E-Vision: A Campus Locator Map Mobile Application using A* Algorithm

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ABSTRACT
Locator maps are developed to access a certain location, and this is widely used in transportation to save time and cost. The usefulness of the locator map increases awareness, satisfaction and improve one’s productivity and accessibility. This study aims to provide a solution specifically be used by the school to guide students to locate specific place in a campus which provide shortest possible route method which also include relevant information about the school offices, building and class schedule. The study adopts the Rapid Application Development model and used ISO9126 to evaluate the application in terms functionality, reliability, usability, efficiency, maintainability and portability with a result of 4.36 “ Excellent” which means the application is acceptable and meet all the requirements.

Keywords: Location, Locator Map, Map, Pathfinding, Shortest Path.

1. INTRODUCTION

Locator Maps as directional aids are next to usefulness [3] since it would help to examine and understand the area [11]. Location is a particular place or position [22] in where people are, which is considered as the "end-point" of the travel [6]. To help you to the right direction going to your desired destination [30]. Map is created for an easier access to location [23]. Technology provides quality of life; the innovation of such locator technologies was developed [25]. And it changes the world to progress [8] by providing immediate information [18]. Several technologies are the Track-D, a driver assistance device which helps track their way to a specific location [20]. Another is either Google Maps which helps people in reaching destination in the most efficient way [12] in mobile or web. Uber and Grab allows people to know the location of a close car-ride in their area [17] [21] and, games like mazes and such can be considered as pathfinding applications [5]. Locator maps are usually used for malls [26], institutions [7], companies [30] and large mass area factories [24]. Most of these maps developed in mobile platform for ease of use, convenience and accessibility purposes.

1.1 Project Context
Locator Maps are considered as a valuable addition to campus efforts. Locating certain places is still a common problem [17]. To reduce the burden, map is created [2]. There are different kinds of map produced for different types of area [24]. Despite it, there are still specific areas which need navigational maps to be navigated [19]. While navigation systems for outdoor environments are readily available, navigation within specific areas still poses a challenge [10]. Every year, hundreds or thousands of new students enroll in a school or university [23]. Schools and universities with a large campus cater more new students every year [22]. Therefore, institutions where the buildings, offices and classrooms are quite complicated [16], a locator map is very essential in order to guide people, especially freshmen and visitors [28]. Students, especially the freshmen students, sometimes find it hard to get to familiarize with the rooms, buildings and different locations inside the campus. [8]. Schools with wide campuses are hard to familiarize and to find the location one wishes to be [3] which lead the researchers to identify the following problem relating to location.

1.2 Specific Problems
(a) Time consuming to locate buildings, offices and classroom. The researcher conducted an observation to various schools here in Biñan particularly schools like Lake Shore Educational Institution, Biñan Elementary School, Jacobo Z. Gonzales Memorial National High School, University of Perpetual Help System Laguna –
JONELTA, La Consolacion College, Sta. Catalina Colleges and Saint Michael’s College of Laguna these are school campuses in Biñan City; however, the researcher observed that these schools posted the layout of the campus map to strategic areas where the student can see it, yet the map only display the 2D sketch with labels. In this regard, to determine really the problem in time consuming, the researcher conducted a one-on-one interview on how they locate a certain building. According to the survey results, one hundred forty-four (144) out of three hundred forty-six (346) respondents said that they used the school map sometimes and one hundred twenty-four (124) out of three hundred forty-six (346) used it rarely. This shows that the campus map layout is not so effective. Furthermore, student was also interviewed regarding their experienced in locating a building they said, “it is tiring” especially those who are not familiar of the campus.

1.3 Research Objective
1.3.1 General Objective
To develop a campus map mobile application that will recommend the shortest path from one specific place to another.

1.3.2 Specific Objective
To design a mobile application that automatically track the location using A* algorithm. The application allows the user to search a location by selecting or typing the building and its origin to a destination or proceeds to the next building. It will show an indication where it serves as a guide for you to proceed to the next destination. Furthermore, the application will also provide building information and office information once you tap a building; by tapping the building icon, it will display the detailed information about the room number, class schedule, course program and name of faculty.

1.4 Scope and Limitation
1.4.1 Scope
The proposed application would include the following features:
Campus map module. This module shows the campus map of the school. The campus map consists of buildings.
Search module. This module allows the user to search a location to its destination.
Building and classroom information module. This module shows the information of the building such as the room number, class schedule, course program and name of faculty.

1.4.2 Limitation
• The programmer of the application will only modify the map application layout update.
• The indicator to direct certain location is static.
• The application runs on smartphones with Android Operating System Version Marshmallow and above.

1.4 Significance of the Study
The study will be a great help to the following:
Schools. The study will be beneficial to the school’s greater accessibility and to provide convenience.
Students. The study will provide information that will benefit the students of the school. Thus, it is made for the students to familiarize their school campus and taught them to be an effective decision maker.
Users. The study will offer accessibility and convenience as well.
Future Researchers. The study will serve as reference for the future researchers to consider the possibility to improve the application.

2. METHODOLOGY
The researchers used the descriptive research design for investigating the current system and processes like the utilization of kiosk used of portal to search rooms and offices and with regards to problem identification the researcher consider the manner of school in using their bulletin board. Specifically, the researchers applied qualitative and quantitative approach. For quantitative approach survey, method was used to determine the degree of using school map utilization and for qualitative approach, interview was used to verify & validate the details giving the location and information.

Fig. 1 shows the model used by the researchers to accomplish the requirement of the application

- Requirement Planning. In this phase, the researchers utilized interview technique to determine educational institution in the use of campus map, the campus map are posted to their website and Facebook page. Also, the researcher study the current infrastructure that will serve as basis of
selecting the tools used in the development. In addition, the researchers conduct group meeting to do brainstorming for the concept of the system. During the discussions, the scope of the system, the processes included and the required data to execute the processes were identified.

- User design. In this phase, the researcher analyzes the system modules designs, then the requirements will translate into graphical presentation such as activity diagram, class diagram, use case and entity relationship diagram.

- Construction. The researchers developed the application guided based from the current infrastructure and preference of the client, the researcher used the recommended tools for the construction of the application in terms of the interface design by the models – Activity Diagram, Class Diagram, and Entity Relationship Diagram. The lead programmer focused on the functionalities of the application while the assistant programmer was assigned to layout the user interface in Android Studios.

- Implementation. In this last phase, the proposed system was build and the students of the campus for searching paths and information will test it. The administrator of the campus will test the application. Its tasks are testing, system implementation and system maintenance. They used the ISO 9126 Software Evaluation to determine the validity of the proposed system.

The researchers begin to code the calculation and capacities for the framework, a few libraries helped to get A* algorithm for the pathfinding of the framework and utilizing the java programming language used to make the capacity of the framework and last, to spare the guide and data of the school outline engineer utilized the JSON record as database of the framework then the android studio will assemble and work as "APK" document compose for the android cell phone with the marshmallow OS of the phone. For the pseudocode of the algorithm, the algorithm starts scanning the map after scanning the map the node will be initialize and start from the zero node then to the goal, the algorithm will be the one to search from node to node if the node is not the goal it will start to search for the other node to get to the goal.

3. RESULT AND DISCUSSION

This section shows if the objectives of the study had been met based on the different tests and survey conducted to assess the system.

Table 1: Survey Question No. 1

<table>
<thead>
<tr>
<th>To whom do you check the classroom or office direction?</th>
<th>No. of Respondent s</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classmate</td>
<td>215</td>
<td>59.07%</td>
</tr>
<tr>
<td>Teacher/staff</td>
<td>64</td>
<td>17.58%</td>
</tr>
<tr>
<td>Bulletin board</td>
<td>77</td>
<td>21.15%</td>
</tr>
<tr>
<td>Web/social media</td>
<td>8</td>
<td>2.20%</td>
</tr>
</tbody>
</table>

Table 1 shows the result of the question on how frequent do you check the campus map. Based on the results, the respondents marked some 39.56% “sometimes” as the highest score, which means that the schools provided information posted their campus map to strategic areas. Some respondents marked some 34.07% “Rarely” because they said that the campus map is not posted, or they can’t find it.

Table 2 shows the result of the question did you have a hard time locating a classroom or office. Based on the result, the respondent marked some 56.59 “sometimes” as the highest score, which means that the students have a hard time locating the classroom and office because its big and too many classrooms to find it.

Table 2: Survey Question No. 2

<table>
<thead>
<tr>
<th>How frequent do you check the campus map?</th>
<th>No. of Respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
<td>9</td>
<td>2.47%</td>
</tr>
<tr>
<td>Sometimes</td>
<td>144</td>
<td>39.56%</td>
</tr>
<tr>
<td>Once in a while</td>
<td>59</td>
<td>16.21%</td>
</tr>
<tr>
<td>Rarely</td>
<td>124</td>
<td>34.07%</td>
</tr>
<tr>
<td>Never</td>
<td>28</td>
<td>7.69%</td>
</tr>
</tbody>
</table>
Table 3: Survey Question No. 4

<table>
<thead>
<tr>
<th>Did you have a hard time in locating a classroom or office?</th>
<th>Respondent</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
<td>24</td>
<td>6.59%</td>
</tr>
<tr>
<td>Sometimes</td>
<td>206</td>
<td>56.59%</td>
</tr>
<tr>
<td>Once in a while</td>
<td>53</td>
<td>14.56%</td>
</tr>
<tr>
<td>Rarely</td>
<td>58</td>
<td>15.93%</td>
</tr>
<tr>
<td>Never</td>
<td>23</td>
<td>6.32%</td>
</tr>
</tbody>
</table>

Table 3 shows the result of the question on to whom you check the classroom or office direction. Based on the results, the respondents marked some of 59.07% “classmate” as the highest score, which means many students troubled on finding classroom and office so that they ask the direction to their classmates.

a. System Requirements

The researchers identified the system requirements needed for the development of the application.

Table 4: System Requirements

<table>
<thead>
<tr>
<th>Desktop/Laptop</th>
<th>Windows 7 and up 2 Gb RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Android Phone</td>
<td>KitKat up to lollipop 512 Mb RAM and up 50 MB and up</td>
</tr>
<tr>
<td>Android Database</td>
<td>JSON File, MySQL</td>
</tr>
<tr>
<td>Programming Software and Tools</td>
<td>Android Studio, Tiled Map Editor</td>
</tr>
</tbody>
</table>

Conceptual Framework

Fig. 3 shows how the system created, it started by creating the map using tiled map to make a cell by cell processed and exported as PNG format and put it in the database, the nodes of the map is saved in the JSON file as database for the system as well as the pictures and information. Using android studio for android phone and java as programming language to create GUI for the E-Vision system and after creating the main program the search location where created by using java and an A* search algorithm to make a path into the map. Building information, staff information and office information where created using java programming language with pictures.

Fig. 4. System Architecture

Fig. 4 shows the system architecture of the application. The IT expert manage the map of the school and deploy the application to an android phone. Users of this application can view and search the map in offline and online mode. For offline mode the application can only fetch the paths in the JSON file or database for the map. For online mode of the application retrieve information of direction and pathways. The main server operated by the Admin of the application can use laptop or desktop to manage the application. SQL server and JSON file is the database used in the application.

Fig. 5. Activity diagrams of E-Vision

Fig. 5 shows the activity of the system; the system has a textbox where the user can input the information or building name then the system will display with line marker from the front gate to the desired location. The menu list will display the
building information or direction, clicking exit the system will close or simply clicking “back button” two times.

The User Interface of the Application

The user interface of the application researchers used tools to create the application such as Android Studios. The following are some of the features and user’s interface design of the application.

Fig. 6. Homepage

Fig. 6 shows the homepage that shows the school map, the color blue are the buildings, the white color is the path where the user can walk and the gray color are the path which the user cannot make a walk on that area.

Fig. 7. Search Bar

Fig. 7 shows the search bar of the application that allows the users to search room, buildings classrooms and offices.

Fig. 8. Marker

Fig. 8 shows the graphical user interface of the marker, the read marker will serve as the guide of the user to determine the exact location. The A* algorithm is applied to calculate the starting point to the destination goal.

Fig. 9. Information

Fig. 9 shows the graphical user interface of the menu list consist of building information, room schedule. It also provide instruction how to reach the location.

Table 5: Software Evaluation Result

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Weighted Mean</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functionality</td>
<td>4.55</td>
<td>Excellent</td>
</tr>
<tr>
<td>Reliability</td>
<td>3.31</td>
<td>Very Good</td>
</tr>
<tr>
<td>Usability</td>
<td>4.62</td>
<td>Excellent</td>
</tr>
<tr>
<td>Efficiency</td>
<td>4.82</td>
<td>Excellent</td>
</tr>
<tr>
<td>Portability</td>
<td>4.53</td>
<td>Excellent</td>
</tr>
<tr>
<td>Weighted Mean</td>
<td>4.36</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

Table 5 shows the result of the software evaluation was evaluated by 4 IT experts and the 15 users of the application. Result showed that the highest weighted mean among all the characteristics is the Efficiency marked a score of 4.82 weighted mean “Excellent “ which means it provide time efficiency to load the request then followed by the Usability marked a score of 4.62 weighted mean “ Excellent” which means that the application satisfy their expectation and easy to use. Functionality marked as score of 4.55 weighted mean “Excellent” which means all components are working and the Reliability marked a score of 3.31 weighted mean “ Very Good “ which means that the application information and functionality are accurate and appropriate, Portability marked a score of 4.53 weighted mean “Excellent” which mean that application run in android phone model as specified and easy to install. The over-all result of 4.36 weighted mean “Excellent” which means that the application meet the requirements agreed.
4. CONCLUSION

Based on the results, the developers conclude that the Mobile Pathfinding Application for Saint Michael’s College of Laguna is needed to enhance the map that the school is using. In addition, the following conclusions were drawn:

- A developed system that finds the shortest path to a specific location.

5. RECOMMENDATION

The developed system provides the user the shortest path to a specific location. This feature would benefit the user in saving time to locate and go to the desired destination. The developer recommends that future researchers who want to improve the system by developing a Mobile Pathfinding Application add the following features:

- Mobile Application System (iOS Version). The continuous growth of mobile application, creating a version of the developed system will increase the accessibility and portability of the system.
- Voice Command With this feature, users can search his desired location without typing it on their mobile phones.
- More control in the app the developers recommend the future developers to further enhance the feature in the system. The system should allow the instructor or administrator to have more control in the app.

6. ACKNOWLEDGEMENT

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REFERENCES