

# Report of 2nd Year's Assistant Engineer Internship

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## **Abstract**

The automation becomes the main melody in the new innovation era. The appearance of autonomous vehicle, unmanned drones and ships accelerate the robotization process. With this innovative engine, many derivative services and applications are born to control and optimize the planning. The WRSC (World Sailing Robotic Championship) follows the similar trace. The championship demonstrates the academic researches in the autonomous sailing robots to prospect the near future.

Under this background, it is indispensable to build a reliable tracking system to supervise the path of sailing robots. This paper introduces the development of the tracking system for the WRSC 2015 during my summer internship at Åland University of Applied Sciences. Especially, this paper aims to describe the ruby on rails framework based development of the new web site with several changes in GUI, account security management, automatic scoring and ranking differed with the previous web sites

## **Keywords**

WRSC 2015, ruby on rails, web site, automatic scoring and ranking

## **Résumé**

Dans le cadre de ses fonctions, l'ingénieur se doit de maîtriser les techniques de base de rédaction de documents.

Le présent guide fournit les premiers éléments visant à la rédaction d'un rapport de projet. Il est destiné aux élèves effectuant un projet dans le cadre de leur scolarité à l'enstab. Sont présentés, de façon synthétique, les bases sur la nature et la structure du rapport, ses règles de composition et de typographie.

## **Mots clés**

Rapport de projet, mémoire, rédaction.

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# 1 Introduction

## 1.1 Presentation of WRSC

The WRSC(World Robotic Sailing Championship) is a competition open to fully autonomous and unmanned sailing boats up to 4m in length. This year's WRSC/IRSC is being held in Finland from August 31st to September 4th, 2015. It is the eighth edition of the regatta, with previous events held in Austria (2008), Portugal (2009), Canada (2010), Germany (2011), Wales/UK (2012), France (2013), and Ireland (2014).

## 1.2 History of the project tracking system

- **First Step**

The initial project was realised by Nicolas BROCHETON in 2013, which aimed to give the possibility to create a reliable tracking system to evaluate the performance of all robots during WRSC. And he decided to send all the GPS data via an Android application by the use of smartphones; also he offers a possibility to show the gathered data in a web server, but with limited amount of data.

- **Reborn - SWARMON**

The SWARMON project was developed by ENSTA Bretagne's students Quentin DESCOURS, Benoit BOURDON, Jean-Jacques BOYE, Simon STEPHAN, under the guidance of Professor Olivier REYNET. Instead of using smartphones, they proposed to use the electronic cards with the special antennae, with this combination, the precision of GPS data was improved hugely. And based on the Ruby on Rails framework, the web site was built in with the essential capacities to display the gathered GPS data in the google map.

- **WRSC 2014**

After the development of SWARMON, Bastien DROUOT and Benoit BOURDON continue this project in the Åland University of Applied Sciences, under the direction of Ronny ERIKSSON, vice rector of the University during their summer internship to complete the functionalities of the tracking system. Further the developed tracking system was used successfully for the WRSC 2014 in Galway (Ireland).

- **MYR**

After the experience of WRSC 2014, Benoit BOURDON and Bastien DROUOT found the potential improvements for the tracking system, then during their third year's project – MYR, a RESTful web site with new style was well settled. And another project in ENSTA Bretagne, which realised by Thibault VIRAUAU, provides the Android application with compatible APIs for the web site and electronic cards.

## 1.3 Internship Objectives

As all the competitive robots accomplish their missions in the sea, and it is really hard to supervise the whole traces of all robots, furthermore it is impossible to measure accurately all the positions of robots, just based on the crews' visions, especially under the extreme weather conditions. From these reasons, it is necessary to build a reliable tracking system which can gather all GPS data and time stamps in order to record all the states during certain periods not only for controlling robots' states in case of intervening collision avoidance, but also for evaluating the final performance of all the robots.

With the efforts of our predecessors, we had already defined the usable APIs for our electronic cards, which means we had already defined the APIs for gathering GPS data including latitude,

longitude, date time, course and speed, but the antennae in the previous version were not suitable and specified for our desired frequency to gather GPS information, although we could also obtain all the GPS data what we want, the precision of measurement remains insufficient. So for the hardware part, we needed to choose appropriate antennae, and we needed to prepare all the materials for the tracking system before the final competition(like batteries, electronic cards, SIMCOM modules, SIM cards, and boxes which were used to put the whole tracker). Unfortunately, at the beginning of our internship, the number of participated teams was still unknown, to make sure that we got enough trackers, we booked 10 for each module.

For software part, the previous version of website based on the web framework Ruby On Rails and the use of google map (JavaScript APIs of google map were provided and published on the Internet by Google Company freely.) And the performance of the previous version web site in Galway (Ireland, WRSC 2014) proved that the website was built successfully. However, the old CSS and HTML were obsolete and the functionality of the web site was incomplete. Additionally, the web site had already the capacity to display the GPS data gathered by the tracker on the google map, but the web site could not handle of these information further until this moment. So far, several domains remain to be improved for the web site:

- The security of account need to be reinforced;
- Replay and real-time display methods need to be improved to reduce the pressure of server;
- Scoring and Ranking based on the data gathered by tracker;
- Admin marker creation need to be added, also need to add the markers to the page replay and page real-time.
- CSS and html features need to be updated.

## 2 Tasks, Projects and Activities

### 2.1 Organization

In fact, Sylvain Hunault and I needed to prepare the web site and trackers in two months. Since Sylvain Hunault knows much more about electronic cards, then he was in charge of the hardware part, including all the antennae, batteries and electronic cards, and I was familiar with ruby on rails because of my experience, so I focused on the software part. Since the web site was much more problematic and needed to be enhanced further, after preparing the hardware part, we two both worked into the web site. Normally we worked separately according to the distributed functions which are necessary to be added into the site. And also we worked together when we needed to integrate all the unitary functions, or when we were in front of some problems. We shared our knowledge and information obtained, and discussed together. In addition, all the useful information and our source code were put into the Github (a tool of the distributed revision control and source code management) repertoire.

Actually, the development of website was function-oriented, the branch "master" was the principal branch which would be released to the public, besides every one or two weeks, a new branch was created, which means a new feature was released. Before merging every new branch into the "master" branch, all unitary tests and integrate tests should be passed.

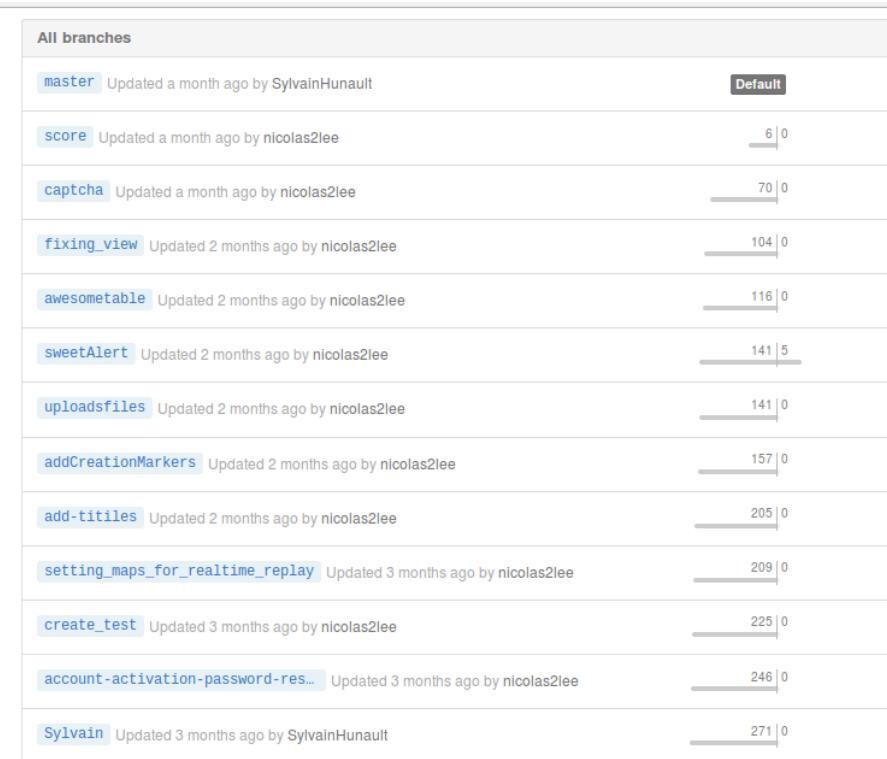


Figure 1: All function-oriented branches

## 2.2 New features

### 2.2.1 New style and New GUI

The web site created for the WRSC 2014 (project SWARMON) contains a no open sources CSS and Layout(left image in the figure before), and at the beginning of 2015, the web site was updated with the latest CSS3 which is open sources and more beautiful and customizable(right image in the figure before). Our current web site based on the latest CSS3.

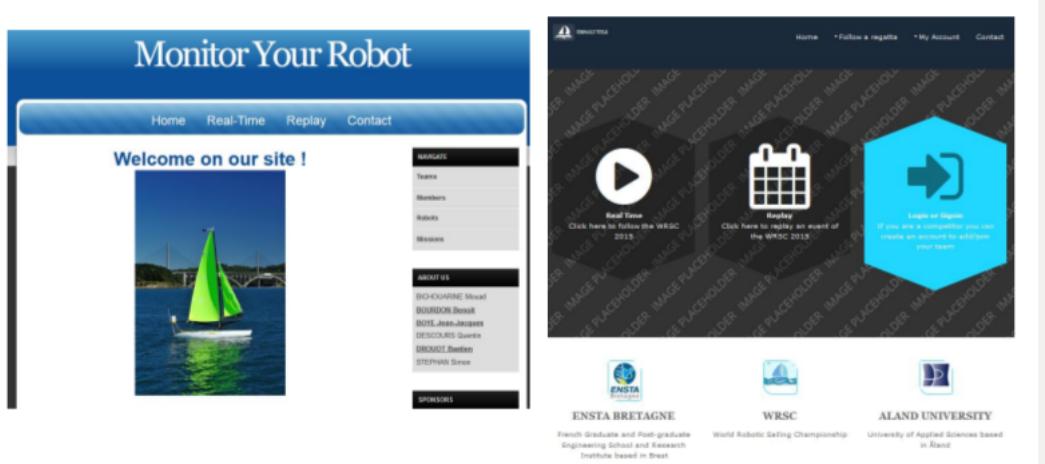


Figure 2: Old home page, WRSC2014(left), MYR2015(right)

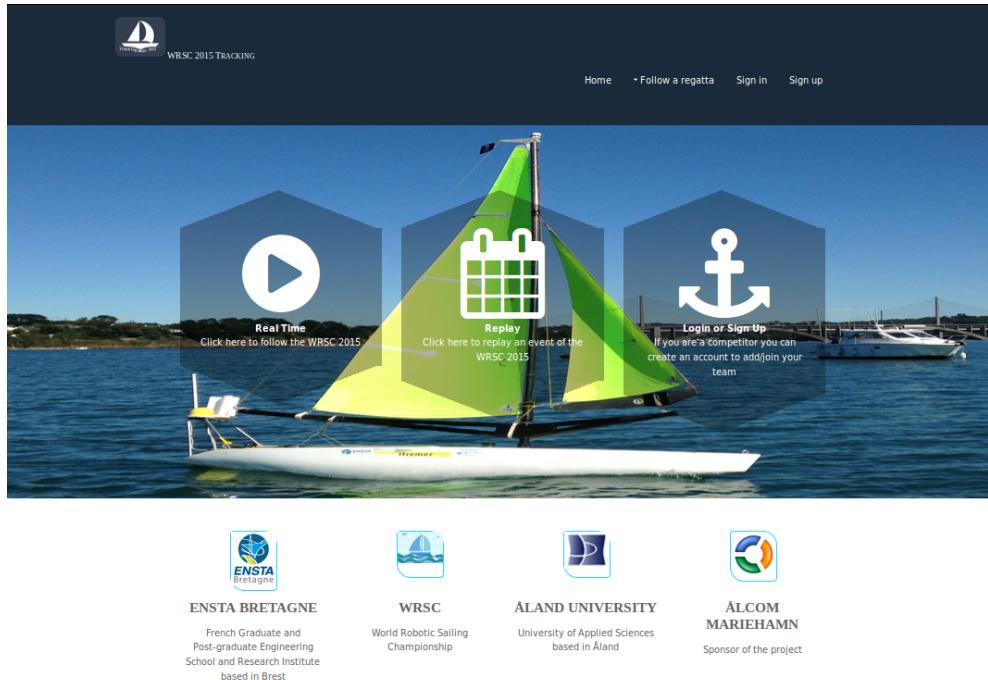


Figure 3: New Home Page

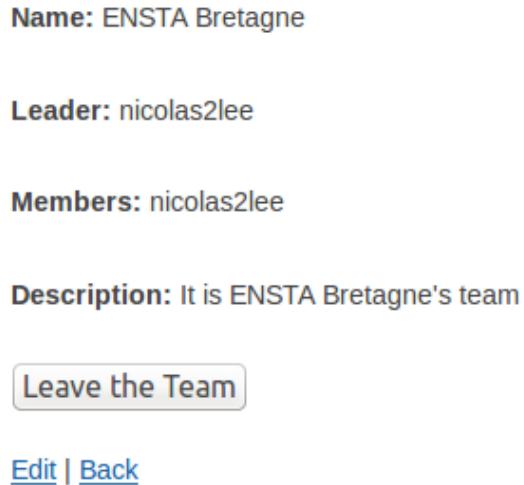


Figure 4: old team show

In the previous version, the web site could only display the basic information about every team, like: team name, leader, members and description. In order to simplify the access of pages and the use for users, we add two fields to show the team's members and robots by loading with two Ajax(asynchronous JavaScript and XML) requests to permit the easy management for members and robots.

Similar to the page team#show, the previous web site could only display the basic information about every robot, like: name, owner(team), category. These information are essential but insufficient, especially for the new users, who are not familiar with our web site. For example, they do not know if they had registered to participate a mission (if they want to know, they need to go to the page attempts, and check if their robot name in the whole list one by one and also if they want to know the time for missions, or/and the time for every attempt, they need to go another page to check all the information). So in order to facilitate the use of web site, we decided to put all these information into the page robot#show. Also we had thought a lot about the form to display all these information to users. Since the logic is that a robot participates several missions, and for every mission, there could be more attempts, and every score and tracker id were attached to an unique attempt. So based on this hierarchical order, it will be better to choose a tree structure chart to show the logic. In order to meet our need, we had chosen google org(organization) charts which are open source and all APIs are provided and published by Google company freely. Since our web site was built up by ruby on rails, and google org charts were released as JavaScript APIs, from this, every time when the site loads the robot#show page, it will recall an Ajax request and send all the associated information from the ruby part to the JavaScript part, then in the JavaScript part, we could use the org charts' APIs directly.

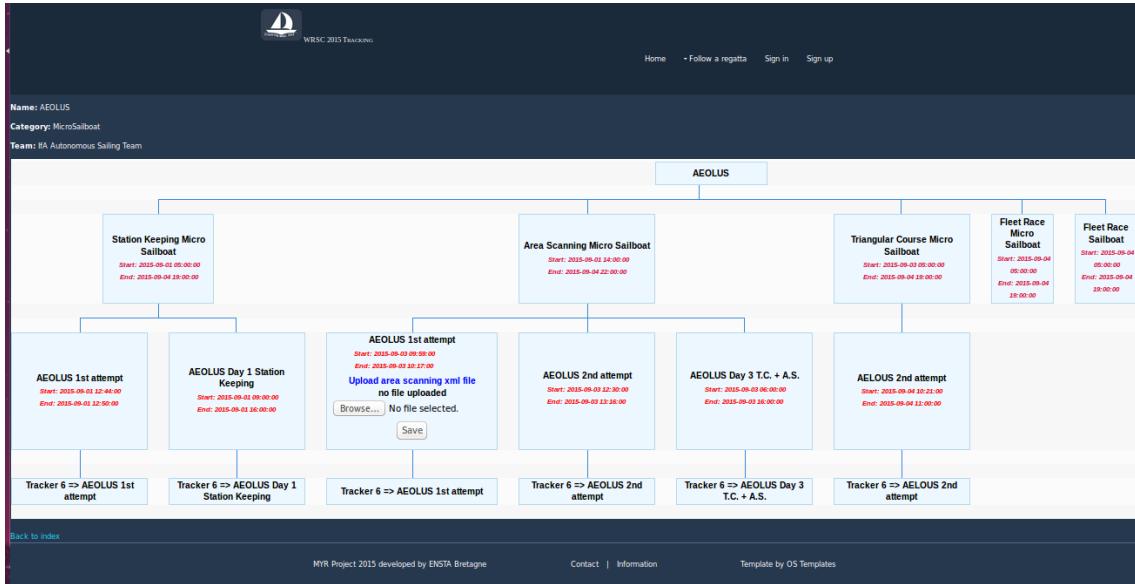


Figure 5: Google org charts example

### 2.2.2 Sortable & Searchable Table

The previous version web site(WRSC 2014 in Galway) used the form of table to list all the information for teams, robots, missions, members and etc. And all these tables were only sortable by the alphabetic order. The only sortable table works well when there is not enormous data, if we suppose that there are more than 100 members in our database, and if you want to find the information about one member and you had only the name of this member, it will be stupid to check the whole list just by eyes. Furthermore, if the web site displays more than 10 records in one page, which often makes the user feel uncomfortable and inefficient. Based on these reasons, we choose a flexible and customizable JavaScript plug-in "DataTable". DataTable is very simple to use as a jQuery plug-in with a huge range of customizable options, and the functions which we are interested in most are sorting(which makes the table sortable by alphabetic order), filtering (which makes the table searchable, we can search one element by typing part of the keyword) and pagination (which limits the number of elements in one page, also it will make the page loading be faster and reduce the pressure of server because of the limitation of elements in the page). What's more, "DataTable" provides more APIs which also make the html table flexible, the developers are easy to get the index or element in the table just by calling the functions, comparing to the static html table, the "DataTable" is more dynamic and interacted for users.

### 2.2.3 Improved Account Management

#### 1. Sign UP

The new sign up page add three new features:

- Uploading local image file instead of typing a link**

In the old version web site, the user could only typing an image file url to upload the logo. And at the side of server, it adopts a gem called "fastimage", which could handle of the url and get the image from this url, but one limitation is the image size could not larger than several hundred pixels \* several hundred pixels, as a matter of fact, this size is quite small comparing to the normal image file which is nearly several mega bytes. So for this reason, the logo field is nearly useless because of the inconvenient.

## List of members

New Member

Name	Email	Role	Team
<a href="#">testAdmin</a>	admin@gmail.com	visitor	
<a href="#">nicolas2lee</a>	example@gmail.com	visitor	
<a href="#">ENSTA Bretagne</a>	nicolas2lee@gmail.com	visitor	

Old Version

Listing Missions						
Name	Type	Category	Start	End		Search:
<a href="#">Area Scanning Micro Sailboat</a>	AreaScanning	MicroSailboat	2015-09-02 05:00:00 UTC	2015-09-02 22:00:00 UTC		
<a href="#">Area Scanning Sailboat</a>	AreaScanning	Sailboat	2015-09-02 05:00:00 UTC	2015-09-02 22:00:00 UTC		
<a href="#">Fleet Race Micro Sailboat</a>	Race	MicroSailboat	2015-09-04 05:00:00 UTC	2015-09-04 19:00:00 UTC		
<a href="#">Fleet Race Sailboat</a>	Race	Sailboat	2015-09-04 05:00:00 UTC	2015-09-04 19:00:00 UTC		
<a href="#">Station Keeping Micro Sailboat</a>	StationKeeping	MicroSailboat	2015-09-01 05:00:00 UTC	2015-09-01 19:00:00 UTC		
<a href="#">Station Keeping Sailboat</a>	StationKeeping	Sailboat	2015-09-01 05:00:00 UTC	2015-09-01 19:00:00 UTC		
<a href="#">Triangular Course Micro Sailboat</a>	TriangularCourse	MicroSailboat	2015-09-03 05:00:00 UTC	2015-09-03 19:00:00 UTC		
<a href="#">Triangular Course Sailboat</a>	TriangularCourse	Sailboat	2015-09-03 05:00:00 UTC	2015-09-03 19:00:00 UTC		

New Version

Figure 6: Comparison of two type tables, UP is the previous version, DOWN is the current version

In order to solve this problem, in the new web site, we used a gem called "carrier-wave"(an open source free project, all the codes are available in their Github repertoire), which permits to upload whatever format file. Furthermore, here we need to treat the image file, so at the side of rails application, it requires another gem "mini\_magick"(Unlike RMagick, MiniMagick is a much thinner wrapper around ImageMagick, that's why we choose MiniMagick rather than RMagick), at the side of server machine, it requires the software "ImageMagick" (under Linux, type "convert -v" to check if the "ImageMagick" was installed).

Once all the gems are installed successfully, a new folder "uploaders" will be added into Rails.root(the root path of rails application)/app, and the creation of uploading action is similar to create a controller/model in rails application, either by the command "rails generate uploader nameoffile", or by create the file manually. And then in the model, we need to mount the uploader, in our case, we need to add:

---

```
"mount_uploader :logo, MemberLogoUploader"
```

---

in the file Rails.root/app/models/member.rb.

After that, the attribute "logo" of "member" would only accept a file uploader object, even at the beginning, we define the type of logo is a string. If we dive deep into the database(either look through by rails console, or by SQLite database browser, the

New Member	
Name	<input type="text"/>
Password	<input type="password"/>
Password confirmation	<input type="password"/>
Email	<input type="text"/>
Role	visitor
Logo	<input type="file"/> Browse... No file selected.
 Enter the image <a href="#">View</a> Enter the code in the box: <a href="#">Refresh</a>	
<input type="button" value="Create Member"/>	
<a href="#">Back to index</a>	

New Version

Name	
Password	<input type="password"/>
Password confirmation	<input type="password"/>
Repeat password	<input type="password"/>
Email	<input type="text" value="email@example.com"/>
Role	visitor
Logo	<input type="file"/>
<input type="button" value="Create Member"/>	
<a href="#">Back</a>	

Old Version

Figure 7: Comparison of page Sign Up

attribute "logo" is filled by a complicated object where it contains the original file name which means the name of uploaded image file, also the name of full name which means the uploaded image file's absolute file name-path in the rails application + file name, and other information). Due to this reason, once an image file was uploaded, we should not change the position of this file, because in the database, the image file was just saved as the path and the name rather than the image self.

What's more, "carrierwave" provided some other customizable convenient options, for instance, we can define our own store directory to put all the image files. Actually by default, all the files accessible for any other user should be put into Rails.root/public. Also do not trust the file uploaded via internet, we should make sure all the files in public directory were inexecutable. From this, "carrierwave" also provide an option to set the extension white list, where we can limit the file format to avoid the virus. In addition, if the rails application was launched by a Linux machine, we can set the permission of the directory "public" to make sure all the users except the owner(admin) could only read and write, but not execute. One way possible to do so is by using the command

---

```
chmod 766 <directory>
```

---

Then with the command

---

```
ls -l
```

---

we can check if the directory permission is

---

```
drwxrwx-rw-
```

---

Also we can define different versions of image files with different sizes based on the initial image, which will be applied once the image file is uploaded.

- **Simple captcha**

Another important change for the sign up page is that we added the captcha to filtering human user and avoid basic attacks. The realization of captcha is also simple. We used a gem called "simple\_captcha2"(an open sources free project, all the codes are also available from Github repertoire). As controller Based, we just need to do: Add the following line in the file "app/controllers/application.rb"

---

```
 ApplicationController < ActionController::Base
   include SimpleCaptcha::ControllerHelpers
end
```

---

In the view file within the form tags add this code

---

```
<%= show_simple_captcha %>
```

---

and in the controller's action authenticate it as

---

```
if simple_captcha_valid?
  do this
else
  do that
end
```

---

- **Activate by email**

In the new web site, we also added the function of sending emails to activate the new account when one user registers on the site. As we did not have any specific email account, we choosed Gmail account as our admin email account because of several reasons.

- In order to display the google map in our web site, we register a google account to obtain a google map JavaScript API key, so already even we did not choose Gmail as our main email, we should at least use the google account for JavaScript API.
- Gmail service is free and easy to use, although Google limits the amount of mail a user can send, via its portable SMTP server, and the amount of sending emails is limited 99 per day, regarding our web site focuses on the participators, even maybe there are some other users, 99 is already enough for the email function. In addition, if we want much more capacity, if the budget allows, we could buy the service of Gmail SMTP server in the future.
- Gmail is secure, wide used and compatible with others email service provider. And sometimes, Gmail is too secure to use. And the problem we meet at the

beginning is that we had sent an email by configuring the SMTP server in our Rails Application, then Google detected this operation was done by machine not a web user and our email was blocked. In order to solve these types of problems, we need to configure our Gmail to less secure status by going to this page <https://www.google.com/settings/security/lesssecureapps> and changing to less secure.

When the Gmail account was setted correctly, and also we can send emails to other users, another problem came to our views. How can we send a unique link to the user and also how can we identify this link is associated with the relative user ? Actually before creating a user, we create a new activate token(which is used to send to the user) and a activate digest(which is saved into database and used to identify the relative user). In the file Rails.root/app/models/member.rb

```
before_create :create_activation_digest
def create_activation_digest
  self.activation_token = Member.new_token
  self.activation_digest = Member.digest(activation_token)
end
```

In fact, all the passwords, or more generally, the important information are encrypted before saving into the database by using the popular gem "Bcrypt". Obviously the security of encryption depends on the longer of generated token(Here we used 64 bits to generate a random token, normally it is long enough) and the algorithm(In this case, it is "Eksblowfish"--"expensive key schedule Blowfish", which based on the algorithm Blowfish. Cryptotheoretically, this is no stronger than the standard Blowfish key schedule). Also we need to pass the user's email address as an argument in the url, then we can identify the token with the associated member which was saved in the database found by the email address. In the file Rails.root/app/models/member.rb

```
def Member.digest(string)
  cost = ActiveModel::SecurePassword.min_cost ?
    BCrypt::Engine::MIN_COST : BCrypt::Engine.cost
  BCrypt::Password.create(string, cost: cost)
end

def Member.new_token
  SecureRandom.urlsafe_base64
end
```

Then the creation of email sending is just like any other page, firstly create the controller with desired actions, and then create the views which would be sent to the user later.

## 2. Sign in

In the new sign in page, we had also added two new features:

- **Remember the User**

The function of "Remember me" is quite similar to sending the activation link to users. If the user choose to remember in the computer, then the server would write the user id and a remember token into cookies. With the function cookies.signed which provided by rails application, the contents in the cookies would be encrypted. Furthermore, something should be noticed:

The figure shows two side-by-side screenshots of a 'Sign In' page. The left screenshot, labeled 'New Version', has a dark blue header with the text 'New Session'. It contains fields for 'Name' and 'Password', a 'Remember me on this computer' checkbox, a 'Sign in' button, and links for password recovery and new user sign-up. The right screenshot, labeled 'Old Version', has a white header with the text 'Name' and 'Password'. It also features a 'Remember me on this computer' checkbox, a large blue 'Open Session' button, and a link for account creation at the bottom.

Figure 8: Comparison of page Sign In

- Cookies exist in different browsers in the same computer, so if the user has more than one browser (for instance: one Firefox and one Chrome), the cookies will be shared between the two browsers.
- The contents in the cookies contains two values, one is what we want to save into the cookie, and the other one is the expire date which indicates the validate time for the cookie. If we use "session", which contains the same contents as cookies, but the expire date is from when the contents were created to when the user close the browser.

- **Reset the Password**

"Reset the password" has the similar principle as the activation email sending. When a user request to reset its password, it needs to provide its email address as a reference. Then the server generate a token and a digest, send the link which contains the user's email address and a reset token to the user. After, when the user clicked the link, the server verifies the digest with the token, if it is the correct token, then the user could change its information.

#### 2.2.4 Admin Markers Creation

- **Markers**

The pages of real-time and replay worked well last year, but the markers(the buoys) were not added to these pages, also the web site did not display any marker's information, which was inconvenient for the observers following the traces of robots. Inspired by these objectives, we designed to add an administration tool to add markers to a specific mission. Based on the initial designed schema by Bastien DROUOT and Benoit BOURDON, finally we obtained the new function of adding markers for administrators.

The realization of creation of markers based on the Google map JavaScript APIs provided by Google company(<https://developers.google.com/maps/documentation/javascript/markers>). Actually, the JavaScript APIs provided the possibilities to add point, line, polygon and circle into the google map. And for each type marker, there are two possibilities to draw on the map: either draw the marker with the given coordinates, so then the marker is fixed on the map and can not be modified later, or draw the marker by clicking on the map directly, then it is up to the developer to add the options to drag or to move the marker or even change the size of marker dynamically. As a matter of fact, the last version web

Administration tool to add markers to a specific mission

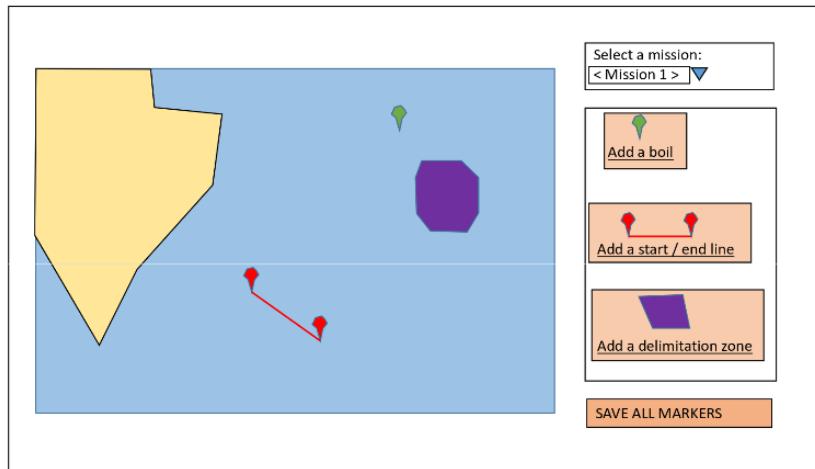


Figure 9: Designed admin markers

site could display some markers in the robots' path by using a gem called "gmaps4rails" which is easy to be applied into rails application, but since this gem also based on the Google map JavaScript APIs, in addition the gem changed and limited some options from Google APIs, so we could not use all the functions provided by Google APIs via the gem. In order to get more freedom, we had abandoned the gem, furthermore, the google APIs provided more customizable options(for example, we can change the icon of marker, add some animations for displaying the marker, the possibility to hide the marker instead of deleting the whole marker and also the adapt zoom for all the markers). Thanks to the project noun, all the icons we used in the admin marker creation were dragged from this project. (<https://thenounproject.com/>)

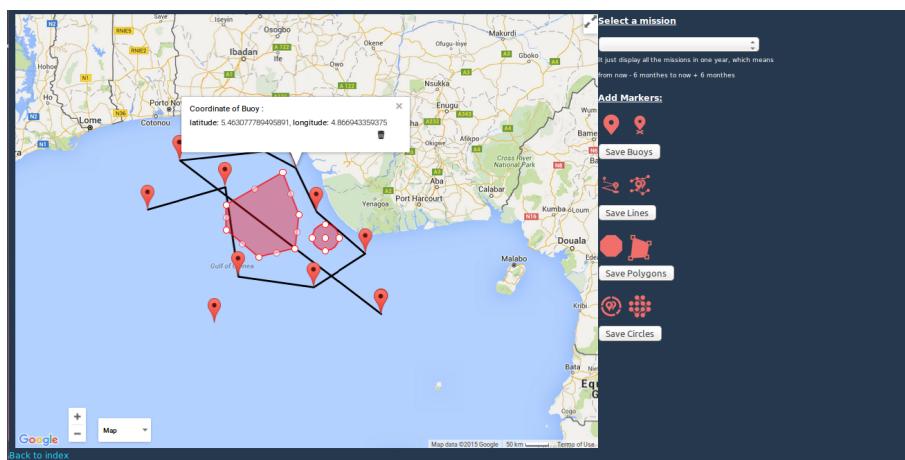


Figure 10: Admin Markers final graphic interface

- **InfoWindow**

Moreover, Google map JavaScript APIs offer the possibilities to add some events to the marker or even some events for the mouse motion. Among all these options, what we are interested in most is the possibility to display the infowindow for every marker to specify the accurate and precise coordinates of the robot's position. In fact, there are two ways to achieve the requirements.

#### – Google API

As a matter of fact, Google APIs provide the possibility to show the coordinates when someone clicks on the map directly, because google map catches the mouse action which are behavioured on the google map and then print the coordinates directly, but the limitation is that google map could only displays the coordinates of markers, if the user want to know much more information about the team(like: team name, the id of attempt and the tracker id), Google APIs could not meet all these demands. One advantage is that using google APIs does not need to communicate with the server, so the response will be faster and it will reduce the pressure of server.

#### – Ajax request to communicate with server

Obviously, communicating with server, we could get all the information we want, but the problem is that we need to send the Ajax requests, at least one Ajax request, which will cost much more time, especially in most cases, there are hundreds and thousands data to display, even if the number of markers is 10 times less than the number of coordinates, we could imagine that 1000 positions need to display, then 1/10 of positions(which means 100) need to be shown with the infowindow, also it means 100 Ajax requests, if every Ajax request lasts 30ms, then 100 Ajax requests last 3s, it means one user click a button one time, it will cost 3s to calculate for the server, when there are more than 10 users do the same things at the same time, the server would be broken absolutely.

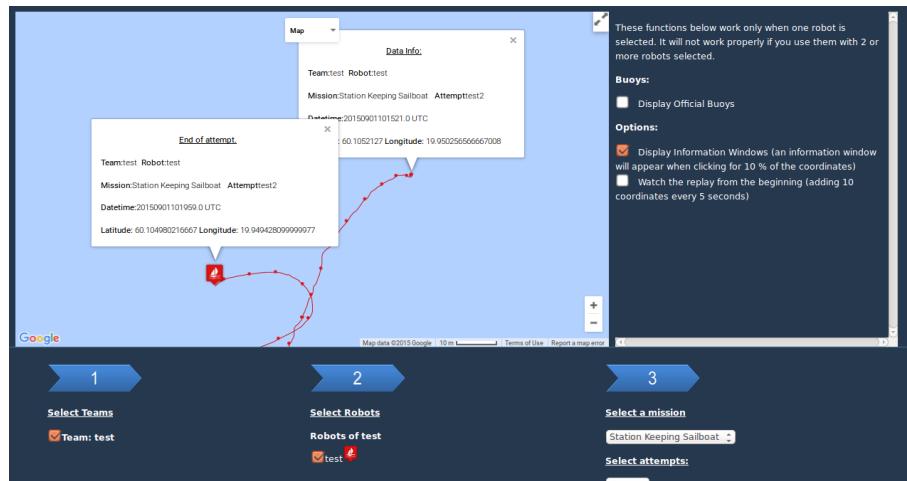


Figure 11: Admin Markers with Ajax request

So actually, there is not any better way to do it, the different methods meet different requirements, finally we decided to use the second way to show the information, because we need to display the team's information, but considering the performance of server, we had displayed 1 markers per 10 coordinates to limit the Ajax request number.

### 2.2.5 Auto Scoring and Ranking

#### 1. Scoring

The WRSC contains 4 missions: Station Keeping, Area Scanning, Triangular Course and Fleet Race. And I was in charge of the scoring for Station Keeping and Area Scanning. So I will introduce the algorithms I had chosen to calculate the score.

- **Station Keeping**

- **Description of mission**

As the WRSC rules described, the objective of the station keeping contest is to evaluate controlled sailing in a limited region with time constraints. Each boat must start outside a 45 m x 45 m box, marked by four buoys. In the team slot time, the boat must enter the box. The boat shall leave the box at a time as close as possible to 5 minutes after entering the box. Boats fulfilling the entry and exit criteria are awarded points based on the following formula:

---

$$P = \max (0, 10 - |T_{enter} + 300 - T_{leave}|/10)$$

Where:  $T_{enter}$  is the timestamp when the boat first enters the box and  $T_{leave}$  is the timestamp

---

when the boat first leaves the box. If the boat enters and leaves the box several times, any leave timestamps within ten seconds from  $T_{enter}$  are ignored. All timestamps are given in seconds.

- **algorithm for Station Keeping**

In general, the aim of station keeping is letting the boat stay 300s exactly in a square(ideally), or more generally stay in a polygon. So the key point of calculating the score is checking whether the position of boat is in the polygon.

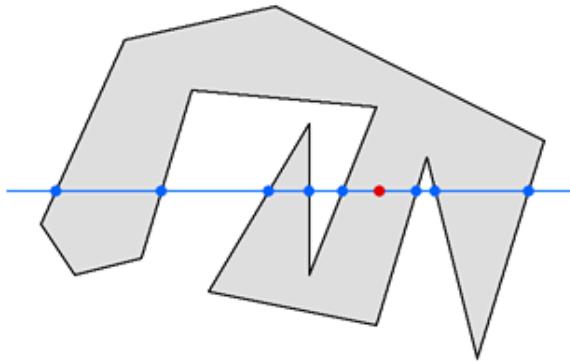


Figure 12: Point in Polygon algorithm example

Based on the Point-in-Polygon Algorithm(<http://alienryderflex.com/polygon/>), here is an example, the solution is to compare each side of the polygon to the Y (vertical) coordinate of the test point, and compile a list of nodes, where each node is a point where one side crosses the Y threshold of the test point. In this example, eight sides of the polygon cross the Y threshold, while the other six sides do not. Then, if there are an odd number of nodes on each side of the test point, then it is inside the polygon; if there are an even number of nodes on each side of the test point, then it is outside the polygon. In our example, there are five nodes

to the left of the test point, and three nodes to the right. Since five and three are odd numbers, our test point is inside the polygon. Then with more examples:

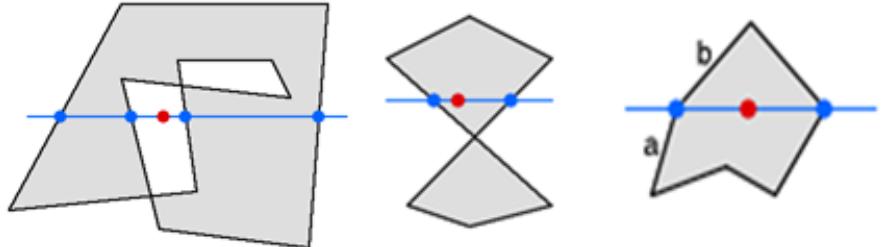


Figure 13: More examples for Point in Polygon algorithm

- **Area Scanning**

- **Description of mission**

The course will be divided into  $10 \times 10$  square sections, each with a width of about 31 m. The sections will be indexed as  $(i, j)$ , where  $i$  goes from 0 to 9 starting at south and going north, and  $j$  goes from 0 to 9 starting at west and going east. From the time the boat enters the first section and within a time of 90 minutes, the boat shall pass through as many square sections as possible. The score for the area scanning contest will be calculated as:

---


$$P = N_{\text{passed}}/10$$

where  $N_{\text{passed}}$  is the number of entered sections.

---

The score will be multiplied with a factor determined from oceanographic measurements provided for each visited section. Depth (m), water temperature ( $^{\circ}\text{C}$ ), air temperature ( $^{\circ}\text{C}$ ), water salinity (%), conductivity (S/cm), chlorophyll (ug/l), ammonium (mg/l), nitrate (mg/l), chloride (mg/l) and total dissolved solids (mg/l) can be provided. Inclusion of depth data will add 0.2 to the multiplication factor, the other measurements each add 0.1. The multiplication factor is 1.0 initially, and the maximum that can be achieved is 1.5. Each team shall provide data on the team's performance to the Race Committee within 5 hours after the start of their slot time. The data shall be in XML, specified by the schema below. The data will contain the team name. For each entered square section the section's indices are required along with a UTC timestamp and corresponding coordinates using `<gml:pos>` property in WGS-84 (EPSG:4326). Optionally the oceanographic data can be added. Each entered section shall be added only once to the XML data.

- **algorithm for Area Scanning**

Actually, for the area scanning contest, the Race Committee decided to do the scoring by themselves, but they ask us to verify the submitted GPS data with XML format from participants with our trackers' data. Fortunately, Åland University of Applied Sciences(ÅUAS) had a python program which can analyse the submitted XML file and then generate a JSON file(which contains all the useful data and this file is easy to be handled by ruby). And then departure from this JSON file, compare the JSON data to the correspondent tracker's data to check if the gaps of positions were under certain tolerance. In order to accomplish this task, several steps were adopted:

- (a) **Uploading XML file by participants**  
The participated team should uploading their XML file to their robot's page (robot#IdOfTheirRobot). And also I added a time stamp to record the time when the team submitted their XML file because the team should upload their XML file in 5 hours since they had finished their attempts.
- (b) **Uploading JSON file by admin**  
With python program(provided by Conny Ljunggren, ÅUAS), I need to generate a JSON file manually. Also I had looked into the python program, in fact the python program used a module called "xml.etree.ElementTree" to analyse the XML file. Unfortunately, I did not find any similar module in Ruby to analyse the XML file, but it was also feasible in ruby. It was just like a compilation project, the code source is XML file, and then the target file is JSON file, so then if we define the grammar of XML, define the lexer and Backus Normal Form(BNF), from the BNF, create the parser to analyse the code source, and store all the separate data in the node of Abstract Syntax Tree(AST), then either by using the visitor pattern, or mix template written by "erb" with visitor pattern, we can generate the target code finally. Since we did not have enough time, we did not realize this function.
- (c) **Calculate the distance** Based on the JSON file, ruby could import the

#### Distance

This uses the '**haversine**' formula to calculate the great-circle distance between two points – that is, the shortest distance over the earth's surface – giving an 'as-the-crow-flies' distance between the points (ignoring any hills they fly over, of course!).

```
Haversine a = sin2(Δφ/2) + cos φ1 · cos φ2 · sin2(Δλ/2)
formula: c = 2 · atan2( √a, √(1-a) )
d = R · c

where φ is latitude, λ is longitude, R is earth's radius (mean radius =
6,371km);
note that angles need to be in radians to pass to trig functions!

JavaScript: var R = 6371000; // metres
var φ1 = lat1.toRadians();
var φ2 = lat2.toRadians();
var Δφ = (lat2-lat1).toRadians();
var Δλ = (lon2-lon1).toRadians();

var a = Math.sin(Δφ/2) * Math.sin(Δφ/2) +
       Math.cos(φ1) * Math.cos(φ2) *
       Math.sin(Δλ/2) * Math.sin(Δλ/2);
var c = 2 * Math.atan2(Math.sqrt(a), Math.sqrt(1-a));

var d = R * c;
```

Figure 14: Latitude longitude to meter formula from Internet

JSON file directly, then we can compare the GPS data to the data in our web site and calculate the difference between the two sets of data. Because all the unities of GPS data are in degree, which are incomprehensible for humans, then we transfer the unity in degree to meter by using the algorithm from internet(<http://www.movable-type.co.uk/scripts/latlong.html>).

And also I had tried the official contest's buoys positions. In fact, the Race Committee declared officially the distance between two buoys is about 31m [(60.1050,19.9500);(60.1080,19.9500)], and from the formula, I obtain the distance is a little more than 30m, so the gap is less than 1m which is acceptable by the GPS precision.

- (d) **Generate the comparison file**

After the comparison, in ruby there are three possibilities(JSON/YAML/XML) to display the result, finally I choose XML not only to keep coherent with what the participants' submitted file format, but also it is easy to read for users. As a matter of fact, files are also like any other resource in the web site(like views), according to the path in the rails application, we can visit the file by typing the url Rails.root/FilePath.

## 2. Ranking

- **Improved Model**

The previous version do not contain the function of scoring and ranking, so the old model do not satisfy the new need. Then we proposed a new model, the principle is every attempt has a unique score, every robot has many attempts, equally every robot has many scores, then we just need to take the best score into account for every robot, at last we compare all the best scores for all the robots. So we add a new table Score into the model and add some new attributes to the table Robot.

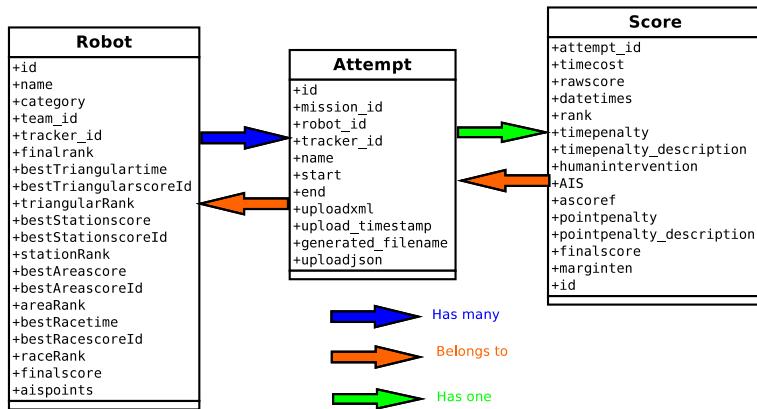


Figure 15: Add new table Score to the database

- **processes of ranking**

Actually, there are 4 missions for the whole championship, and every mission has different rules and penalties, but the processes of every mission works similarly, when a team finished an attempt, we should create a score for this attempt, from the algorithm we used, we could get the time cost or a raw score differed from missions. Here I take an example of triangular course to illustrate the process to obtain the best score, where Hi means human intervention:

After obtaining the best score for every team, we could calculate the rank. Here something should be noticed, the AIS points are not taken into account in every single mission, but in the final score, we should add the AIS points.

Based on all the new features, finally we improved our database which is more complete.

### 2.3 Settings in the virtual machine

After we had finished our development of web site, we need to put our site into the internet. Thanks to Ålcom Mariehamn(A telecommunication company in Mariehamn, Finland) who sponsored a virtual machine to run our server. Initially the server was inaccessible from outside, which means the server do not allow the user from internet to connect to this server. So in order to put our server on the internet, we need to configure the firewall at first. By default, rails

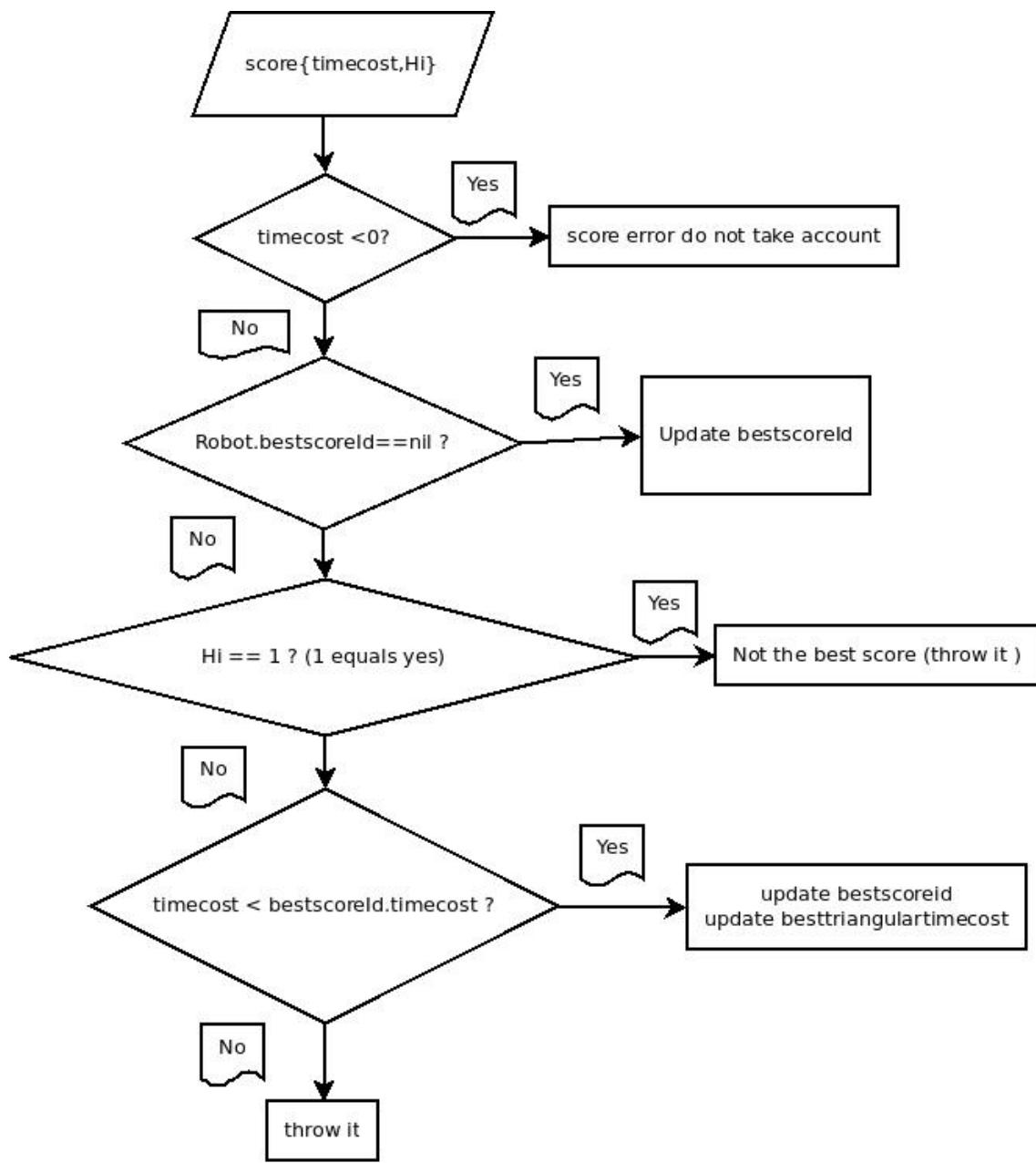


Figure 16: Triangular Course best score chosen process

application uses the port 3000 to run the server, but then the url will be terminated with :3000, which is not the familiar convention for the most users, so we choose the port 80 rather than the port 3000 to offer our service by using "iptables", since it was a Linux machine.

With the command:

---

```
sudo iptables -I INPUT -p tcp --dport 80 -j ACCEPT
```

---

we enable the visit outside to the port 80.

After setting the secret\_key\_base into the environmental variable in the virtual machine, we

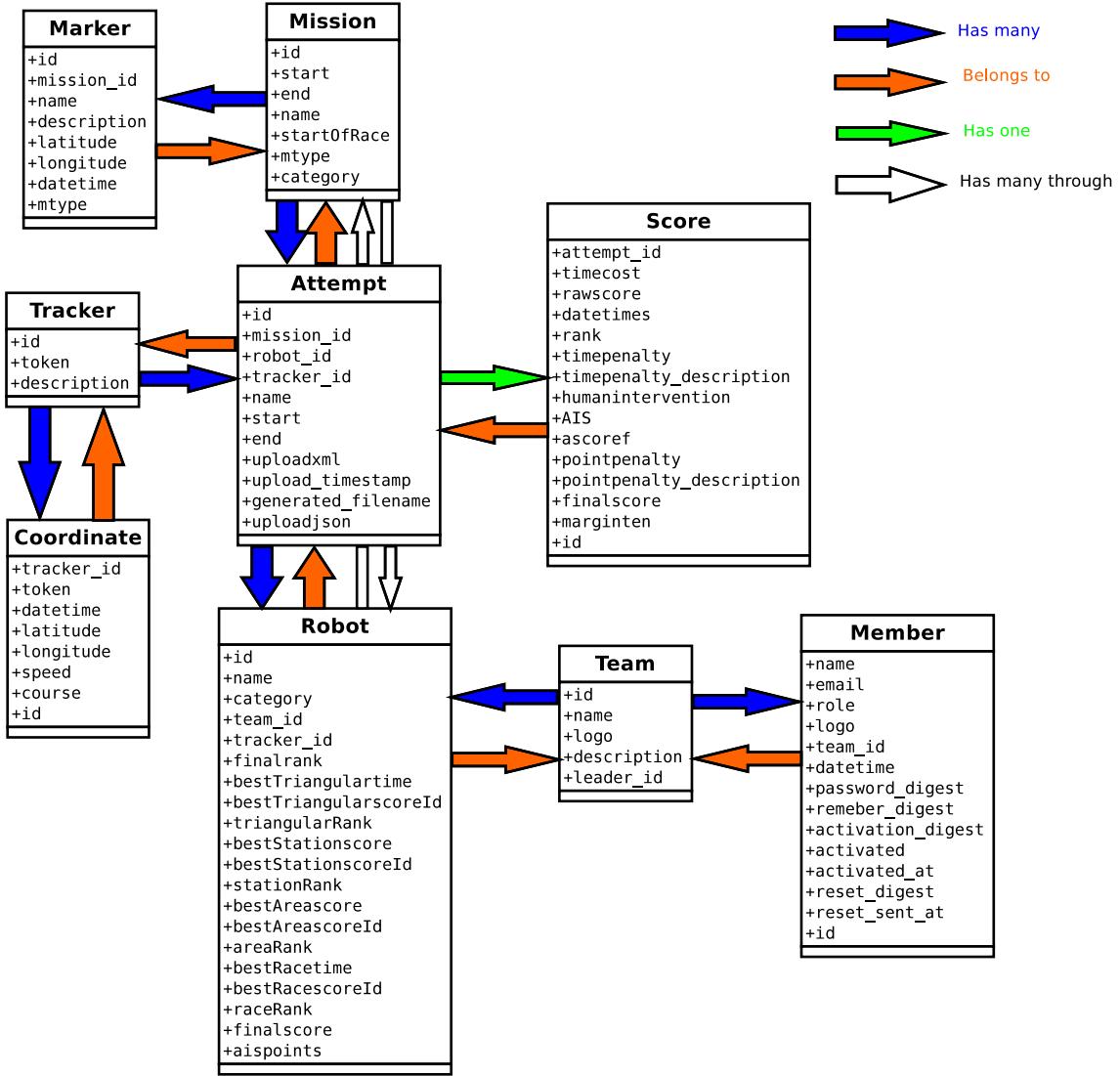


Figure 17: The final Database for WRSC2015

launched the machine with production mode(which is light and safer than development and test mode), our server was well prepared for the service.

## 2.4 Result for Tracking System and WRSC

Fortunately, our web site works quite well, all the functions we added perform as we expected.

### 1. Email

Our admin Gmail account works well, it can send the activation emails and reset password emails perfectly, all the users received their emails.

### 2. Tracking system

Here are some captures of missions: As the figures demonstrated, our web site could indicate the whole trace of all robots clearly, the tracking system works perfectly.

<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: wih6	Account activation - Monitor Your Robot Hi naturesyouth, Welcome to Monitor Your Robot! Click on the link below to	3 Sep
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: olelux42	Account activation - Monitor Your Robot Hi Ole, Welcome to Monitor Your Robot! Click on the link below to activate your	2 Sep
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: teni	Account activation - Monitor Your Robot Hi Terje Nilsen, Welcome to Monitor Your Robot! Click on the link below to	1 Sep
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: nicolas2lee	Account activation - Monitor Your Robot Hi nicolas2lee, Welcome to Monitor Your Robot! Click on the link below to activ:	1 Sep
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: simenweum	Account activation - Monitor Your Robot Hi Autonomus, Welcome to Monitor Your Robot! Click on the link below to activ	31 Aug
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: conny.ljunggren	Account activation - Monitor Your Robot Hi conny, Welcome to Monitor Your Robot! Click on the link below to activate yc	31 Aug
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: fabrice.le_bars	Account activation - Monitor Your Robot Hi lebarsfa, Welcome to Monitor Your Robot! Click on the link below to activate	31 Aug
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: dac46	Account activation - Monitor Your Robot Hi Daniel Clark, Welcome to Monitor Your Robot! Click on the link below to	31 Aug
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: hesseh (2)	password reset - Password reset To reset your password click the link below: Reset password This link will expire in	31 Aug
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: hesseh	Account activation - Monitor Your Robot Hi Henrik Hesse, Welcome to Monitor Your Robot! Click on the link below to	30 Aug
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: nicolas2lee	Account activation - Monitor Your Robot Hi nicolas2lee, Welcome to Monitor Your Robot! Click on the link below to activ:	28 Aug
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: toto (2)	Inbox Account activation - Delivery to the following recipient failed permanently: toto@toto.toto Technical details of pe	28 Aug
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: bastien.drouot	Account activation - Monitor Your Robot Hi Bastien DROUOT, Welcome to Monitor Your Robot! Click on the link below t	28 Aug
<input type="checkbox"/>	<input type="star"/>	<input type="square"/>	To: benoit.bourdon	Account activation - Monitor Your Robot Hi Benoit Bourdon, Welcome to Monitor Your Robot! Click on the link below to	27 Aug

Figure 18: Admin Gmail sending records

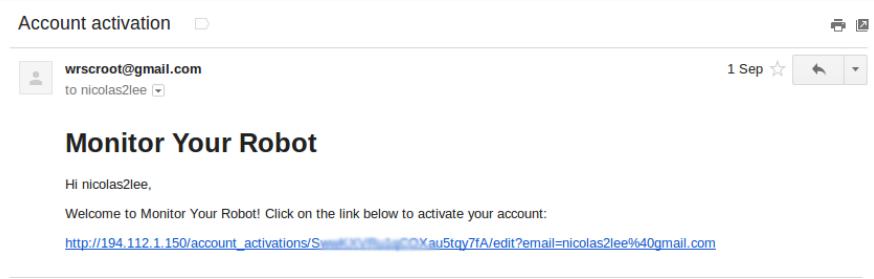
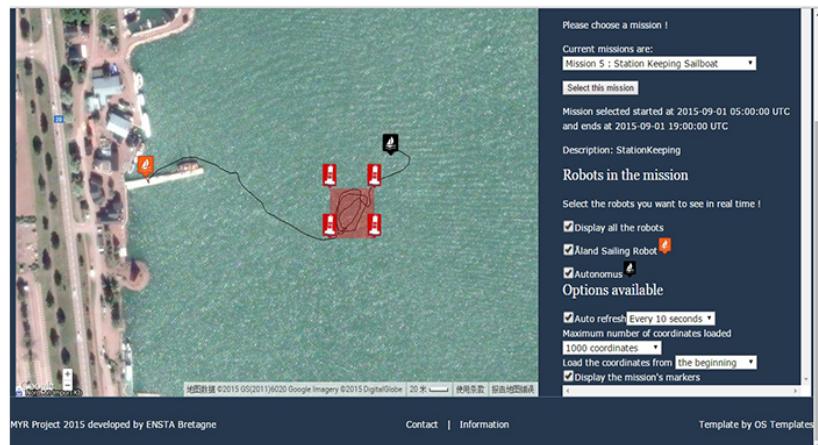


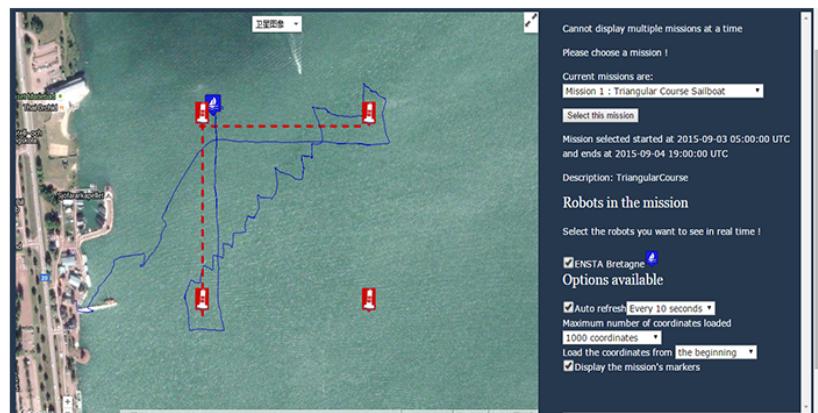
Figure 19: An example of activating email content

### 3. Scoring and Ranking

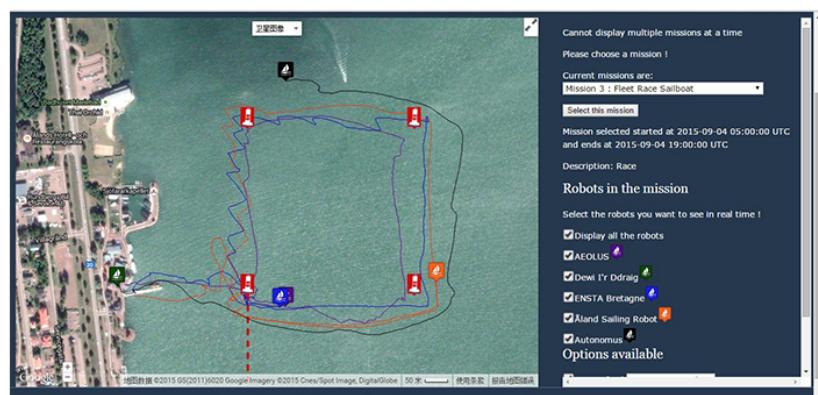
Before this year, all the scores were given by the Race committee and were measured by humans, but this year, with our tracking system and our algorithms, we can obtain more objective scores, so after discussing with the Race committee, the final result based on our calculations. Here is a quick view of the final standing: Also the uploading file function works well, and based on the submitted data and our trackers' data, here is a hint about the comparison of these two sets of data, finally the maximum difference is about 8 meters which is acceptable.



Station Keeping



Triangular Course



Fleet Race

Figure 20: Captures of WRSC mission in the real-time page

WRSC 2015 FINAL STANDING									
Category: Sailboat									
Rank	Team	Robot	Station keeping	Area scanning	Triangular course	Fleet race	AIS Points	Final Score	
1	Åland Sailingrobots	Åland Sailing Robot	8.10 319	9.68 0	10.00 1488	16.00 2829	0	43.78	
2	ENSTA Bretagne	ENSTA Bretagne	9.20 292	10.00 0	9.00 1949	15.00 3587	0	43.2	
3	Autonomus	Autonomus	8.20 282	?	?	2.00 99999	0	10.2	

Category: MicroSailboat									
Rank	Team	Robot	Station keeping	Area scanning	Triangular course	Fleet race	AIS Points	Final Score	
1	IfA Autonomous Sailing Team	AEOLUS	9.00 310	9.90 0	10.00 209	16.00 3416	0	44.9	
2	Aber Sailbot	Dewi I'r Ddraig	?	?	?	?	0	0.0	

Figure 21: Final Standing of WRSC2015

**AEOLUS 1st attempt**

*Start: 2015-09-03 09:59:00*  
*End: 2015-09-03 10:17:00*

**Upload area scanning xml file**  
**no file uploaded**

No file selected.

**Upload area scanning json file**  
 [XML IfA\\_Sailing\\_2ndAttempt.json](#)

No file selected.

**IfA\_Sailing\_generated\_2015-09-03 19:08:39 +0300.xml**

```
<@oacum>
<@datum>
  <section></section>
  <section></section>
  -<geo-position-checking type="array">
    -<geo-position-checking>
      <coord-test>20150903150217.0</coord-test>
      <coord-test-id type="integer">186063</coord-test-id>
      <coord-latitude>60.107395083333</coord-latitude>
      <coord-longitude>19.955701366667</coord-longitude>
      <datetime>20150903150217</datetime>
      <difference-from-tracker-to-team type="float">5.493222813555402</difference-from-tracker-to-team>
    <geo-position-checking>
    <geo-position-checking>
    <Section-Max-difference-from-tracker-to-team type="float">5.493222813555402</Section-Max-difference-from-tracker-to-team>
  </datum>
  <@datum>
    <section></section>
    <section></section>
    -<geo-position-checking type="array">
      -<geo-position-checking>
        <coord-test>20150903150244.0</coord-test>
        <coord-test-id type="integer">186109</coord-test-id>
        <coord-latitude>60.107691383333</coord-latitude>
        <coord-longitude>19.95565335</coord-longitude>
        <datetime>20150903150244</datetime>
        <difference-from-tracker-to-team type="float">2.6533701589466516</difference-from-tracker-to-team>
      <geo-position-checking>
      <geo-position-checking>
      <Section-Max-difference-from-tracker-to-team type="float">2.6533701589466516</Section-Max-difference-from-tracker-to-team>
    </datum>
    <@data>
    <Max-distance-from-all-sections type="float">8.626826611257618</Max-distance-from-all-sections>
  </hash>
```

Figure 22: Uploading file and an example of comparison XML file

### 3 Reflection

#### 3.1 Perspective

Although our web site was improved greatly, but the amelioration is always existing.

1. Security The security is always the most important thing to verify. Several actions could be adopted to reinforce the security.

- **HTTPS Protocol**

For the users' sign in and sign up pages, they should be applied the HTTPS protocol to provide a white list to avoid attackers instead of the HTTP Protocol in the current web site, but also it will increase the budget because we need to buy a certificate.

- **Robots Exclusion Protocol**

Robots exclusion protocol is used to define what we want to be quoted by the search engine (like google, yahoo). Some admin parts of the web site and also some private data do not hope to be published into the internet, then we can define the contents what we hope not to be visited by the search engine in robot.txt, and put this file into the Rails.root path. But this protocol based on the willingness of companies, there is not any mandatory action to make sure all the search engines obey the rule, the only tool we could use is the ethics.

## Robots.txt File Explained

Use the robots.txt file to restrict search engine crawlers from indexing selected areas of your website.

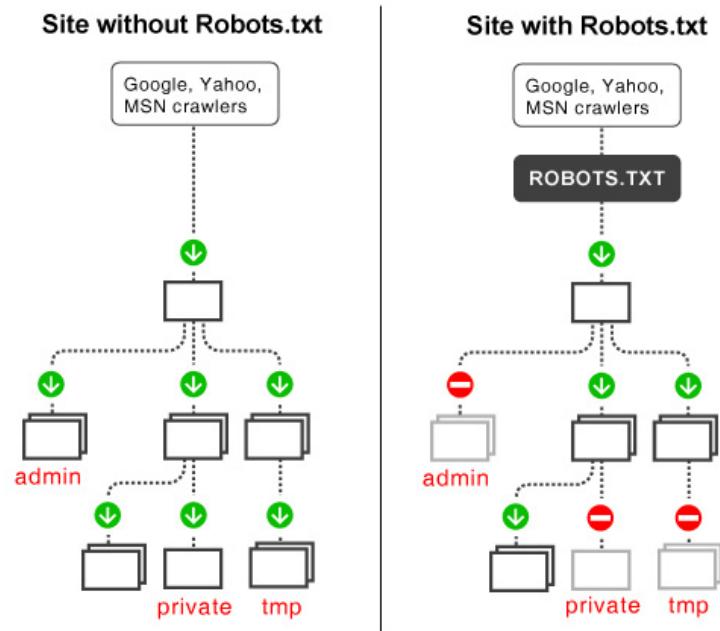


Figure 23: Robots Exclusion Protocol

### 3.2 Industrial analyse

After WRSC, occasionally discussed with some Finnish engineers, we found out that they had developed a similar tracking product in order to follow the trace(<http://www.thingsee.com/>) based on language c and Microsoft .net. Comparing to our tracking system, they had much more sensors, so they can measure more parameters, like: temperature, motion, orientation and so on, and their own OS based on Nuttx, the official declaration of lifetime is more than 1 year. The price of their product is more than 300 Euros. Although our tracking system do not have the same sensors, but actually the whole price we need to pay is about all the materials including one battery, two antennae(one for GPS, one for GSM), one electronic card with SIMCOM module, a SIM card and a SD card(in case of losing internet, it is optional). The total price is less than 100 Euros.

In addition, we found another similar project from the internet, in Brittany, France.(<https://www.gwenneg.bzh/fr/tifiz>) With a glance of these projects, it was not impossible to develop our own product with a lower cost, more functionalities, cross platform and stable performance in the near future.

### 3.3 Personal analyse

- **Technical benefits**

Thanks to this opportunity, I am able to master the development by using the ruby on rails framework, also with the front end design technologies(CSS, HTML, JavaScript). In addition, I am capable to cooperate with other developers not only with my workmates, but also include many other open source projects' developers. Keep a readable and clear coding habit, sum up the functionalities, provide well-explained APIs with concrete examples, would save a lot of time for the following developer and speed up the whole development, to make it become the real agile development.

- **Professional career**

It is a good experience to work with so many kind and smart people in such a beautiful place. The internship reached my expectation, not only it meets the technical requirements, but also it satisfies my personal self-feelings. The project of Tracking system is quite a good example to discover the method of technical development. This project started from 2013, and it is enhanced year by year by different developers. It covers and shows different developments in multi-domains. A RESTful web site, an Android application and reasonable electronic cards, and all these different services share the same usable APIs. It is a good example to define our own protocol. We are individuals, but we are not alone, the well-defined protocol make it possible to communicate with the previous developers and restart from their fruit, even the different developers may stay in different eras. Further the model driven development and test driven development focus on the global view, it is a systematic and efficient way to develop any other system.

## 4 Conclusion

Based on a ruby on rails framework, with jQuery libraries, building up a web server is not simple as what we see. In order to make a good product, we need to familiar with font end design technologies(html, CSS, JavaScript). Especially all the new technologies are born quickly, vast solutions and enormous tools appear. Even sometimes, it will be a little hard to struggle with the latest techniques and run after time, but keep a positive attitude to face the new things and get the capacity to filter the important information in such a big data era would be the key to success. In addition, script programming, knowledge of database and network, all of them are the basic elements to construct the final building. A wide view of multi-domains will facilitate the innovation.

Personally I am quite satisfied with what I had done. Every one or two weeks, a new feature was added, in other words, I got many different experience every one or two weeks. But also I discover the importance of test and management of project. The quality is much more important than the quantity. A few stable functions will be much better than a lot features which could not work. Further, the tests play a really important role in the development, before this internship, I thought the test time could not more than the development, it could only reach half of the whole period, but in the reality, the developers always pass most of time to check. What's more, it is impressive to work with kind and smart people in such a beautiful country.

A full stack engineer is not only an expert in a domain, but also should be familiar with different fields, then be capable to adapt to different environment and be capable to work under pressure. This internship not only allow me to learn much more scientific technologies, but also a good experience to be a responsible engineer.

## 5 Reference

- [1] Benoit B, Quentin D, Simon S, Mouad B and Jean-Jacques B, "Projet SWARMON - Rapport de Projet", 6 June 2014
- [2] Benoit B, Bastien D, "Final Report SWARMFRAME Project", 2015
- [3] Michael Hartl, "Ruby on Rails Tutorial: Learn Web Development with Rails", 3rd version, 2014 - <https://www.railstutorial.org/book>
- [4] Darel Rex Finley, "Point-In-Polygon Algorithm — Determining Whether A Point Is Inside A Complex Polygon", 2007 - <http://alienryderflex.com/polygon/>
- [5] "Calculate distance, bearing and more between Latitude/Longitude points", visit on Aug 20, 2015 - <http://www.movable-type.co.uk/scripts/latlong.html>
- [6] "Rules for World Robotic Sailing Championship 2015", May 09, 2015 - <http://wrsc2015.com/wp-content/uploads/2015/02/RulesWRSC2015May9.pdf>

## 6 Appendices

- **Appendix 1**

All the referred projects and the projects mentioned in the article

- **Appendix 2**

Versions about Ruby on Rails

- **Appendix 3**

The Python Program used to generate JSON file with an input XML file

- **Appendix 4**

Internship Agreement

- **Appendix 5**

Assessment Report

## **6.1 All the referred projects and the projects mentioned in the article**

### **1. JQuery**

A fast, small, and feature-rich JavaScript library(<https://jquery.com/>)

### **2. Google Map JavaScript APIs**

Provided by Google freely, enormous APIs associated with google map(<https://developers.google.com/maps/documentation/javascript/tutorial>)

### **3. Google chart**

Provided by Google freely, enormous APIs for many different types of graphs(<https://developers.google.com/chart/interactive/docs/>)

### **4. SWARMON**

A second year students' project realised by Benoit BOURDON, Quentin DESCOURS, Simon STEPHAN, Mouad BICHOUARINE and Jean-Jacques BOYE, under the supervision of Olivier REYNET at ENSTA Bretagne, aims to provide a tracking system for WRSC

### **5. MYR**

A 3rd year students' project at ENSTA Bretagne based on the SWARMON by Bastien DROUOT and Benoit BOURDON, which aims to enhance the development of web site of tracking system and create a web generator for monitoring robot(<https://github.com/Sylion/MYR>)

### **6. DataTable**

A project based on the jQuery JavaScript libraries aims to create a dynamic and interacted data table with any html table(<http://datatables.net/>)

### **7. Carrierwave**

A gem(open source and free to use) for ruby on rails makes easier to control the uploading files to the sites based on rails framework(<https://github.com/carrierwaveuploader/carrierwave>)

### **8. Mini\_magick**

A light gem(open source and free to use) and a ruby wrapper for ImageMagick or GraphicsMagick(<https://github.com/minimagick/minimagick>)

### **9. Simple\_captcha**

A gem(open source and free to use) easy to add captcha into web sites based on rails framework(<https://github.com/galetahub/simple-captcha>)

### **10. Noun**

A project offers enormous awesome icons(<https://thenounproject.com/>)

### **11. Favicon**

A project offers awesome icons which could be inserted easily into html code(<http://fontawesome.github.io/Font-Awesome/3.2.1/examples/>)

### **12. Current Web site**

All the codes are in my Github repertoire(<https://github.com/nicolas2lee/AdvancedMYR>)

## 6.2 Versions about Ruby on Rails

Actually my work environment is ubuntu 14.04. In order to install ruby on rails, I used rvm which is easy to control the version of ruby. All the versions about ruby on rails for WRSC 2015 are listed below:

---

```
rvm -v:  
rvm 1.26.11 (latest) by Wayne E. Seguin <wayneeseguin@gmail.com>, Michal Papis  
<mpapis@gmail.com> [https://rvm.io/]
```

```
ruby -v:  
ruby 2.1.1p76 (2014-02-24 revision 45161) [i686-linux]
```

```
rails -v:  
Rails 4.2.3
```

---

### 6.3 The Python Program used to generate JSON file with an input XML file

This program is which I used to generate a JSON file from a XML file during WRSC.

---

```
#Author is Conny Ljunggren, Aland University of Applied Sciences - Finland
namespaces = {'gml': 'http://www.opengis.net/gml'}
import json
import xml.etree.ElementTree as ET

tree = ET.parse('XML_IfA_Sailing_2stAttempt.xml')
root = tree.getroot()

data = []
for section in root.findall('Section'):
    si = section.find('sectioni').text
    sj = section.find('sectionj').text
    timeString = section.find('dateTime').text
    timeCleaned = timeString.replace('-', '').replace('T', '').replace(':', '',
        '').replace('Z', '')

    position = section.find('gml:pos', namespaces).text
    latitude = float(position.split()[0])
    longitude = float(position.split()[1])
    data.append({"sectioni":si, "sectionj":sj, "position": [{"latitude":latitude,
        "longitude":longitude, "datetime":timeCleaned}]})

fullData = {"tracker_id":"6", "name":"IfA_Sailing", "data":data}

with open('XML_IfA_Sailing_2ndAttempt.json', 'w') as outfile:
    json.dump(fullData, outfile)
```

---

### 6.4 Internship Agreement

# INTERNSHIP AGREEMENT

## HOST ESTABLISHMENT NON-SUBJECT TO FRENCH LAW

**Between:**

**ENSTA Bretagne - Ecole Nationale Supérieure de Techniques Avancées Bretagne,**

2 rue François Verny  
29806 BREST Cedex 9 France

Represented by Mr Patrick Puyhabilier, duly authorized in his capacity as Director  
Hereinafter referred to as "**ENSTA Bretagne**"

**And**

### HOST ESTABLISHMENT :

**ALAND UNIVERSITY A.S.**  
Aland University of Applied Sciences  
BP 1010, AX-22111 MARIEHAMN  
ALAND FINLAND

Represented by Mr/Ms/Mrs/Miss \_\_\_\_\_ duly authorized in his/her  
capacity as \_\_\_\_\_

Hereinafter referred to as the "**Host Establishment**",

**And**

**Mr Tao ZHENG** student of ENSTA Bretagne (**Civilian student**)

Nationality : Chinoise

Born on 16 October 1991 at ZHEJIANG (999) - CHINE

N° Sécurité Sociale (National Insurance Number) :

Title of Course : CI - Année 2 - Branche SPID -

Year: 2014 - 2015

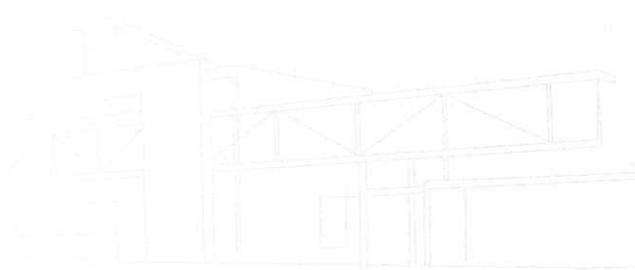
Profile : Systèmes - perception - information - décision

Hereinafter referred to as "**The Intern**",

2 rue François Verny  
29806 Brest Cedex 9  
Tél. +33 (0)2 98 34 88 00  
Fax +33 (0)2 98 34 88 46



École Nationale Supérieure de Techniques Avancées Bretagne - Membre du Groupe ENSTA



**Hereinafter collectively referred to as “The Parties”,**

**The following has been agreed :**

**ARTICLE 1 : SCOPE**

The present agreement determines the conditions of organization and procedure of the internship accomplished by The Intern within the Host Establishment.

**ARTICLE 2 : THE PEDAGOGICAL PROJECT AND INTERNSHIP CONTENTS**

**2.1 Expectations of the Internship in Terms of the Pedagogical Project, the Objectives and Results:**

The internship is compulsory. It is part of the training program of ENSTA students in the first year/second year/third year/masters/post masters degree.

An internship program is established in common agreement between the two parties, according to the training received by The Intern at ENSTA Bretagne. The aim is to enable The Intern to experience practical training which will complement and complete the theoretical training.

Theme of the internship: (to be completed by the Host Establishment)

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**2.2 Activities Entrusted to The Intern (to be completed by the Host Establishment):**

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## **ARTICLE 3 : ORGANIZATION OF THE INTERNSHIP**

The internship takes place from **01 July 2015** to **31 August 2015**. Under no circumstances, may the internship end after graduate.

The duration of the internship can be modified by simple amendment of the present agreement.

Upon request of ENSTA Bretagne, The Intern may occasionally interrupt his internship (viva voce etc). The Host Establishment will be forewarned of these dates.

## **ARTICLE 4 : SUPERVISION**

The Host Establishment will appoint a training supervisor **Ms Anna FRIEBE** in charge of technical supervision and optimization of the internship conditions of achievement. The pedagogical supervisor appointed by ENSTA Bretagne is :

- Mr Joël CHAMPEAU, head of profil SPID/SLS.

## **ARTICLE 5 : DISCIPLINE AND ABSENCE**

During the internship and his presence on the premises of the Host Establishment, The Intern is subject to the in-house rules of the Host Establishment, notably those concerning working hours, safety and medical visits.

In the case of non-respect of the in-house rules of the Host Establishment, on the part of The Intern, the internship may be terminated. Any disciplinary action falls within the jurisdiction of ENSTA Bretagne, the Host Establishment will provide the constituent elements should this be the case.

The Registrar of ENSTA Bretagne will be notified of any absence.

## **ARTICLE 6 : THE GRATUITY**

### **6.1 Military Student**

The military student may not receive a monthly gratuity.

### **6.2 Civilian Student**

For the duration of the internship, the Host Establishment will make provision for the payment of a monthly gratuity of \_\_\_\_\_ euros/dollars/other (*to be completed by the Host Establishment*).

Travel and accommodation costs incurred by The Intern on behalf of the Host Establishment, as well as training costs that may be required by the internship, are wholly taken care of by the Host Establishment, according to the procedure in force in the Host Establishment.

List of proposed advantages :

- \_\_\_\_\_  
- \_\_\_\_\_  
- \_\_\_\_\_

## **ARTICLE 7 : SOCIAL WELFARE**

### **7.1 Work-Related Accident**

Should The Intern fall victim to a work-related accident due to or during the internship, the Host Establishment and/or The Intern will immediately inform ENSTA Bretagne and transmit the elements necessary for the declaration and processing of the work-related accident.

#### **7.1.1 Military Intern**

During the internship period, the military Intern will be considered to be on duty. He is thus covered by the French State for any accident that could arise during the internship and associated travel. ENSTA Bretagne will declare the work-related accident to the appropriate services, according to the information communicated.

#### **7.1.2 Civilian Intern**

The coverage of the risk of professional accidents and illness depends on the gratuity paid to The Intern.

**i) Gratuity less than or equal to 13.75% of the French hourly earnings threshold (the internship being considered as non-remunerated as regards the French laws of social welfare) :**

The coverage of work accidents and work-related illnesses of The Intern affiliated to the French regime is maintained for a maximum period of twelve (12) months, in accordance with Article R.444-7 of the French Code de Sécurité Sociale (Code of Social Welfare). The Intern continues to benefit from the specific work-related accident coverage in Article L. 412-8 (2°) of the French Code de Sécurité Sociale, student regime, relative to work-related accidents. In the case of an accident, the Director of the Host Establishment undertakes to alert ENSTA Bretagne (Registrar) as soon as possible, to indicate the circumstances of the accident so as to enable a declaration to be made to the relevant Caisse Primaire d'Assurance Maladie (National Health Insurance Office). These steps are identical for The Intern receiving no gratuity.

**ii) Gratuity greater than 13.75% of the French hourly earnings threshold (the internship being considered as remunerated as regards the French laws of social welfare) :**

*To be advised by the Host Establishment (delete where inappropriate)*

- *The host country has the benefit of a work accident and work-related illness protection scheme and the Host Establishment pays contributions pertaining to coverage of these risks. In the case of a work-related accident, The Intern will be able to benefit from social welfare protection in the host country.*
- *The host country does not have the benefit of a work-related accident and work-related illness protection scheme. The Intern is strongly advised to subscribe to a private insurance scheme.*

## **7.2 Responsibility for Medical Expenses**

### **7.2.1 Internship carried out in an EU<sup>1</sup>/EEA<sup>2</sup> country or Switzerland<sup>3</sup>**

Before leaving to do the internship in an EU/EEA country or Switzerland, whatever the amount of the gratuity paid, The Intern must apply for a European Health Insurance Card (EHIC) :

- i) If the intern is a civilian, from his Caisse Primaire d'Assurance Maladie ( National Health Insurance Office) at least two (2) weeks before his departure ;
- ii) If he is a military Intern, from the Caisse Nationale Militaire de Sécurité Sociale (National Military Health Insurance Office), at least twenty (20) days before his departure.

This card is valid for a maximum of a year. It attests Health Insurance rights during the stay. The EHIC (or if urgent, the Provisional Replacement Certificate – PRC, valid 3 months) guarantees the payment of medical care necessary during a stay abroad, under the same conditions as those of insured citizens in the host country.

### **7.2.2 Internship outside an EU/EEA country and Switzerland**

#### **i) Military Student**

##### **Medical expenses**

Medical expenses incurred by The Intern, military student, in a foreign country outside the EU/EEA and Switzerland, are covered by the Caisse Nationale Militaire de Sécurité Sociale (National Military Health Insurance Office. Thus in application of Articles R.761-12 and R.761-13 of the Code de la Sécurité Sociale (Code of Social Welfare), the military intern benefits from the provision, in kind, of health insurance and maternity coverage throughout his carrying out of duties abroad, under the terms and according to the refund rates made provision for in the general welfare regime for adherents on assignment abroad.

##### **Medical Transport and Repatriation**

Only transport expenses incurred in the host country are refundable. This notwithstanding, medical repatriation costs are covered in the case of serious accident or acute phase of an illness occurring unexpectedly, which cannot be treated in situ and which require hospitalization in France.

#### **iii) Civilian Student**

##### **Medical Expenses**

Certain countries have an agreement with France<sup>4</sup>. The Intern should contact his health insurance organization in order to obtain information as to the terms of social welfare protection.

For an internship outside an EU/EEA country/Switzerland, in a country which has not signed an agreement with France, only urgent medical expenses may be covered by the Caisse d'Assurance Maladie (National Health Service), or mutuelle étudiante (mutual student insurer) on the presentation of bills or receipts to the limit of the refund rates in force in France.

It is in The Intern's best interest to ensure his complete social welfare protection

- by subscribing to private insurance from his “mutuelle etudiante” (mutual student insurer)
- or adhering to a student welfare protection scheme in the host country
- or by taking out insurance from the Caisse des Français à l'Etranger ([www.cfe.fr](http://www.cfe.fr)) (French Expatriates' Health Office)
- Medical Transport and Repatriation

The Intern is strongly advised to take out international health and repatriation insurance in case of illness abroad.

#### **ARTICLE 8 : PUBLIC LIABILITY AND INSURANCE**

Each of the three Parties declares that they are covered for Public Liability.

Injuries or accidents experienced by The Intern and attributable to the Host Establishment or its personnel, are compensated for according to the rules in force in the Host Establishment and/or the place of internship. The details of these rules are available to The Intern on simple request.

The Host Establishment undertakes to pay for any damage which could be caused by The Intern in the course of his internship duties. The Host Establishment accepts that it will not initiate proceedings against The Intern, or ENSTA Bretagne, to seek compensation for this damage, except in the case of willful error.

Should the Host Establishment make a vehicle available to The Intern, it is responsible for ascertaining beforehand that the insurance policy covers the vehicle's use by The Intern.

In the case of personal liability, without a direct link to the service or the internship, The Intern can be called upon to bring his personal public liability insurance into play.

#### **ARTICLE 9 : CONFIDENTIALITY**

The Intern is subject to the rules of confidentiality and/or loyalty in force in the Host Establishment.

#### **ARTICLE 10 : INTERNSHIP REPORT, VIVA VOCE AND EVALUATION**

The internship will be the subject of a report and a viva voce. The mark attributed will be integrated into the global marking scheme.

For students following a second year or third year pedagogical curriculum, wherever possible, a representative of the Host Establishment will be a member of the viva voce jury.

The Intern will also forward a copy of his report to his internship supervisor. The latter will inspect the contents , notably in respect of Article 9, “Confidentiality” and forward his evaluation to ENSTA Bretagne who will take this into account in the attribution of a viva voce mark.

At the end of the internship, the Host Establishment will deliver a certificate of achievement to The Intern, indicating the nature and duration of the internship.

Made in Brest, in three copies, one for each Party

Date: 08/04/2015

The Intern,

邹倩

For ENSTA Bretagne,

Patrick Puyhabiller, Director



For the Host Establishment,

Date:

Representative of the Host Establishment

(name and position)

Host Establishment Stamp

<sup>1</sup> EU : European Union (28) : Austria, Belgium, Bulgaria, Cyprus (southern zone under the control of the Government of the Republic of Cyprus, excepting the northern zone under the control of the Turkish Army and excepting the buffer zone under the control of the UN) the Czech Republic, Croatia, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal (including the archipelagoes of the Azores and Madera), Romania, Slovakia, Slovenia, Spain (the Iberian Peninsula, the Balearic Islands and the Canaries), Sweden, the United Kingdom (England, Scotland, Wales, Northern Ireland and Gibraltar).

<sup>2</sup> EEA : European Economic Area = EU +Norway + Iceland + Liechtenstein (These countries are not part of the European Union but have concluded a cooperation agreement on the European Economic Area).

<sup>3</sup> The Swiss Confederation concluded an agreement with the European Union on the free movement of persons, which entered into force on 1 June 2002.

<sup>4</sup> List of countries having concluded an agreement with the French Sécurité Sociale (National Health Service): Algeria, Andorra, Benin, Bosnia-Herzegovina, Cameroun, Canada, Cap-Verte, Chili, Congo, Côte d'Ivoire, the United States, Gabon, Israel, Jersey, Macedonia, Madagascar, Morocco, Mauritania, Monaco, Mali, Niger, Nouvelle Caledonia, the Philippines, Polynesia, Québec, San Marin, Senegal, Togo, Tunisia, Turkey, the Federal Republic of Yugoslavia.

## 6.5 Assessment Report



### RAPPORT D'EVALUATION ASSESSMENT REPORT

**ENSTA**  
Bretagne

**Merci de retourner ce rapport dès la fin du stage à / Please return this report at the end of the internship to :**

**ENSTA Bretagne – Bureau des stages - 2 rue François Verny - 29806 BREST cedex 9 –  
FRANCE**

**■ 00.33 (0) 2.98.34.87.70 - Fax 00.33 (0) 2.98.34.87.90 - [stages@ensta-bretagne.fr](mailto:stages@ensta-bretagne.fr)**

#### I - ORGANISME / HOST ORGANISATION

NOM / Name Aland University of Applied Sciences

Adresse / Address PB 1010 AX - 22111 MARIEHAMN  
Aland, Finland

Tél / Phone (with country and area code) +358 18 53 7000

Fax / Fax (with country and area code) +358 18 16 913

Nom du superviseur / Name of the person in charge of the placement

Anna Friebe  
Fonction Project manager, Åland Sailing Robots

Adresse e-mail / E-mail address anna.friebe@ha.ox

Nom du stagiaire accueilli / Name of the trainee

Tao Zheng

#### II - EVALUATION / ASSESSMENT

Veuillez attribuer une cote, en encerclant le chiffre approprié, pour chacune des caractéristiques suivantes. Cette note devra se situer entre A (très bien) et F (très faible)  
*Please give a mark between A (very good) and F (very weak).*

##### MISSION / TASK

❖ La mission de départ a-t-elle été remplie ?  A B C D E F  
*Has the task been carried out well ?*

❖ Le stagiaire a-t-il apporté des connaissances nouvelles à l'organisme d'accueil ?  non/no  
*Did the trainee bring news skills to the host organisation ?*  oui/yes

Lesquelles ? Which ones ? Ruby on rails

❖ Manquait-il au stagiaire des connaissances ?  oui/yes  non/no  
*Was the trainee lacking skills ?*

Si oui, lesquelles ? / Which ones ? \_\_\_\_\_

##### ESPRIT D'EQUIPE / TEAM SPIRIT

❖ Le stagiaire s'est-il bien intégré dans l'organisme d'accueil / Did the trainee easily integrate into the host organisation?  
(disponible, sérieux, adaptation au travail de groupe)  
*(flexible, dedicated, adapts himself (herself) to the team work)*  A B C D E F

Avez vous des observations ou suggestions à nous faire part / Do you have any remarks or suggestions to comment ? \_\_\_\_\_

#### **COMPORTEMENT AU TRAVAIL / BEHAVIOUR TOWARDS WORKS**

Le comportement du stagiaire était-il conforme à vos attentes (*Ponctuel, ordonné, respectueux, soucieux de participer et d'acquérir de nouvelles connaissances*) ?

Did the trainee come up to expectations (*Punctual, methodical, responsive to management instructions, concerned with quality, concerned about gaining new skills*) ?

A B C D E F

Avez vous des observations ou suggestions à nous faire part / Have you any remarks or suggestions to comment ? \_\_\_\_\_

#### **INITIATIVE – AUTONOMIE / INITIATIVE – AUTONOMY**

Le stagiaire s'adaptait vite à de nouvelles situations ?  
(*Proposer des solutions aux problèmes rencontrés, autonome dans son travail,..*)

Did the trainee adapt himself (herself) well to new situations ?  
(*Suggest solutions to problems met, was independent in his/her job...*)

A B C D E F

Avez vous des observations ou suggestions à nous faire part / Have you any remarks or suggestions to comment ? \_\_\_\_\_

#### **CULTUREL – COMMUNICATION / CULTURAL – COMMUNICATION**

Le stagiaire était-il ouvert, d'une manière générale, à la communication  
*Was the trainee open to listening and expressing himself (herself)*

A B C D E F

Avez vous des observations ou suggestions à nous faire part / Have you any remarks or suggestions to comment ? \_\_\_\_\_

#### **OPINION GLOBALE / OVERALL ASSESSMENT**

❖ La valeur technique du stagiaire était :  
*The technical skills of the trainee were :*

A B C D E F

#### **III - PARTENARIAT FUTUR / FUTURE PARTNERSHIP**

❖ Etes-vous prêt à accueillir un autre stagiaire l'an prochain ?

*Are you prepared to host another trainee next year ?*  oui/yes  non/no

Fait à Marihamn, le 24, In August 2015

Signature Irina Fieble

*Merci pour votre coopération  
We thank you very much for your cooperation*