Abstract:

Football is becoming popular with the increase in the number of players (users) and field owners. Services, however, are not good enough to meet the growing demand. Normally, people who want to reserve a football field have to book offline, or call the field owner. Or else, they have to give up because they just know a few familiar football fields. To 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 address these problems, and provide some additional services for users and field owners as a whole.

Key Words:

Reserve, football field

1. Introduction:

When users want to reserve a field, there are two possibilities:  
-1: If the user has enough people to divide into 2 teams, then the field is ready to be reserved.  
-2: If the user needs to find an opponent, he must request the field owner to find an opponent team. If found, then the field will be set (or 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

To the field owner, conflicts and missing are more likely to occur when processing requests on paper. The absence of visitors during low season also makes field owners unable to secure their revenue. To the user, some very common problems may occur: difficult to reserve the field during peak hours, difficult to find opponents if there are not enough players/ people to split into 2 teams, etc.  
The Football Field Reservation System provides services mainly divided into two components:  
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 low season.  
  
To the user, the system helps him find surrounding areas. The opponent search tool allows the user to find the opponent that suits him most. If no suitable match is found, then the user can leave the matching request to other users who can find him (the user).

1. Plan implementation
2. Reserve field

The system helps the user find the surrounding area. 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 customize the scope and search new locations (via google api). After a field is selected, the System will respond by informing when the field is available. The user selects the time frame and then reserves the field.  
However, if many users are looking for a field at the same time, the system will have to do excessive calculations. To improve the performance, the system imports a constant to support calculating latitude and longitude.

1. Matching opponent

The opponent search tool allows the user to find the opponent that suits him most. The system will rely on the user's rank, distance between two users and the list of their favorite fields to make a list of matches suitable for both. If no match is found, the user can leave the matching request for other users who can find him (latter).  
  
Other **set favorite field** and blacklist users tools make the matching system more accurate and preferable to users. After completing a match, two users will confirm the matching scores, which enables the system to rank 2 users more accurately. To encourage 2 users to confirm scores (which will help the system run correctly and efficiently), the system will reward each user who gives correct/ honest rankings bonus points (in exchange for a voucher).

1. Manage field

Via the web-app, the field owner can create fields, create time enable for each day of the week and set the price for each time frame. The System supports field owner to optimize peak-time periods: the user must reserve the whole time frame set by the field owner. In order to facilitate the transference to web-app, the System provides a tool that allows field owner to reserve a period of time, provided that no other users have previously reserved it. The online payment system also allows quick and easy payment, which minimizes the risk to the field owner. Field owner can launch promotion schemes to attract players during low season. The system also uses min 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 quickly know which field owner can satisfy the user’s request. If H (0, ..., k, ..., 23) is the set of vacant fields for one hour from k (H (k), the number of vacant 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*.