



**Organization** - National Digital Education Architecture (NDEAR), Department of School Education & Literacy (DoSEL).

**Problem - Statement** Bringing power of AI/ML to aid of teacher in a classroom.

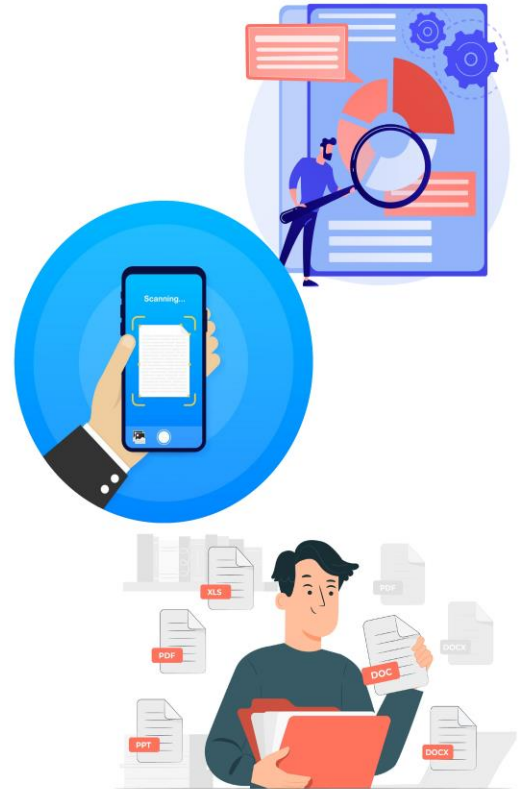
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## Introduction

As the report of 2018, 25 crore students are enrolled in school where 13.1 crore are from government and rest 11.9 crores are from private school.

It is very onerous for teachers and time spending deal to update records related to student attendance, reports and uniform management, mid-day meal on a computer where it is very essential for managing a large-scale schooling operation in all over India.

That is why Artificial Intelligence and Machine learning comes into picture where we can skip a time taking task on a single click.

Yes, it is very possible to convert the text from images to a digitized and usable machine-encoded text. This can be done with the technology(algorithm) OCR and OMR stands for optical character recognition and optical mark recognition.

## **Problem Statement**

There is a **10,83,678** government schools and **400000** private schools in India, to manage all document related data and to convert data in digitalized format to save time and energy of teacher and administration Staff to update data, related to student Academics, report management etc. using OCR/OMR technology.

## **Purpose**

The soul aim of this project is to help the authorities with fast, automated, statistical way of uploadation of records and keeping a track of all the schooling operations, which covers over 23 crore students of India, with the robust use of AI powered smartphone application and web portal, leveraging the building blocks of NDEAR with national/state dashboard.

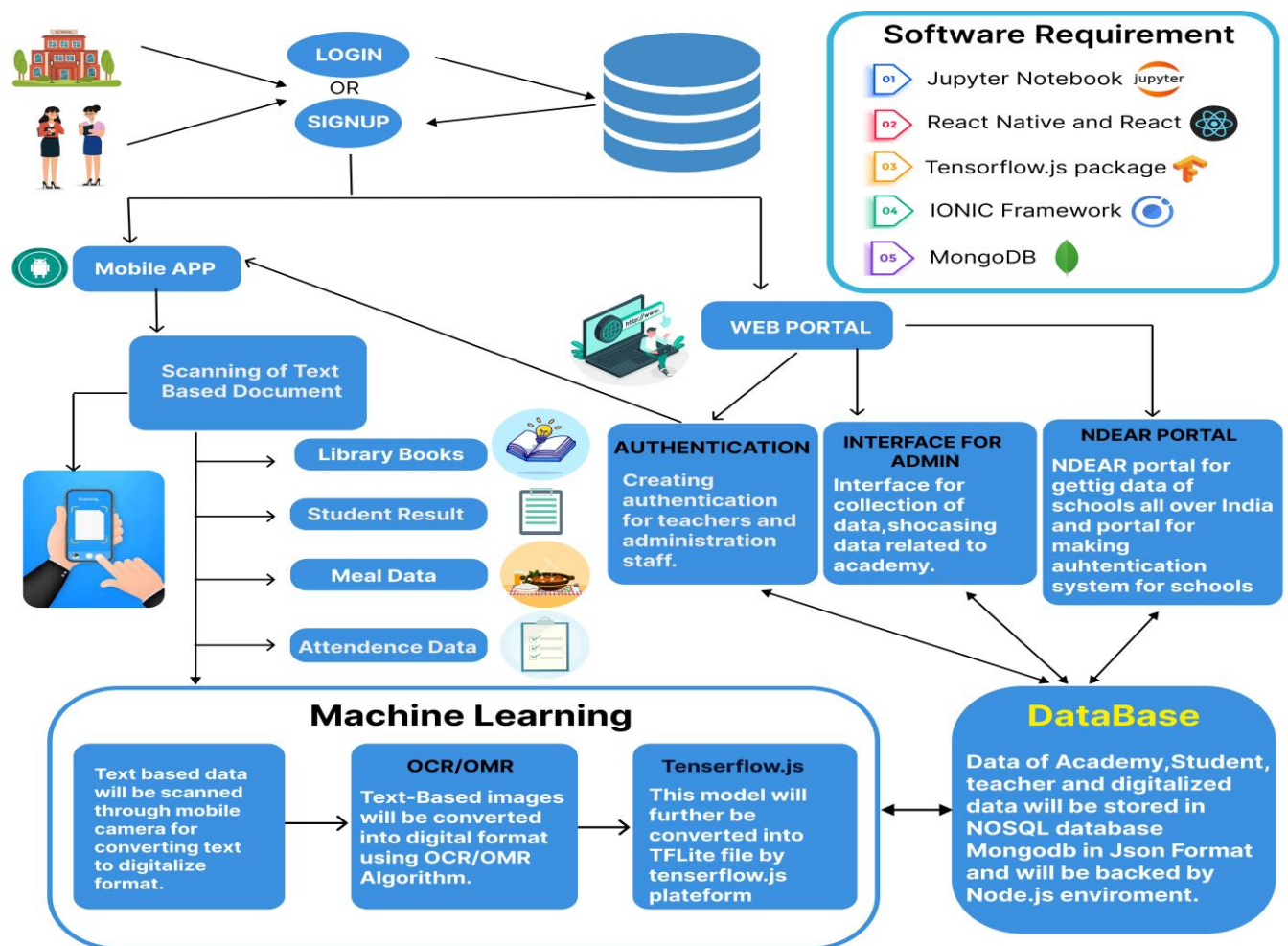
## **Description**

As per the Problem statement, the text data will be captured from the images would be transformed into digitalized format as machine-encoded text using OCR/OMR model.

For solution of this problem, we need an advanced tech-stack. We will be using MERN stack for web application where the school administrator can have all the data uploaded by teachers and staff related any academic reports.

For staff we would be creating a mobile app using react native and ionic where they can update form-data into digital format using mobile camera with one click. This will help in making the automation fast, accurate, cost-effective and easy to implement.

## Work-Flow Diagram and Dependencies



### Administration Staff and teacher's authentication

It is necessary for every user who have access to upload data or retrieve data form database to have an authentication system.

So, to have the access of data, administrator of school must login to retrieve data and for teacher and staff, it is must to login to upload data using mobile application.

## **Web Application**

**NDEAR** will have the access of web portal where they have facility to authorize each and every school of India, to give access to their academic related data through means of web portal, **NDEAR** will authorize the school giving them a unique token and email- password.

School administrator will be having the access of web portal who can have all the data related to its academic field. It will be easier to interact with Web portal in the terms of analysing data of students, teachers and other field of data like: - mid-day meal data, uniform distribution etc.

Each School will be given authority to create an authentication for their staff to upload data using mobile application through web portal.

MERN stack will be used to create a web application for admin where Node.js will be used for backend having NoSQL database MongoDB.

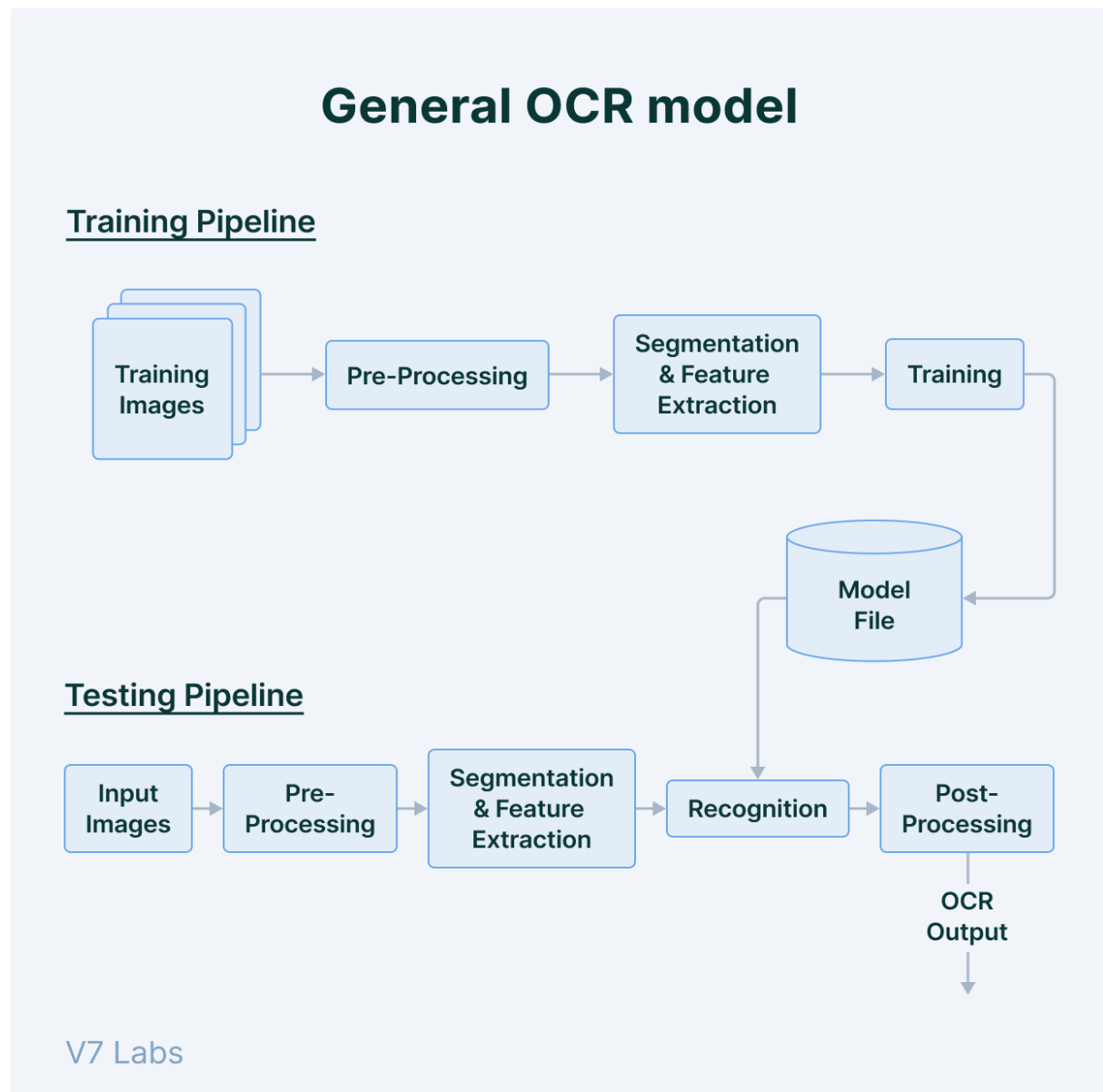
## **Mobile Application**

Mobile Application will be used to upload data using its camera by the staff and teachers of the school where they will be putting data related to students' attendance, report cards and data of mid-day meal, data of uniform distribution, data of fees paid or due etc.

Scanned data through mobile application will get stored in mongodb database before which it will get converted into a digitized usable machine encoded-text and after get stored in mongodb database in Json format.

Mobile application will be made using the React Native and Ionic framework, Node.js will be used as backend and having NoSQL database MongoDB.

## Machine Learning



After Capturing Images from mobile application, we put those images to OCR/OMR model for data detection and conversion for digitized format.

## **What is OCR?**

OCR stands for optical character recognition; it is the process of detecting and reading text in images through computer vision.

Detection of text from document images enables Natural Language Processing algorithms to decipher the text and make sense of what the document conveys.

Furthermore, the text can be easily translated into multiple languages, making it easily interpretable to anyone.

## **Pre-Processing**

Traditional Approaches to OCR go through a series of pre-processing steps where the inspected document is cleaned and made noise-free. Above this, the document is binarized for subsequent contour detection to aid in the detection of lines and columns.

Character building the line are extracted, segmented and identified via various machine learning algorithms like k-nearest neighbours and support vector machines.

While this work great on simple OCR dataset like easily distinguishable printed data and handwritten MNIST data, they miss out on many features, making them fail when working complex datasets.

The raw data depending on the data acquisition type is subjected to a number of preliminary processing steps to make it usable in the descriptive stages of character analysis. The image resulting from scanning process may contain certain amount of noise Smoothing implies both filling and thinning. Filling eliminates small breaks, gaps and holes in digitized characters while thinning reduces width of line.

## **OCR with Deep Learning**

Deep learning-based methods can efficiently extract a large number of features, making them superior to their machine learning counterparts.

Algorithms that combine Vision and NLP-based approaches have been particularly successful in providing superior results for text recognition and detection in the wild.

Furthermore, these methods provide an end-to-end detection pipeline that frees them from long-drawn pre-processing steps.

Generally, OCR methods include vision-based approaches used to extract textual regions and predict bounding box coordinates for the same. The bounding box data and image features are then passed onto Language Processing algorithms that use RNNs, LSTMs, and Transformers to decode the feature-based information into textual data.

## **Recognition**

After the image segmentation and extraction, model will be trained to give a model file where we recognize the text in images and convert them into digitized format with the following steps:

1. Extraction of Character boundaries from Image.
2. Building a Convolutional Neural Network(ConvNet) in remembering the Character images.
3. Loading trained Convolutional Neural Network(ConvNet) Model.
4. Consolidating ConvNet predictions of characters.

## **Post-Processing**

Optical Character Recognition (OCR) Post Processing involves data cleaning steps for documents that were digitized, such as a book or a newspaper article. One step in this process is the identification and correction of spelling and grammar errors generated due to the flaws in the OCR system.

## **OCR Data Output**

After post processing we will get an output from model where the data has been converted into a digitized usable machine encoded data from images based on text.

## **Database**

Here we will be using a NoSQL database mongoDB where we will store all the data related to NDEAR, Schools, student, teacher and staff. Converted images will also be stored in database.

Same Database will be connected to the mobile app and web application where teachers only have access to put data on database where administrator and NDEAR staff will have access to get the data from database.



# Software Requirement

## React

React is a free and open-source front-end JavaScript library for building user interfaces based on UI components. It will be used for creating web portal for NDEAR and school.

## React Native and Ionic

React Natives an open-source UI software framework. It is used to develop applications for Android, Android TV, iOS, macOS, tvOS, Web, Windows and UWP by enabling developers to use the React framework along with native platform capabilities. It will be used for making a mobile application for teacher and administration staff.

Ionic is an open source UI toolkit for building performant, high-quality mobile and desktop apps using web technologies — HTML, CSS, and JavaScript — with integrations for popular frameworks like Angular, React, and Vue.

## Jupyter

The Jupyter Notebook is the original web application for **creating and sharing computational documents**. It offers a simple, streamlined, document-centric experience.

Jupyter notebooks can illustrate the analysis process step by step by arranging the stuff like code, images, text, output etc. in a step-by-step manner. It helps a data scientist to document the thought process while developing the analysis process.

It provides an interactive computational environment for developing data science applications. Jupyter notebooks combine software code, computational output, explanatory text, and rich content in a single document. Notebooks allow in-browser editing and execution of code and display computation results.

## **Tensorflow.js Package**

It is an open-source artificial intelligence library, using data flow graphs to build models. It allows developers to create large-scale neural networks with many layers. TensorFlow is mainly used for: Classification, Perception, Understanding, Discovering, Prediction and Creation. Tensorflow.js is a library for machine learning in JavaScript. Develop ML models in JavaScript, and use ML directly in the browser or in Node. js.

## **Mongodb Database**

Mongodb database will be used to store all kind of data from mobile and website application using node.js as a backend server.

## **Requirements**

Central Processing Unit (CPU) — Intel Core i5 6th Generation processor or higher.

RAM — 8 GB minimum, 16 GB or higher is recommended.

Graphics Processing Unit (GPU) — NVIDIA GeForce GTX 960 or higher.

## **Conclusion**

Extricating the administration staff from the traditional sophisticated process of records uploadation with AI/ML technology OCR/OMR of computer vision to recognize the text-based images and convert it into digitized format to update the records.

This will provide an ease to government and NDEAR to track the information of academic related activities and analyse it in a better statistical way.

Reliability, transparency and automation of data is the outcome assumed from this project.