

Project Design Phase
Problem – Solution Fit Template

Date	28 June 2025
Team ID	LTVIP2025TMID35624
Project Name	Revolutionizing Liver Care: Predicting Liver Cirrhosis Using Advanced Machine Learning Techniques
Maximum Marks	2 Marks

Problem – Solution :

We propose building a machine learning (ML)–based predictive model to detect liver cirrhosis in its early stages using non-invasive, routinely available clinical and laboratory data. The model will assist in identifying high-risk individuals and support early diagnosis and proactive intervention.

1. Data Source:

Source: <https://www.kaggle.com/datasets/bhavanipriya222/liver-cirrhosis-prediction>

Description: This dataset includes structured, anonymized patient records featuring:

- **Demographics:** Age, Gender, Location
- **Medical History:** Alcohol consumption, Hepatitis infections, Diabetes
- **Laboratory Tests:** Blood counts, liver function tests, lipid profiles
- **Clinical Indicators:** Blood pressure, obesity status, family history

2. Solution Workflow

1. Data Collection & Preprocessing

- Perform preprocessing steps such as:
 - Handling missing values
 - Encoding categorical variables (e.g., gender, yes/no lifestyle factors)
 - Normalizing continuous features
 - Feature selection to retain only the most relevant attributes
- Data Exploration and Preprocessing
 - Univariate Analysis: Histograms were plotted for numerical features.
 - Bivariate Analysis: Scatter plots and pair plots explored relationships between features.
 - Outlier Handling: Outliers were detected and managed using the IQR method.

2. Model Development

- Train and evaluate multiple machine learning algorithms, including:
 - Random Forest

- Naïve Bayes
- XG Boost
- Logistic Regression CV
- Random Forest
- Support Vector Classifier
- Ridge Classifier
- Logistic Regression
- K-Nearest Neighbors (KNN)
- Apply cross-validation and hyperparameter tuning to optimize performance.
- Use evaluation metrics: Accuracy, Precision, Recall, F1-score, and Confusion Matrix to validate the models.

3. Model Selection

We will select and optimize the best model based on performance metrics to achieve the highest accuracy.

4. Prediction

- Generate predictions in the form of: Binary classification (Cirrhosis: Yes/No)

5. Interface Design

- Building a user-friendly web or mobile platform using tools like: HTML/ CSS +JavaScript(Frontend),Flask (Backend)
- Users can input lab results and receive the Prediction results.

Template:

1. CUSTOMER SEGMENT(S) CS Individuals at high risk of liver cirrhosis.	6. CUSTOMER CONSTRAINTS CC Delayed detection of liver cirrhosis to prevent disease progression diagnostic tools.	5. AVAILABLE SOLUTIONS AS Delayed detection due to the lack of compressible, non-invasive diagnostic tools.
2. JOBS TO BE DONE / PROBLEMS J&P Early identification of liver cirrhosis to prevent disease progression.	9. PROBLEM ROOT CAUSE RC Delayed detection due to the lack of reliable diagnostic tools to remain motivated to use diagnostic tools.	7. BEHAVIOUR BE Fear of and hesitation in using a potentially diagnostic tool due to the lack of information and not symptoms become pronounced.
3. TRIGGER TR Individuals motivated by their concerns about liver health. Involving family members to use or provide tools.	10. YOUR SOLUTION SL Building an ML-based predictive model to detect liver cirrhosis in the early stage using non-invasive and MRI and ultrasound data, and laboratory data, and then to the high risk, individuals and support early diagnosis and proactive intervention.	8. CHANNELS of BEHAVIOUR CH Online Using platforms such as a video portal or mobile app to help with accessing the model.
4. EMOTIONS: BEFORE / AFTER EM Individuals experience less anxiety in using the tool to be accessing. After using the tool, increased confidence from timely detection.		8. CHANNELS of BEHAVIOUR Select the model directly for each user to get the results and receive the recommendations.

References:

- <https://www.ideahackers.network/problem-solution-fit-canvas/>
- <https://medium.com/@epicantus/problem-solution-fit-canvas-aa3dd59cb4fe>