Using geographical information system for campus navigation: case study in Egypt

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GIS, Learning, student satisfaction, University, Egypt

Abstract
Purpose – The purpose of this paper is to propose the idea of using Geographical Information System to guide fresh students in University Campus.

Design/methodology/approach – A proposed framework was designed and implemented and a structured questionnaire was developed on a sample of 300 students.

Findings – The findings of this study have shown that students approved the idea of using GIS in the University Campus and they emphasis the importance of such facility to be available on their mobiles.

Practical Implications – It is important to provide the student with a new facility to assist them in their new academic life, this also will affect their satisfaction and loyalty to be a part of the University asset.

Research Limitations – The research was limited to one of one of the Campus of one of the private Egyptian university.

Originality/Value – This study contributes in adding a facility to the University and the study had shown the importance of using new automated tools to assist students and enhance their satisfaction level within the Egyptian context.

Introduction
Enhancing the Higher education is a vital process. All Universities aim is to satisfy the students and increase the loyalty level of their customers. One of the most effective tools in education sector is the loyalty and satisfaction of students. Student's satisfactions are considered very strong tools for gaining competitive advantages in any business environment (Alzamel, 2014). The aim of this research is to propose a new facility in one of the private Egyptian university. The research designs and develops a GIS tool that guide students to gain a greater understanding of the locations in the University Campus. The proposed application enables the student finding paths to specific locations on campus and offers him the ability to explore the campus environment via a GIS mobile application.

This is no different for third level institutions. According to Smayling and Miller (2012) industrial psychologists and management theorists that been examining the linkage between job satisfaction and job performance for at least fifty years, they quote William Shakespeare who wrote „To business that we love, we eagerly rise, and go to with delight”. Although it seems intuitively obvious to extent this to students and argue that the happy student will be a more productive student, empirical tests of that assumption are curiously sparse (Rode et al, 2005).

Literature Review
Information and Communication Technology (ICT) is developing all the aspects of live as it assists analyzing huge volume on information in a designed and organized interface and available via internet browsers (Eleiche, 2011). The trends of the Information Technology and Geographic Information System sciences are used in different fields like the higher education field. GIS are used in the following fields: real estate analysis, utilities management market analysis, land use planning, visual impact analysis, facilities management, landscape assessment and planning, transportation and infrastructure planning, tax assessment and many other applications. Eleiche (2011) defined the
functions of the GIS which are: data entry, data display, data management, and information retrieval and analysis.

GIS is defined as “a collection of computer software, hardware, data, and personnel used to store, manipulate, analyze, and present geographically referenced information” (Eleiche, 2011). Spatial data and associated attribute information can be layered on top of one another for viewing and analysis. There is a broadly accepted definition of GIS as defined by the National Centre of Geographic Information and Analysis: a GIS “is a system of hardware, software and procedures to facilitate the management, manipulation, analysis, modeling, representation and display of georeferenced data to solve complex problems regarding planning and management of resources” (Abdelwahab, 2013,p). Abdelwahab (2013) listed GIS applications: mapping locations, mapping quantities, mapping densities, finding distances and mapping and monitoring change. Abdelwahab (2013) designed and developed a web application that assists the users to research different available physicians and hospitals within the user location.

Information System is used in education sector, it is used to assist teachers in implementing GIS in their lessons. Demirci and Karaburun (2009) defined the implementation of GIS for Teachers for geography education in Turkey. They concluded that more than half of the teachers (66%) did not exactly know what GIS is and 82% of the teachers did not know how to use it in geography lessons. Demirci and Karaburun (2009) defined the obstacles confronting the successful incorporation of GIS in geography lessons in Turkey which are lack of time for teachers to learn GIS, lack of time to learn how to use GIS in the classroom, unwillingness of teachers to utilize GIS technology, and the difficulties of using GIS software (Marsh et al. 2007; Bednarz 2004 Kerski 2003; Meyer et al. 1999).

(Demirci, 2009) defines the factors that affect the user not to use GIS, these factors are lack of knowledge and skills about GIS and how it can be used as a tool for geography lessons, lack of digital data and GIS software, and lack of lessons plans and instruction materials showing teachers how to incorporate GIS into the geography curriculum.

Sweeney (2015) developed and analyzed a model whose aim is to understand the factors that lead to dissatisfaction of students. Sweeney (2015) spread a questionnaire for 10,110 Euro-student to test student attitude and satisfaction in Ireland, he created a decision tree analysis using regression tools. He concluded that the factors that affect student satisfaction are teaching quality, teaching staff, facilities, finances, accommodation and friendship. Fleming (2009) stated the importance of understating the student satisfaction factors in the Ireland Universities. =

The importance of student success in higher education is unquestionable (Yorke and Longden, 2004). Retention rates are an important concern for any University. A positive reputation increases the college’s ability to attract the best students and faculty (Clark, 2013;Hagedorn et al., 2005). Student satisfaction occurs when perceived performance meets or exceeds the students’ expectations (Mark, 2013). A study carried out by Kunanusorn and Puttawong, (2015) concluded that student satisfaction is a positive and significant predictor of student loyalty. Enache (2011) stated that the factors affect the student satisfaction provide colleges with the tools needed to improve the quality of their services (and could give a college a competitive advantage (Stukalina, 2014)

Smayling and Miller’s (2012) tested the relationship between satisfaction and performance of 359 students; he concluded that there is positive relationship between these variables. Zeitun et al. (2013) found a positive relationship exists between satisfaction and performance based on students team. Martirosyan et al. (2014) defined a significant relationship between student satisfaction and academic performance.

Thompson et al.(2013) defined the factors external to the institution which may affect dissatisfaction among students such as serious illness, financial problems or family issues. Sargent and Hannum ( 2009) had shown that student retention affected by student satisfaction and gender.

Egyir (2015) analyze the antecedents of student satisfaction and loyalty in Higher Education Institutions (HEIs) in Ghana. He concluded that perceive value, image of the university and perceive
service quality positively influence the level of student satisfaction and these three antecedents together with student satisfaction positively influence student loyalty. He listed customers of HEIs as the students, the parents of students, the employees, the employers, the public sector, the industry and wider community.

Facilities of HEIs improve the perception of the image of the institution which enhances student satisfaction (Jiewanto et al., 2012). Egyir (2015) defined the facilities of HEIs such as international curriculum, high speed internet access, compatible computer laboratory, audio systems in class, library, student offices, lecture rooms, campus book store, catering facilities, and other luxurious ones such as Sports Centers, NBA Basket Ball Courts, swimming pools, Department stores, and hospitals.

Keblawi et al. (2013) aim is to find out how the business administration students of Kristianstad University feel satisfied based on service quality. They concluded that students were satisfied with the university, despite a negative service quality-gap. Eleiche (2011) stated that there is a huge demand on mobile GIS. GIS Mobile applications are used in many areas such as medical applications and education, proximity analysis, navigation, optimal path, communications and many others.

Lautenschläger (2012) defined the main objective of the mobile GIS which is minimizing. Mobile users are expanding all over the world which motivates the mobility computing in different areas such as education. The mobile GIS needs to access the geodatabases, perform spatial analysis, acquires geospatial knowledge, and obtains spatial decision support in real time everywhere. Lautenschläger (2012) designed a mobile navigation application for the University of Calgary. A graphical user interface was developed for the use of mobile users. The mobile navigation application provides users with location tracking algorithm based on wireless network signals to determine the geographical position inside buildings. The Global Positioning System (GPS) is new technology designed to determine locations on mobile devices. Lautenschläger (2012)’ mobile application services find paths on campus to user-defined locations and routing feature.

Research Methodology

The research was implemented in the Arab Academy for Science, Technology and Maritime Transport (AASTMT) University. AASTMT started as a notion in the Arab League Transport Committee’s from 1970. The United Nations Development Program (UNDP) approved funding AASTMT, the committee chose the city of Alexandria as a location since its location in the middle of the whole Arab region. AASTMT has 5 campuses: Alexandria, Cairo, South Valley, Smart Village, and Port Said. Alexandria has 2 main campuses Abo-kir and Miami. The research was implemented in Abukir Campus. Abukir Campus has 3 buildings based on the following Colleges: College Engineering, Computer Science and Logistics Colleges and Maritime Transport College. Abukir Campus has 11 facilities building which are: Mosque, Clinic, Registration Department, Financial Department, Human Resources Department, Library, Networks and Communication, Dorms, Computer Center, Information Communication, and Cafeteria. A proposed framework was designed and implemented and a structured questionnaire was developed on a sample of 300 student. The proposed framework passes by the following steps: the web application interface will start communicating the system through the user (student). The student enters a query about a location through the system first phase which is the mobile application. The mobile application contacts the GIS application to search for the location. The GIS application sends the query to the database which starts to find the location and send it back with the coordinates. The GIS plots the coordinates on the map in the mobile application and send the location to the student, Figure 1.1 shows the sequence of the System processes.
Unified Modeling language (UML) is defined as “a standardized modeling language enabling developers to specify, visualize, construct and document artifacts of a software system. Thus, UML makes these artifacts scalable, secure and robust in execution. UML is an important aspect involved in object-oriented software development. It uses graphic notation to create visual models of software systems” (Kendall and Kendall, 2008).

The use case describes the main functions of the system. The system contains of the student actor call the set Search Query use case it extend the search Room()use case it include and consists of get Room Location()use case and plot Location()use case , and it extend the search College()use case it include and consists of getCollegeLocation()use case and plotLocation()use case , and it extend the searchFacility()use case it include and consists of getFacilityLocation()use case and plotLocation()use case , and it extend the searchBuilding()use case it include and consists of getBuildingLocation()use case and plotLocation()use case.
attributes are building number, building location, and building college, the fourth class is “schedule” the class attributes are schedule ID, student registration number, course name, room name, and course time, the fifth class is “course” the class attributes are course name and college name, the sixth class is “facility” the class attributes are facility name, and facility location, the last class is “room” the class attributes are room name, building number, room location and floor number.

Figure 1.3 System Class Diagram

The sequence diagram shows the different system scenarios, the main components of the sequence diagram is the actors. Each actor has a timeline; the timeline will contain all methods called by the other actors. Each actor communicates with the other actors using its public methods.

In the Student scenario, the user actor communicates with AAST-GIS actor, it calls the setsearchquery() method. The AAST-GIS takes the search query of the user and send it as a parameter to the Room as it calls searchroom() method if it is related to room class and if it is related to Facility class the AAST-GIS takes the search query of the user and send it as a parameter to the Facility class as searchfacility() method, if it is related to College class the AAST-GIS takes the search query of the user and send it as a parameter to the College as searchcollege() method and if it is related to Building class then the AAST-GIS takes the search query of the user and send it as a parameter to the Building class as searchbuilding() method. Finally, the AASTGIS will plot the location to the student class as plotlocation() method.

Figure 1.4 System Sequence Diagram
After designing the framework a prototype was designed, the following figures will describe the main screens in the proposed application. A Survey was designed and spreaded over 300 students to validate the usage of the new application. The following figure represents the survey questions.

<table>
<thead>
<tr>
<th>#</th>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Does AASTGIS give a professional impression?</td>
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<tr>
<td>2</td>
<td>Is the navigation of the screens obvious and efficient?</td>
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<tr>
<td>3</td>
<td>Does AASTGIS appear user friendly?</td>
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<td>4</td>
<td>Does all the necessary information available?</td>
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<tr>
<td>5</td>
<td>Does all the information easily understood?</td>
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<tr>
<td>6</td>
<td>Do you think you will use AASTGIS in a regular basis?</td>
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<tr>
<td>7</td>
<td>Do you think the layout of AASTGIS is easy to follow?</td>
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<tr>
<td>8</td>
<td>Have AASTGIS provided the information you want?</td>
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<tr>
<td>9</td>
<td>Student ID</td>
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<tr>
<td>10</td>
<td>Major</td>
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<tr>
<td>11</td>
<td>Academic Year</td>
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<tr>
<td>12</td>
<td>What do you think we can add for AASTGIS to be more helpful?</td>
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</tbody>
</table>

Figure 1.5 Questionnaire Questions

Conclusion and Future Work

The paper designed a campus navigation framework that can be used in different Universities. The questionnaire was filled by 300 students and 93% accepted the framework and were satisfied with the new facility added in the university, however 7% did not accept the idea of the application, there had some comments on the interface and they added some features to the proposed application.

The paper offers a new facility to the University since the GIS is used in different fields; it can also be used in the campus to help the students to be familiar with University. The new framework can increase the statidication of the students especially students in the first academic year since they usually need help in understanding the different places and the facilities places. The paper has some limitations since it will be activated in Aboker Campus however can be generalized into the other University campus, the questionnaire used in the paper is limited to only 300 students. Finally the proposed model and the designed application is still a design and need to be implemented to be a real application downloaded on the students device. The researcher aim is to work on this research and apply the application to be used in the AAST University while covering all the design limitation proposed by the students in the questionnaire.

References


