



JIBON

A Machine Learning approach to detect

Thalassemia Minor and Iron Deficiency precisely

Track 1: Humanitarian Project Exhibition/Showcasing

Members

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1. Problem Description & Humanitarian Need

In Bangladesh, approximately 10–12% of the population are carriers of Thalassemia Minor. Due to the high cost (3000 BDT) and limited availability of Hb Electrophoresis tests, millions remain undiagnosed. This creates a severe humanitarian risk: when two carriers marry, there is a 25% chance of their child having Thalassemia Major, a condition requiring lifelong blood transfusions.

Our project “**JIBON**” addresses this by providing an affordable (400 BDT) AI-driven pre-screening tool that uses common CBC report data to identify high-risk individuals early.

2. Methodology & Prototype Logic

The prototype is a full-stack web application integrated with a Machine Learning engine.

A. The ML Core

We used a Random Forest Classifier trained on clinical datasets. The model doesn't just look at Hb levels; it analyzes 11 distinct features to differentiate between simple Iron Deficiency and Thalassemia.

- **Key Medical Indices:** The prototype automatically calculates the Mentzer Index (MCV/RBC) and the **Green & King Index**.

B. Prototype Workflow

1. **Input:** User enters values from a standard CBC report.
2. **Processing:** Node.js passes data to a Python script (predict.py).
3. **Result:** The system provides a probability score and color-coded medical advice.

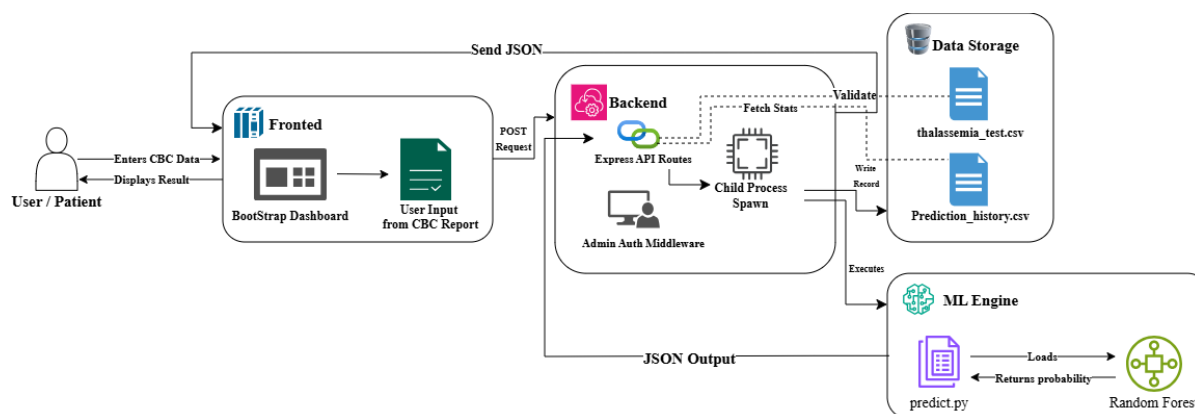


Fig1: Overall Functionality of the prototype of “JIBON”

JIBON is a full-stack humanitarian web application designed to precisely detect Thalassemia Minor and Iron Deficiency using an AI-driven pre-screening approach. The architecture begins with a Bootstrap-based frontend where users or patients input standard CBC report data. This data

is sent via JSON to a Node.js backend, which utilizes Express API routes and authentication middleware to manage requests. To perform the diagnosis, the backend initiates a Python child process that triggers the ML engine, where a Random Forest Classifier analyzes eleven distinct blood features and medical indices like the Mentzer Index to generate a probability score and medical advice. Finally, the system ensures data persistence by saving screening results and validation samples into local CSV files, allowing for offline review by medical professionals.

3. Prototype Functionality & Features

3.1 Screening Interface

The screening tool is designed for ease of use by community health workers or patients themselves. It includes fields for CBC values and clinical symptoms (Jaundice, Fatigue, etc.).

রক্তের ডাটা প্রদান করে কৃত্রিম বুদ্ধিমত্তার মাধ্যমে ফলাফল জানুন

Hematology (CBC) Data

Age (Years)	Gender	Hb (Hemoglobin)
<input type="text" value="12"/>	<input type="text" value="Male"/>	<input type="text" value="12"/>
MCV	MCH	
<input type="text" value="45"/>	<input type="text" value="24"/>	
RDW	RBC Count	
<input type="text" value="12"/>	<input type="text" value="4"/>	

Clinical History

Fatigue Frequency	Family History?
<input type="text" value="Every week"/>	<input type="text" value="Yes"/>
Relation with affected person	
<input type="text" value="Sibling"/>	

☐ Jaundice History ☒ Splenomegaly or Cholelithiasis

RUN AI DIAGNOSIS

Fig 2: User Input for screening

3.2 Real-Time Result Analysis

Upon submission, the prototype generates a detailed report. It uses a "Traffic Light" system:

- Red: High probability of Thalassemia Minor.
- Orange: Likely Thalassemia/Iron Deficiency.
- Green: Normal.

Sibling

☐ Jaundice History
 ☒ Splenomegaly or Cholelithiasis

RUN AI DIAGNOSIS

THALASSEMIA STATUS

Normal Healthy

পরামর্শ: আপনার রিপোর্ট স্বাভাবিক। সাধারণ সুখম খাবার গ্রহণ করুন।

IRON STATUS

No Iron Deficiency

পরামর্শ: আপনার আয়রনের ঘাটতি রয়েছে। আয়রন রিচ ডায়েট (কেনিজো, দুধ, ডিম, শাক-সবজি) বেশি করে খান।

Fig 3: Screening Result

3.3 Admin Dashboard

To help health organizations track regional trends, the prototype includes an Admin Panel. This dashboard displays the total number of screenings and the accuracy metrics of the model.

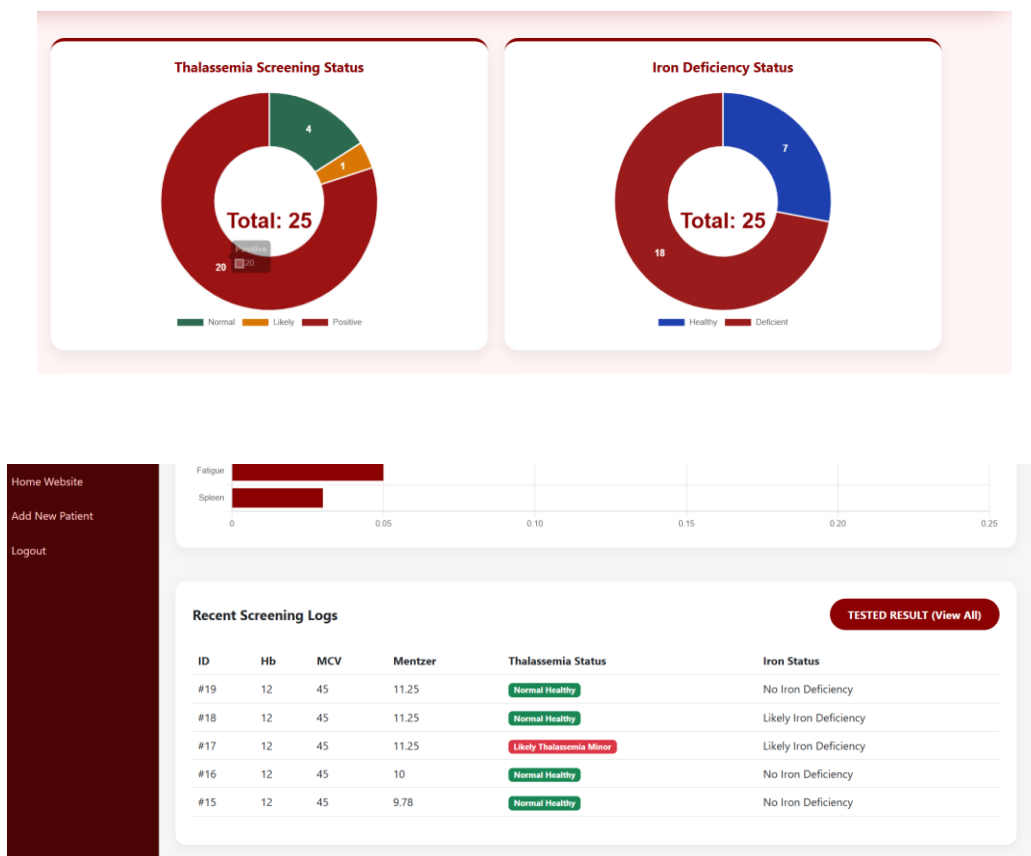


Fig 4: Functionality of Admin Panel

4. Prototype Validation

The prototype has been validated using a test dataset of 200 clinical samples.

- Accuracy: 96.4%
- Precision: 94.2%
- Persistence: All data is saved to a local CSV (prediction_history.csv) for offline
- Reviewed & validated by doctors.

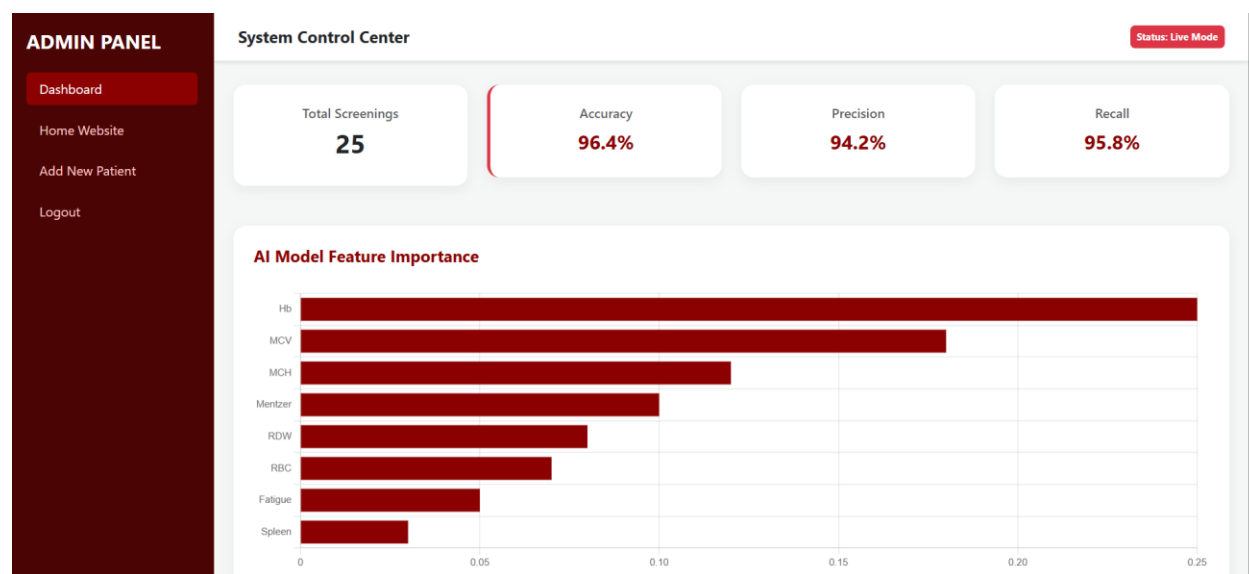


Fig 5: Dashboard of Admin Panel

5. Conclusion & Sustainability

This prototype serves as a bridge between expensive clinical diagnostics and the general public. By making screening as simple as entering a CBC report, we can significantly reduce the birth rate of Thalassemia Major patients in Bangladesh.