Spatio-Temporal Data Mining based Task Reminder System

Final Year Project Proposal

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BS in Computer Science / Software Engineering (CUI)

Department of Computer Science

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Project Registration

Project ID (for office use)						
Type (Nature of project)	[ ] **D**evelopment		[ ] **R**esearch		[*] **R**&**D**	
Area of specialization	Data Mining, Spatio-Temporal Data					
Project Group Members						
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(iii)						
Name & Signature of Batch Advisor (If students are eligible for FYP)						

Plagiarism Free Certificate

This is to certify that, I am Abdul Dayyan S/o Shafiq Ahmad, group leader of FYP under registration no CIIT/FA16-BCS-037/LHR at Computer Science Department, COMSATS Institute of Information Technology, Lahore. I declare that my FYP proposal is checked by my supervisor and the similarity index is _____% that is less than 20%, an acceptable limit by HEC. Report is attached herewith as Appendix A.

Date: September 5, 2019.   Name of Group Leader: Abdul Dayyan   Signature: _____

Name of Supervisor: Dr. Hamid Turab Mirza   Co-Supervisor (if any):_____

Designation: _____   Designation: _____

Signature: _____   Signature: _____

Approval of FYP Management Committee

Committee Member 1:   Name: _____

[ ] Accept   [ ] *Defer   [ ] *Reject   Signature: _____

*Remarks: _____

Committee Member 2:   Name: _____

[ ] Accept   [ ] *Defer   [ ] *Reject   Signature: _____

*Remarks: _____

Convener: Name: _____

[ ] Accept   [ ] *Defer   [ ] *Reject   Signature: _____

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Project Abstract

People of today's age are usually busy in their hectic routines and are sometimes unable to remember what tasks they had to accomplish at any specific time and location. Here comes the need for a reminder systems, but the problem arises when and where to remind the user of a specific reminder? When reminded, the user might be busy or may not want to accomplish the task yet or may be too distant from the location. The problem with the temporal reminder is that it reminds the user on a specific time. The location based reminder is not also very efficient as it works on the basis of Euclidean distance which is not efficient. Here comes the need of the reminder system that could remind the user of the task beforehand based on his/her past activities and route patterns. The solution to this problem is the intelligent reminder system which doesn't remind the user based on time like the typical mobile phone reminders does but suggest the user beforehand on the basis of the past routine of the user.

Introduction

Today's era is the 21st century, an era where human beings have started being dependent on computers. It would not be wrong to say that humans have been surrounded by the machines, instead of machines are surrounded (used) by them. In near future, people may become dependent on computers which can think like humans and take decisions like a human brain. While there are self-driving cars implemented by Google [1], Hollo Lens by Microsoft [2], voice assistants like Cortana and Siri [1], self-learning algorithms in Neural Networks [2] which execute and train themselves like human brain does. With the emergence of the fields of Data Science, Data Mining and Big Data which are all tightly coupled, software engineers started to develop applications based on users' activities and behaviours. And with the increasing demand of reminder systems which most of the people use to get a notification from their electronic gadgets mostly mobile phone or smart watch, the scientists planned to develop an intelligent reminder system based on the user's routine routes and activities.

The simple time-based reminders systems are not much helpful because even the user doesn't know when he/she will be at a certain location. An intelligent reminder system notifies the user of the set reminders based on the collected data from the user's daily routine and not on a specific time. Instead of setting the reminder based on a specific time, or setting a reminder at all, the system will learn from the user's daily routine, the paths of travelling and the activities and then it will notify the user of a specific tasks after learning from the routine. There are usually 3 types of reminder systems: temporal reminder system which is simply a time based reminder system, location based reminder system which reminds the user of the set reminders based on the location and future based reminders which learn from the route patterns of the user and then remind the user.

This project aims to develop an intelligent reminder system which will access the user's location using GPS and will mine user's routine and route patterns. The system will first store the patterns of the user's routes, which turn the user takes from a specific road to determine the routes the user uses the most. The user will first have to store the locations to get reminders to those locations

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[1] https://medium.com/swlh/autonomous-vehicles-and-their-impact-on-society-eff8f3fd766f
[2] https://www.forbes.com/sites/solrogers/2019/09/11/what-we-know-about-hololens-2/

before going there after learning from the user's routine. Then it will store the user data of all the frequently used routes. Then the system will analyse and determine the next probable task of the user and will trigger the message based on what the user does on that specific time of the week in a month or some other time span.

There are two ways to trigger the reminder based on the location: either by calculating a Euclidean distance and setting a threshold distance or by storing the user routes and drawing the next probable routes of the user by using the data mining algorithms. The Euclidean distance is the straight line distance between two points on the plane. The Euclidean way of triggering the notification is not very efficient as it only calculates the distance between the user and the set location without considering the routes. It is possible that the user is near to the location, the reminder is triggered and there is no road to the destination. So, the system will be storing the data of the user's routes and will apply the data mining algorithms on the dataset and will consider the next estimated tasks of the user to remind the user of a task. Before this, the user will store the locations frequently visited so that the system can specially keep record of route patterns of those locations.

Motivation and Scope

The reason for choosing this project is that there are no or a very few systems that have been implemented by the data mining algorithms. Almost every reminder system built out there is based on the Euclidean distance, so they are not accurate. They remind the user as soon as the distance between the user's location and the destination location is below the threshold distance set. Most of the times, there is no road to go to that point. Especially in European countries and United States there are such roads where there is no U-turn or any road to a location. The Euclidean distance may be even a few hundred meters only but the road distance makes up to 6 to 8 kilometres easily. So the motivation will be to try the best to implement the system on the data mining algorithms to trigger a reminder.

Since, the project is being built on data mining techniques and the system will store the user route patterns first, so this system can be used in any country of the world beside Pakistan. Any user will be able to load it in the smart phone, save the locations on which he/she wants the notifications to be triggered and the system will store the routes patterns for the first 2 to 4 weeks and then it will determine the user's routes based on the data gathered. So, the system will be set according to the each user's routing routines and will work equally efficient for everyone.

Related Work

Many reminder systems have been built until now but majority of them are simply time based [3] reminder systems. And out of those which are distance based systems, almost all of them are Euclidean base systems. Only a few systems have been built based on data mining techniques such as iReminder [4] system which works on this type of technique. It was built and implemented in China. Only a few other systems would have been built in this way.

There are a few future prediction based reminder systems built to date. Almost every other reminder system which is famous these days is location based. These are Placeit [5], Place Mail [6] and iReminder [4]. The first two of these are based on Euclidean distance technique. So these are not accurate as much. However, iReminder [4] has improved the accuracy of the reminder systems. But it is also a location based reminder system. The focus of this project will be to try to implement a reminder system which will learn from the users' past routine patterns. And it will work on the actual road distance rather than the Euclidean way and will try to improve the performance and accuracy of the system even more.

These are probably the only systems build yet. A lot of research is being done on these system. Developers and researchers are working together to improve the performance of the location based reminders [7]. But they are not much helpful. The need is to move towards the pattern mining based reminder systems. Of course, there will be applications developed in future which will implement the system in a more accurate way. The new algorithms will be developed and then implemented to improve the accuracy of the designed system.

The iReminder [4] system which is an intuitive reminder system is based on the user's locations and the trends of selecting the routes. The iReminder [4] system can be installed on the user's mobile phone with the GPS services kept on. When the user passes through a specific location, it notifies the user of the set task and shows the message on the screen. The user just needs to put the message and the location where the message will be shown and in its surroundings. So, for example, if the user sets the reminder for buying bread and eggs at the near bakery, the reminder message will pop up whenever the user will pass by that location.

System Architecture
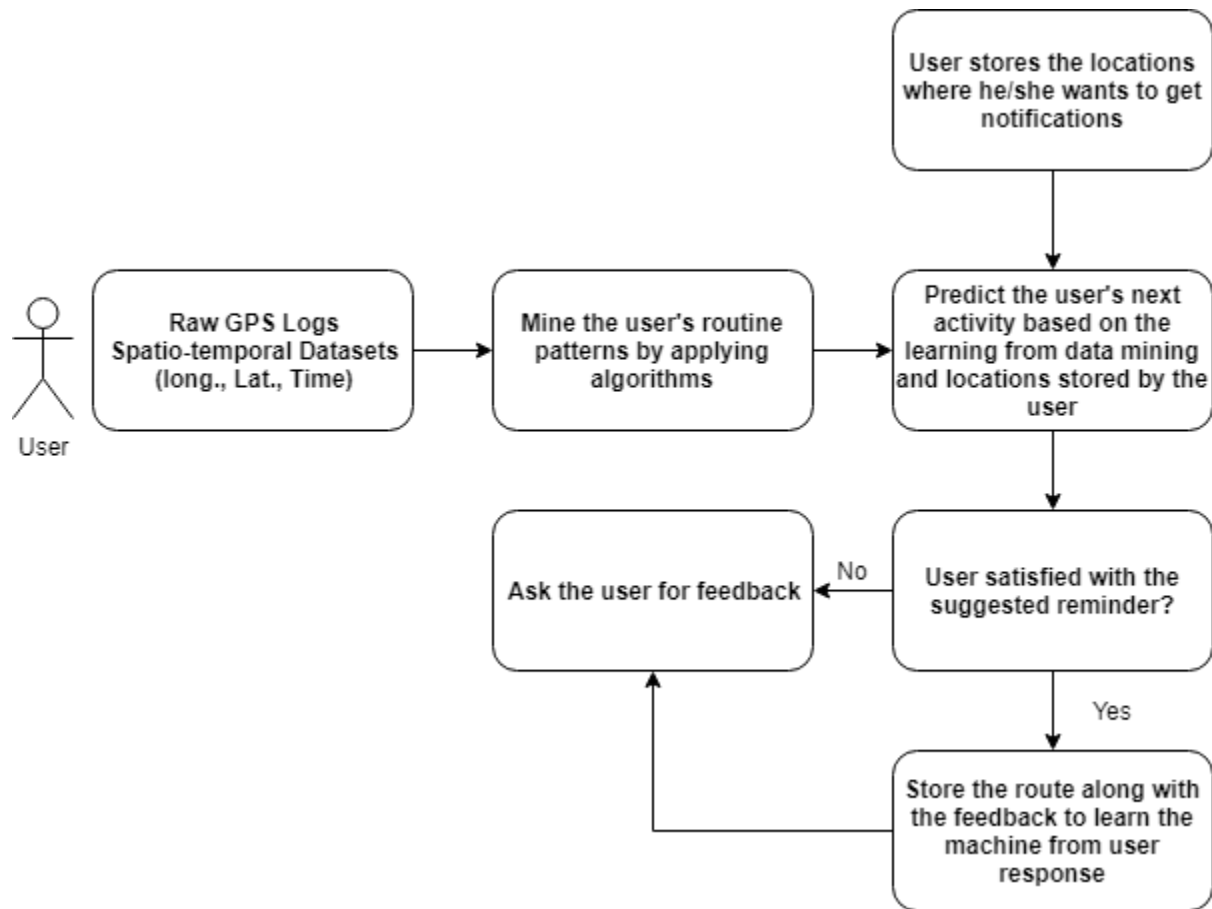
Figure 1: System Architecture

Goals and Objectives

Goal of this project is to provide users with a system which can remind them of their set reminders based on their location. More specifically, goals and objectives to be achieved by this project are as follows:

- Remind the users of the set reminders based on their past routine
- Using spatio-temporal datasets instead of Euclidean datasets to improve accuracy
- Using different settings for different users to activate notifications depending upon their daily routines and activities.
- Easy to use design and interface

Individual Tasks

Sr. No.	Reg. No.	Name	Responsibilities
1	FA16-BCS-184	Soha Bilal	- Studying the research papers - Developing the front-end for the project - Gathering the datasets - Developing the reminder system
2	FA16-BCS-037	Abdul Dayyan	- Studying the research papers - Studying the data mining algorithms and comparing them - Developing the reminder system

Gantt Chart
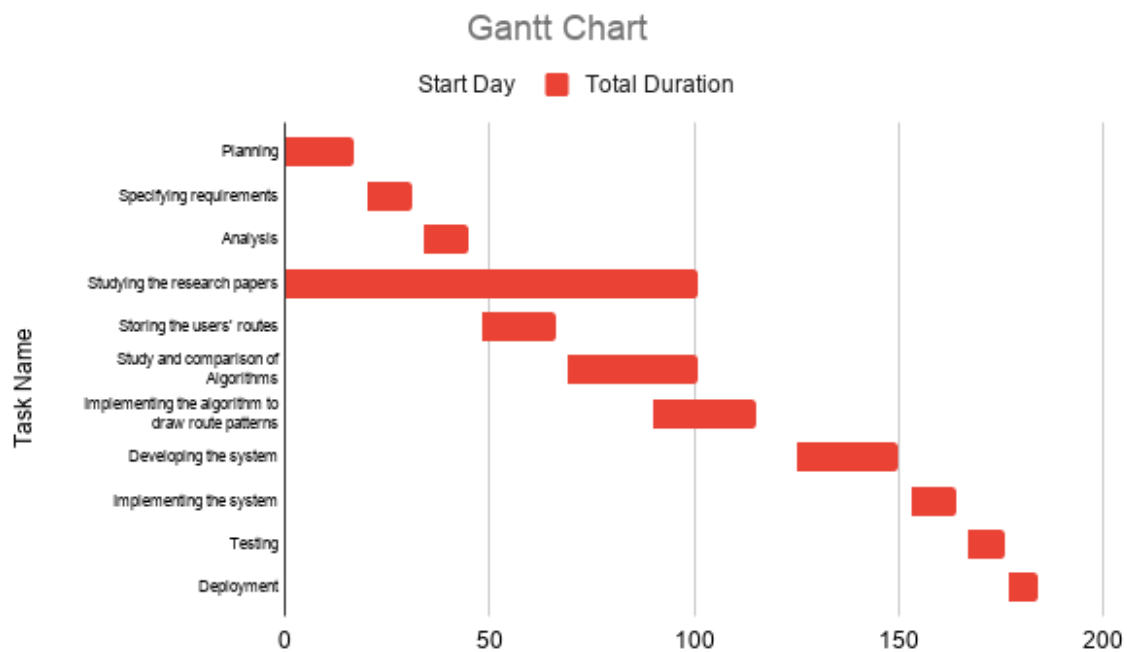
Figure 2: Gantt chart

Tools and Technologies

For the research and related work, the HEC digital library will be used to search for and accessing the journals and research papers. The Google's Scholar Search Engine will also be used for this purpose.

For this project, the python programming language will be used to develop the system. The intelligent reminder system will be implemented using a data mining algorithm which will be implemented using the python and its libraries like Numpy, Pandas, Sci-kit learn and Google's Tensorflow. For IDE, the PyCharm and Anaconda Navigator will be used. And for storing the data, MySQL database will be used.

For the application, we will be using React Native to develop the User Interface for the application. For writing code, Visual Studio Code and Atom will be used.

References:

[1]. Matthew B. Hoy (2018) Alexa, Siri, Cortana, and More: An Introduction to Voice Assistants, Medical Reference Services Quarterly, 37:1, 81-88, https://doi.org/10.1080/02763869.2018.1404391

[2]. Andre Esteva, Brett Kuprel, Roberto A. Novoa, Justin Ko, Sussan M. Swetter, Helen M. Blau and Sebastian Thrun (2017) Dermatologist-level classification of skin cancer with deep neural networks, DOI: https://doi.org/10.1038/nature21056

[3]. David Graus, Paul N. Bennett, Ryen W. White, and Eric Horvitz. 2016. Analyzing and Predicting Task Reminders. In Proceedings of the 2016 Conference on User Modeling Adaptation and Personalization (UMAP '16). ACM, New York, NY, USA, 7-15. DOI: https://doi.org/10.1145/2930238.2930239

[4]. You Tu, Ling Chen, Mingqi Lv, Youbiao Ye, Weikai Huang & Gencai Chen (2013) iReminder: An Intuitive Location-Based Reminder That Knows Where You Are Going, International Journal of Human–Computer Interaction, 29:12, 838-850, DOI: 10.1080/10447318.2013.796440

[5]. Sohn T., Li K.A., Lee G., Smith I., Scott J., Griswold W.G. (2005) Place-Its: A Study of Location-Based Reminders on Mobile Phones. In: Beigl M., Intille S., Rekimoto J., Tokuda H. (eds) UbiComp 2005: Ubiquitous Computing. UbiComp 2005. Lecture Notes in Computer Science, vol 3660. Springer, Berlin, Heidelberg

[6]. Because I Carry My Cell Phone Anyway: Functional Location-Based Reminder Applications - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/The-PlaceMail-web-user-interface-design-Specifying-Message-Delivery-Users-can-specify_fig1_221517760 [accessed 17 Sep, 2019]

[7]. Yao Wang and Manuel A. Perez-Quinones. 2015. Beyond "Geofencing": Specifying Location in Location-Based Reminder Applications. In Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '15). ACM, New York, NY, USA, 1767-1772. DOI: https://doi.org/10.1145/2702613.2732780

SPATIO-TEMPORAL DATA MINING BASED TASK REMINDER SYSTEM

ORIGINALITY REPORT

2%	1%	0%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Malta Student Paper	1%
2	abiz.ru Internet Source	1%