

# **TECHNICAL DOCUMENTATION**

**Title:** Customer Churn Prediction using Machine Learning

## **1. Project Overview and Objectives**

Every telecom company faces the problem of losing customers, which reduces revenue and increases marketing costs.

The objective of this project is to **predict which customers are likely to churn** so that the companies can take proactive actions to retain them.

### **Key Goals:**

- Analyze customer behavior and understand factors leading to churn.
- Build a machine learning model to predict churn.
- Deploy the model as a web application for easy usage.
- Provide actionable business recommendations based on model insights.

## **2. Setup and Installation Instructions**

### **1. Save the important project files**

`app.py` → Flask application

`model.pkl` → Trained model

`scaler.pkl` → MinMax Scaler

`pca.pkl` → PCA transformation

`templates/` → HTML files like `index.html` and `result.html`

### **2. Install required Python packages:**

```
pip install flask numpy pandas scikit-learn matplotlib.pyplot pickle
```

### **3. Run the Flask app:**

```
python app.py
```

### **4. Enter the customer details and check prediction:**

Enter customer details include:

- **Contract Type**(Month-to-Month/One-year/Two-year)
- **Payment Method**(Electronic-Check/Credit-Card/Bank-Transfer)
- **Paperless Billing**(Yes/No)
- **Senior Citizen**(Yes/No)
- **Tenure**(Months)

- **Monthly Charges**(Amount)
- **Total Charges**(Amount)

### **3. Code Structure Explanation**

The project code is organized in a way that follows the complete data science workflow:

#### **1. Data Loading:**

Load the whole csv file into the Dataframe.

#### **2. Data Understanding:**

Perform EDA and Analysis Every Feature of the Dataset and Also Find the Relationship between them.

#### **3. Data Preprocessing and Feature engineering:**

Handles missing values, encodes categorical features, scales numeric features, applies PCA.

#### **4. Training and Tuning:**

Trains the model, tunes hyperparameters, saves the model, scaler, and PCA objects.

#### **5. Deployment (Flask Web App):**

- `app.py` → Main application file.
- `/` → Homepage: form to enter customer data.
- `/predict` → Receives input, scales, applies PCA, predicts churn, shows result.

#### **6. Templates Files:**

- `templates/index.html` → Homepage with dropdowns and input fields.
- `templates/result.html` → Shows prediction results with user-friendly values.

### **4. Screenshots of Working Application**

Website is looking like :

The screenshot shows a web browser window titled "Customer Churn Predictor" with the URL "127.0.0.1:5000". The page has a dark blue header and a light blue main content area. The content area is titled "Welcome to Churn Predictor!" and contains a form for entering customer details. The form fields include dropdown menus for "Contract Type" (Month-to-Month), "Payment Method" (Electronic Check), "Paperless Billing" (No), "Senior Citizen" (No), and a text input for "Tenure (months)". Below these are two more text inputs for "Monthly Charges" and "Total Charges", both currently empty. At the bottom of the form is a blue "Predict" button.

## **5. Explanation of How Technical Requirements are Met**

<b><u>Requirement</u></b>	<b><u>How It Is Met</u></b>
Data Preprocessing	Handled missing values, encoded categorical features, scaled numeric features, applied PCA
Model Training	Used Decision Tree with hyperparameter tuning
Model Evaluation	Accuracy score, confusion matrix calculated and verified
Deployment	Flask app created with interactive form and result page
User-Friendly Input	Dropdowns and input fields with numeric mapping explained
Complete Workflow	From data collection → preprocessing → modeling → deployment → business insights

## **6. Testing Evidence by entering Customer details**

**Examples of test cases and validation**

**Homepage:**

Customer Churn Predictor

127.0.0.1:5000

Welcome to Churn Predictor!

Enter your customer details to check if they might churn.

Contract Type:

Month-to-Month

Payment Method:

Credit Card

Paperless Billing:

Yes

Senior Citizen:

No

Tenure (months):

8

Monthly Charges:

120

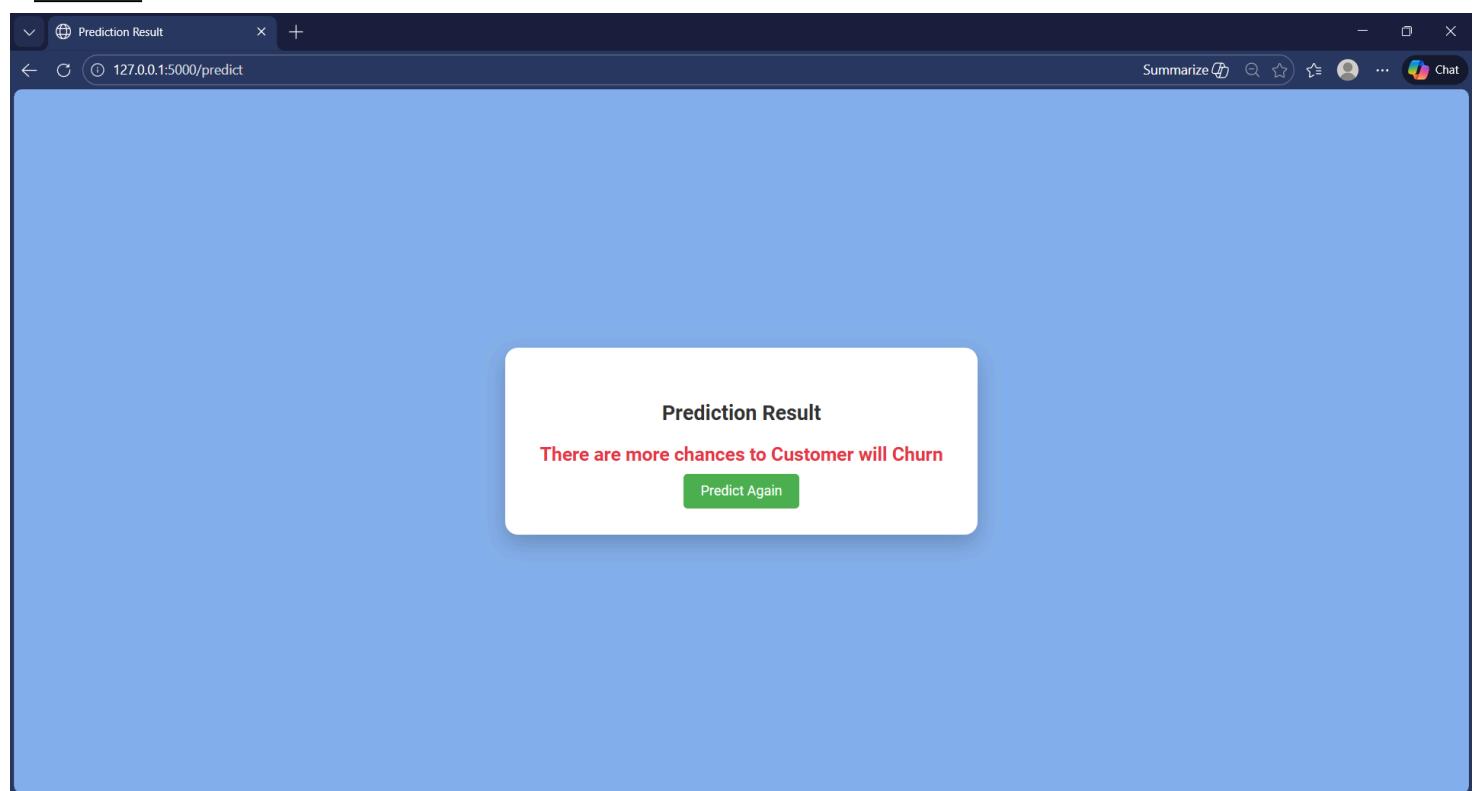
Total Charges:

900

**Predict**

This screenshot shows the 'Customer Churn Predictor' application interface. It features a light blue header with the title 'Customer Churn Predictor' and the URL '127.0.0.1:5000'. Below the header is a large, rounded rectangular form card with a light teal background. The card has a heading 'Welcome to Churn Predictor!' and a sub-instruction 'Enter your customer details to check if they might churn.' Inside the card are several input fields: dropdown menus for 'Contract Type' (set to 'Month-to-Month'), 'Payment Method' (set to 'Credit Card'), and 'Paperless Billing' (set to 'Yes'); a dropdown menu for 'Senior Citizen' (set to 'No'); and text input fields for 'Tenure (months)' (set to '8'), 'Monthly Charges' (set to '120'), and 'Total Charges' (set to '900'). At the bottom of the card is a prominent blue button labeled 'Predict'.

## Result:



Testing Evid

