**IT4010 – Research Project - 2024**

**Topic Assessment Form**

**Project ID:** 24-25J-092

1. Topic (12 words max)

Mobile application to scan and Extract historically and architecturally accurate data of an archaeological object

2. Research group the project belongs to

**Knowledge Inspired Computing (KIC)**

3. Research area the project belongs to

**Knowledge Inspired Computing (KIC)**

4. If a continuation of a previous project: No,

| | |
|---|---|
| Project ID | |
| Year | |

5. Brief description of the research problem including references (200 – 500 words max) – references not included in word count.

The preservation and study of archaeological objects are crucial for understanding human history and cultural heritage. However, traditional methods of documenting and analyzing these artifacts are often time-consuming, require specialized equipment, and can be prone to human error. Advances in mobile technology and machine learning offer a promising solution to these challenges. This research aims to develop a mobile application capable of scanning and extracting historically and architecturally accurate data from archaeological objects.

Key Challenges:

1.Image Acquisition and Object Recognition

Advanced algorithms are crucial for preprocessing images of archaeological objects, ensuring consistency and quality due to lighting conditions, shadows, and angles in challenging environments.

2. Historical Data Retrieval

Machine learning models are crucial for identifying archaeological objects and retrieving historical data, recognizing objects from diverse cultures and periods, and providing context through historical records and databases.

3.Architectural Feature Detection

Architectural features like inscriptions, carvings, and structural designs require precise image processing techniques for accurate capture and interpretation, necessitating the development of algorithms for various conditions.

4. 3D Object prompt generation

Creating accurate 3D models from 2D images is essential for a comprehensive understanding of archaeological objects

References:

1. Lowe, D. G. (2004). Distinctive image features from scale-invariant keypoints. International Journal of Computer Vision, 60(2), 91-110.
2. Forsyth, D. A., & Ponce, J. (2011). Computer Vision: A Modern Approach. Pearson
3. LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. Nature, 521(7553), 436-444.

6. Brief description of the nature of the solution including a conceptual diagram (250 words max)

1. Image Acquisition and Object Recognition:
The application employs advanced algorithms to preprocess images in challenging environments, adjusting lighting, shadows, and angles for high-quality, consistent results, enhancing analysis accuracy.

2. Historical Data Retrieval:
Machine learning models accurately identify archaeological objects, retrieving historical data from a cloud-based database, providing context on origin, cultural significance, and timeline.

3. Architectural Feature Detection:
The application uses advanced image processing to analyze architectural features like inscriptions, carvings, and structural designs, providing insights into architectural style and construction techniques for historical and cultural analysis.

4. 3D Object prompt generation:
By using third-party solutions for creating 3D models from 2D images, archaeologists can enhance their research capabilities, preserve cultural heritage, and make historical artifacts more accessible to the public.

7. Brief description of specialized domain expertise, knowledge, and data requirements (300 words max)

**Domain Expertise:**

Archaeology and History:

Experts in archaeology and history are crucial for understanding the cultural and historical context of the objects. Their expertise ensures accurate identification, classification, and interpretation of the artifacts, providing valuable insights into their significance and historical background.

Computer Vision and Machine Learning:

Specialists in computer vision and machine learning are needed to develop and fine-tune algorithms for object recognition, feature detection, and 3D reconstruction. Their knowledge in training models with large datasets and improving the accuracy of image processing tasks is vital for the application's success.

Software Development and Mobile Application Design:

Skilled software developers and mobile application designers are essential for creating a user-friendly interface and ensuring the seamless integration of various functionalities. Their expertise ensures the application is efficient, responsive, and accessible to users in the field.

3D Modeling:

skills of AI prompt generation for creating accurate 3D models from 2D images

**Knowledge Requirements:**

Image Processing Techniques:

Understanding advanced image processing techniques is necessary to preprocess images, enhance quality, and adjust for various environmental conditions, such as lighting and shadows.

Machine Learning Algorithms:

Knowledge of machine learning algorithms is crucial for training models to recognize objects, detect architectural features, and retrieve historical data accurately.

**Data Requirements:**

Extensive Image Datasets:

Access to large datasets of high-quality images depicting archaeological objects from diverse cultural backgrounds, historical periods, and conditions is necessary for training and validating machine learning models used in the application.

8. Objectives and Novelty

| Main Objective<br><br>Develop a mobile application to scan archaeological objects, employing advanced image processing, machine learning, and 3D reconstruction techniques. The goal is to extract precise historical and architectural data, enhancing documentation accuracy and supporting cultural heritage preservation and scholarly research | | | |
|---|---|---|---|
| Member Name | Sub Objective | Tasks | Novelty |
| Ekanayake T. E. M. A. P. | 3D Object prompt generation | 1.Develop algorithms to convert 2D images into 3D models.<br><br>2.Implement texture mapping to preserve the object's surface details.<br><br>3.Create tools for users to interact with and manipulate the 3D models.<br><br>4.Optimize the 3D generation process for mobile devices. | • Ensure the process is optimized for mobile use, making 3D modeling accessible to a wider audience.<br>• Utilize photogrammetry and advanced 3D reconstruction techniques to create highly accurate 3D models. |
| Jayawardhana J.R.K.B. | Historical Data Retrieval | 1.Collect and curate a comprehensive dataset of archaeological objects.<br><br>2.Train machine learning models to recognize and | • Create a specialized dataset that focuses on the unique features of archaeological objects. |

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| | | classify these objects.<br><br>3.Implement a data retrieval system to fetch historical context from databases.<br><br>4.Develop an API to integrate the model with the mobile application.<br><br>5.Continuously update the model with new data and findings. | • Integrate with global historical databases to provide users with up-to-date and accurate information.<br>• Employ state-of-the-art machine learning techniques suited to historical artifact recognition |
| Ediriwickrama E.A.K.V. | Architectural Feature Detection | 1. Develop image processing techniques to detect inscriptions, carvings, and structural designs.<br><br>2. Create algorithms to accurately capture and interpret architectural features.<br><br>3. Implement methods to analyze features in different conditions.<br><br>4. Integrate feature detection with the mobile app for user interaction. | • Novel algorithms for capturing and interpreting diverse architectural features.<br>• Enhanced precision in detecting and analyzing historical and architectural details. |
| Serasinghe G.P.G.Y | Image Scanning and Object Recognition | 1.Develop a high-resolution image capturing mechanism.<br><br>2.Implement feature detection algorithms.<br><br>3.Integrate real-time image processing capabilities. | • Utilize advanced computer vision techniques to enhance the accuracy of feature detection in archaeological contexts.<br>• Develop a user- |

| | | | |
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| | | 4.Create an intuitive user interface for seamless image capturing.<br><br>5.Ensure the system can handle various lighting conditions and angles. | friendly interface that simplifies the scanning process for non-experts.<br>• Incorporate adaptive lighting correction algorithms to improve image quality in diverse environments. |

9. Supervisor checklist

a) Does the chosen research topic possess a comprehensive scope suitable for a final-year project?

| Yes | | No | |
|---|---|---|---|

b) Does the proposed topic exhibit novelty?

| Yes | | No | |
|---|---|---|---|

c) Do you believe they have the capability to successfully execute the proposed project?

| Yes | | No | |
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d) Do the proposed sub-objectives reflect the students' areas of specialization?

| Yes | | No | |
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e) Supervisor's Evaluation and Recommendation for the Research topic:

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10. Supervisor details

| | Title | First Name | Last Name | Signature |
|---|---|---|---|---|
| Supervisor | | | | |
| Co-Supervisor | | | | |
| External Supervisor | | | | |
| Summary of external supervisor's (if any) experience and expertise | | | | |

**IT4010 – Research Project - 2024**

**Topic Assessment Form**

**<u>This part is to be filled by the Topic Screening Panel members.</u>**

Acceptable: Mark/Select as necessary

| | |
|---|---|
| Topic Assessment Accepted | |
| Topic Assessment Accepted with minor changes (should be followed up by the supervisor)* | |
| Topic Assessment to be Resubmitted with major changes* | |
| Topic Assessment Rejected. Topic must be changed | |

* Detailed comments given below

## Comments

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## The Review Panel Details

| Member's Name | Signature |
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*__Important__:

1. According to the comments given by the panel, make the necessary modifications and get the approval by the **Supervisor** or the **Same Panel**.
2. If the project topic is rejected, identify a new topic, and follow the same procedure until the topic is approved by the assessment panel.