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## Development of Muslim Graveyard Management System (MGMS) Using Geospatial Technology Applications

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### Abstract

The management of Islamic cemeteries is a social requirement that needs to be implemented in Malaysia community especially among Muslims. The cemetery management system is particularly inadequate because of the current rapid development and a high number of deaths in specific urban areas. This circumstance has produced several concerns, including the lack of an orderly death record and the non-uniform arrangement of grave sites, all of which contribute to the lack of a cemetery. Therefore, the emerging demands in creating the Muslim cemetery management system are highly significant. The Muslim Graveyard Management System (MGMS) was created using a combination of Geographical Information System (GIS), aerial imagery and the used of Survey123 Mobile Apps technologies. This study focuses on the development of GIS and web-based systems to assist authorities in managing funeral records more effectively. The study was also conducted to assist the deceased's heirs in identifying the location of their family graves. This system is well equipped with a search function that can provide information of the deceased by using an Internet browser. In addition, the use of quick response code (QR code) in this IGMS system allows various types of information to be directly accessible and easily generated with fast-reading accuracy. Consequently, this study has foreseen the practicality and potential of this MGMS system through a conducted case study at the Islamic cemetery, Bukit Kiara Kuala Lumpur.

**Keywords:** Cemetery, Geospatial, Technology, Management, GIS.

## Introduction

The Muslim cemetery is one of the symbology to the organizations related to the Muslim community image. Irregular management of Muslim cemeteries is a major problem that is often raised (Ahmad et al., 2015). Nowadays, the unorganized management of Muslim cemeteries has become a major problem and raises difficulties to locate the grave location and overlapping arrangement (Abdul Rasam et al., 2013). In addition, lack of land for funerals is also emerging issues raised from the rapid urban growth in most Asian developing countries including Malaysia (Daud et al., 2015). Most Muslim graveyards that have reached the age of decades and above begins to be unrecognizable by the heirs to identify the exact location or position of the grave. To maintain their principal role as a resting place for the deceased, cemeteries require long-term planning, which is the long-term viability of urban cemeteries, rules and standards must consider both management and regeneration issues (Afla et al., 2018).

The problem of overcrowding and land shortage in Muslim cemeteries is also a factor in the intention of developing this cemetery management system (Afla et al., 2018 & Daud et al., 2015). Unmanaged cemeteries systematically have caused society to become less interested in visiting the cemetery (Noratikah, 2019; Ahmad et al., 2015). The issue of Muslim cemeteries is not only happening in Malaysia, but also occurs in foreign countries such as Indonesia, Vietnam, Germany, and Austria (Ladianto, 2016). The need for a cemetery is just as important as any other basic facility.

Due to the lack of parcel land, this problem becomes more critical especially in densely populated areas, such as cities. The government must provide adequate funeral facilities for the growing city residents. Some of burial grounds which have been with the stack system on the old cemetery which had been outstanding for more than decades. It is seen from the decreasing availability of vacant land in urban areas and green spaces which are transformed to housing and settlement (Ladianto, 2016). The growth of population also affects high death rate and required high demands of cemetery land.

The younger generation today finds it difficult to locate family cemeteries when there are old graves and headstones without labels. With this system, it can help the community to use smartphones to identify the graves of deceased families. There is still no use of a cemetery system that can help identify old unlabeled graves and missing headstones. Due to these circumstances, this study assists in implementing planning and monitoring for cemeteries by using more effective geospatial technology applications.

Besides, the methodology also makes it easier for local authorities or housing developers to develop suitable locations for cemeteries in areas that are being developed using geospatial technology. Therefore, the aim of this study attempts to cast the light on these matters and develop the Muslim cemetery system through adopting the spatial technology applications. This study is based on a common scenario nowadays in Islamic cemeteries which are usually located in under the management and supervision of a local authority or religious department.

## Materials and Methods

In this study, Bukit Kiara is selected as the study area. Bukit Kiara is located under the administration of Petaling district in Mukim of Bandar Kuala Lumpur (Figure 1). Bukit Kiara is

a luxury suburb of Kuala Lumpur. This study area is close to other exclusive towns such as Bukit Damansara, Mont Kiara, Sri Hartamas and Bangsar. Bukit Kiara is also known as the “green lung of Kuala Lumpur”, this is through the characteristics of hills and forests which has become a favorite of the locals in carrying out activities in the form of health. Moreover, the location has potential to be harnessed to maintain its attractiveness, comfort, and satisfaction for development commercial and exclusive housing in Kuala Lumpur. Therefore, the government and private agencies need to provide or improve the Muslim cemetery management system to be more organized.

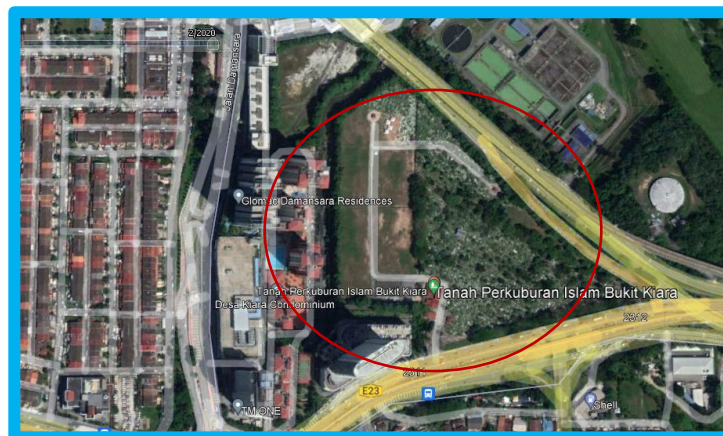


Fig. 1. Study Area  
Source: Google Map (2020)

The existing plots of graves in this study region were split into two categories: adults and children. The division area of adult and child cemetery is determined by the Islamic religious council. Figures 2 shows the plot graves data layout of adults and children in the cemetery provided by Department of Survey and Mapping Malaysia (JUPEM).

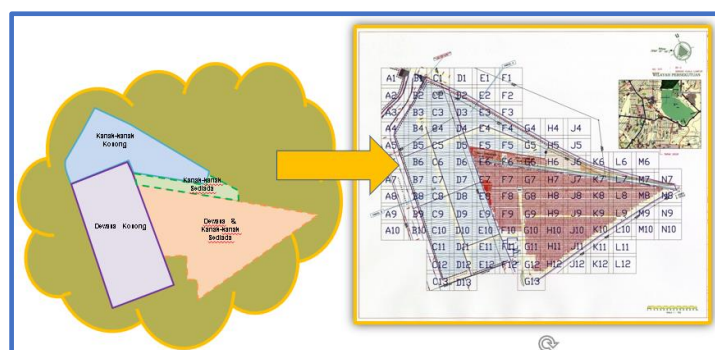


Fig. 2. Graveyard Layout (Location of the Study Area)  
(Source: JUPEM)

### GIS Web Development

This management system adopted ArcGIS software, which includes various analysis and updating of information can be made. The use of GIS system allows Islamic Religious Department to act as an administrator, to update the provided database. The mapping and developing of Muslim grave lots are focused using the Geographical Information System (GIS) applications. With the help of GIS web applications, it can be further strengthened monitoring



work on graves and make it easy for the heirs to facilitate and find the grave of the deceased. In this study, ArcGIS Pro and ArcGIS Online software are used to perform the process of analysis and web application.

ArcGIS Pro is the latest professional desktop GIS application which can explore, visualize, and analyze data; create 2D maps and 3D scenes. Meanwhile, ArcGIS Online is a cloud-based software to create and share interactive web maps. Figure 3 shows the process of data entry for deceased.

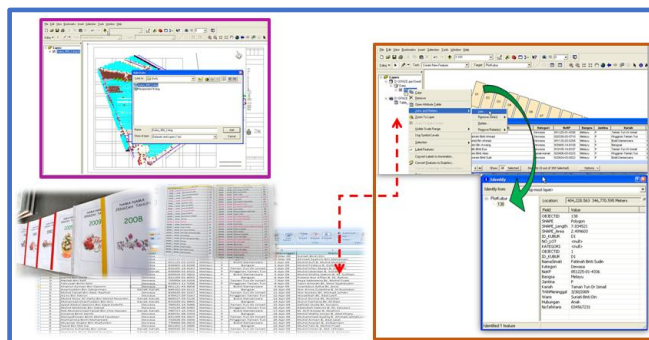


Fig. 3. Spatial and Attribute Data

### Geospatial Technology Applications

The geospatial technology applications can be developed through digital mapping of graveyard locations which forms a more informative GIS base and systematic information. In this study, spatial data such as land lots and roads data were obtained from the Department of Survey and Mapping Malaysia (JUPEM), while the location of the cemetery plot was obtained by the image satellite and Survey123 Mobile Apps technology. The development of this database is more specific referring to the spatial data and the relationship in developing a GIS system of the Muslim cemeteries. Moreover, a holistic Muslim cemetery with a better design and organized approach for the Muslims deceased were established (Ahmad et al., 2015 & Omar, 2007). The grave plots are designed in ArcGIS pro software. ArcGIS Pro has much more capability to perform complex analysis and customize the display of data than ArcGIS Online does. Figure 4 shows the location of grave plot data in ArcGIS Pro.

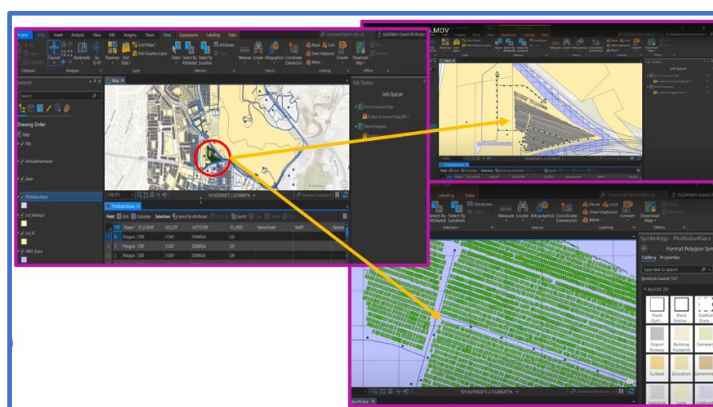


Fig. 4. Grave Plot Location using ArcGIS Pro

Meanwhile, ArcGIS Online is a platform for web GIS accessed through a website in a browser. All the data is processed and stored on web servers. The data from ArcGIS Pro was transfer to ArcGIS Online to be stored on those servers. Generally, ArcGIS Online has much more capability for interactive and collaborative use of GIS than ArcGIS Pro (Figure 5). By using this system, some analysis and updating of information can be made and subsequently allows the Pejabat Agama Officer to act as administrator to update the database base on the latest information.

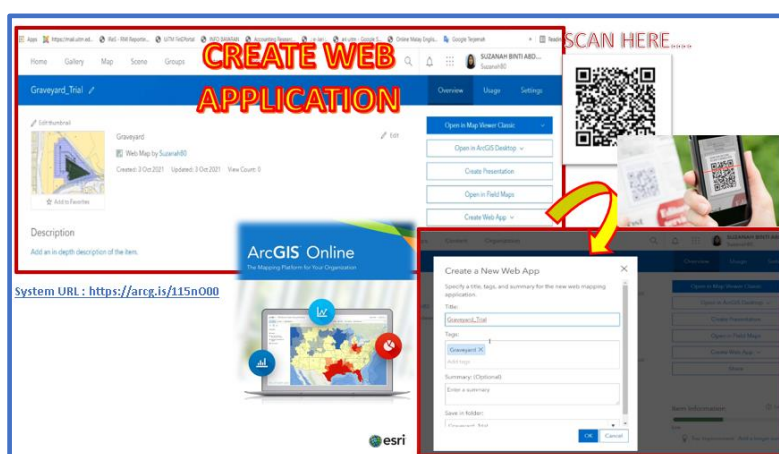


Fig. 5 Web GIS Application for Islamic Graveyard

### Quick Response Application

On IOS and Android-based mobile devices, the QR code application serves as the foundation for a geometric locating and monitoring system for Muslim Cemetery (Isik et al., 2017). This application helps to retrieve information using a smart phone, when performing the process of searching or navigating to the grave location. The user is another component of monitoring and assessment systems. The user can check to get the certainty of the grave location according to the desired information. In this system, all data can be effectively defined, stored, processed, and analyzed in the same database. This system can be navigated using a mobile phone that allows an accuracy of more than 1metre. Therefore, with this QR code, the user can validate their verification of cemetery plots within a radius of 1 m using this QR code. Figure 6 shows how a QR code application can be used to display detailed information on a deceased person.

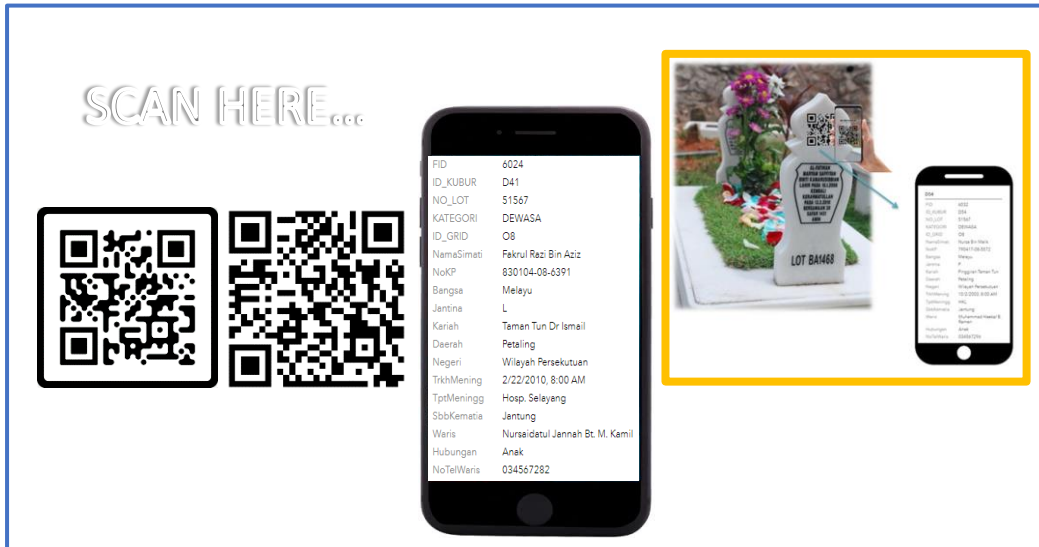


Fig. 6. Retrieve Detail Deceased Information Using Qr-Code Application

### Result and Discussions

In the current of development based on information at the fingertips, the Internet is a key element in realizing the goal of developing Muslim cemeteries systematically. Apart from search, this system can also be used to create data editing involving the work of adding new death records.

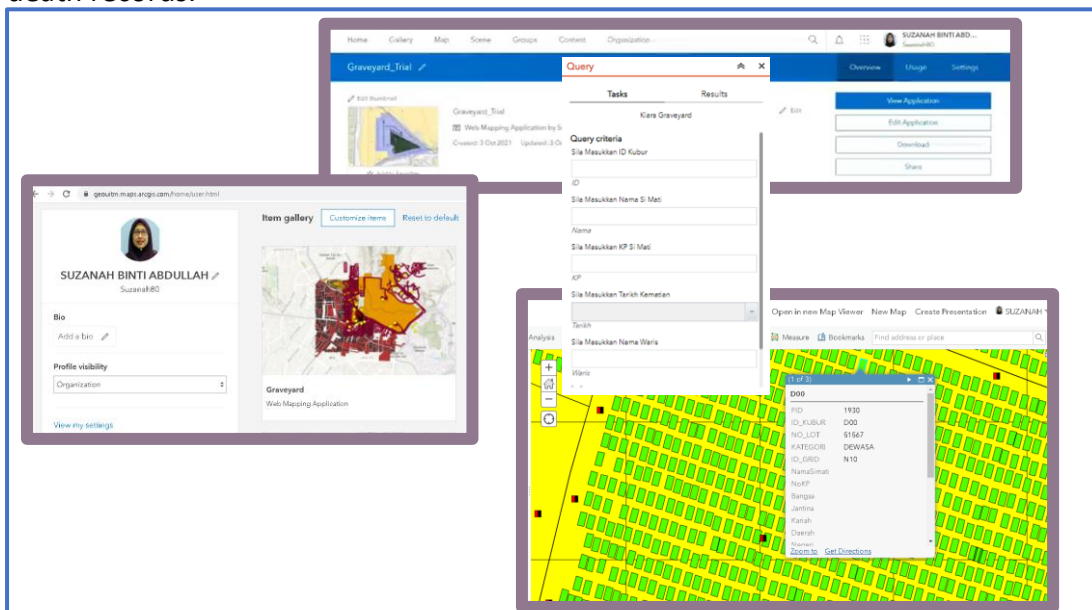


Fig. 7. Web GIS Development using ArcGIS Online

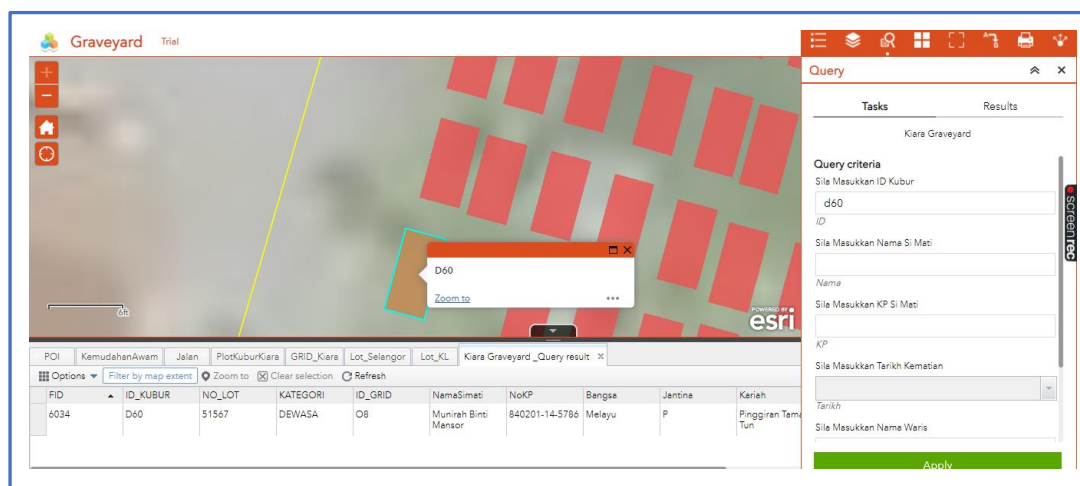


Fig. 8. Searching or Querying Process for Muslim Graveyard Information

The information of deceased will be recorded in a database such as name, date of death, and grave plot number. The search for deceased information can also be done using QR code access. This method is very simple and helps all users in finding information about the deceased.

### Conclusion

Nowadays the internet is the most up-to-date and convenient source of information. Apart from the internet, Geographic information systems (GIS) are also the foundation for the Muslim Graveyard development system. The public and the Islamic Religious Department will benefit from the establishment of the GIS database and the Muslim Cemetery Web. This system is sufficient, provides convenience and reliable to everyone, especially to the heirs during their visits to the family grave at the Muslim cemetery. This established system can deliver grave information to anyone, and it can aid in the faster and more effective processing of death records.

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