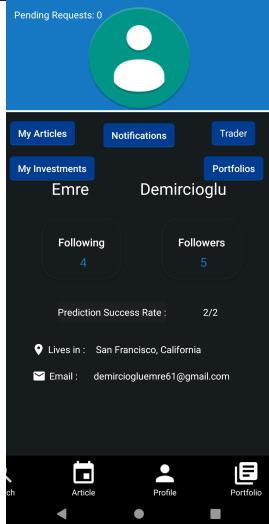
If you click on search icon at the menu, a searchbar with 4 tabs will appear. You can search for users, articles, trading equipment or events. You can select the category by selecting the tab or by sliding the screen. You can click on any row and this will show you the details.

## Article



If you click on article icon at the menu, a page with list of articles will appear. If you select any of them, you can read an article about economics. You can make image or text annotations. You can vote for that article and see the average of these votes. Also, you can make a comment if you are interested. If you don't like your comment, you can click on delete icon at the right of your comment.

## User Profile



If you click on profile icon at the menu, this page will show. You can see your portfolios, articles, notifications, investments and pending requests. If you are a private user and somebody wants to follow you, you have a follow request and in order to accept or reject it, you can click the "Pending requests" text at the top of the page. You can see the list of users that are followed by you or

following you by clicking those texts. You can see your email and location at the bottom of the page. If you are a private user, these information will not be seen by any user that doesn't follow you. You can also see the prediction rate. If you are a guest user, you cannot see profile icon in the menu.

### Investment

**My Investments**

**Balance**  
Total Profit: -0.0470000000000015 EUR  
EUR: 1232.7045  
TRY: 15.0

**Transactions**

- 780 EUR deposited to account.  
At Wed Jan 01 19:14:37 GMT 2020
- 10 TRY sold.  
When TRY/EUR was 0.1497  
At Wed Jan 01 19:14:16 GMT 2020  
Profit: 0.0020
- 25 TRY bought.  
When TRY/EUR was 0.1517  
At Tue Dec 24 11:10:57 GMT 2019  
Profit: -0.0450
- 1235 EUR deposited to account.  
At Tue Dec 24 11:10:24 GMT 2019

**Orders**  
buy 25.0 AUD when AUD/EUR is higher than 0.7

**My Investments**

**Balance**  
Total Profit: -0.0499999999999982 EUR  
EUR: 1232.7045  
TRY: 15.0

**Transactions**

- 10 TRY sold.  
When TRY/EUR was 0.1497  
At Wed Jan 01 19:14:16 GMT 2020  
Profit: 0.0000
- 25 TRY bought.  
At Amount: 780  
At IBAN: DE44500105175407324  
931

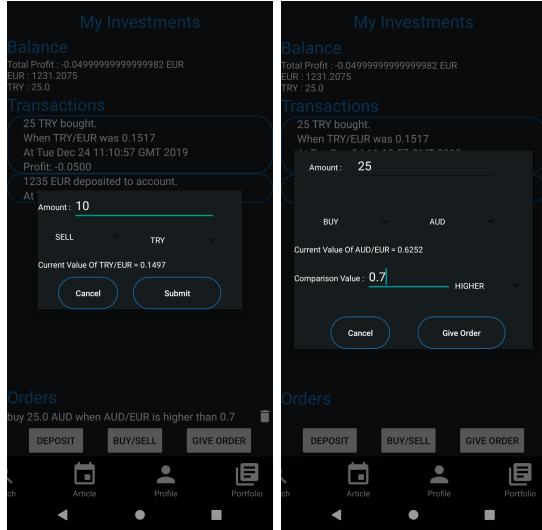
**Orders**  
buy 25.0 AUD when AUD/EUR is higher than 0.7

**DEPOSIT BUY/SELL GIVE ORDER**

**DEPOSIT BUY/SELL GIVE ORDER**

If you click on my investment button on profile, this page on the left will show. You can see your balance, old transactions and buy/sell order that you created. This page is available only "Trader" users. If you click container icon at the right of a particular order, that order will be removed.

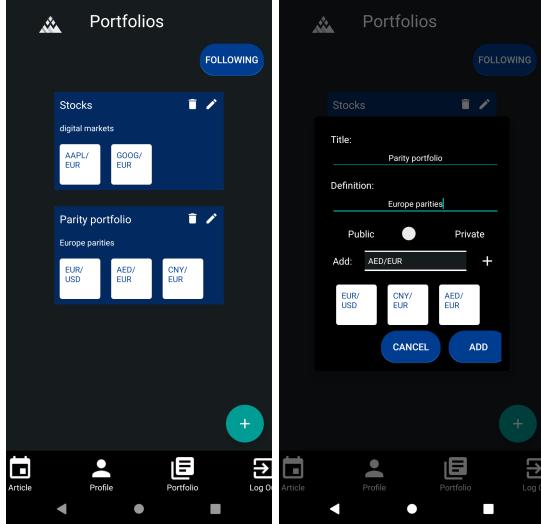
If you click on deposit button on my investment page, this dialog on the right will appear. You can enter amount and iban number to deposit EUR to your account. In this version only EUR deposit is available. The IBAN number you gave while register to our system will be appear as default value for deposit. You can cancel deposit dialog via clicking cancel button.



If you click on BUY/SELL button on my investment page, this dialog on the left will appear. You can enter amount and select a trading equipment to buy or sell. In this version if you sell a trading equipment its EUR equivalent will be added to your balance or buy a trading equipment its EUR equivalent must be available on your balance. Current value of trading equipment/EUR parity will be seen when you select a trading equipment. You can cancel BUY/SELL dialog via clicking cancel button.

If you click on "Give Order" button on my investment page, this dialog on the right will appear. You can enter amount , select buy or sell option for order, comparison value and comparison type higher or lower. When you select all options a order definition will appear at the bottom. You can submit your order via clicking add button. You can cancel "give order" dialog via clicking cancel button.

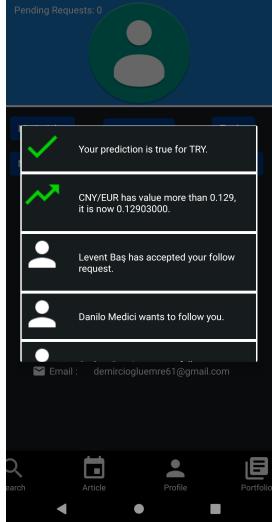
## Portfolio



You can see your portfolios by clicking on portfolio icon on menu or via your profile page. You can create a new portfolio by clicking the add button at the right bottom of the page. A dialog appears for creating a portfolio. You can choose the name of the portfolio and the description. You can make your portfolio public or private. Private portfolios can only be seen by you. Public ones can be seen by the ones who can see your profile details. You can add a trading equipment by selecting from the dropdown and clicking add icon. If you already have that parity in your portfolio, this will give an error. If you want to delete a trading equipment from your list, you can click on that item. You can create that portfolio by clicking "Add" button.

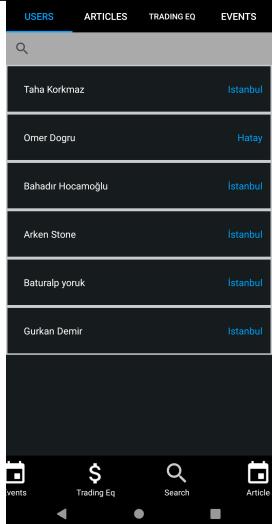
You can delete your portfolios by clicking delete icon. You can update your portfolios by clicking edit icon ant the top of the portfolio. You can see your following portfolios by clicking "Following" button. You can follow a portfolio by clicking portfolios from another user's profile. If you want to follow a portfolio, you can click on the star icon at the bottom of each portfolio. Then you can see them in your following portfolios page. By tapping one more time at the star, you unfollow the portfolio.

## Notification



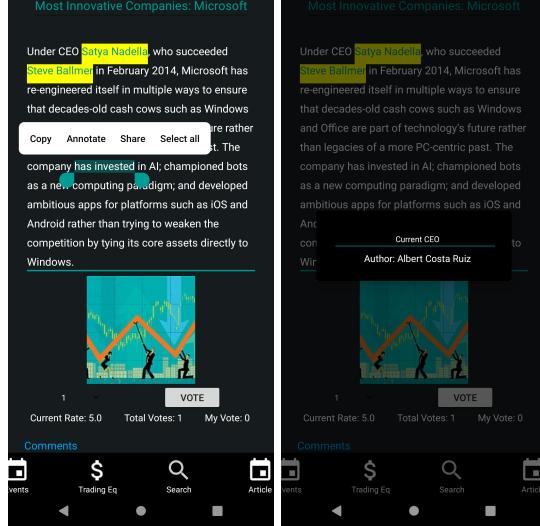
You can see your notifications by going your own profile page and then by clicking on the notifications button. Here you will see your notifications with some icons specific to that notification. If you have made a wrong prediction, you will see a red cross at that notification row, you will see a blank-user icon if a user wants follow you etc.

## Recommendation

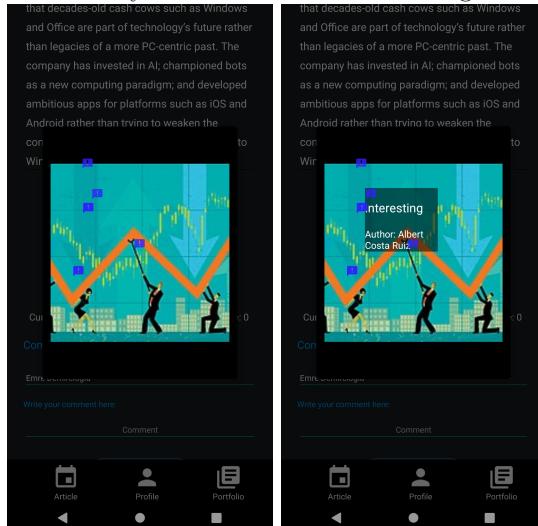


You can see your recommendations at the search page. When you have not typed anything to search bar, you can see some articles and users recommended to you. The users that are recommended to you whether have a high prediction rate or living in the same country. Also, the articles that are recommended to you are the top rated ones.

## Annotation



You can select text on the article by pressing long. When you select the text menu will appear which is on the left picture. The default actions provided varies according to your phone but annotate button will appear particularly on our app. After clicking annotate button a dialog will appear and in this dialog you can only either enter text and click submit button to annotate the selected words or click somewhere else on the page and close the dialog. If you click yellow highlighted text on the article an annotation dialog will appear which you can see on the right. In this dialog you can see the annotation text and its author. If you want to cancel the dialog clicking somewhere else is enough.



By pressing the image of the article, a menu with two items appear. You can add an annotation by selecting the first item of menu. You can drag your finger in

order to change the height and width of the annotation. You can write your text if you click the center of that rectangle. If you want to cancel the annotation, you can click delete icon and rectangle will disappear and you can start again. If you click the checkbox, a dialog will appear asking whether you want to add your annotation or not. After creating your annotation, you can see it by going back and pressing the image again.

If you select "See annotations" item, you can see the blue icons on the image. By clicking on them, you can see the width, height, author and the text of these annotations. If you are the writer of an annotation, you can change the text by clicking on it and in order to update your annotation, you need to click on checkbox.

## 9 System Manual

In order to successfully run the system locally, database should be started before running others. Our web application depends on the API and annotation server, so these two should be started before running web application as well. Android app cannot access the local environment, so we made it use our live API and annotation servers.

Some very useful one-liner commands to run database, API, annotation server and the web application are provided below. These assume the local machine already has the required dependencies; namely Docker, Docker-Compose, npm, NodeJs. Each of these commands should be run at the root directory of the delivery package, in separate terminals and in given order.

- Start database: `docker-compose up -d`
- Start annotation server: `cd app/annotation-server/ && npm install && npm start`
- Start API server: `cd app/backend/ && npm install && npm run dev`
- Start web application: `cd app/frontend && npm install && npm start`

### 9.1 Backend

- Run `npm install` in `/app/backend` directory to install dependencies.
- Development server can be started with `npm run dev`. It runs on **localhost, port 8080**.
- The API should be provided with a secrets.js file for it to run properly. One sample file is added to the files submitted.

Parameters

- dbCredentials: To authenticate as a user, you must provide a user-name, password, and the authentication database associated with that user.
- sessionSecret: A session secret in connect is simply used to compute the hash. Without the string, access to the session would essentially be "denied".
- tradingEquipmentKey: To fetch trading equipment values from a 3rd party api "Alpha Vantage"
- sendgridAPIKey
- senderEmail
- alphaKey
- currencyLayerKey
- website
- frontend

An example environment file should look like this:

- dbCredentials
  - \* username: "mongoadmin"
  - \* password: "secret"
  - \* ip: "databaseServerIP:27017"
- sessionSecret: "some secret text"
- tradingEquipmentKey: "AlphaVantageAPIKey"
- sendgridAPIKey: "SendGridAPIKey"
- senderEmail: "sample@email.address"
- alphaKey: "SAMPLEAPIKEY"
- currencyLayerKey: "SAMPLEAPIKEY2"
- website: "address.ofthe.website"
- frontend: "address.ofthe.website"

## 9.2 Database

We've used MongoDB as our database solution. To run the same instance locally, a database backup folder and docker-compose file is provided. In the root folder of the delivery package, running the command **docker-compose up -d** should be sufficient to start the database. It should also be noted that this command assumes that the local machine has running versions of Docker and Docker-Compose.

An interface for database is served at localhost, port 8090. Username is **arkenstein** and password is **qwerty**, which can be changed from the docker-compose file.

### 9.3 Frontend

Frontend is bootstrapped with Create React App. In the /app/frontend directory, run **npm install**, then **npm start**. Application is run in the development mode. Open **localhost:3000** to view it in the browser. The page will reload if you make edits. You will also see any lint errors in the console. If you run npm run build in app/frontend directory, this builds the app for production to the build folder. It correctly bundles React in production mode and optimizes the build for the best performance. The build is minified and the filenames include the hashes. Application is ready to be deployed!

### 9.4 Mobile

Arkenstone mobile application uses the Gradle build system. To build this project, use the gradle build command in app/android directory or use "Import Project" in Android Studio

#### 9.4.1 Dependencies

Android Studio 3.x

## 10 Project Plan

Team	Members
Backend	Bahadir Hocamoğlu, Cemal Aytekin, Gürkan Demir
Frontend	Ege Başural, Muhammed Bera Kaya, Taha Korkmaz
Mobile	Baturalp Yörük, Elif Çalışkan, Emre Demircioğlu, Levent Baş

Table 5: Members of Each Subgroup in Our Team

Task	Time Reserved	Start	Due Date	Assigned to
Login-signup @backend	5 days	30/09/2019	04/10/2019	Backend team
Homepage & events @backend	5 days	07/10/2019	11/10/2019	Backend team
Viewing trading equipments @backend	5 days	14/10/2019	18/10/2019	Backend team
Login-signup @frontend	5 days	30/09/2019	04/10/2019	Frontend team
Homepage & events @frontend	5 days	07/10/2019	11/10/2019	Frontend team
Viewing trading equipments @frontend	5 days	14/10/2019	18/10/2019	Frontend team
Login-signup @mobile	5 days	30/09/2019	04/10/2019	Mobile team
Homepage & events @mobile	5 days	07/10/2019	11/10/2019	Mobile team
Viewing trading equipments @mobile	5 days	14/10/2019	18/10/2019	Mobile team
Deployment	1 day	21/10/2019	–	Bahadır Hocamoğlu

Table 6: Milestone 1

Task	Time Reserved	Start	Due Date	Assigned to
Search-comment-prediction @backend	10 days	23/10/2019	05/11/2019	Backend team
User profile @backend	5 days	06/11/2019	12/11/2019	Backend team
Portfolio @backend	5 days	13/11/2019	19/11/2019	Backend team
Follow system @backend	4 days	20/11/2019	25/11/2019	Backend team
Search-comment-prediction @frontend	10 days	23/10/2019	05/11/2019	Frontend team
User profile @frontend	5 days	06/11/2019	12/11/2019	Frontend team
Portfolio @frontend	5 days	13/11/2019	19/11/2019	Frontend team
Follow system @frontend	4 days	20/11/2019	25/11/2019	Frontend team
Search-comment-prediction @mobile	10 days	23/10/2019	05/11/2019	Mobile team
User profile @mobile	5 days	06/11/2019	12/11/2019	Mobile team
Portfolio @mobile	5 days	13/11/2019	19/11/2019	Mobile team
Follow system @mobile	4 days	20/11/2019	25/11/2019	Mobile team

Table 7: Milestone 2

Task	Time Reserved	Start	Due Date	Assigned to
Investment & profit loss @backend	5 days	27/11/2019	03/12/2019	Backend team
Notification & recommendation systems @backend	5 days	04/12/2019	10/12/2019	Backend team
Annotation @backend	5 days	11/12/2019	17/12/2019	Backend team
Investment & profit loss @frontend	5 days	27/11/2019	03/12/2019	Frontend team
Notification & recommendation systems @frontend	5 days	04/12/2019	10/12/2019	Frontend team
Annotation @frontend	5 days	11/12/2019	17/12/2019	Frontend team
Investment & profit loss @mobile	5 days	27/11/2019	03/12/2019	Mobile team
Notification & recommendation systems @mobile	5 days	04/12/2019	10/12/2019	Mobile team
Annotation @mobile	5 days	11/12/2019	17/12/2019	Mobile team

Table 8: Final Milestone

## 11 User Scenarios

A user persona is a fictional representation of your ideal customer. A persona is generally based on this user research and incorporates the needs, goals, and observed behavior patterns of your target audience. We presented 1 scenario including 2 sub-scenarios in the final milestone, that are combined and cover all the features that have developed during the semester.

## **11.1 User 1: Albert Costa Ruiz - Economics Student**

### **11.1.1 Demographics:**

- Karlsruhe Technical University
- 23 Years old
- Follows blockchain technologies and markets
- Registered to System as a Trading User

### **11.1.2 Goals:**

- He wants to check read articles about Microsoft Stocks.
- He wants to find his friends.
- He wants to read recommended articles.
- He wants to annotate images.
- He wants to set alerts for a trading equipment.

## **11.2 User 2: Giuseppe Montemurro - Economics Student**

### **11.2.1 Demographics:**

- Karlsruhe Technical University
- 25 Years old
- Have some funds and want to make investment
- Registered to System as a Trading User

### **11.2.2 Goals:**

- He wants to find his friend easily from recommended users.
- He wants to annotate texts.
- He wants to read articles about Litecoin.
- He wants to invest on Litecoin.
- He wants to set a buy order for a trading equipment.
- He wants to deposit money to his account.

### 11.3 Scenario:

Albert and Giuseppe are two friends. They met at Erasmus Exchange Program in Karlsruhe, Germany.

Albert graduated from computer science and now studying economics as a master student. After he took access control systems course, he started to deal with blockchain technologies. He read a lot about litecoin. Then, he started to share his opinions about litecoin on arkenstone trading platform. He wrote an article named "Litecoin is the new Bitcoin".

Giuseppe is studying economics. He had some fund. He wants to raise his money wisely. He is using our platform and checking comments about trading equipments. But he cannot decide which trading equipment to invest on.

One day, Albert and Giuseppe sit in University Cafeteria. Giuseppe talks about his problem and confusion to Albert. Albert suggest him to read his article about Litecoin on arkenstone platform. After that, Albert says he want to invest on Microsoft. Giuseppe recommend him his friend Thomas. Thomas has articles about some of the biggest American companies' stocks.

Then, Albert opens our mobile app and Giuseppe opens our website platform.

- Giuseppe signs in to our web site. Then he clicks recommended users. He sees Albert and sends a follow request to him.
- Albert gets notified about new friendship request. He accepts it and follow Giuseppe back.
- Then Giuseppe opens Albert's articles and finds the one about Litecoin.
- He reads the article. He displays the annotations on that article while he is reading. He also annotate some part of the article which compares Bitcoin and Litecoin. He writes his opinions as text.
- Then he opens trading equipment page and filters for Litecoin. He observes the Litecoin graphics. He reads comments
- Then he decides to invest on it. He opens the "My Investments" page and buy some Litecoin.
- Alberts open Articles Page and filters for Microsoft. Then he finds the one written by Giuseppe's friend Thomas.
- He reads the article. He displays the annotation while he is reading.
- Since he finds the image of the article interesting, he makes a text annotation on the image as "interesting".
- Since he is planning to invest on Microsoft he opens trading equipment page, finds Microsoft and sets an alert for it. He set a "higher" alert for a value to get notified when the Microsoft stock value exceeds that value.

## **12 Evaluation of Tools and Managing the Project**

### **12.1 Mobile**

The communication between team members is very active and we are using Slack to communicate. We are keeping track of the works by Github and helping each other via Slack or by having some meetings face-to-face. Furthermore we meet each week, go over what has been done so far and get each other's opinion in order to make our app user friendly and convenient.

#### **12.1.1 Android Studio**

Android Studio is very easy to use since it has a preview property in layout and shape resources. Since it has a version control inside, it is more convenient to use Git in Android Studio rather than using terminal or another GUI.

#### **12.1.2 Java/Kotlin**

Java is a language which we are all were familiar with, from our freshman year. This fact was important for us to use it. Kotlin has some advantages compared to Java, so we are also using it in our project.

#### **12.1.3 Gradle**

Gradle is an important tool for android project. It is actually a build tool that collects all dependencies according to their versions that used in the project. It is very effective to use different android packages in the project.

#### **12.1.4 Navigation - RecyclerView - Retrofit**

Navigation is an android tool that helps fragment switching and parameter passing between fragments. Recyclerview is used in the listing pages. It helps customizing row view and data binding. Retrofit is used for API calls and json mapping to data models via callback methods.

#### **12.1.5 AnyChart**

AnyChart is a js based chart or graph viewing tool. Used in trading equipment page to show historical data as line graph. Also used AnyStock chart to make the graph flexible such that it shows price indicator on click and time range can be changed. AnyChart is a little slow on creating the view but it provides very useful functionalities for various kinds of charts.

### **12.2 Backend**

The backend development in our project has been very smooth so far, actually. Our backend team was familiar with the technologies we used, as we used them in the previous course, CmpE352, as well. The backend channel in our Slack

group was very active, always discussing any difficulties they faced and searching for solutions, helping each other by recommending various resources, etc.

### **12.2.1 NodeJS/ExpressJS**

We have used ExpressJS framework in our backend, as it's very easy to learn and extensible, thanks to its minimalistic and unopinionated nature. We have added some small libraries for input sanitation, external API access, sending email, etc. and it was very easy to integrate them into our application.

### **12.2.2 MongoDB**

MongoDB is a NoSQL library, using collections and JSON documents instead of tables and table entries. The documents aren't restricted to follow a certain predefined structure, which is the case for any SQL database, and that helps us develop and modify our database without worrying about data migrations and compatibility issues. We are using MongooseJS ORM library to access our database, which makes it even easier to work with MongoDB, as it provides lots of predefined schema types, validation and middleware options.

## **12.3 Frontend**

The frontend team uses a Slack channel for team communication. The progress and the work done by team members are tracked via GitHub. The Slack channel was used actively in helping other team members and asking for help, since most of the team was not familiar with frontend development and needed help of other team members.

### **12.3.1 ReactJS**

ReactJS is an open-source JavaScript library which is used for building user interfaces specifically for single page applications. ReactJS is chosen as frontend framework by the team, because of previous familiarity and it's ease of learning. Its basic structure of state, props and life cycle methods makes it easier to understand and start developing quickly. Component based system helps developers creating more readable code.

### **12.3.2 Webstorm**

As frontend team, we didn't decide on a IDE to use. However, we are all using WebStorm as our frontend IDE. It is a JavaScript IDE, with git integration and version control functionalities. Main advantages of it includes its conflict solver, which creates a great advantage in multi member projects.

### **12.3.3 Redux**

Redux is a predictable state container for JavaScript apps, as it's documentation says. It is a framework that can also be connected to React, that makes as able to pass on data and actions between components of React, which is a lot of pain without frameworks like it.

### **12.3.4 Semantic UI React**

We have chosen Semantic UI React between other UI frameworks, because of it's ease of use and simplicity. We didn't need complex working components for our project, so UI framework is mostly used for the design.

## **12.4 Managing the Project**

### **12.4.1 Code Structure**

As a whole team, we were very consistent throughout the project with how we implement new features and how we deal with bugs and issues. We created branches for each feature and assigned enough number of people to implement that feature. After writing out the code locally, we opened a pull request and assigned our team members to review the code we have written regarding the corresponding feature. If all of the assignees approved the pull request, we merged the branch into our development branch (android-dev, backend-dev, frontend-dev).

Whenever a bug was found after a pull request was approved and the corresponding branch was merged, we created another branch to fix the bug and went through the same steps as explained above.

### **12.4.2 Communication**

Group communication was a determining factor for our success in delivering the expected results so far. Backend team, frontend team and mobile team all used necessary communication means to deal with issues and decide how they should be organized as a sub-team to deliver their own part. However, internal communication in sub-teams was not enough, all of the sub-teams were also in contact with other sub-teams and knew what the others were doing so that they were in synch as a whole group. Each sub-team had its own channel in Slack where the group members of related sub-teams were discussing their implementation details and each sub-team was allowed to monitor the communication between members of other sub-teams.