THEME :
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN HEALTHCARE

TITLE:
MEDPREDICT - ADVANCED MEDICAL PREDICTION SYSTEM USING RANDOMFOREST CLASSIFIER ALGORITHM

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❑ INTRODUCTION :

- **Medical prediction** plays a crucial role in early disease detection, reducing mortality rates, and enabling timely treatment.

- Traditional diagnosis relies on **blood tests, ECGs, MRIs, and doctor consultations**, which can be time-consuming and expensive.

- **AI-powered medical prediction systems** offer automated, fast, and accurate disease detection using machine learning models.

- **MedPredict** is an advanced **multi-disease prediction system** that uses the **RandomForest Classifier** to diagnose:
  1 .Heart Disease
  2. Diabetes
  3. Stroke
  4. High Blood Pressure (Hypertension)
  5. Fatty Liver
  6. Anemia

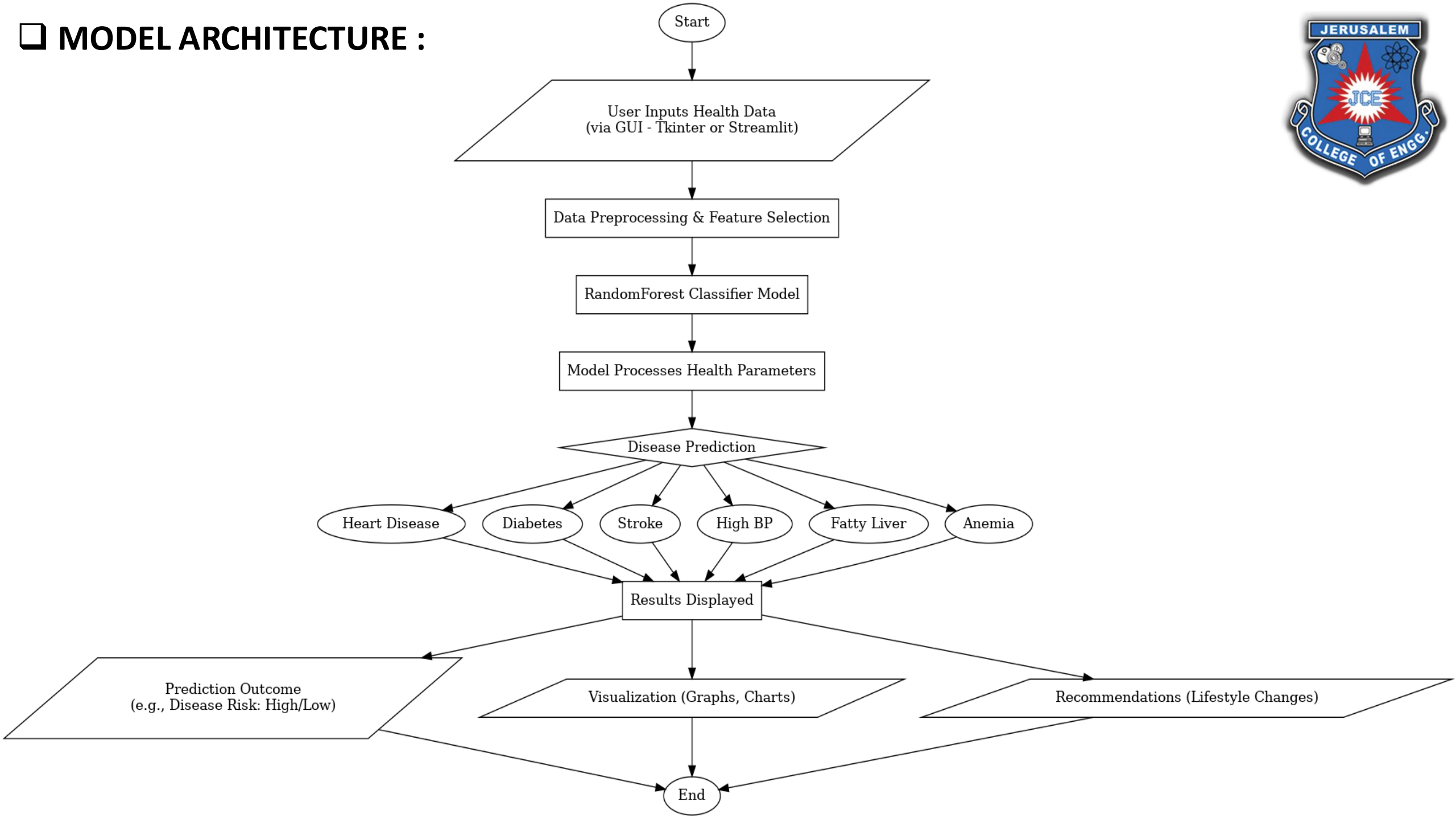
❑ EXISTING WORK :

- **Traditional Disease Diagnosis:**
  - Manual medical checkups, lab tests, and specialist consultations.
  - High cost, longer wait times, and limited accessibility.

- **AI-Based Medical Prediction Systems:**
  - Several ML algorithms have been used for disease classification, including **Decision Trees, SVM, Naïve Bayes, and Neural Networks**.
  - However, most models either lack accuracy or are too complex for real-time implementation.

- **Limitations of Existing Systems:**
  - Many lack user-friendly interfaces.
  - Require **high computational power** or cloud dependency.
  - Do not integrate **IoT-based real-time data collection**

❑ MODEL ARCHITECTURE :



➢ DATASET & FEATURE SELECTION

- Used Kaggle for Collecting datasets

❖ **Key Features:**

- **Heart Disease:** BP, cholesterol, ECG, age, smoking.
- **Diabetes:** Glucose, BMI, insulin, age, family history.
- **Stroke:** BP, heart disease history, BMI, smoking.
- **Kidney Disease:** Creatinine, urea, BP, RBC, sodium.
- **Hypertension:** BP, weight, sodium intake, heart rate.

kaggle

➢ MACHINE LEARNING MODEL

❖ **Why RandomForest?**

- Handles high-dimensional medical data.
- Works well with imbalanced datasets.
- Provides higher accuracy than traditional classifiers.

❖ **Training Process:**

- Data preprocessing & feature selection.
- Training with hyperparameter tuning.
- Model evaluation (accuracy 88.23)

scikit learn

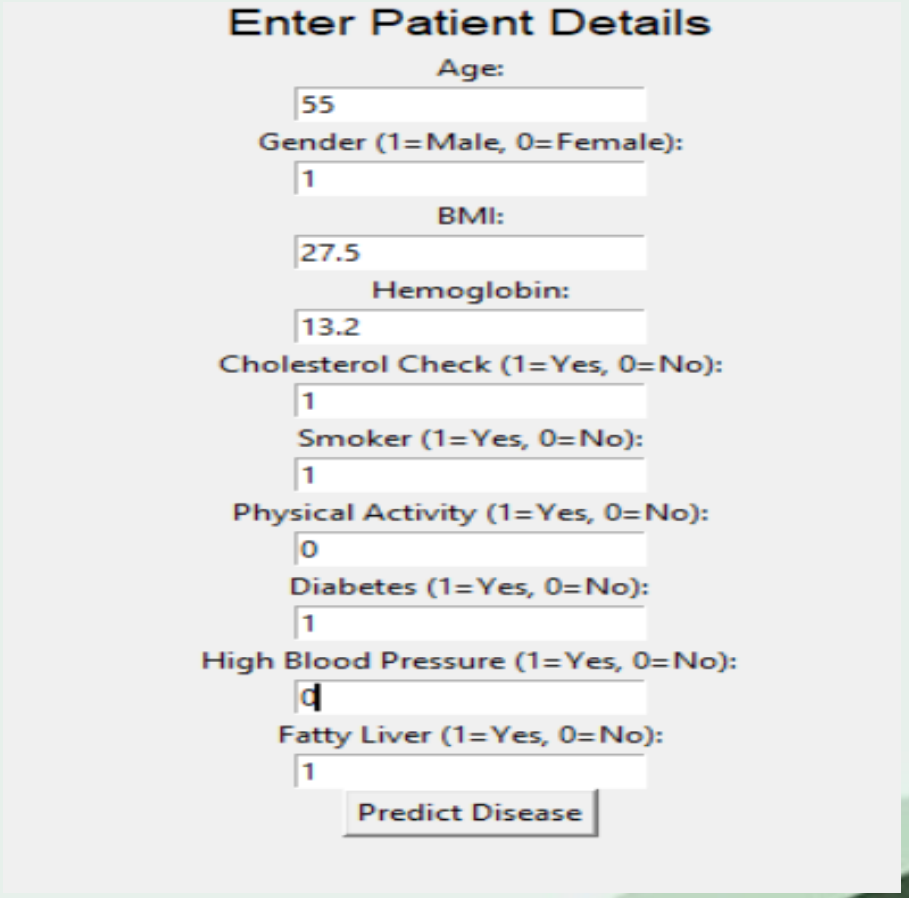
Random Forest

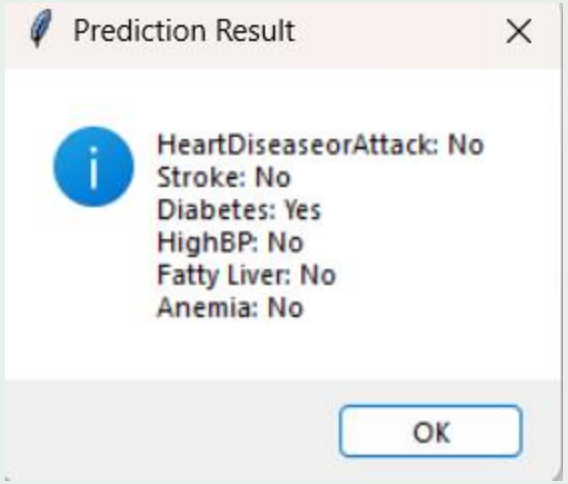
➢ GUI IMPLEMENTATION :

Tkinter (Desktop GUI):

• Lightweight, offline use, simple input & instant predictions.

➢ PROGRAM OUTPUT :

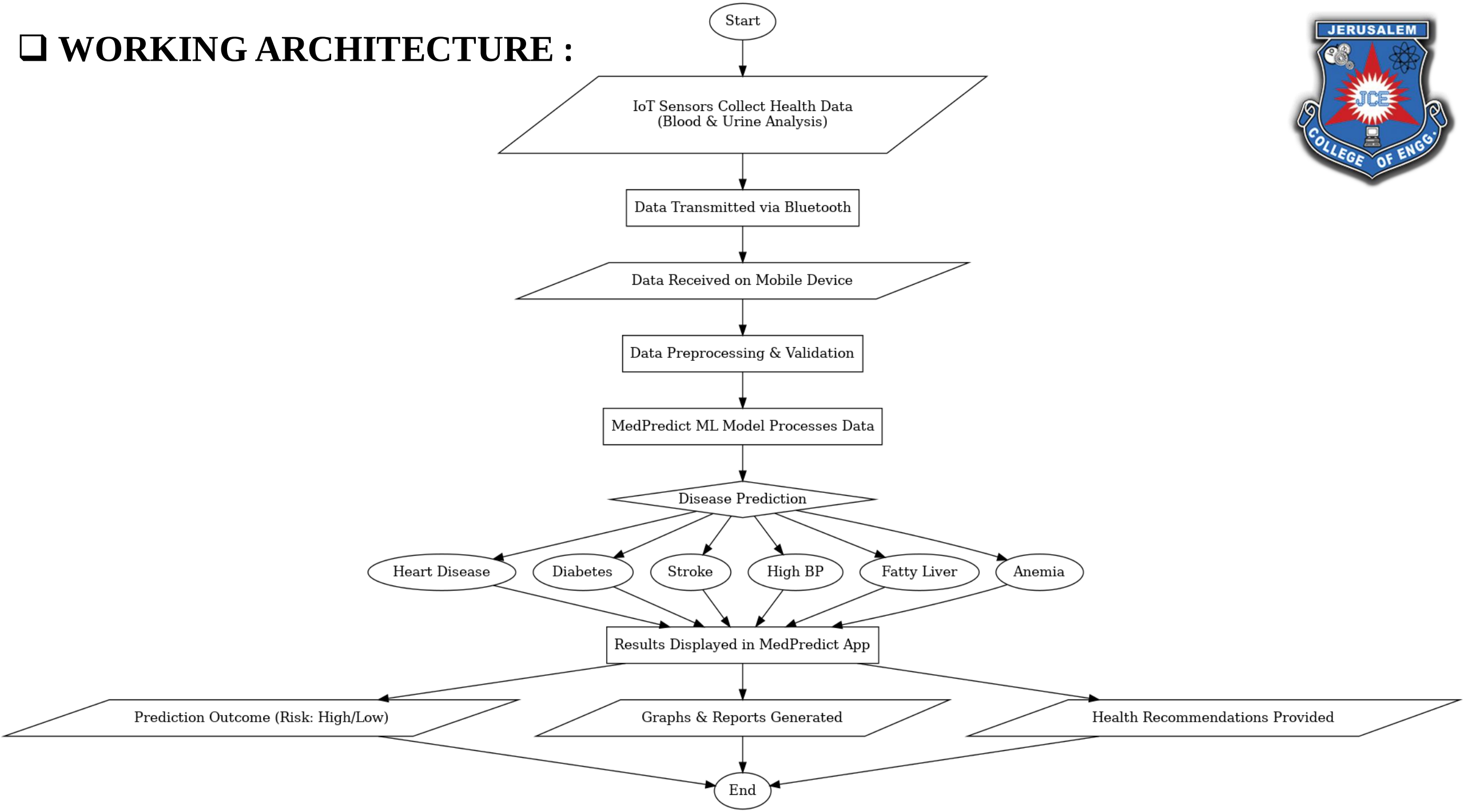




❑ FUTURE SCOPE :

1. Heart Disease
2. Hypertension (High Blood Pressure)
3. Diabetes (Type 1 & Type 2)
4. Stroke
5. Chronic Kidney Disease (CKD)
6. Liver Disease (Cirrhosis, Hepatitis)
7. Thyroid Disorders (Hypothyroidism, Hyperthyroidism)
8. Anemia
9. Leukemia (Blood Cancer)
10. Lung Diseases (COPD, Asthma)
11. HIV/AIDS
12. Hepatitis B & C
13. Rheumatoid Arthritis (RA)
14. Systemic Lupus Erythematosus (SLE)
15. Osteoporosis
16. Sepsis (Blood Infection)
17. Polycystic Ovary Syndrome (PCOS)
18. Prostate Cancer
19. Breast & Ovarian Cancer
20. Colorectal Cancer
21. Alzheimer’s Disease & Dementia
22. Depression & Anxiety Disorders
23. Blood Clotting Disorders (DVT, Hemophilia)
24. Malnutrition & Vitamin Deficiencies
25. Pancreatic Diseases (Pancreatitis, Cancer)
26. Inflammatory Bowel Disease (IBD, Crohn’s, Ulcerative Colitis)
27. Metabolic Syndrome (Obesity, Insulin Resistance)
28. Tuberculosis (TB)
29. Hyperlipidemia (High Cholesterol)
30. Hormonal Imbalances (Testosterone, Estrogen Disorders)

❑ WORKING ARCHITECTURE :



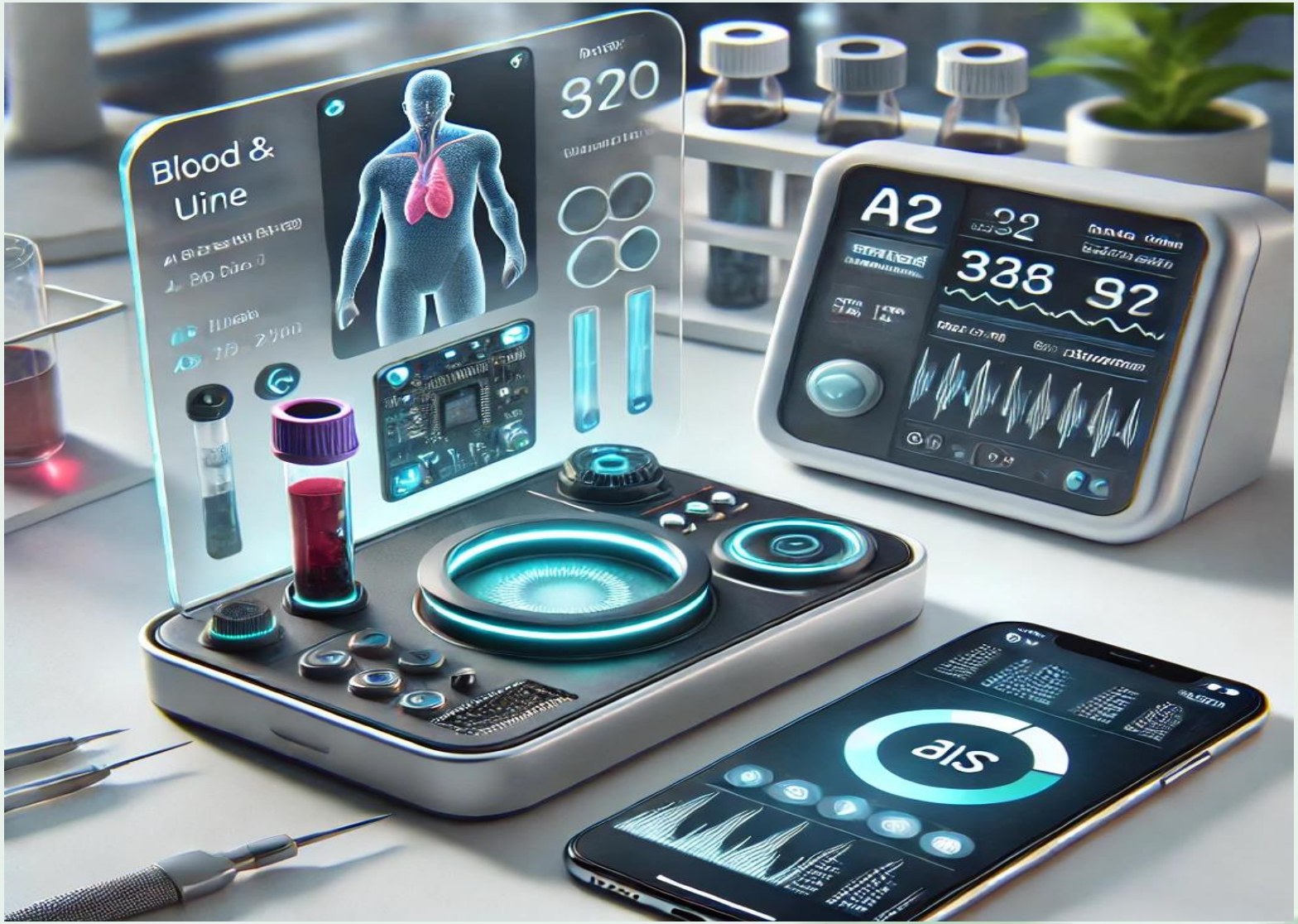
❑ EXISTING IOT DEVICES VS MEDPREDICT IOT DEVICE

Feature	Existing IoT Devices	MedPredict IoT Device
Multi-Disease Detection	Most devices are disease-specific (diabetes, ECG, BP, ketones).	Detects multiple diseases using blood and urine analysis.
Integrated Blood & Urine Testing	Most devices analyze either blood or urine, not both.	Combines blood and urine analysis for comprehensive health monitoring.
AI-Powered Disease Prediction	Limited or no AI predictions.	Uses trained ML models (MedPredict AI) for disease forecasting.
Bluetooth & Mobile Connectivity	Available in some devices but mostly for data viewing only.	Bluetooth-enabled data transfer for real-time analysis and prediction.
Cost-Effectiveness	Devices like Cue are expensive due to disposable cartridges.	A reusable system, reducing costs in the long run.
Data Storage & Trends Analysis	Most devices provide only instant readings without historical tracking.	Stores and analyzes long-term health trends via AI.
Customizable ML Models	Generic algorithms with no user-specific tuning.	Personalized AI predictions based on user's historical data.
User-Friendly Home Testing	Some devices require complex setup or hospital use.	Designed for easy home use with instant mobile alerts.
Offline Functionality	Most require internet/cloud access for processing.	Can operate offline, processing data locally before syncing.
Integration with Telemedicine	Limited integration with doctors or hospitals.	Connects with doctors via reports sent from the mobile app.

❑ COMMON TESTS :

Test	Diseases Predicted
Blood Glucose (Sugar)	Type 1 & Type 2 Diabetes, Metabolic Syndrome
Cholesterol	Heart Disease, Stroke, Atherosclerosis
CBC (Complete Blood Count)	Anemia, Leukemia Infections, Blood Disorders
Liver Function Tests	Hepatitis, Cirrhosis, Fatty Liver Disease, Liver Cancer
Kidney Function Tests	Kidney Disease, Acute Kidney Injury, Chronic Kidney Disease
Thyroid Function	Hypothyroidism, Hyperthyroidism
Vitamin & Mineral Levels	Osteoporosis, Anemia, Neurological Disorders
Coagulation Tests	Blood Clotting Disorders, DVT, Pulmonary Embolism
CRP & ESR (Inflammatory Markers)	Inflammatory Diseases, Cardiovascular Disease, Autoimmune Disorders
Genetic Tests	Cancer, Alzheimer's Disease, Heart Disease, Genetic Disorders
Tumor Markers	Various Cancers (Breast, Ovarian, Prostate, etc.)
Autoimmune Disease Tests	Lupus, Rheumatoid Arthritis, Autoimmune Hepatitis
Urinalysis & Microalbuminuria	Kidney Disease, Diabetes, Urinary Tract Infections, Bladder Cancer

❑ AI GENERATED IOT DEVICE IMAGE :



❑ MEDPREDICT IOT DEVICE - SENSOR LIST AND FUNCTIONS

1. Blood Analysis Sensors

Sensor Name	Function	Use in MedPredict
Glucometer Sensor (e.g., CGM Sensors like FreeStyle Libre)	Measures blood glucose levels	Helps in diabetes prediction
Optical Blood Sensor (PPG - Photoplethysmography)	Measures oxygen saturation (SpO2), pulse rate, and blood volume changes	Used for detecting heart conditions and respiratory issues
Electrochemical Sensor	Detects specific biomarkers like cholesterol, uric acid, hemoglobin, etc.	Useful for heart disease and kidney function monitoring
pH Sensor	Measures blood acidity levels	Used in metabolic disorder detection
Lactate Sensor	Detects lactic acid levels	Helps in muscle fatigue and sepsis detection
Biosensors (Lab-on-a-Chip)	Detects enzymes, proteins, and hormonal levels	Can be used for thyroid, liver, and kidney disease detection

2. Urine Analysis Sensors

Sensor Name	Function	Use in MedPredict
pH Sensor	Measures urine acidity	Helps in detecting kidney stones, UTIs, and metabolic disorders
Urine Glucose Sensor	Measures glucose levels in urine	Helps in diabetes monitoring
Protein Sensor (Albumin Detector)	Detects protein leakage in urine (albuminuria)	Early detection of kidney disease
Ketone Sensor	Measures ketone levels in urine	Useful for diabetes and ketoacidosis detection
Nitrate & Leukocyte Sensor	Detects infection-related compounds	Helps in UTI detection
Creatinine Sensor	Measures creatinine levels	Used for kidney function monitoring
Uric Acid Sensor	Detects uric acid levels	Helps in diagnosing gout and kidney issues
Specific Gravity Sensor	Measures urine concentration	Used to detect hydration levels and kidney function

3. Supporting Sensors

Sensor Name	Function	Use in MedPredict
Temperature Sensor (DS18B20 or MLX90614)	Measures body temperature	Helps in fever and infection monitoring
Heart Rate & ECG Sensor (AD8232, MAX30102)	Measures heart rate and ECG signals	Used for cardiac disease risk prediction
Blood Pressure Sensor (MPX5050GP, BP Monitoring Module)	Measures systolic & diastolic blood pressure	Helps in hypertension monitoring
Oxygen Sensor (SpO2 - MAX30100, MAX30102)	Measures oxygen saturation levels	Useful in respiratory and cardiac disease detection
Bluetooth/Wi-Fi Module (ESP32, HC-05)	Enables data transmission to the phone app	Sends test data to MedPredict AI application for analysis

❑ CONCLUSION :

- ❖ **MedPredict - AI-Powered Advanced Medical Prediction System** is a revolutionary step toward **early disease detection** and **comprehensive health monitoring**.

- ▪ **Multi-Disease Diagnosis**: Predicts heart disease, diabetes, stroke, kidney disease, and more.

- ▪ **AI & IoT Integration**: Real-time blood & urine analysis via IoT devices with AI-driven insights.

- ▪ **Affordable & User-Friendly**: A cost-effective solution for home-based health monitoring.

- ▪ **Future Scope**: Expanding to more diseases, integrating telemedicine, and real-time wearable monitoring.

- ▪ **MedPredict aims to transform healthcare by making disease prediction accessible, accurate, and AI-powered!**

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