Abstract:

Football is becoming popular with the increase in the number of players and field owners. Services, however, are not good enough to meet the growing demand. Usually, people who want to reserve a football field have to go to the field to reserve, or call the field owner. Or else, they have to give up because they just know few familiar football fields. For the field owners, they cannot find the channel to advertise their fields to potential users. That is the reason why we create **Football Field Reservation System** to resolve these problems, and provide some additional services for users and field owners.

Key Words:

Reserve, football field

1. Introduction:

When user wants to reserve a field, there are two possibilities:  
-1: Reserve field.  
-2: If the user needs to find an opponent, he must request the field owner to find an opponent team. If field owner find an opponent team, then the field will be reserved.  
Solutions that the Football Field Reservation System provide is that it allows field owners and users to communicate in a quicker and more convenient way. In particular, the main purpose of the System is that field owners can manage their fields more effectively, while users can reserve fields online and find the-same-level opponents based on rating points. Rating points are calculated by ratings and comments of users after a matching process has finished.

1. Problem and solution plan

For the field owner, conflicts and missing are likely to occur when processing requests on paper. The absence of customers during off-peak time also makes field owners unable to secure their revenue. For the user, some very common problems may occur: difficult to reserve the field during peak hours, difficult to find opponents, etc.  
The Football Field Reservation System provides services to 2 type of customers:  
1. To the field owner, the system helps with field management, time management and price management of football fields. Field owner can launch promotion schemes to attract players during off-peak time.  
2. The system helps user find field. The opponent search function allows the user to find the opponent that suits him/her most. If no suitable opponent is found, then the user can leave the matching request to other users who can find him/her.

1. Plan implementation
2. Reserve field

The system helps the user find the nearby fields. The system locates the coordinates of the user through GPS (Global Positioning System) and compares theirs with the coordinates of available fields in the database. The user can also choose search distance and new locations (via Google API). The System will inform user when the field is available. Then user will select the time frame and reserve the field.  
However, if many users are looking for fields at the same time, the system will have to do excessive calculations. To improve the performance, the system imports some constants to support calculating latitude and longitude.

1. Matching opponent

The search opponent function allows user to find suitable opponents. The system will rely on the user's rank, distance between two users and their favorite fields list to make a list of suitable fields for both. If there are no suitable opponents, the user can leave the matching request for other users who can find him/her later.  
  
Set favorite field and blacklist functions make the matching system more accurate and preferable to users. After completing a match, two users will rate the match, which enables the system to calculate 2 users’ rank more accurately. To encourage 2 users to rate, the system will reward each user who gives correct / honest rating bonus points for exchanging voucher.

1. Manage field

Via the web application, field owner can create fields, time enable for each day of the week and set price for each time frame. The system supports field owner to optimize peak-time periods: in optimized time frame, the user must reserve the whole time frame set by the field owner. In order to facilitate the transference to web application, the system allows field owner to reserve a period of time, provided that no other users have previously reserved it. The online payment system also allows payment become quick and easy, which minimizes the risk to the field owner. Field owner can launch promotion schemes to attract players during off-peak times. The system also sets minimum price for every time frame and every location to prevent anti-dumping and create a healthy business environment for field owners.

The field management system is based on vacant time frames of the field, so that the System can know which field owner can satisfy the user’s request. If H (0, ..., k, ..., 23) is the set of active fields for one hour from k to k + 1 (H (k), the number of active fields between k and k + 1 hour).  
When a user reserves the field from x to y hour(s). The system will check H (k) with x <= k <= y-1 with all H (k)> 0, there exists at least 1 vacant field from x to y.

4. Analysis

For any two points on a sphere, the haversine of the [central angle](https://en.wikipedia.org/wiki/Central_angle) between them is given by

{\displaystyle \operatorname {hav} \left({\frac {d}{r}}\right)=\operatorname {hav} (\varphi \_{2}-\varphi \_{1})+\cos(\varphi \_{1})\cos(\varphi \_{2})\operatorname {hav} (\lambda \_{2}-\lambda \_{1})}

where

* hav is the [haversine](https://en.wikipedia.org/wiki/Haversine" \o "Haversine) function:

{\displaystyle \operatorname {hav} (\theta )=\sin ^{2}\left({\frac {\theta }{2}}\right)={\frac {1-\cos(\theta )}{2}}}

* *d* is the distance between the two points (along a [great circle](https://en.wikipedia.org/wiki/Great_circle) of the sphere; see [spherical distance](https://en.wikipedia.org/wiki/Great-circle_distance)),
* *r* is the radius of the sphere,
* *φ*1, *φ*2: latitude of point 1 and latitude of point 2, in radians
* *λ*1, *λ*2: longitude of point 1 and longitude of point 2, in radians

The latitude of Ho Chi Minh City, Vietnam is **10.762622**, and the longitude is **106.660172.**

A(lat1, long1) B(lat 2, long2).

1. Lat1 = lat 2 = 10.76, d=5(km), r= 6.367.449(m)
   * Long2 = long1±0.0455 (in decimal)
2. Long1 = long2, d=5(km), r=6.367.449(m)
   * Lat2 = lat1±0.045 (in decimal)

https://www.movable-type.co.uk/scripts/latlong.html

<https://en.wikipedia.org/wiki/Haversine_formula>

[*van Brummelen, Glen Robert*](https://en.wikipedia.org/wiki/Glen_Robert_van_Brummelen) (2013). [*Heavenly Mathematics: The Forgotten Art of Spherical Trigonometry*](https://books.google.com/books?id=0BCCz8Sx5wkC&pg=PR7). [*Princeton University Press*](https://en.wikipedia.org/wiki/Princeton_University_Press). [*ISBN*](https://en.wikipedia.org/wiki/International_Standard_Book_Number) [*9780691148922*](https://en.wikipedia.org/wiki/Special:BookSources/9780691148922). 0691148929*. Retrieved 2015-11-10*.