ExploX - Seminar Project Proposal

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ABSTRACT

In this proposal, we present ExploX, an app that allows for route creation and exploration of less frequented areas.With this we want to enable the user to generate a more holistic image of their living surroundings and allow them to escape their daily routine.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous; See http://acm.org/about/class/1998/ for the full list of ACM classifiers. This section is required.

Author Keywords

Route planning; Exploration of unfamiliar areas; Navigation; Ubiquitous Sports technologies; Endurance sports; Motivation

INTRODUCTION

In the last 10 years, the services such as Google Maps that enable point to point navigation and Geocaching that enable people to explore unfamiliar areas have made great progress and bring more fun. Nowadays also a variety of services such as Strava and Komoot emerge not only navigation but also route planning for running and biking. Based on these services, we want to develop an app which could plan routes and help do personal exploration of the unseen area with the history data using the API of Strava, motivating athletes to cover more less visited parts of their environment.

Our aim here is to motivate athletes to explore more of less visited parts of cities. To accomplish this ,firstly we aim to create routes along paths around areas that the user is most unlikely to know about. The maps would be divided into two parts, the familiar area and unfamiliar area using the history data. The app would recommend person A the routes in seldom visited area but frequent visited by person B, in terms of safety. Secondly our work will allow the user to explore neglected areas knowing the current location and specific destination. So the generated route could be downloaded and preview before exploring. Thirdly, the explored areas would fade out from dark black to transparent according the the frequency of visiting.

Psychogeography is the practice of exploring the urban environment with the intention to investigate the effects on feelings and behavior. To generate a complete image of the city this is necessary, as the Psychogeographers argue. This is one of the reason we want to create the fading map.

Taking routes of another athlete could avoid the case of illegal exploration or simply routes that are not suited for running or cycling. One has to explore parts of the environment that are normally not frequented.As our aim with this project is not to support illegal activities we do not consider the actual exploration of such areas which is regarded as danger.

Using the social media sources and personal location history we determine areas that are less frequented and might be unknown even to citizens living in the city for a long time. The design of the ExploX application, tries to combine the ideas of the psychogeography movement from the 60s with more recent developments of the exploration and Strava communities. With this we want to enable the user to generate a more holistic image of their living surroundings and allow them to escape their daily routine. Additionally we hope to complete the users spatial memory about their city.

The paper is structured as follows. First we present the introduction and related work that led to the development of this idea. Afterwards we lay out the designing milestones, a list of equipment and resources we need and the formal requirements for this prototype. Thereafter we will present how we want to conduct the user study in order to evaluate our approach.

RELATED WORK

In the following section, we will examine previous work done on the topics of route planning, (urban) exploration and motivation in sports and sightseeing. While the former two topics will give us an overview over different approaches to navigation and goals in exploration, the latter will help us design our prototype in order to motivate users to explore unfamiliar

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areas as well as complete their training routine and become better athletes.

Route Planning

Route planning has become a very hot research topic in mobile HCI because of the rise of smartphones, smartwatches and other wearables. Pedestrian navigation is particularly interesting because it is much more diverse than the regular turn-by-turn navigation used in car navigation systems.

McGookin and Brewster have done an analysis on how runners navigate the environment and presented a novel navigation system for runners [3]. Their main finding was that there are two types of running practices. *Familiar location running* is characterized by loops (i.e. circuit tracks). Runners usually plan the route beforehand but only use their mental model of the environment while running. On the other hand, *unfamiliar location running* usually have back runs (i.e. runners go from A to B and then the same way back to A). This is a problem, because unfamiliar location running is mainly used "as a way to explore the environment and identify places to later visit". Our approach will address this problem by giving the runners the opportunity to explore new areas and at the same time see as much as possible by not running the same way back again.

In order to provide a good running experience, the route has to be selected carefully. There are many approaches that not only use distance and time to calculate a route but also take into account other factors. Stolfi and Alba noticed that most navigators calculated the same route leading to traffic jams [9]. They proposed a system that uses traffic data to re-direct cars in order to spread traffic more evenly, leading to an overall better traffic situation. In particular, they improved travel times by 18% and greenhouse gas emission by 14%.

Katayama et al. took a similar approach and navigated visitors of events using body-worn sensors in order to avoid congestions and other problems that are difficult for event managers [2].

There are web mapping services such as Strava (www.strava.com) and Komoot (www.komoot.com) that also provide information about the surface of the track in order to better plan the route. For instance, cyclists can easily identify off-road streets and plan their route accordingly.

As an extension to those online services, Daiber et al. have proposed a concept of *pioneers* to support mountaineers in their route planning. The idea is that users can select a number of friends or experienced mountaineers called *pioneers*. The user will see the routes their pioneers have recently taken and can incorporate them into their own route planning [1].

Exploration

As already identified by McGookin and Brewster, exploring the environment is an important motivational factor for runners [3]. In familiar location running, the main objectives are to meet a distance, time or place target rather than enjoying the environment. However, when the athlete is in an unfamiliar location, these objectives are reversed. They find that this is mostly the case on holidays, however, we want to find out whether we can get athletes to take unfamiliar routes and explore areas of cities in which they have been living for a longer period of time as well.

Robinson et al. have implemented an approach where they encouraged people to explore an area by giving different haptic feedback when they can take alternative routes [7]. They could show that people were able to reach their target with only low-resolution haptic feedback and providing users with alternative path awareness is also beneficial.

In a similar way, O'Hara could identify discovering and exploring new places as one of the main motivations in geocaching [4]. The targets geocachers are looking for are often hidden in special places that are particularly beautiful or abandoned such as old factories or hospitals.

There has also been a movement called *urban exploration movement* where people go to and explore abandoned places [5]. The growing interest in geocaching and urban exploration shows that people care about the environment they are living in and want to find out more about it. To support this, Quercia et al. have build a system to determine aesthetic qualities of a city [6]. They used this data in a navigation system where users are guided through particularly beautiful, happy or quiet areas.

Motivation and Design

When designing our system, we must not forget about what motives athletes to do sports in the first place. It is our goal to provide a motivating way to explore the city but this alone will probably not suffice to encourage athletes to use our system in their regular training routine. We will try to incorporate several motivational factors into the design of our system.

Vallerand et al. have identified three psychological needs which are the reason why people take part in sports [10]. Those needs are the need for autonomy, competence and relatedness [11]. The need for competence is satisfied by giving the athletes regular success and not make them fail all the time. Some competition is good but overall the training climate should be mastery-oriented and not highly competitive. The need for relatedness is satisfied by providing the possibility for athletes to cooperate, share and do activities together. Giving the users some freedom of what they want to do satisfies their need for autonomy [10].

In a similar fashion, Ross and Iso-Ahola have identified knowledge-seeking and social interaction as the dominating motivation force in sightseeing. The bottom line from their research is that it is important to teach users something while they are exploring and at the same time give them the opportunity for social interaction [8].

DESIGN AND IMPLEMENTATION

Vertical Prototypes

Our system is very dependent on different third party libraries, web services as well as technical capabilities of the platform. Therefore, it is wise to develop quick vertical prototypes for those parts first, before starting with the design and development of the actual software architecture. In this section we will have a quick look on the vertical prototypes we implemented for various critical functionalities, both those that failed and those that worked.

Since our system performs a lot of calculations on existing route data, we had to find an efficient way to store and execute spatial queries on spatial data. Routes and activities consist of a list of ordered coordinates, represented as latitude-longitude pairs, which act as waypoints. We chose MongoDB, which is a database that specifically supports such coordinates and allows to execute queries such as ”Find all coordinates within 20km of a given point”. After designing our route generation algorithm in theory, we tested the relevant queries on the database in order to verify that it suits our needs.

A critical component of our system is the visualization of the map which includes displaying explored areas as well as single routes. We researched ways how we can display maps on a website and found Leaflet.js as a good candidate. By studying the documentation, we learned that there exist several plugins for this library. We had a look at each of the relevant libraries individually and tested it out with some sample data.

The main use case of our system is the generation of new cycling routes, so we had to find a service that can do that. The Open Source Routing Machine (OSRM) is the most popular way to do this. We will explain this part in more detail below.

Implementation

The software has been implemented in JavaScript. Although we have a front-end graphical user interface that runs in the browser, the main program logic happens on the server. To achieve that, we used Node.js as JavaScript runtime, which is basically JavaScript for the back-end. This allows the JavaScript code to be programmed in a very efficient asynchronous and non-blocking way and run on the server. The main reasons why we think using Node.js in this context is a good idea are, first, the application is communicating a lot with other APIs by sending and receiving requests over the network. Second, we have a front-end that runs JavaScript in the browser but also third, the Node.js ecosystem has grown a lot in recent years and there is a huge number of open-source packages available, whose dependencies can easily be managed by using the Node package manager.

As discussed earlier, an incremental and iterative approach is very useful when designing and implementing software, which is why we deeply incorporated that paradigm into our development process. After implementing a certain feature, it went through a short phase of testing and evaluation, before we proceeded to the next feature. Also, for most of the methods and functionalities, we created unit tests that constantly ensure the correctness of our code.

The whole system has been designed in a modular way which allows it to easily be maintained and modified for other projects. In the following, we will explain the non-trivial parts of the implementation.

User Management

//TODO Kevin

Spatial Queries

//TODO Kevin

Strava API

//TODO Kevin

Map Visualization

//TODO Kevin

Routing Generation

//TODO Kevin

EVALUATION

//TODO Lukas

CONCLUSION

//TODO

One paragraph about individual contribution

I think this should go into a separate document.

REFERENCES

1. Florian Daiber, Felix Kosmalla, Frederik Wiehr, and Antonio Krüger. 2017. Follow the pioneers: towards personalized crowd-sourced route generation for mountaineers. 1051–1055.
2. Takuya Katayama, Masashi Yamishita, Masaki Nakamiya, Kazuya Murao, Kohei Tanaka, Tsutomu Terada, and Shojiro Nishio. 2008. Development of a navigation system with a route planning algorithm using body-worn sensors. 88–93.
3. David K. McGookin and Stephen A. Brewster. 2013. Investigating and Supporting Undirected Navigation for Runners. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems (CHI EA '13)*. ACM, New York, NY, USA, 1395–1400. DOI: http://dx.doi.org/10.1145/2468356.2468605
4. Kenton O'Hara. 2008. Understanding geocaching practices and motivations. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 1177–1186.
5. David Pinder. 2005. Arts of urban exploration. *cultural geographies* 12, 4 (2005), 383–411. DOI: http://dx.doi.org/10.1191/1474474005eu347oa
6. Daniele Quercia, Neil O'Hare, and Henriette Cramer. 2014. Aesthetic capital: What makes london look beautiful, quiet, and happy? (02 2014), 945–955.
7. Simon Robinson, Matt Jones, Parisa Eslambolchilar, Roderick Murray-Smith, and Mads Lindborg. 2010. "I Did It My Way": Moving Away from the Tyranny of Turn-by-turn Pedestrian Navigation. In *Proceedings of the 12th International Conference on Human Computer Interaction with Mobile Devices and Services (MobileHCI '10)*. ACM, New York, NY, USA, 341–344. DOI: http://dx.doi.org/10.1145/1851600.1851660
8. Elizabeth L. Dunn Ross and Seppo E. Iso-Ahola. 1991. Sightseeing tourists' motivation and satisfaction. *Annals of Tourism Research* 18, 2 (1991), 226 – 237. DOI: http://dx.doi.org/https://doi.org/10.1016/0160-7383(91)90006-W
9. Daniel H. Stolfi and Enrique Alba. 2017. Computing New Optimized Routes for GPS Navigators Using Evolutionary Algorithms. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '17)*. ACM, New York, NY, USA, 1240–1247. DOI: http://dx.doi.org/10.1145/3071178.3071193

10. Robert J Vallerand. 2007. Intrinsic and extrinsic motivation in sport and physical activity. *Handbook of sport psychology* 3 (2007), 59–83.

11. Robert J Vallerand and Gaétan F Losier. 1999. An integrative analysis of intrinsic and extrinsic motivation in sport. *Journal of applied sport psychology* 11, 1 (1999), 142–169.