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Research paper

Digital Campus

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Abstract

Mobile is everywhere, changing the way we work, play, socialize, and learn. Students nowadays are immersed in a digital culture driven by mobile consumer experiences across a range of devices, from wearable to phones, tablets and virtual-reality platforms. Digital Campus is a website application that is in University Tun Hussien Onn Pagoh Campus. The purpose of this website is to search all locations located in Pagoh Campus such as laboratory, admin office, dean office, cafe and classroom. Digital campus website is embedded with Open Street Map. It is open databased licensing and it is a collaborative mapping. This website is developed using Joomla 3.8.13 with PHP version, 5.6.25. There are 204 locations were plotted using this link https://digitalcampus.uthm.edu.my/index.php. Digital campus based on Open Street Map can helps students, admin staff, lectures and visitors to find location in very easy way by using digital platform. Thus, this application facilities can optimization of administration work and promote university management to higher performances.

Keywords: *Digital Campus; Smart Campus; Map; Navigation; Location.*

1. Introduction

According to Yunchen Jiang, student or guest who is not familiar in new place are relevant to had location information [1]. Method to accessing location information are crucial especially in a new campus in rural area due to guest are unable to find desired location. In recent years, with the rapid development of computer, wireless communications and internet technology, internet of things had been implemented everywhere. Thus, Open Street Map is one of successful method for search location via mobile services. Open Street Maps provide support for dynamic geo-spatial information application and by accessing to it, it leads user's location information to track all locations around campus. At the same time, it is important for campus to provide on-site information in order to equip facilities for teachers, students, administrators with effective work and study life. The location of study is at Fakulti Teknologi Kejuruteraan, Universiti Tun Hussein Onn Malaysia (FTK, UTHM) as in Figure 1.



Fig. 1: FTK, UTHM high education located in rural area.

Digital Campus has been developed as an application campus navigation with specific details. The purpose of digital campus was developed as an initiative to student, staff academic, and society to help them to find locations in FTK, UTHM. Digital Campus are linked between FTK, UTHM website and Open Street Map application. Open Street Map is a customizable software available with many integrated modules which include location information, architecture, features and real time direction. As different institution shall have their own academic structure, the system was designed to be as generic and to be very configurable by users, so that it can suit to any institution environment [2]. Digital Campus System has been developed by mapped on-site then digitally drawn into Open Street Maps application then published into UTHM Website. Thus, this system is useful for students, lectures, and guest to go to their desired location.

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2. Literature review

2.1. Comparison existing system

There is digital campus system that developed many functions such as library management system, smart learning management system, tracking system, and attendance system [3]. Adaption of new system for students and academia are driven by advanced technology especially smart phones. Many studied shown that software platform nowadays is part of smart campus was accessing by rapid speed with the increasing number of smart phones used within college campuses. Five similar systems have been studied to analyse pro and cons of the system as in Table 1. University Digital Campus is one of the features provide by Tohoku University. This system provides information service for education purpose which focus on navigation system that include interactive maps that was embedded by google maps platform. In other hand, location can be trace by sort into category [4]. Meanwhile, Griffin Digital Campus, Australia is an online learning system [5]. The system provides course online in range for under-graduate and postgraduate degree. Learning access and IT Support are 24 hours service. In addition, there also provide library online can be access anywhere.
Digital School Campus Application is developed by India Company VisualBench Technologies is a management information system dedicated for educational institutes to simplify the complexities in administration process. The system provides all administration process based on education such as attendance tracker, admission management, student management and inventory management [6].
Another digital campus is Electronic Course Network developed by WALSH University. This system is about provides an online library, plagiarism guide benefit for lectures to trace plagiarism task given to student and distance education guide is more like long distance learning [7].
Uitm Digital Campus developed by Uitm Digital Campus, Malaysia provides management information system in application platform for their university such as Private application may include application that can be access by certain user only, i-student that more focus on student source of learning and i-staff is for staff either to monitor student, and schedule [8]. Digital Campus by Yonsei University, Korea provide open campus experience manage and provide all the information that are created within the campus such as academic activities notified to student via mobile calendar, attendance check by smartphones and provide anti plagiarism system [9].

Table 1: Summarize of Similar Digital Campus System

No.	Digital Campus	Description
1.	Tohoku University, Japan [4]	Provide information service for education purpose in Tohoku University - Interactive maps Maps data from Google Maps Platform - Location can be sort into category
2.	Griffin Digital Campus, Australia [5]	Provide course online in range for undergraduate and postgraduate degree - 24/7 learning access - Online library - IT support
3.	Digital School Campus developed by India Company VisualBench Technologies [6]	Management information system dedicated for educational institutes to simplify the complexities in administration process - Attendance Tracker - Admission Management - Student Management - Inventory Management
4.	WALSH University, UK [7]	Provide Electronic Course Network is a learning management system - Library online - Plagiarism Guide - Distance Education Guide
5.	Uitm Digital Campus, Malaysia [8]	Uitm management information system in application platform - Private application - i-student - i-staff
6.	Yonsei University, Korea [9]	Provide Open Campus Experience manage and provide all the information that are created within the campus - Academic activities notified to student via mobile calendar - Attendance check by smartphones - Provide anti plagiarism system

3. Methodology

3.1. Digital campus analysis and design

Digital Campus based on UTHM Pagoh Campus is an overview to guide visitors to archive localization, map query, navigation guide, tracking and other basic function. The software system is developed by using Content Management Joomla version 3.8.13 with PHP version 5.6.25. Digital campus system chooses Open Street Map application for embedded all block identified located mapped onto the digital by draw all block into Open Street Maps. The duration time of this project to be delivered is about 1 month started on August 2018. The system can be access either through website via mobile phone, laptop and desktop. Digital Campus website enable user to search location by access into link https://digitalcampus.uthm.edu.my /index.php. There are 3 easy steps to find your location. Step 1: Click search button; Step 2: Type your location such as Auditorium 1; Step 3: Click button at your current position. Figure 2 shows the flow chart on planning, collecting, validation phase and analysis. In the flowchart shown, there are phases which are planning and feasibility phase, collecting and validation phase, analysis and design phase, system and unit development phase and lastly maintenance and testing phase. In the first phase, study on total areas, total blocks, blocks structure and block name is done. Then, in the next phase, data such as pictures and blueprints are collected after the site visit. In analysis and design phase, all the collected will be illustrated into open street maps application. After that, the OSM application will be linked to the Digital Campus website and every blocks' name and details will be validated. For the last phase, user acceptance testing be done to test the website and the illustration of the maps.

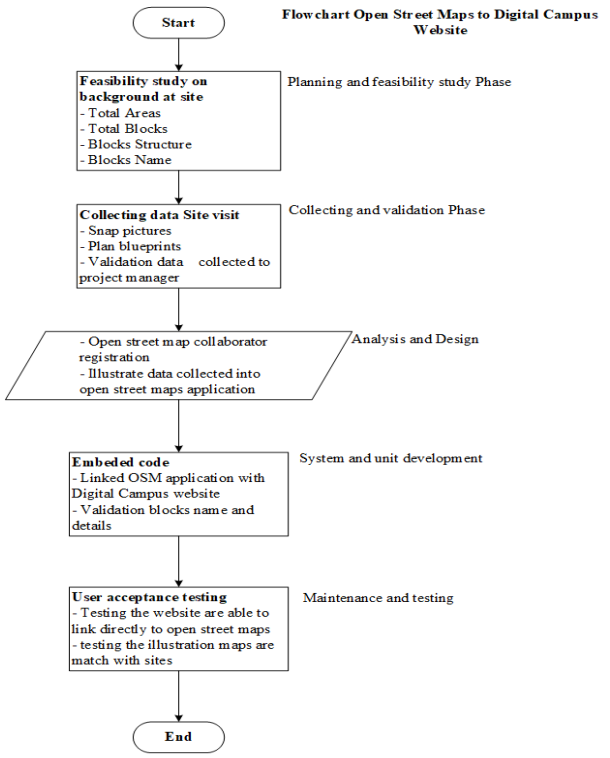


Fig. 2: Flow chart on processing using Open Street Map.

Enter the name of location correctly, Open Street Map will help to find your interest location. The Open Street Map is embedded in website FTK, UTHM to make it more visible. Figure 3 shows the flow chart on processing the digital campus website. The system will start with the main interface which is Home that contain a few functional button such as About Us, Lost and Found and the Street Maps. In addition, as this navigation are more like tracking system that can know your current location in case you are lost at FTK, UTHM. Through the function of user acceptance testing and validation data had been done, Digital Campus was long term application proved the validation and high efficiency. The architecture on the successful digital campus website is shown in Figure 4.

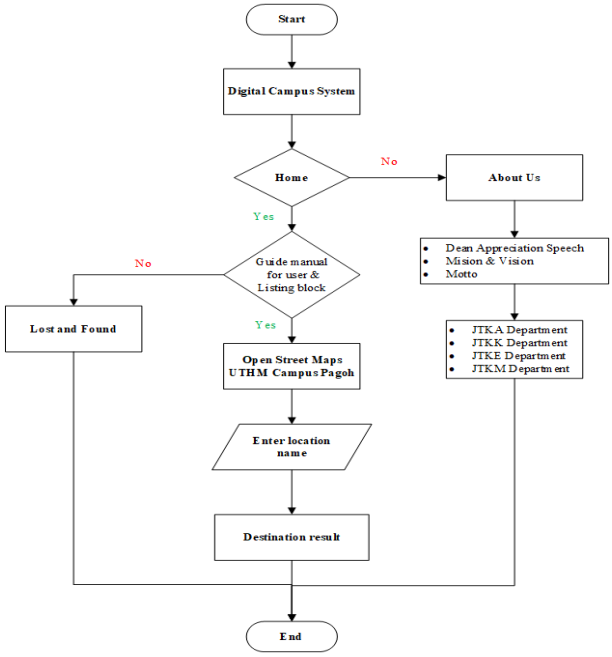


Fig. 3: Flow chart using Digital Campus website.



Fig. 4: System architecture for Digital Campus.

3.2. Open Street Map Application

Here are the guidelines to excess and generate map using Open Street Map Application. Figure 5 shows the Open Street Maps Application is to register as the collaborators by fill out required field to access the system. Then, once it can be accessible user can choose area of mapping. Log in interface of Open Street Maps Application. To choose location area to map, click on "Edit" menu to start draw building or features according to area of virtual reality. Click "Edit" button shown in Figure 6. The example area of mapping location such as add park or building is to create a building, click on "Area" shown in Figure 7. Building is created by first point is connected back with last point. Once the building is created on certain area but does not have it features yet, white colour will be shown in Figure 8.

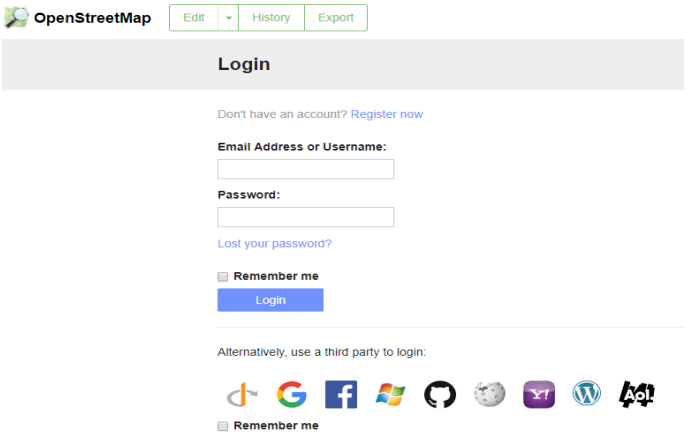


Fig. 5: Login to Open Street Maps application.

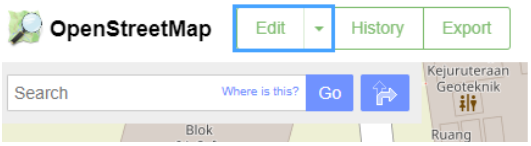


Fig. 6: Edit Button to Choose Maps Type Mode.

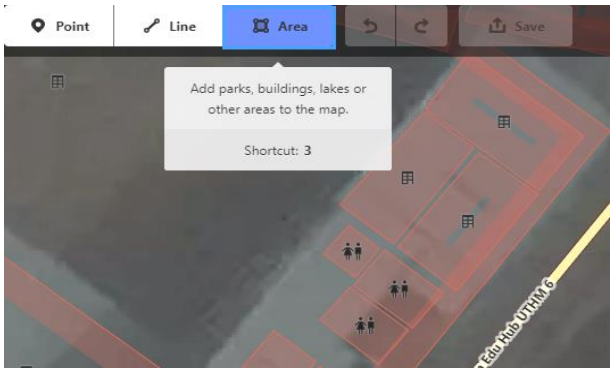


Fig. 7: Area button to draw a building.

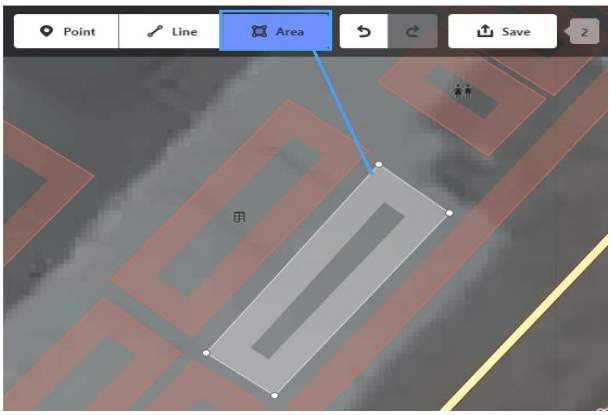


Fig. 8: Building with no setup

Next phase, user need to specify what kind of building based on virtual reality so that it will visible on open street map. Figure 9 shows note that on left side bar there are features menu based on what collaborator create. Click on "Building Features" to set type of building. Finally, building created must is not smaller to avoid undetected building. This case shows the setup of "University Building" features. The features already setup with building features is shown red colour as shown in Figure 10. At the end of mapping, the map will show different building features had different colour.

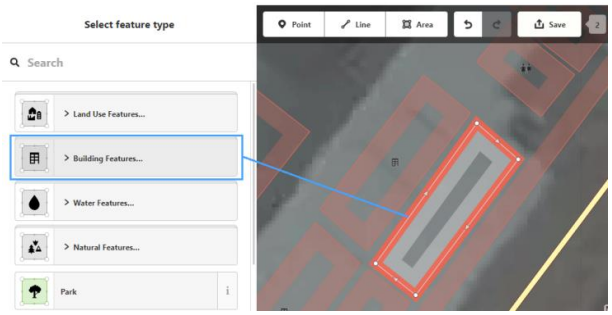


Fig. 9: Building being setup based on selected features.

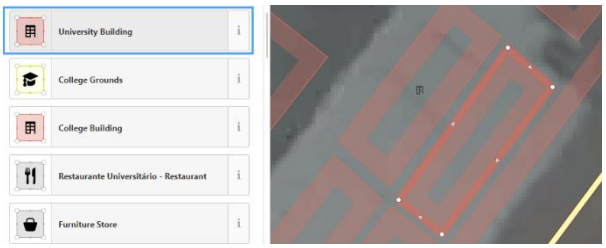


Fig. 10: Building being setup as university building.

Figure 11 shows a tagging phase once the building is done created; user must fill out field required purposely for details of building. All details make it visible on maps can easily search by using search option. This part is critical one, user had to remains the tag "add: city" fixed in description of building shown in Figure 12. So, the system able to detected location of the building area. Click on save button to save all mapped created in OSM. Refer to Figure 13, the illustration blocks surrounding Pagoh Campus had been mapped. The name is tagged based on actual site.

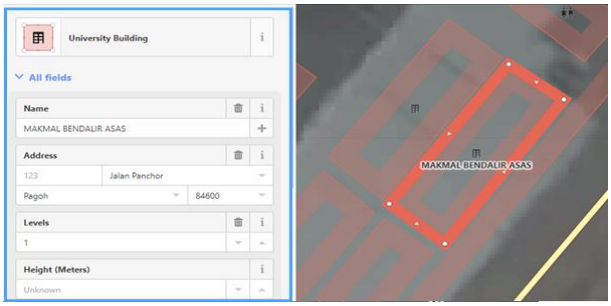


Fig. 11: Tagging phase.

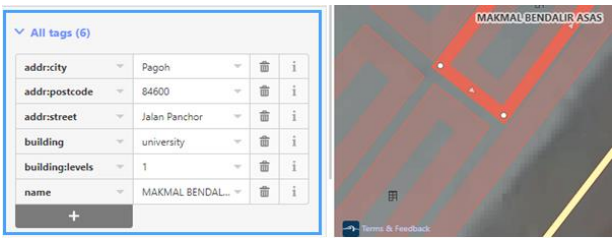


Fig. 12: Description of building.



Fig. 13: Block mapped into OSM.

3.3. Open street map embedded to digital campus

Admin system need to access into Joomla by enter username and password as being explained above that digital campus is a website that embedded with Open Street Map application. Meanwhile, Figure 14 is example of system architecture in Joomla application refer to main interface of digital campus system in term of administration phase. Result of system design and main interface in browser is show in Figure 15.

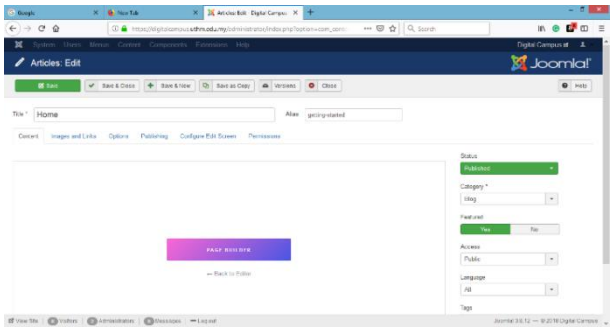


Fig. 14: System homepage in Joomla.

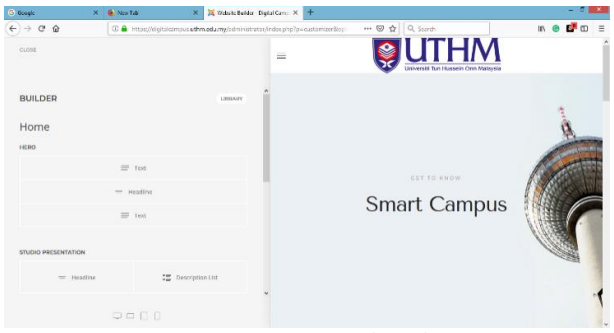


Fig. 15: System design and main interface of Digital Campus.

4. Result and findings

Digital campus website successfully had been embedded with Open Street Maps link https://digitalcampus.uthm.edu.my/index.php. The Digital Campus System had covered High Education Pagoh Campus at latitude and longitude 2.1494379, 102.7310593. There are 204 locations that is successfully plotted. Digital Campus at FTK, UTHM already launch on September 2018. Digital campus website had been successfully designed and develop to make it more visible for users as shown in Figure 16. Figure 17 refer to first step accessing into digital campus. User need to click on search button before proceeding to next stage. Figure 18 shows that is an interface of user need to enter your interest location.

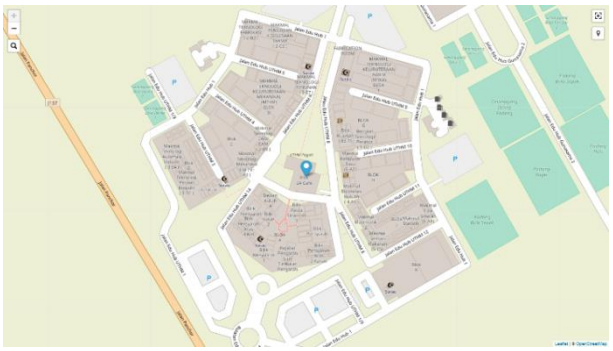


Fig. 16: Main interface of OSM.



Fig. 17: Search for location.

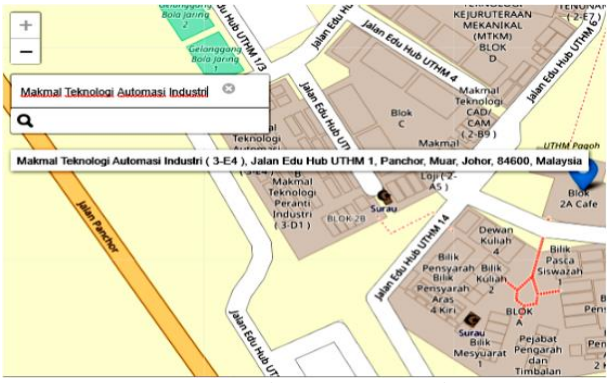


Fig. 18: System interface to enter name of location.

Figure 19 shows the result once location name example of Makmal Teknologi Automasi Industri had been entering correctly the map automatically show the real location. Noted that all building had been design by level. In this laboratory, the location of Makmal Teknologi Automasi Industri is at Level 1, Block B. For more details, user can use other options through open street maps application for details information. Open Street Maps is a navigation application which is it can show direction by clicking on current position button as in Figure 20. The maps will show the direction to reach the destination. There are standard to follow for mapping and maintenance the data during constructing the digital campus [10].



Fig. 19: Blue circle indicates the desired location.



Fig. 20: Current position of visitor.

5. Conclusion

In conclusion, Digital Campus by using Open Street Map embedded with Joomla 3.8.13 with PHP version, 5.6.25 can provide clear digital mapping. It will help students, staff academic and visitors to find their desired location within a campus in easy way. They will be on-time every time they have class and meeting. Thus, their work optimization will give advantages to all parties and be adaption in digitalization in this era can stimulate university management to different platform toward Industrial Revolution 4.0. The developed system is hoped to be implement to other locations and enhance digital application.

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