Prepared by group 5

Project Proposal

AI-Based MCQ Checker for Primary Level Mathematics

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Brief about the project:

Introduction

In educational systems, the grading process can often be time-consuming, especially for subjects involving numerous multiple-choice questions (MCQs). Primary level mathematics, being a foundation for future learning, requires accurate and timely feedback. Current grading systems rely heavily on manual efforts, which may lead to delays and human errors. This project aims to develop an AI-based MCQ checker that automatically solves mathematics MCQs, compares student answers, and grades them accordingly.

The solution will be designed for easy integration into a digital classroom setting, assisting teachers in automating the grading process for primary level mathematics. The system will use advanced AI models to solve mathematical problems, detect the student's marked answer, and provide a fair and consistent grading system.
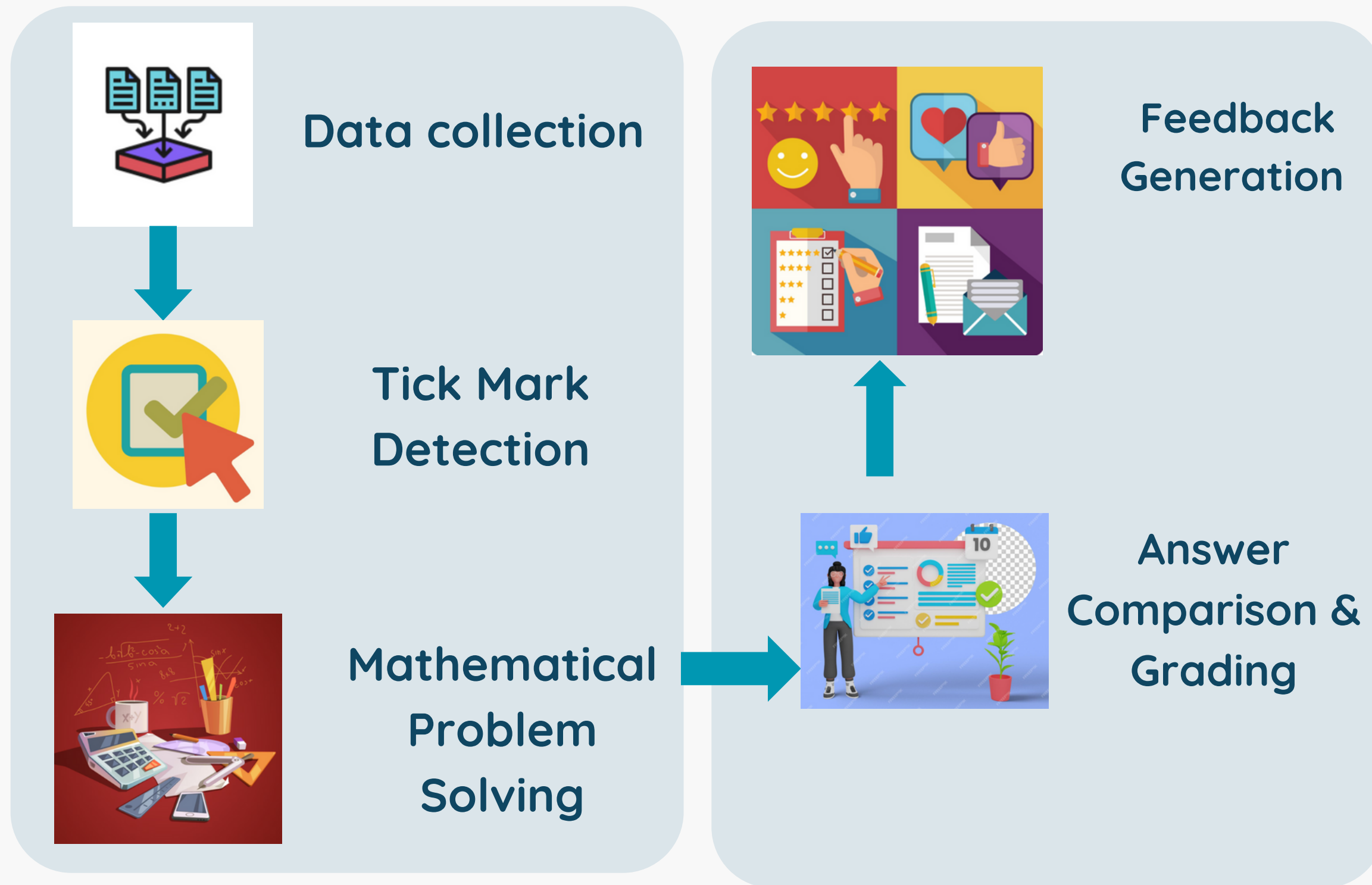
Objectives

- **Develop an AI model** that automatically solves basic mathematics MCQs for primary-level students.
- **Create an accurate tick detection system** to recognize the student's selected answers using a custom dataset of 20-25 pages.
- **Compare the student's selected answer** against the AI-generated solution to determine if the student answered correctly.
- **Grade the student's answers** automatically based on the comparison.
- **Provide feedback** to both teachers and students based on the AI's evaluation.

Complete Pipeline

Data collection

Tick Mark Detection

Mathematical Problem Solving

Feedback Generation

Answer Comparison & Grading

Methodology

- **Data Collection:**
    - A dataset of 20-25 pages of scanned or photographed MCQ answer sheets will be collected, containing tick marks in varying positions. This dataset will help train the tick mark detection model, enabling the system to recognize the student's selections accurately.

- **Tick Mark Detection:**

    - A custom-trained detection model will be employed to recognize tick marks on MCQ sheets. This will help in extracting the student's selected answers. The dataset will serve as the basis for training the detection system.

- **Mathematical Problem Solving:**
    - For solving the MCQs, two advanced models—Phi-2 and Mistral 7B—will be used. These models are pre-trained on a broad range of general knowledge, and with fine-tuning, they will be adapted to solve primary-level mathematics problems. The models will be tasked with interpreting the problem and providing an accurate solution.

- **Answer Comparison and Grading:**
    - After the AI solves the mathematical problem, the system will compare the AI's solution with the student's marked answer (detected via tick mark detection). Based on the comparison, the system will automatically grade the student's response.

- **Feedback Generation:**
  After grading the test, the AI system will generate feedback for both the teacher and the student, helping improve learning outcomes.

A high-level software diagram
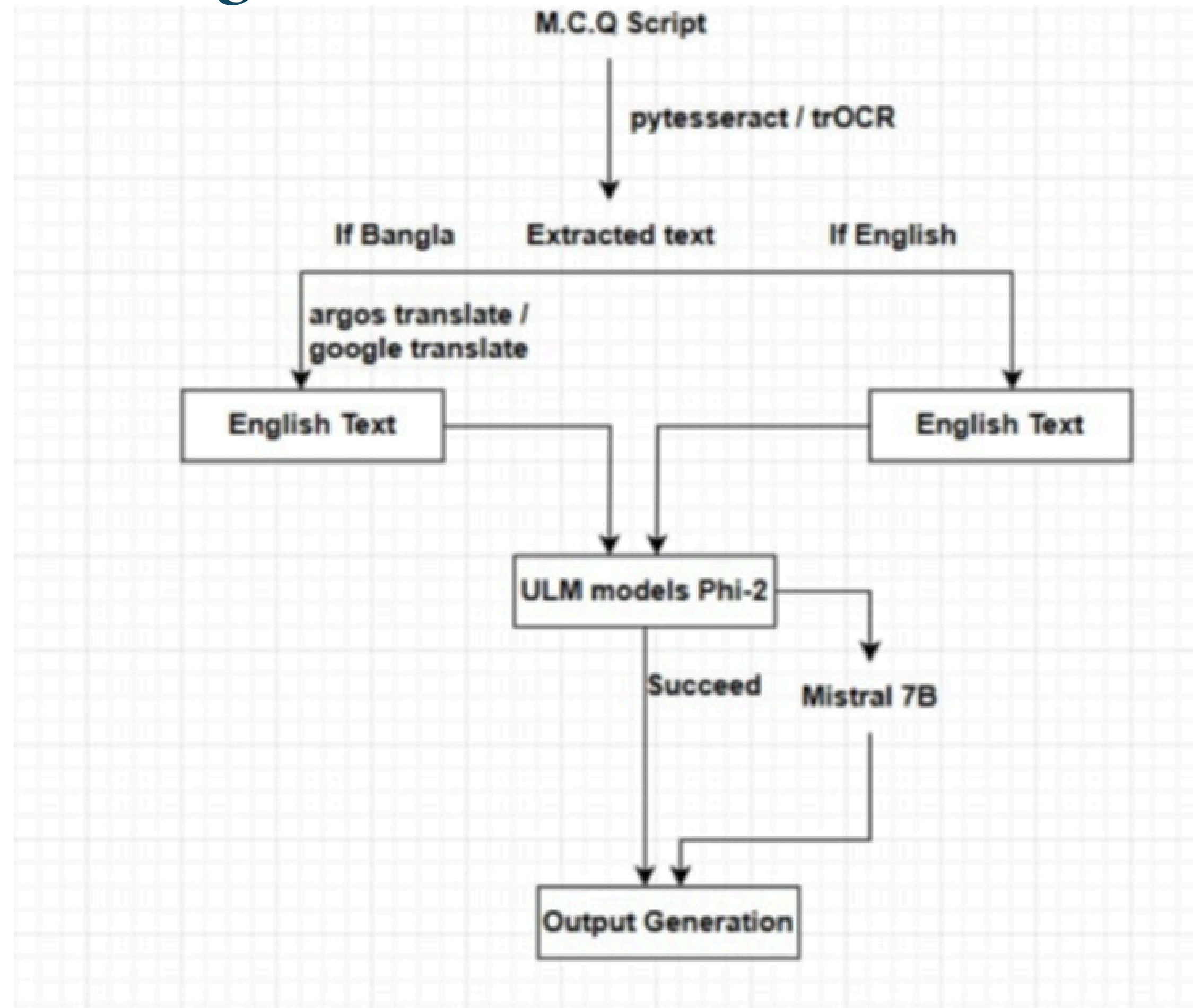
Expected Outcomes

- **Automated grading** for primary-level mathematics MCQs will significantly reduce the time and effort involved in traditional grading methods.
- **Improved accuracy** in detecting answers, minimizing human error.
- **Increased efficiency** in providing instant feedback to students.
- **Scalable solution** that can be easily integrated with digital classrooms or online learning platforms.
- **Customizable feedback** based on student performance, allowing teachers to address areas of weakness effectively.

Timeline

- **Phase 1: Data Collection and Preprocessing (Weeks 1-2):**
  - Gather and preprocess the dataset of MCQ answer sheets with tick marks.
  - Label the dataset and perform image preprocessing.

- **Phase 2: Model Training and Fine-Tuning (Weeks 3-5):**
  - Train the tick mark detection model on the custom dataset.
  - Fine-tune Phi-2 and Mistral 7B models on primary-level mathematics problems.

- **Phase 3: Integration of AI Models (Weeks 6-7):**
  - Integrate the tick detection model with the mathematical problem-solving models.
  - Implement the grading and feedback generation logic.

- **Phase 4: Testing and Evaluation (Weeks 8-9):**
  - Test the system with various sample MCQ answer sheets.
  - Evaluate the accuracy of the tick mark detection and grading system.

- **Phase 5: Deployment and Final Adjustments (Weeks 10-12):**
  - Deploy the system in a real-world classroom scenario.
  - Make necessary adjustments based on feedback from teachers and students.

Resources Required

Hardware:

A computer with sufficient GPU resources for training AI models.

Software:

Python-based libraries for image processing (OpenCV, PIL).

Transformers library for working with Phi-2 and Mistral 7B models.

Flask for building the web interface for the system.

Data storage for holding the dataset and results.

Human Resources:

AI and Machine Learning expertise for model training and fine-tuning.

Data labeling and preprocessing expertise for the dataset.
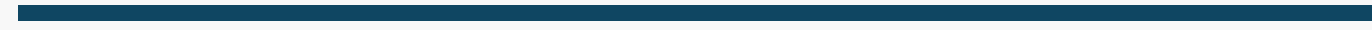
Software development skills for system integration.

Budget

There are no specific costs associated with this project, as the necessary resources (computational tools, libraries, etc.) will be provided internally. The dataset is self-generated, and there are no plans to acquire external resources.

Significance/Impact

This project will have a significant impact on the educational landscape by automating tedious and error-prone tasks, such as grading and providing feedback. It will streamline the grading process for teachers, enabling them to spend more time on student interaction and teaching. Additionally, the system will provide students with real-time feedback, helping them understand their mistakes and improve their learning outcomes.

In conclusion, the AI MCQ checker will enhance both teaching and learning experiences, improving efficiency, accuracy, and scalability in primary-level mathematics education.

Thank you