*Research Article*

# Cemetery Land: Sustainable Dashboard Development for Perlis E-Cemetery

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*Abstract:*
*The Perlis E-Cemetery Dashboard offers a sustainable solution to address the growing need for efficient cemetery land management in areas with limited land like Perlis. Traditional methods lack predictive insights and real-time data visualization, leading to poor long-term planning. This dashboard integrates demographic analysis, predictive modeling, and interactive visual tools to forecast cemetery land utilization and estimate when full capacity will be reached. It supports proactive decision-making, aligns with Islamic Cemetery Planning Guidelines, and encourages sustainable land use. The system has strong commercialization potential and can be adapted by other regions to enhance urban planning and community resource management.*

## 1. INTRODUCTION

Efficient management of cemetery land is essential for sustainable urban development, particularly in regions facing rapid population growth and limited land resources such as Perlis. Traditional cemetery land management systems typically rely on retrospective data without advanced predictive capabilities, often leading to inadequate long-term planning and resource mismanagement. The Perlis E-Cemetery Dashboard addresses these challenges by integrating robust predictive analytics, demographic insights, and intuitive data visualization tools to optimize cemetery land utilization.

## 2. RESEARCH GAP

Existing cemetery management methods lack comprehensive predictive analysis and real-time data visualization, limiting the ability to effectively manage cemetery resources. There is a clear gap in solutions that not only predict future land utilization but also integrate demographic and birth data to facilitate holistic urban planning. Additionally, previous methodologies rarely account for sustainability, community impact, and commercial scalability.

## 3. LITERATURE REVIEW

Efficient cemetery management is critical due to increasing urbanization and the limited availability of land resources (Coutts, Basmajian, & Chapin, 2011). Accurate cemetery land projections require detailed demographic data, including mortality rates, population growth, and birth rates (Noor & Sabir, 2023). Prior research has identified the necessity of incorporating geospatial technologies and predictive analytics in cemetery management for more efficient land utilization and better urban planning (PLANMalaysia, 2023). Islamic Cemetery Planning Guidelines also emphasize sustainable land use through standardizing cemetery plot sizes and optimizing land design to ensure efficient space utilization (PLANMalaysia, 2023).

## 4. OBJECTIVES

The primary objectives of this project are:

4.1    To conduct accurate projections of cemetery land utilization based on detailed demographic analysis, including population growth, death rates, and birth data.

4.2    To provide stakeholders with estimated timelines for cemetery land utilization, enabling proactive planning and resource allocation.

4.3    To present user-friendly, visually intuitive data for effective community engagement and informed decision-making.

4.4    To promote sustainability by optimizing cemetery land use, thus reducing unnecessary land consumption.

## 5. DATA SOURCES

5.1    Department of Statistics Malaysia (DOSM): Population and death rate data (2019-2023)

5.2    PLANMalaysia: Population growth projections and cemetery planning standards

5.3    Islamic Cemetery Planning Guidelines: Average cemetery lot sizes and design requirements

## 6. SOLUTION

The Perlis E-Cemetery Dashboard is an innovative, sustainable solution integrating detailed demographic analytics, predictive modeling, and interactive visualizations into a single accessible platform. It not only forecasts cemetery land utilization but also incorporates real-time insights into population dynamics and birth rates, providing a comprehensive view for stakeholders. This solution significantly improves decision-making processes, facilitates sustainable land management, and has high potential for commercialization across urban planning sectors.

## 7. METHODOLOGY

This study applies a two-stage projection method which is designed to firstly, forecast the annual demand for burial land and then, determine whether there will be a surplus in subsequent years.

In the first stage, the demand for cemetery land, denoted as $C_t$, is calculated using equation …(1) and assumed to remain constant for each year. This calculation takes the average of Perlis population and the average of mortality rate from year 2019 to 2023.

$$C_t = (\overline{P_t}) \times (\overline{M_r}) \times S_z \times R_g \qquad \text{…(1)}$$

where

$C_t$ = Cemetery land requirement on Year t

$(\overline{P_t})$ = The average of population (2019-2023)

$(\overline{M_r})$ = The average of mortality rate (2019-2023)

$S_z$ = The average of cemetery lot size

$R_g$ = Distance between reuse cemeteries

According to Islamic Cemetery Planning Guidelines, the average of cemetery lot size, $S_z$ and distance between reuse cemeteries $R_g$ is equal to $8.36 m^2$ and 30 years respectively. However, in this study, $R_g$ is set to be 1 as the land requirement is determined on a yearly basis. This method proceeds to calculating the annual land surplus until the year of full land utilization is determined using equation …(2), supported by geographical information in 2018.

$$surplus_t = available_t - C_t \quad \text{for } t = 2018, 2019, 2020, … \qquad \text{…(2)}$$

where

$$available_t = surplus_{(t-1)}$$

It is important to note that for Perlis State, the population data is available from year 2019 to 2023. However, for specific districts such as Kangar, Arau, Padang Besar and Kuala Perlis, the only available population data is on 2018. Therefore, an extrapolation method as shown in equation…(3) (Luchko et al. 2021) is used to determine the population of these districts from year 2019 to 2023 prior to calculating the cemetery land requirement, $C_t$.

$$P_t = P_0 \times (1+r)^t \qquad \text{…(3)}$$

where

$r$ : average population growth rate

$P_t$ : projected population on year, t

$P_0$ : population at the beginning of the forecast period

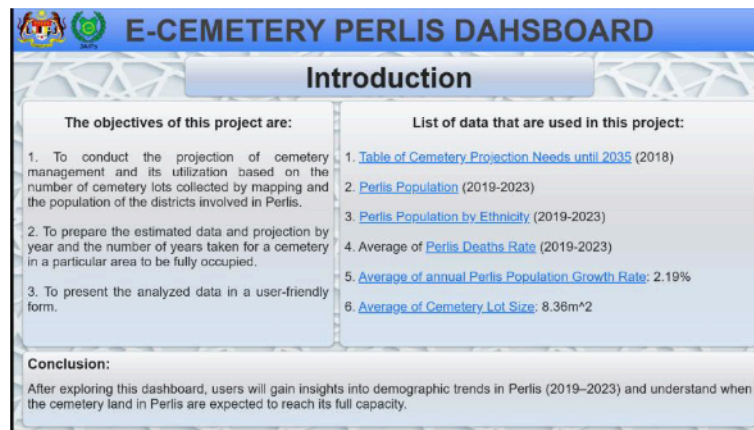$t$ : forecast period

## 8. OVERVIEW OF DASHBOARD



**Figure 1.** Introduction page of Perlis e-cemetery dashboard

**Figure 1** displays the main page of the Perlis e-cemetery dashboard, which contains the study objectives, the data involved throughout the research, as well as expected outcomes after the exploration of the dashboard. In the data list section, phrases highlighted indicate embedded links that will direct users to websites or scholarly articles serving as the sources for the respective data.
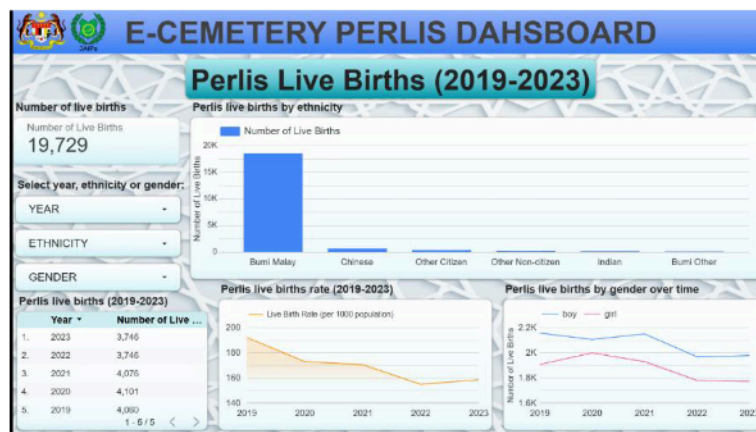


**Figure 2.** Live births demographic page in Perlis e-cemetery dashboard

**Figure 2** shows the birth demographics in Perlis. This page only includes data from 2019 to 2023 to identify current patterns in birth numbers and birth rates in the state. For user convenience, dropdown menus are provided to filter the data by year, ethnicity, and gender.
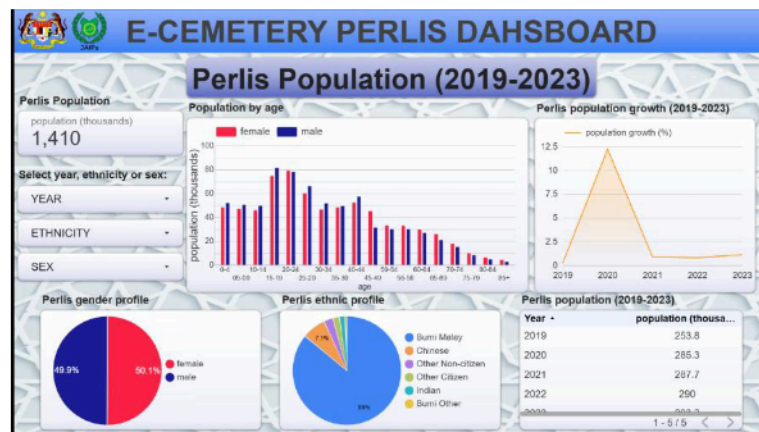
**Figure 3.** Population demographic page in Perlis e-cemetery dashboard

**Figure 3** presents demographic information on Perlis population. The data displayed on this page covers only the years 2019 to 2023 in order to identify recent trends in population size and growth rate in the state.
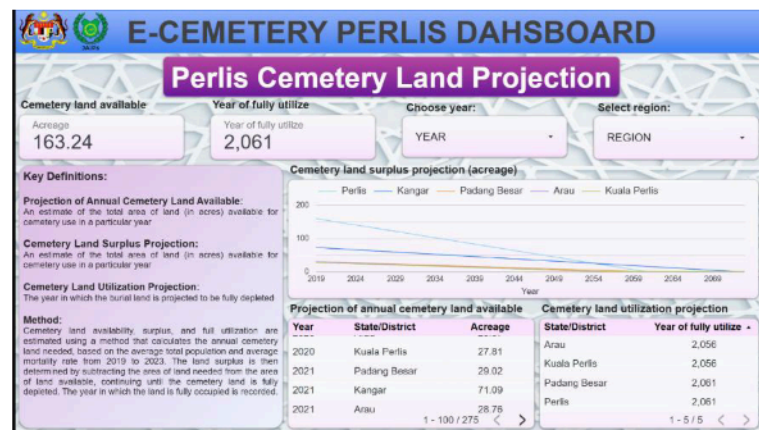


**Figure 4.** Page of cemetery land projection in Perlis e-cemetery dashboard

**Figure 4** shows the annual projections of cemetery land utilization in Perlis. This page highlights land area (in acres) for each estimated available land and annual land surplus by district. Additionally, the projected year when cemetery land is expected to reach its full capacity is displayed in a table and on a scorecard. To assist users, dropdown menus for year and region filters are provided. If no filters are applied, the dashboard will by default display results with the year set to "2019" and the area set to "Perlis."

Overall, after exploring the dashboard, users will gain an overview of the demographic trends in Perlis from 2019 to 2023. Furthermore, they will be able to identify the estimated year when cemetery land in Perlis is expected to reach full capacity.

## 9. COMMERCIALIZATION AND COMMUNITY CONTRIBUTION

This dashboard presents significant commercialization potential as a scalable, customizable tool for local governments and urban planning authorities nationwide. By fostering efficient land management practices, it directly contributes to community welfare, ensuring sustainable and

respectful allocation of cemetery resources, thus enhancing overall community planning and quality of life in Perlis.

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