e-Cemetery Portal: A Tool for Digitizing the Cemetery Culture in Malaysia

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Abstract— **The cemetery is known as a sacred void space where the living and the dead symbolically become one by performing the funeral memorial rites. In Malaysia, the cemetery culture is widely practiced by all major ethnicity. However, past studies highlighted that the burial ground allocation in Malaysia has reduced due to poor cemetery management and rapid infrastructure development to promote housing and tourism sector. Therefore, this research proposes the e-Cemetery portal to increase the efficiency of the existing Cemetery Management systems and to adhere to the new demands from the tech-savvy millennial. This e-Cemetery portal digitized the cemetery culture by using the Rapid Application Design (RAD) approach to develop the system. The portal was further tested and validated to determine the efficacy of the design. A total of 10 respondents participated in the validation process of the e-Cemetery portal design. It is found that the design successfully digitized the roles of the e-Cemetery target users and enhanced the cemetery management protocol. However, the research has some limitation as it does not address the various security issues. Some implications of the findings are discussed in this paper.**

Index Terms— **e-Cemetery, portal, web services**

1. Introduction

In recent years the death toll in Malaysia has plummeted. Although Malaysia is classified as one of the smallest countries in the world, it is very alarming to comprehend the sudden increase of the death rate that lead to being the third highest death rate country in comparison to two big lands, China and India which are very highly populated (Ruxyn, 2017). According to the researcher, the death rate of 23 per 100,000 populations had led to about 7000 to 8000 deceased citizens every year. Therefore, the need arises for the Malaysian government to identify new burial grounds to allow the memorial rites to take place smoothly. In line with this, researcher Zaccheus (2017) affirms that the Muslim graves at the Choa Chu Kang Muslim Cemetery will be exhumed from September 26 2018 under the Phase VI of the ongoing exhumation exercise due to land scarcity. This issue is also aligned with the article by McManus (2015) that highlighted insufficient burial grounds are one of the looming problem in many parts of the world. It was also discussed that almost half of the existing England's cemeteries could run out of space within the next 20 years. To add on, Pocklington (2013) stated that the majority of respondents in his study agreed that the cemetery management stated that the existing burial grounds can only accommodate burials for the next 20 years.

In a similar study conducted in Malaysia by Afla and Reza (2012), it was found that the Christian cemetery in Cheras has insufficient burial space due to high demands from the community and the allocated space by the management failed to meet all the burial requests. Besides that, there are many unknown burial places in Malaysia. This is due to the poor cemetery management which failed to keep track of the burial requests and burial grounds (AsiaNews, 2014; Daud et al, 2013).

Along similar lines, Huffman (2016) highlighted that the Mississippi governor's business has a good impact on the failure of grave tracking. In this article, the land had been used for development purpose without being known by the African American themselves. He also mentioned that Mississippi officials sold a piece of public land to a German manufacturer for rapid infrastructure development. Thus, it can be concluded that without proper management protocol, the cemetery culture will be forgotten by the new millennials and the descendants will not be able to retrieve information related to their ancestors in the future. This was supported by the findings from a study conducted by Epochtimes (2005) who had affirmed that it is a painful and tedious task to locate the ancestor's grave after some years as the records are not stored electronically. Besides that, the process is very time consuming to locate the grave number by the management due to inefficiency and the drawback of the traditional management system.

In this era, most organizations tend to transform their management system using information system in order to speed up and enhance their business benefit as well as their services provided to the customer. In addition, the cemetery services provided by the organization has also undergone a massive transformation. Traditionally, the memorial service providers process data manually and store data in the form of hard copy and not electronically. It is not an easy task to locate cemeteries and to retrieve information of the deceased. As for the customers, it is a tedious process to locate a specific grave or to retrieve records of their ancestors. Since the existing cemetery

management is less user friendly and does not address the needs of the new millennium, this study proposes the e-Cemetery system which aims to address the highlighted cemetery management issues.

Since the cemetery culture in Malaysia is widely practiced by all ethnicity, it is crucial to determine the trending issues related to the existing cemetery management system without being specific to any religion. To achieve the objectives of the study, a web portal known as the e-Cemetery was developed using the Rapid Application Development (RAD) known as an object-oriented approach that includes method as well as software tools to digitize the cemetery culture in Malaysia and to improvise the cemetery management protocol.

2. Literature Review

Over the years, the proportions of deaths resulting in cremation has risen from 4% to just over 71% (London Planning Advisory Committee, 1997). It was advocated that the burial request is more than the expected figure. Adding on, the Centre for Disease Control and Prevention (CDC) reported that there are more than 2500 people killed by Ebola virus in Africa (CDC, 2015). Therefore, the CDC collaborated with the Ministry of Health and Sanitation (MOHS) to assess the burial and cemetery management due to huge demand. The number of deaths are more than the availability of the burial space. The cemetery management could not handle such large demand systematically. It was also reported that a cemetery portal can help to gather relevant information easily besides having a central control over the manpower issues (CDC, 2015).

In Malaysia, Daud et al. (2013) predicted that the population in Malaysia is expected to increase 45 percent from 1980 till 2020. Hence, there is a rapid increase of 80% of golden citizen group. The cemetery land shortage issue arises in many major cities such as Kuala Lumpur, Ipoh and Johor Bharu (Daud et al, 2013; Khalid, 2007; Bavani. M, 2012).

In a past research by Carrington (2016), reusing graves was identified as a solution for the insufficient of burial space to meet the demand of the public. Reusing grave helps the cemetery management to reduce the allocation of space and the cemetery will not run out of space. (Carrington, 2016; McManus, 2015). Reused graves solved the issue related to limited burial space. The main perspective to be noted is the willingness of families of the deceased to share the graveyard among relatives or from the same family tree. On the other hand, Clayden et al. (2017) asserted that natural burial within urban cemeteries plays an important role in helping to move public acceptance towards a less intensively managed landscape and less manicured that can avoid a drastic climate change. Hence, the management need to have a proper management system to ease the data collection process for the cemeteries. As a result, the management can manage their data more systematically as information management becomes a difficult task without a proper database collect all the data required. (McManus, 2015; Clayden et al, 2017). Along similar lines, Mattaway (2006) mentioned that only limited information is gathered by a government agency to maintain death registry. Hence, a family tree structure can be implemented via a web portal to update all information regarding each family members as well as to embed their biographies in the portal (Mattaway, 2006). With the increased death toll every year, it is vital that every country must have a centralized management system to update and store all the information of the citizens.

In addition, IBM (2005) concluded that a web portal service will be able to improve the overall productivity, increasing customer satisfaction, enhancing business responsiveness and maintaining a competitive edge because it provides simple access to let the user perform the tasks for it. It is also proven that a portal is a good tool to help manage the cemetery (Mattaway, 2006).

Along similar lines, Nielson (2015) found that many of the relative's graves of a certain community were buried in unmarked graves which makes identification of graves very difficult. Apart from this, archaeologist would also like to gather more information from the older generation to assist in their theoretical findings. Hence, the portal can help the family as well as the scientists to locate the unmarked cemetery burials which people do not know (Hansen et.al, 2014). Although it will be an expensive endeavor for the government to implement such portal to ease the management process in the cemeteries, it is worth the effort for a better future of the digital community (Park, 2016).

2.1 Cemetery Management System

Nebraska Gravestone is a portal that allow people to search for gravestone, upload photo of the gravestone, browse the gravestone by surname and browse the gravestone by cemetery (Pocius, 1981). Although this website provides a user friendly platform for users to search for gravestone, the visibility of the ancestor's information is unclear. Nebraska Gravestone does not provide sufficient information for the users as it only contains the snapshot of the gravestone to enable users to identify a specific grave. Similarly, 'Find a Grave' is a portal by Tiption (1995) that provides multiple functions to the user. Some of the services provided by 'Find a Grave' are users can search for famous graves, browse for grave by location, search using a specific date and locate the most popular graves. Besides this, it also provides a

community chat room for the members to share thoughts and ideas related to military, social as well as to provide instant feedback to the administrator regarding the cemetery database. There are many positive feedbacks posted by the community in the chat room. Amongst the postings are the success stories of users who have managed to locate their grandparents and relative's graves. It can be seen that all of these can help the community a lot and bring a lot of benefits to the society.

On the other hand, the Institute of Cemetery and Crematorium Management, a cemetery portal deployed to manage the cemetery was adapted widely in London (Rugg, 2006; Woodthorpe, 2011). In this portal, a list of cemetery services is displayed and this enables the users to locate the nearest memorial service provider to identify the location of burial grounds and to plan the memorial service. However, it is noted that this portal is more suitable for the administrators rather than the community as there are many third party memorial service providers link that is very confusing (Woodthorpe, 2011).

3. Research Methodology and Discussion

Figure 1 depicts the three phases of this research. The identified three phases are data collection, Rapid Application Development (RAD) approach and the data analysis phase.

Phase one is the data collection process where an online form was used to collect data from 80 respondents. The demographics of respondents are listed below:

- Gender : 54% Male; 46% Female
- Age Group : 20- 40 years
- Ethnicity : Chinese 48%; Indian 22%; Malay 21%; Others 9%

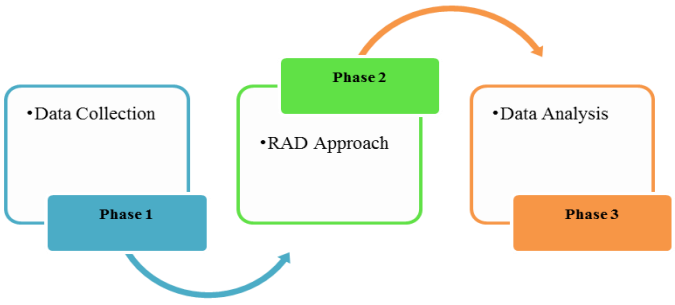

Figure 1: Research phases

The objective of the questionnaire is to gain the preliminary understanding on the user requirements for the e-Cemetery portal. Since this is a user centric design portal, it is vital to identify the user needs. The questionnaire had 17 questions which were divided into two sections. The first section was on the respondent's demographics and the next section displayed questions related to the cemetery services. Besides this, to enhance the usability of the system, the researchers conducted a face-to face interview with cemetery management to gather better information on the requirement for the proposed system. The data collected from both users and the management gives a comprehensive understanding to the problem addressed in this study. Thus, the developed system will be able to tackle the issues as well as propose a holistic user centered design approach.

The second phase of the research is the implementation of Rapid Application Development (RAD) approach. RAD is more cost effective compared to the Waterfall and Extreme Programming (XP) model. This is due to the fact that the Waterfall model requires a longer timeframe while XP, an agile programming that implements the pair programming approach to develop a certain system. On another note, RAD reduces the risk factor of the project which means when the project is having problem, the project can be reverted instantly (Morse, 2016; Thakur, 2017). With this in mind, the e-Cemetery portal was developed using the stated RAD approach. The e-Cemetery approach's initial step was to identify the key issues and combine the elements for the development of the system. Next, the user design phase permits the user to interact with the portal that allows users to understand, modify, and eventually approve the working model of the proposed e-Cemetery portal. This is then followed with the construction phase that focuses on program and application development task where the users can still propose improvements. The final RAD step is the cutover that includes the implementation and testing of the e-Cemetery portal. Usability Testing was conducted for the e-Cemetery portal. The Usability Testing is used to identify the efficacy of the portal as well to determine the limitations of the designed portal. To simplify, Usability Testing focuses on measuring a human-made product's capacity to meet its intended purpose. In this study, a total of 16 questions were answered by the users using the online form. A total of 10 respondents participated in this phase of research. The questions were adapted from a similar research study conducted by Noguera et al. (2012). The questions are tabulated in Table 1.

Table 1: Usability Testing

No.	Questions
Q1	Overall, I am satisfied with how easy it is to use this system.
Q2	It was simple to use this system.
Q3	I was able to complete the tasks and scenarios quickly using the system.
Q4	I felt comfortable using this system.
Q5	It was easy to learn to use this system.

Q6	I believe I could become productive quickly using the system.
Q7	The system gave error message that clearly told me how to fix problems.
Q8	Whenever I made a mistake using the system, I could recover easily and quickly.
Q9	The information (such as online help, on-screen messages and other documentation) provided with this system was clear.
Q10	It was easy to find the information I needed.
Q11	The information was effective in helping me complete the tasks and scenarios.
Q12	The organization of information on the system screens was clear.
Q13	The interface of this system was pleasant.
Q14	I liked using the interface of this system.
Q15	This system has all the functions and capabilities I expect it to have.
Q16	Overall, I am satisfied with this system.

The data collected from the Usability Testing as shown in Table 1 is further analyzed in the final phase to determine the efficacy of the system to digitize the cemetery culture in Malaysia. The data was analyzed using simple descriptive statistical analysis.

4. Results and Discussion

In phase 1 of the research, a total of 80 respondents comprising of 55% male and 45% female participated in this research in order to determine the core requirement of the portal. The results show positive feedback from the respondents that such portal benefits the user in the future. Forty percent (40%) of the respondents felt that the cemetery service provided in Malaysia is efficient but it is not digitalized and not user-friendly. One of the key areas identified was the communication service where a total of 40 % of the respondents felt it is hard to contact the cemetery management and it is time consuming to request for a specific service from the management which needs further improvisation.

On another note, more than 50% of respondents agreed that information provided by the cemetery management is insufficient and not updated. Meanwhile, another 75% of the respondents admitted that they are keen in gathering more information regarding their ancestors using a cemetery portal which will enhance their knowledge on their family tree. With this new updated feature and comprehensive information, it eases the information collection process with reduced cost and effort. On the whole, the majority of respondents felt that there is a need to design a cemetery portal that can enhance the quality of living simultaneously improving the quality of service provided by the cemetery management.

Figure 2 below illustrates the screenshot of the main page of the e-Cemetery portal. Once the user enters the portal, all the types of services of services provided by the cemetery management will be shown. At the right corner, there is a live chat function which enables the user to chat and answer them the questions about the burial request. The user is able to register a new account for the portal by clicking the register button and fill in all the required information. Subsequently, they can login to navigate the respective pages.

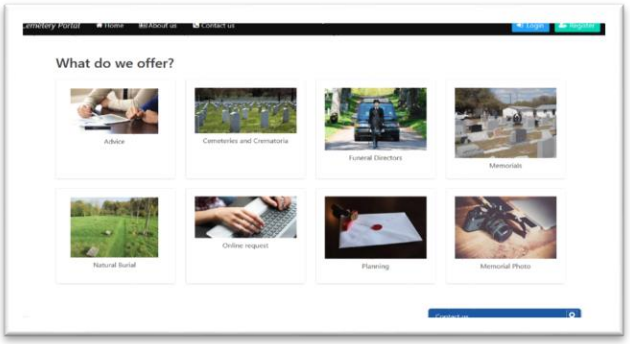

Figure 2: e-Cemetery Portal Main Page

Figure 3 is the screenshot of the Admin page which allows to add cemetery area as well as view the lot in the cemetery area. The admin is able to add new cemetery area by filling in the respective location and row with columns. Next, the admin is also able to edit the cemetery area for changing purpose.

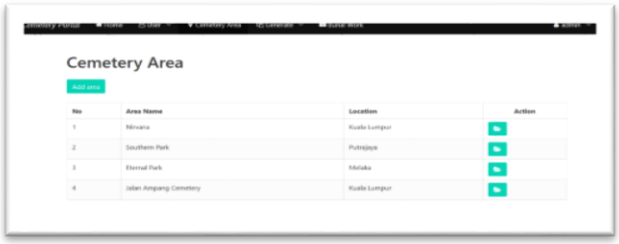

Figure 3: Screenshot of Managing the Cemetery Area Page

Figure 4 depicts the page in which the admin as well as general user view the lot of specific burial area. The admin can change the status of the lot based on the requirement of the cemetery management. Meanwhile, the general user can view and book the available lot for burial.

A total of 10 respondents participated in the Usability Testing to evaluate the e-Cemetery portal developed by the researcher. As shown in Figure 5, it is noted that most of the respondents are satisfied with the developed portal. 60% of the respondent mentioned that the system is easy to learn, recover easily and effective to help in

work. 70% of them said the system is easy to use due to clear message given, and good interface. Up to 90% of them said that the system is simple to use and easy to find the information as well. To conclude, most of the respondents showed positive feedback in the Usability Testing.

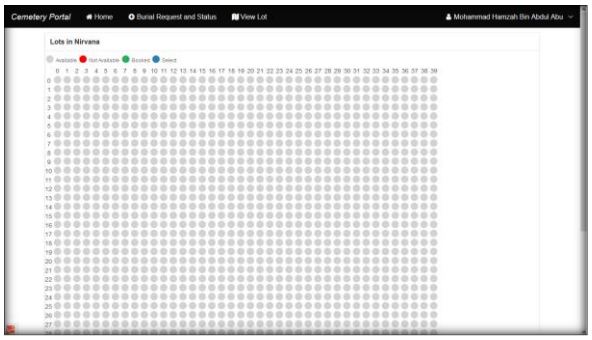

Figure 4: Screenshot of View lot

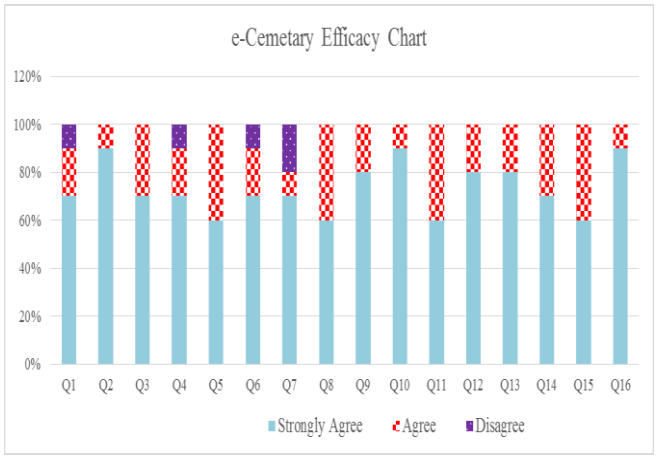

Figure 5: Usability Testing

5. Conclusions

Throughout the result and discussion, it can be foreseen that digitalizing the cemetery management work able to help by using the portal as well as speed up the process of working. As stated by Kara and Patty (2014), portal featuring all or most necessities for employees' success. Most of the enterprise use portals to boost up their daily operation (Kara & Patty, 2014). By putting all the information into the portal, the cemetery management as well as the general user are able to either request his/her burial easily or manage the burial in a more efficiency way. Through the results of the usability testing, we know that the portal is very efficient for the user which supports what had been mentioned by Reddy (2017). It explained what had been discussed by Interbrand (2018) which talked about the growth of the business. It also shows that a portal can help identify the audience well because it helps to build a solid foundation for the business. One of the advantage of the system is the descendants can easily to get the information of their ancestors.

In comparison with 'Find a grave' portal, the general user is able to include all the information of their ancestors and allow the descendants to retrieve more information about them. Corresponding with Institute of Cemetery and Crematorium Management cemetery portal, the user does not need to include all the annual fee as all the services will be done by the cemetery management. Even though Nebraska Gravestone has the feature to include the photo of the cemetery into the system, it is believed that in the future enhancement, the 'View lot' function may be integrated with Google maps which will make it much easier for the user to view it. Furthermore, the e-Cemetery portal has a good interface design which is similar to the Institute of Cemetery and Crematorium Management cemetery portal in order to guide the user easily to find the function that they need to use.

The limitation of this portal will be the security as there is a lot of information of the ancestors which need to be encrypted by the developer so that it will not be misused by hackers when they hack into the system since data protection is very important nowadays. Salting and hashing the information may be used in the future enhancement of the portal to make sure the data is secure enough.

In future research, the process of notification can be further enhanced by integration of text messages and voice chat function into the portal which can lead to easier burial management and allow the user to know the status of the burial request especially those who are in rural areas with limited internet accessibility. With all of the justification above, it is believed that an e-Cemetery portal can able to bring the cemetery management to another level.

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