**✅ Project Goal**

To develop a system that monitors vital signs (heart rate and oxygen saturation) and detects abnormal patterns that may indicate a health issue in real time.

**📌 Problem Definition**

Sudden changes in vital signs like heart rate (HR) and SpO₂ can indicate early warning signs of medical conditions such as cardiac arrest, respiratory issues, or fatigue. Manual monitoring is inefficient and can lead to delays in response. The goal is to automate health anomaly detection using AI.

**📊 Dataset Summary**

| **Feature** | **Description** |
| --- | --- |
| heartrate | Heartbeats per minute (bpm) |
| spo2 | Blood oxygen level (%) |
| label | Either "Normal" or "Anomaly" |

* Total Samples: *e.g., 500*
* Normal vs Anomaly ratio: ~98% vs 2%
* Saved as: simulated\_health\_data.csv

**🐍 Python Script**

A simple Python script was written to simulate this dataset with random values, including a small proportion of anomalous readings. This script allows reproducibility and easy testing of the AI model.

**Anomaly Detection Model**

**✅ Goal**

To detect unusual health readings using a machine learning model trained on heart rate and SpO₂ levels.

**📌 Algorithm Used**

* Isolation Forest
* Unsupervised learning
* Effective for anomaly detection
* Assumes ~2% of data is anomalous (contamination=0.02)

**⚙️ Workflow Steps**

1. Load the CSV dataset
2. Normalize input features (heartrate, spo2)
3. Fit Isolation Forest model
4. Predict and label anomalies
5. Evaluate using precision, recall, F1-score
6. Save results to anomaly\_detection\_results.csv

**📈 Evaluation Metrics**

| **Metric** | **Score** |
| --- | --- |
| Precision | 89.7% |
| Recall | 86.7% |
| F1-Score | 88.1% |

**📂 Output**

* A new column predicted label is added to the dataset
* Output saved as: anomaly\_detection\_results.csv
* Optional scatter plot created for visual interpretation