Project ID : R25-082

1. Topic (12 words max)

> **Automated FlexoPlate Manager: Optimizing Plate Usage through Similarity Detection**

2. Research group the project belongs to

> **TIM - Technology Integration and Management**

3. Specialization of the project belongs to

> **Information Technology (IT)**

4. If a continuation of a previous project:

Project ID	
Year	

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

> Flexographic printing, or flexo printing, is a dominant technique in the packaging industry due to its versatility and efficiency. However, the process relies heavily on polymer plates, which are created for each color in an artwork. For example, a 7-color job requires 7 separate plates. While this ensures high-quality prints, it leads to significant material waste and increased production costs, especially when similar artworks are printed at different times. Currently, the identification of reusable plates for similar artworks is done manually, relying on the operator's experience and memory. This manual process is inefficient, error-prone, and impractical, particularly when there is a large time gap between jobs. As a result, plates are often recreated unnecessarily, increasing costs, material waste, and environmental impact [1].
>
> The core problem lies in the lack of an automated system to:
>
> 1. **Identify Similar Artworks**: Detect whether a new artwork is similar to previously printed ones, enabling the reuse of existing plates.
>
> 2. **Track Physical Plates**: Maintain an organized inventory of physical plates, including their location and usage history.
>
> The current reliance on manual processes creates additional challenges. When an experienced operator retires or leaves the company, the knowledge of which plates can be reused for specific artworks is lost. The company must then train a new operator, which can take a significant amount of time. During this training period, the new operator may not be aware of the commonalities between previous and new artworks, leading to the unnecessary creation of new plates. This lack of continuity and knowledge transfer results in increased costs and material waste, as plates that could have been reused are instead recreated.

Existing plate management systems in the flexo printing industry are limited to basic inventory tracking and lack advanced features like artwork similarity detection. This gap creates inefficiencies in plate usage, leading to higher operational costs and environmental concerns. According to a study by Grand View Research (2022), the global flexographic printing market is expected to grow significantly, emphasizing the need for sustainable and cost-effective solutions in this sector [2].

To address these challenges, this research proposes the development of an intelligent software system that integrates AI-based artwork similarity detection and physical plate tracking. The system will:

- Store detailed information about each artwork and its corresponding plates in a centralized database.

- Use image processing and machine learning algorithms to compare new artworks with existing ones and identify reusable plates [3].

- Implement a physical plate tracking mechanism (e.g., barcodes or RFID tags) to monitor the location and usage history of each plate [4].

By automating these processes, the system aims to reduce material waste, lower production costs, and improve operational efficiency in flexo printing. This research aligns with global sustainability goals and contributes to the growing demand for eco-friendly solutions in the printing industry [5].

References

[1] Kipphan, H. (2001). *Handbook of Print Media: Technologies and Production Methods*. Springer.

[2] Grand View Research. (2022). *Flexographic Printing Market Size, Share & Trends Analysis Report*. Retrieved from https://www.grandviewresearch.com/

[3] OpenCV. (2023). *Image Processing and Machine Learning Libraries*. Retrieved from https://opencv.org/

[4] Smith, J. (2020). *AI in Industrial Automation: Trends and Applications*. Journal of Intelligent Manufacturing.

[5] Tarr, A. (2018). *Sustainable Printing Practices: A Guide for the Packaging Industry*. Packaging World.

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

The proposed solution, **"FlexoPlate Manager: Optimizing Plate Usage through Similarity Detection,"** is an intelligent software system designed to address inefficiencies in flexo printing by automating **artwork similarity detection** and **physical plate tracking**. The system leverages **AI-based image processing** and **machine learning algorithms** to analyze new artworks and compare them with previously stored designs in a centralized database. If a similar artwork is found, the system recommends reusable plates, reducing the need for new plate creation and minimizing material waste.

The solution operates in three key steps:

1. **Artwork Analysis:** New artworks are uploaded to the system, where AI algorithms extract features (e.g., color separations, patterns) and compare them with existing designs.

2. **Plate Recommendation:** If a match is found, the system suggests reusable plates, along with their physical location and usage history.

3. **Plate Tracking:** Physical plates are tagged with barcodes or RFID, enabling real-time tracking and inventory updates.

The system also includes a **user-friendly interface** for operators to input artwork data, view recommendations, and manage plate inventory. By automating these processes, the **FlexoPlate Manager** reduces material waste, lowers production costs, and improves operational efficiency in flexo printing. This solution aligns with global sustainability goals and provides a scalable, eco-friendly approach to plate management in the printing industry.

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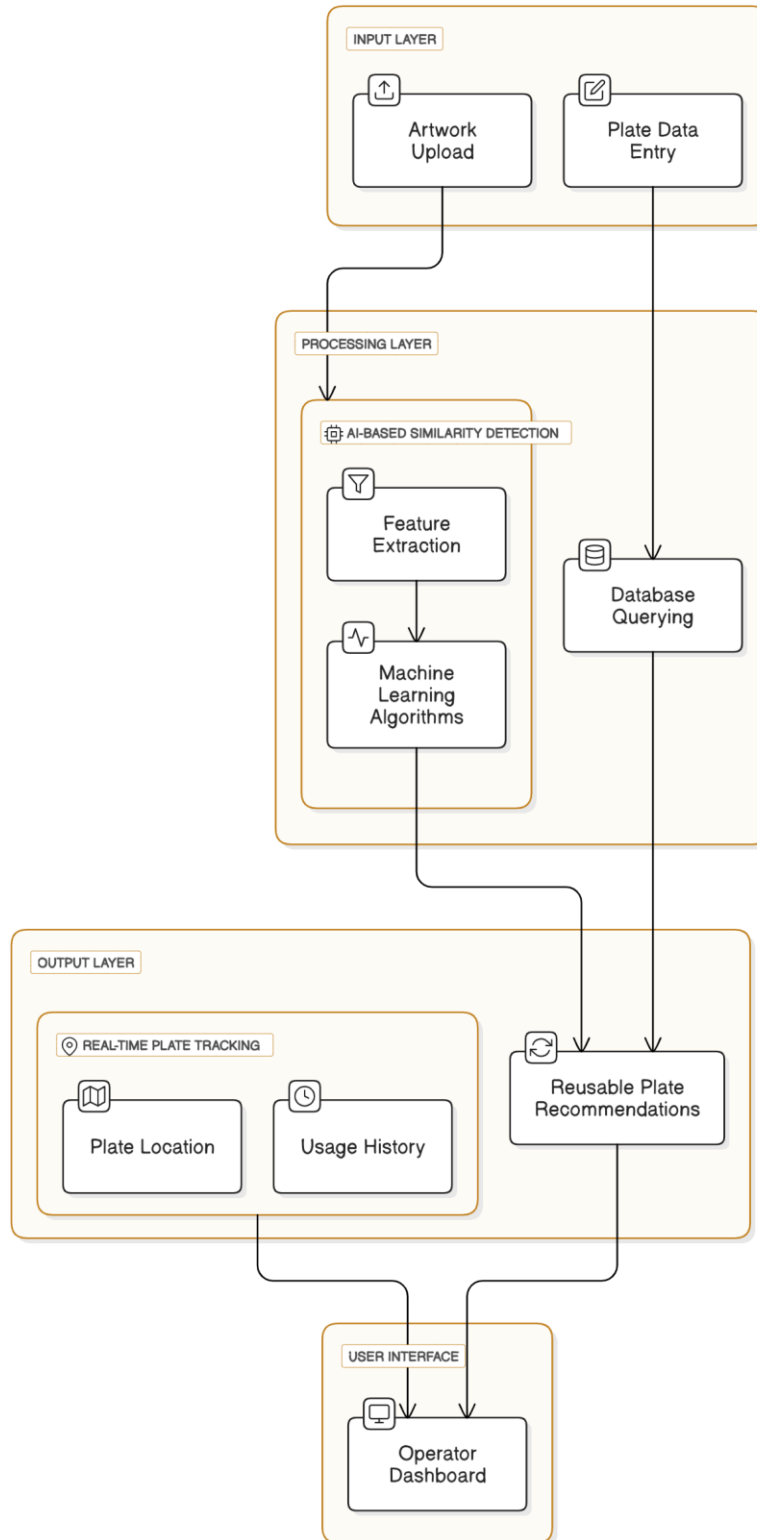
7. Brief description of specialized domain expertise, knowledge, and data requirements (300 words max)

> **1. Specialized Domain Expertise**
>
> - **Flexographic Printing:** In-depth knowledge of flexo printing processes, including plate creation, color separation, and artwork preparation, is essential to understand the challenges and requirements of the industry.
>
> - **Artificial Intelligence (AI) and Machine Learning (ML):** Expertise in AI-based image processing, feature extraction, and pattern recognition is necessary to develop algorithms for artwork similarity detection.
>
> - **Database Management:** Proficiency in designing and managing centralized databases to store and retrieve artwork and plate data efficiently.
>
> - **Software Development:** Skills in developing user-friendly interfaces and integrating AI algorithms with backend systems.
>
> - **RFID/Barcode Technology:** Knowledge of physical plate tracking systems, such as RFID or barcode technology, to enable real-time inventory management.
>
> **2. Knowledge Requirements**
>
> - **Image Processing Techniques:** Understanding of techniques like edge detection, color analysis, and pattern matching to compare artworks effectively.
>
> - **Machine Learning Models:** Familiarity with supervised and unsupervised learning models to train the system on historical artwork data.
>
> - **Data Security and Privacy:** Knowledge of best practices for securing sensitive data, such as artwork designs and plate inventory details.
>
> - **Sustainability Practices:** Awareness of eco-friendly practices in the printing industry to align the system with global sustainability goals.
>
> **3. Data Requirements**
>
> - **Artwork Data:** High-quality digital files of artworks (e.g., PDF, AI, or image formats) with metadata such as color separations, dimensions, and job details.
>
> - **Plate Inventory Data:** Information about physical plates, including plate ID, color, dimensions, location, and usage history.
>
> - **Historical Job Data:** Records of previous printing jobs, including the artworks used, plates utilized, and job outcomes.
>
> - **Training Data for AI:** A large dataset of annotated artworks to train machine learning models for similarity detection.
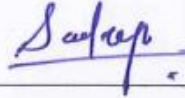
8. Objectives and Novelty

Main Objective

The main objective of this research is to develop **"FlexoPlate Manager: Optimizing Plate Usage through Similarity Detection,"** a software system that enhances efficiency in flexo printing by automating **artwork similarity detection** and **physical plate tracking**. The system utilizes advanced AI techniques, including machine learning and image processing, to identify reusable plates for similar artworks and track their physical location. By reducing material waste, lowering production costs, and improving operational efficiency, the project aims to provide a sustainable and scalable solution for the flexo printing industry.

Member Name	Sub Objective	Tasks	Novelty
Premajayantha W.H.S.I.	1. **Artwork Similarity Detection:** To accurately identify reusable plates by comparing new artworks with previously stored designs using AI-based image processing and machine learning algorithms.	1. **Artwork Analysis and Feature Extraction:** ○ Develop algorithms to extract key features (e.g., color separations, patterns) from uploaded artworks. ○ Use image processing techniques like	1. **AI-Driven Artwork Matching:** ○ Unlike traditional manual methods, this system uses advanced AI algorithms to detect similarities between artworks,

2. **Physical Plate Tracking:** To implement a robust system for tracking the location and usage history of physical plates using barcodes or RFID technology.

3. **User-Friendly Interface:** To develop an intuitive interface for operators to upload artworks, view plate recommendations, and manage inventory efficiently.

edge detection and color analysis to compare artworks effectively.

2. **Machine Learning-Based Similarity Detection:**
   o Implement machine learning models (e.g., Support Vector Machines, Neural Networks) to classify and match artworks.
   o Train models using historical artwork data and validate them with new datasets.

3. **Plate Tracking System Development:**
   o Design a barcode or RFID-based system to track the physical location and usage history of plates.

enabling the reuse of plates and reducing waste.

2. **Integrated Plate Tracking:**
   o Combines digital artwork analysis with physical plate tracking, providing a comprehensive solution for plate management.

3. **Sustainability Focus:**
   o Promotes eco-friendly practices by minimizing material waste and optimizing resource usage in flexo printing.

4. **Scalability:**
   o Designed to handle large

		- Integrate the tracking system with the software for real-time updates. **4. User Interface Design:** - Create a user-friendly dashboard for operators to upload artworks, view recommendations, and manage plate inventory. - Ensure the interface is intuitive and accessible for users with varying levels of technical expertise.	volumes of artworks and plates, making it suitable for industrial-scale applications.

9. Supervisor details

	Title	First Name	Last Name	Signature
Supervisor	Mrs.	Dushanthi	Kurappu	_(signature)_
Co-Supervisor	Mrs.	Fathima	Fenoon	_(signature)_
External Supervisor	Mr	Chinthaka	Perera	_(signature)_

Summary of external supervisor's (if any) experience and expertise

Manager of Operations of the Tags & Envelop Dep. at Printcare PLC.

This part is to be filled by the Topic Screening Staff members.

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 | |

d) Do the proposed sub-objectives reflect the students' areas of specialization?

| Yes | ✓ | No | |

e) Supervisor's Evaluation and Recommendation for the Research topic:

> Since this student has find this solution for a problem he encountered in his intern work place and as an individual projed, student has to commit to build working product

Acceptable: Mark/Select as necessary

Topic Assessment Accepted	
Topic Assessment Accepted with minor changes*	
Topic Assessment to be Resubmitted with major changes*	
Topic Assessment Rejected. Topic must be changed	

* Detailed comments given below

Comments

Staff Member's Name	Signature

***Important**:

1. According to the comments given by the evaluator, make the necessary modifications and get the approval by the **Evaluator**.

2. If the project topic is rejected, identify a new topic, and request the RP Team for a new topic assessment.