Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	03 October 2022
Team ID	PNT2022TMID53601
Project Name	Project - A Novel Method for Handwritten Digit Recognition System
Maximum Marks	4 Marks

Technical Architecture:

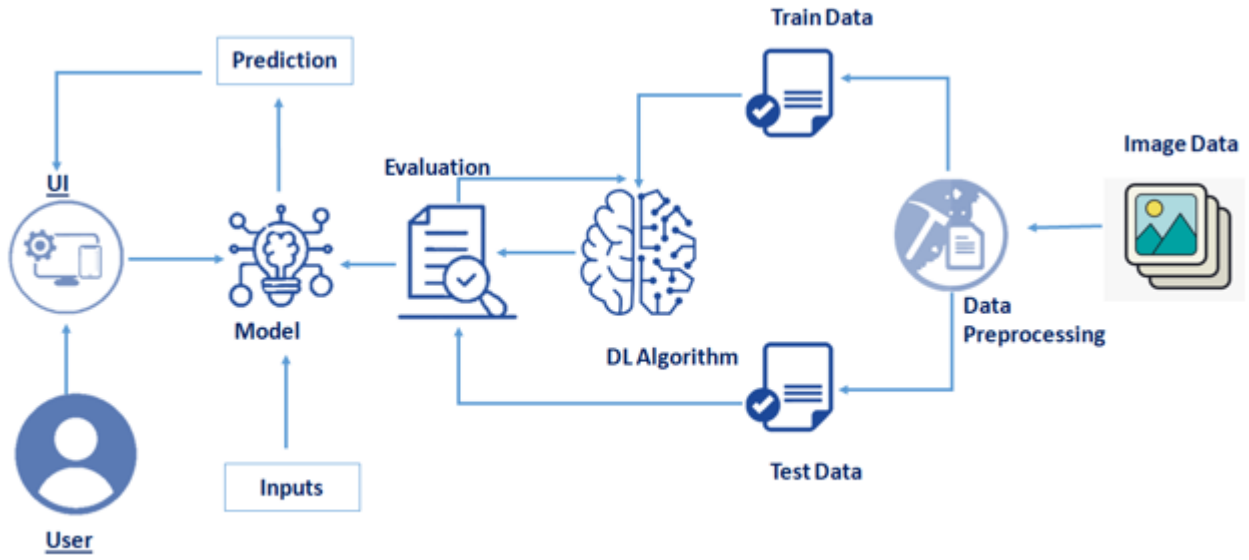

Table-1: Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Web UI for uploading and obtaining the result.	HTML, CSS, JavaScript.

2.	Application Logic-1 Preprocessing of Numerical images.	The uploaded image is to be preprocessed using Python libraries viz. numpy, scikit-learn, pandas matplotlib.pyplot.	Python
3.	Application Logic-2 Model Construction and Building	A Convolutional Neural Networks based model is implemented with the given dataset and stored the model in the name of “bestmodel.h5” after performing a certain number of epochs.	Python, TensorFlow, Keras, IBM Watson Studio, Flatten, Dense, Conv2D, MaxPool2D layers.
4.	Application Logic-3 Web application development for predicting the output through a user interface.	Web application to take the numerical image as input and display the predicted output after clicking the “Predict” button.	Front-End: HTML, CSS,JavaScript Back-End: Flask, Python
5.	Cloud Database	The numerical images will be stored on a cloud database for training the machine learning model	IBM Cloudant
6.	File Storage	Local file system is used to store user input images	Local file system
7.	Machine Learning Model	CNN model is to be used to classify preprocessed frames segmented from an input image using 2d Convolution layers and Max Pooling layers.	CNN-based Handwritten Digit Recognition Model using Tensorflow, Keras.
8.	Infrastructure (Server / Cloud)	Application is to be deployed on a local server. **Local Server Configuration:** Hostname: localhost (127.0.0.1) HTTP port: 5000 SSL(HTTPS) Port: 8443 Connector: 8081 Database: Yes (IBM Cloudant DB) Cloud Server Configuration: in IBM Cloud	Local/ Cloud

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Open-source software is to be used for web application development, model training, deployment, and version control system.	**Web Application:** HTML, CSS, JavaScript **Model Training:** Python, TensorFlow, Keras **Model Deployment:** IBM Cloud **Version Control System:** Git, GitHub
2.	Robustness and Accuracy	The numerical images can be captured at different angles and under varied lighting conditions, and the model has the potential to provide very accurate results.	Scikit-learn, Matplotlib.pyplot.
3.	Scalable Architecture	The system shall limit the number of user requests to one per second, and serve each request on a separate thread and needs advanced servers for handling multithreaded requests.	Python
4.	Availability	The application needs to be deployed on a high-performance, reliable server to handle more requests and to avoid crashing the server.	IBM Cloud
5.	Performance	CNN-based deep learning model with low inference time, with Conv2D, MaxPool2D, Flatten, Dense layers	TensorFlow, Keras

References:

https://towardsdatascience.com/a-comprehensive-guide-to-convolutional-neural-networks-the-eli5-way-3bd2b1164a53

https://careereducation.smartinternz.com/Student/guided_project_workspace/16951

https://www.ibm.com/in-en/cloud/learn

https://www.kaggle.com/competitions/digit-recognizer

https://medium.com/the-internal-startup/how-to-draw-useful-technical-architecture-diagrams-2d20c9fda90d