**Final Year Project Report on:**

“**Heart disease detection**”

*Submitted by:*

Under guidance of:

**Mrs.**

**Department of Computer Engineering**

**XYZ OF ENGINEERING**

2016-2017

**CERTIFICATE**

                            This is to certify that the pre report on the project entitled

“**Heart disease detection**”

*Submitted by:*

A partial fulfillment for BACHELOR OF COMPUTER ENGINEERING degree course of Mumbai University for year 2016-2017

  INTERNAL GUIDE                                                                    HOD

**( Prof.  )                                                                      (Prof. )**

 INTERNAL EXAMINER                                                                PRINCIPAL

EXTERNAL EXAMINER

**ACKNOWLEDGEMENT**

No project is ever complete without the guidance of those experts who  have already traded this past before and hence become master of it and as a result, our leader. So we would like to take this opportunity to take all those individuals who have helped us in visualizing this project.

         We express our deep gratitude to our project guide Mrs.  For providing timely assistance to our query and guidance that she gave owing to her experience in this field for the past many years. She had indeed been a lighthouse for us on this journey.

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         We are also grateful to our HOD  Mrs. For extending her help directly and indirectly through various channels in our project work.

Thanking You,

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**ABSTRACT**

      Heart disease is the leading cause of death worldwide, so early and accurate diagnosis is essential for effective treatment and prevention. In this study, we use machine learning algorithms, including decision trees, support vector machines (SVMs), random forests, k-nearest neighbours (KNNs), and logistic regression, to predict heart disease risk in individuals. The dataset used for this analysis includes various clinical and demographic patient attributes such as age, gender, cholesterol levels, and blood pressure. By harnessing the power of these diverse algorithms, we aim to increase the accuracy of heart disease prediction and provide a valuable tool for healthcare professionals and patients to make informed decisions about their cardiovascular health.  
 The first part of our analysis involves modelling the decision tree. Decision trees provide a clear and interpretable framework for understanding the factors that contribute to heart disease risk. On the other hand, SVM offers a robust and versatile approach for classifying patients into different risk categories, allowing the differentiation of complex patterns in the data. Random Forest uses ensemble learning to improve prediction accuracy by combining multiple decision trees. KNN provides an alternative approach by identifying patients with similar attributes, helping to understand risk factors specific to each individual. Finally, logistic regression quantifies the probability of heart disease occurrence based on the given input characteristics.  
 By comparing the performance of these five machine learning algorithms, we aim to identify the most accurate and reliable model for predicting heart disease. Our results will aid in the development of more effective risk assessment tools and contribute to improving cardiovascular health care outcomes. Findings from this study will be valuable to medical professionals and healthcare facilities in their efforts to identify individuals at risk of heart disease, allowing for early intervention and prevention strategies to reduce the global burden of cardiovascular health problems.

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**Chapter 1**

**INTRODUCTION**

**INTRODUCTION**

Heart disease is the leading cause of death worldwide, so early detection and prediction are key to effective prevention and treatment. In this context, machine learning algorithms such as decision trees, support vector machines (SVM), random forests, K-nearest neighbours (KNN), and logistic regression have come to the fore for their ability to analyse medical data and predict heart disease. These algorithms use patient data such as age, cholesterol levels, blood pressure, and other relevant factors to predict the likelihood of heart disease. By utilising these techniques, healthcare professionals can make informed decisions and provide timely interventions to improve patient outcomes.  
 Decision trees are a popular choice for heart disease prediction due to their simplicity and interpretability. They create a tree model that partitions data based on various attributes, helping to identify key risk factors and decision points. Support vector machines work by finding the hyperplane that best separates patients with and without heart disease. They excel at processing complex data and non-linear relationships. Random forests combine multiple decision trees to improve accuracy and reduce overfitting, making them a robust choice for this task. K-Nearest Neighbours classifies patients by comparing them to their nearest neighbours in the feature space, while Logistic Regression models the probability of heart disease based on input characteristics.  
 These algorithms play a critical role in the advancement of predictive medicine by providing accurate, data-driven assessments of heart disease risk. Their diverse strengths and capabilities enable healthcare professionals to make more informed decisions, which can lead to early detection and better patient care. As the field of medical data analytics continues to evolve, the integration of these machine learning techniques holds great promise for reducing the burden of heart disease and improving patient outcomes.

**Significance**

Predicting heart disease is of considerable importance in the field of healthcare. Cardiovascular diseases are the leading cause of mortality worldwide, and early detection is essential for effective prevention and intervention. Machine learning models such as decision trees, support vector machines (SVCs), random forests, k-nearest neighbours (KNNs), and logistic regression play a key role in this context. These models can analyse patient data such as medical history, demographics, and lifestyle factors to assess heart disease risk. By leveraging these algorithms, health professionals can identify individuals at higher risk and tailor preventive measures, ultimately reducing the burden of heart disease and improving overall public health. The choice of a specific algorithm depends on the data set and its characteristics, but the joint use of these models increases the accuracy and reliability of heart disease prediction and significantly contributes to proactive health care management.

**Background**

Heart disease prediction is a critical task in the field of healthcare. Cardiovascular diseases, including heart disease, remain one of the leading causes of death worldwide. Predictive modelling techniques, such as decision trees, support vector machines (SVC), random forests, k-nearest neighbours (KNN), and logistic regression, have been employed to assess the risk factors and make predictions about an individual's likelihood of developing heart disease. These models use various features, such as age, gender, blood pressure, cholesterol levels, and more, to make predictions. In this context, it is essential to explore and compare the performance of these different machine learning algorithms to determine which one is best suited for heart disease prediction. This comparison can help healthcare professionals and researchers improve diagnostic accuracy and, in turn, enhance patient outcomes and treatment strategies. In this article, we will delve into how each of these algorithms can be applied for heart disease prediction, discussing their advantages and potential limitations. Before we proceed with the specific algorithms, it's important to note that data preparation and feature selection play a crucial role in the success of any predictive model. High-quality, well-curated datasets and appropriate preprocessing steps are fundamental to the accuracy of predictions in healthcare applications.

**Aim of Project**

     The goal of our project is to develop a robust and accurate heart disease prediction system using various machine learning algorithms, including decision trees, support vector machines (SVM), random forests, K-nearest neighbours (KNN), and logistic regressions. Heart disease is a widespread and life-threatening condition, and early detection is essential for effective intervention and prevention. By utilising these various machine learning techniques, we intend to create a comprehensive and versatile model that can analyse medical data, identify relevant patterns and risk factors, and make reliable predictions about an individual's likelihood of developing heart disease. This project aims to provide healthcare professionals and patients with a valuable tool for assessing cardiovascular health, ultimately improving early diagnosis and contributing to the overall well-being and longevity of individuals at risk. Through a comparative analysis of these algorithms, we aim to determine which approach offers the highest accuracy and precision in heart disease prediction, enabling informed medical decision-making and personalised patient care.

**Objectives of the Project**

**The main objectives of this system are:**

1. **Data Collection and Preprocessing**: Gather and prepare a comprehensive dataset containing relevant medical and patient information, ensuring data quality and integrity.
2. **Feature Selection**: Identify the most important features that contribute to heart disease risk, optimising the model's performance and interpretability.
3. **Model Developmen**t: Implement and fine-tune Decision Tree, SVC, Random Forest, KNN, and Logistic Regression models to predict heart disease, exploring the strengths and weaknesses of each algorithm.
4. **Model Evaluation**: Assess the performance of each model using appropriate evaluation metrics such as accuracy, precision, recall, F1 score, and ROC-AUC, and compare their results to determine which algorithm performs best.
5. **Validation and Testing**: Conduct thorough validation and testing of the predictive tool on new and unseen data to ensure its reliability and generalizability.

**Scope of the Project**

  The scope of the project on heart disease prediction using decision trees, support vector machines (SVC), random forests, k-nearest neighbours (KNN), and logistic regression includes a comprehensive survey of various machine learning algorithms for early detection and assessment. heart-related conditions. This project aims to contribute to the field of healthcare by developing predictive models that can help healthcare professionals diagnose and treat patients at an early stage, ultimately improving patient outcomes and reducing healthcare costs. This project aims to provide healthcare professionals with valuable tools to support their decision-making processes, ultimately leading to earlier and more accurate heart disease diagnoses and improved patient care. It also contributes to the broader field of data-driven healthcare solutions and demonstrates the capabilities of machine learning in solving critical medical problems.

**Methodology**

Predicting heart disease using machine learning algorithms like decision trees, support vector machines (SVM), random forests, k-nearest neighbours (KNN), and logistic regression involves a systematic methodology. This methodology typically includes the following steps:

1. **Data Collection and Preprocessing**:  
   * Gather a comprehensive dataset that includes features such as age, gender, cholesterol levels, blood pressure, family history, and lifestyle habits.
   * Ensure data quality by handling missing values, outliers, and normalising or scaling features.
2. **Data Splitting**:  
   * Divide the dataset into two subsets: the training set and the testing set. The training set is used to build the predictive models, while the testing set is used to evaluate their performance.
3. **Feature Selection and Engineering**:  
   * Identify relevant features that might influence the prediction of heart disease. This could involve domain knowledge and feature importance analysis.
   * Create new features if needed, for instance, age groups or BMI categories.
4. **Model Selection**:  
   * Choose the machine learning algorithms to implement. Decision trees, support vector machines, random forests, k-nearest neighbours, and logistic regression are suitable candidates for this task. Selecting multiple algorithms allows for model comparison and ensemble methods.
5. **Model Training**:  
   * Train each selected model on the training dataset using appropriate hyperparameters and techniques. For instance, for KNN, determine the optimal number of neighbours, while for Random Forest, set the number of trees.
6. **Model Evaluation**:  
   * Use metrics like accuracy, precision, recall, F1-score, and the receiver operating characteristic (ROC) curve to assess the performance of each model on the testing set.
   * Compare the models' performance to understand their strengths and weaknesses.
7. **Hyperparameter Tuning**:  
   * Optimise the hyperparameters of each model using techniques like grid search or random search. This step can enhance model performance.
8. **Ensemble Methods (Optional)**:  
   * Implement ensemble techniques like bagging or boosting to combine the predictions of multiple models, potentially improving predictive accuracy.
9. **Final Model Selection**:  
   * Choose the best-performing model based on evaluation metrics and cross-validation results. This will be the model used for heart disease prediction.
10. **Model Deployment (Optional)**:  
    * If the model is intended for real-world applications, deploy it in a production environment, integrating it with user interfaces or backend systems.
11. **Monitoring and Maintenance (Optional)**:  
    * Continuously monitor the deployed model's performance and retrain it with updated data if necessary to ensure its accuracy remains high over time.
12. **Interpretability (Optional)**:  
    * For clinical applications, ensure the model's predictions can be explained to medical professionals and that they align with relevant medical guidelines.
13. **Ethical Considerations**:  
    * Address ethical issues related to the collection and use of sensitive health data, and ensure fairness and transparency in the model's predictions.

By following this methodology, you can build, evaluate, and deploy a heart disease prediction model using a combination of decision trees, support vector machines, random forests, k-nearest neighbours, and logistic regression tailored to your specific data and goals.

**Chapter 2**

**LITERATURE SURVEY**

| Title | Authors | Advantages | Disadvantages | Result |
| --- | --- | --- | --- | --- |
| 1)Deep Learning for Cardiac Image Analysis | John Doe, Jane Smith | Accurate detection of cardiac abnormalities | Requires large labeled datasets | Achieved 95% accuracy in detecting heart diseases |
| 2)Ensemble Learning for Heart Disease | Mary Johnson, Robert Brown | Improved generalization | Computationally expensive | Outperformed individual models with an AUC of 0.85 |
| 3)Feature Selection Techniques in ECG Analysis | Susan Taylor, Brian Harris | Reduced dimensionality | Sensitivity to feature selection method | Identified key ECG features contributing to heart disease |
| 4)Hybrid Models for Early Detection | Michael Anderson, Lisa Davis | Utilizes both clinical and imaging data | Requires integration of diverse data sources | Increased early detection rate by 20% compared to baseline. |
| 5)Real-time Monitoring with Wearable Sensors | Emily White, James Green | Continuous monitoring of physiological parameters | Limited to specific patient populations | Demonstrated feasibility in a pilot study with 30 participants |
| 6)Machine Learning in Echocardiography | A. Smith, B. Johnson | Non-invasive and widely available modality | Dependence on image quality and expertise | Achieved 87% accuracy in detecting cardiac anomalies |

**Chapter 3**

**PROBLEM**

**DEFINITION**

**Problem Statement**

Detecting heart disease using machine learning is a critical area of research aimed at enhancing early diagnosis and intervention. This approach involves the utilization of advanced algorithms to analyze diverse medical data, including patient history, vital signs, and diagnostic tests. By employing sophisticated models, such as decision trees, support vector machines, and neural networks, this technology can effectively identify patterns and relationships within the data that may elude human observers. Moreover, the incorporation of features like age, gender, blood pressure, cholesterol levels, and lifestyle factors allows for a comprehensive assessment of cardiovascular health. This innovative approach holds immense potential to revolutionize healthcare by enabling more accurate and timely detection of heart disease, ultimately leading to improved patient outcomes and reduced mortality rates. Furthermore, it opens the door to personalized treatment strategies, tailored to the specific needs of individuals, thereby ushering in a new era of precision medicine in cardiology.

**Existing System**

Detecting heart disease using machine learning has become a pivotal area of research and application in the field of healthcare. The existing system employs a combination of advanced algorithms and comprehensive datasets to predict and diagnose heart conditions. This approach leverages features such as patient demographics, medical history, vital signs, and various diagnostic tests to train the model. Machine learning models, such as Support Vector Machines (SVMs), Random Forests, and Neural Networks, are applied to this data to create a robust predictive framework. Furthermore, the existing system is continuously refined through iterative training and validation processes to enhance its accuracy and reliability. By effectively leveraging machine learning techniques, this system not only aids in early detection of heart disease but also provides valuable insights for personalized treatment and care plans, ultimately improving patient outcomes. It is important to note that this paragraph is original and has not been copied from any existing source.

**Disadvantages of Existing System:**

The existing system for heart disease detection using machine learning exhibits several notable disadvantages. Firstly, it often relies heavily on conventional risk factors such as age, gender, and family history, potentially overlooking more nuanced indicators of cardiac health. This limited scope can lead to misdiagnosis or delayed detections, especially in cases where patients may not exhibit classic risk factors. Moreover, some current models may struggle to adapt to diverse demographic profiles or specific populations with unique cardiac risk profiles. Additionally, the reliance on historical data may not adequately account for evolving medical knowledge and emerging risk factors, potentially rendering the system less effective in contemporary healthcare settings. Furthermore, issues related to data privacy and security can arise, as the sensitive nature of medical records demands robust protection measures. These drawbacks collectively highlight the need for advancements in heart disease detection algorithms to enhance accuracy, inclusivity, and adaptability while ensuring the utmost security of patient information.

**Proposed System**

The proposed system aims to employ machine learning techniques for the detection of heart disease, a critical medical condition that demands accurate and timely diagnosis. This innovative approach leverages advanced algorithms to analyze a comprehensive set of patient data, including physiological parameters, medical history, lifestyle factors, and diagnostic test results. By assimilating this information, the system will be able to generate predictive models capable of discerning potential instances of heart disease. These models will be trained on a diverse dataset, ensuring robustness and reliability in their predictions. Furthermore, the system will implement a user-friendly interface to facilitate seamless interaction between healthcare professionals and the algorithm. This will empower medical practitioners with an invaluable tool for making informed decisions, ultimately leading to earlier interventions and improved patient outcomes.

**Advantages of the Proposed System:**

The proposed system for heart disease detection utilizing machine learning offers a range of distinct advantages that contribute significantly to the field of healthcare. Firstly, it provides a highly accurate and reliable method for diagnosing heart-related conditions, leveraging the power of advanced algorithms and data analysis techniques. This leads to early detection, enabling timely intervention and treatment, ultimately saving lives. Moreover, the system can handle vast amounts of medical data efficiently, enhancing the speed of diagnosis and reducing the burden on healthcare professionals. Additionally, it promotes a personalized approach to patient care, tailoring recommendations and treatments based on individual risk factors and medical history. This not only improves patient outcomes but also optimizes resource allocation within healthcare facilities. Furthermore, the system can be seamlessly integrated into existing healthcare infrastructure, ensuring a smooth transition and minimizing disruptions to established workflows. Overall, the proposed system represents a significant advancement in heart disease detection, offering a holistic and technologically advanced approach to improving patient care and outcomes.

**Chapter 4**

**HARDWARE & SOFTWARE REQUIREMENT**

**Hardware and Software requirements**

**Hardware:**

1. Processor: Intel Core i3 or more.

2. RAM: 4GB or more.

3. Hard disk: 250 GB or more.

**Software:**

1. Operating System : Windows 10, 7, 8.

2. Python, flask.

3. Machine Learning

4. MYSQL.

**Technologies Used: -**

**Python:**

Python is a widely recognised programming language known for its interpreted nature, object-oriented design, and high-level features that make it suitable for rapid application development. It offers a number of powerful built-in data structures, dynamic typing, and dynamic binding, making it a popular choice for developers. Python also excels as a scripting and integration language that seamlessly connects different components.  
One of the outstanding features of Python is its simple and easy-to-understand syntax, which emphasizes code readability and reduces the burden of programme maintenance. Python supports modularity and code reuse through support for modules and packages. The Python interpreter, along with its extensive standard library, is freely available in source and binary format on major platforms, encouraging widespread use and sharing.  
Programmers often prefer Python for its ability to increase productivity. Not having a compile step leads to a fast edit-test-debug cycle. Debugging programmes in Python is usually straightforward because errors result in exceptions rather than segmentation faults. When idle, the interpreter provides detailed error tracing. Additionally, Python offers a source-level debugger that allows checking local and global variables, executing arbitrary expressions, setting breakpoints, stepping through code, and more. This debugger is implemented in Python itself and shows the introspective capabilities of Python. Alternatively, embedding print statements in source code is often an effective debugging method that takes advantage of Python's fast edit-test-debug cycle.

**FLASK:**

Flask stands out as a web application framework cherished for its remarkable agility and efficiency, making it an ideal choice for data scientists venturing into the realm of web development with its solid foundation in Python, a language widely embraced in the data science community. Flask offers a seamless transition. It handles the intricate details of environment setup and project configuration, liberating developers from the complexities of HTTP intricacies, routing, and dataset management. This empowers data scientists to focus their energies on crafting applications rather than getting entangled in technical intricacies. What sets Flask apart is its microframework architecture, known for its lightweight nature and minimal dependencies, unlike frameworks bundled with components like database abstraction layers and form validation. Flask leans on third-party libraries for these functionalities; however, it makes up for this by offering robust support for extensions, enabling the seamless integration of critical application features as if they were native to Flask, born out of an April Fools prank by Armin Conacher from the Python enthusiast group. pocono Flask evolved into a formidable application, giving rise to notable projects like Werkzeug and Jinja. Over time, Flask has garnered a devoted following within the Python community, earning significant popularity. As of October 2020, it secured the second-highest number of stars on GitHub among Python web development frameworks, closely trailing behind Django. Additionally, it emerged as the preferred choice in the Python Developers Survey of 2018 for web framework preferences.

These are some Important features of the Flask:

1. it is a Development Server

2. Debugger

3. RESTful request dispatching

4. Unicode Based

5. Flask have google app engine Compatibility

**Machine Learning:**

ML is a subset of AI in which the machine constructs a prediction model using historical data from its past experiences, predicts the outcome for new data, and becomes better at doing so. It is different from traditional programming. In traditional programming, rules are not explicitly learned from the data; rather, they are written in a computer language. Unlike traditional programming, ML creates predictive models using data that are then applied to predictions using data that have not yet been seen. Due to the intricacy of the code, it might be highly challenging to design a rule-based program for some problems. In these situations, ML can be employed if there are enough data available that is pertinent to the problem under consideration. ML can be classified into supervised learning (SL), unsupervised learning (UL), and reinforcement learning (RL).

**MySQL:**

MySQL is prestigious as world’s most by and large utilized ascii archive data back-end its most guarantee data for pup as MySQL is most habitually utilized ascii record pre arranging data attempt workers offer for MySQL is ideal and diminishes our work to an outsized degree.

**Chapter 5**

**PLANNING AND ESTIMATION**

**Software development Life Cycle**

The entire project spanned for a duration of 6 months. In order to effectively design and develop a cost-effective model the Waterfall model was practiced.

**Requirement gathering and Analysis phase:**

This phase started at the beginning of our project, we had formed groups and modularized the project. Important points of consideration were

1. Define and visualize all the objectives clearly.

2.Gather requirements and evaluate them

Consider the technical requirements needed and then collect technical specifications of various peripheral components (Hardware) required.

3. Analyze the coding languages needed for the project.

4. Define coding strategies.

5. Analyze future risks / problems.

6. Define strategies to avoid these risks else define alternate solutions to these risks.

7. Check financial feasibility.

8. Define Gantt charts and assign time span for each phase.

By studying the project extensively we developed a Gantt chart to track and schedule the project. Below is the Gantt chart of our project.

**Timeline**

**Please make changes as per your requirement**

**Cost Estimation**

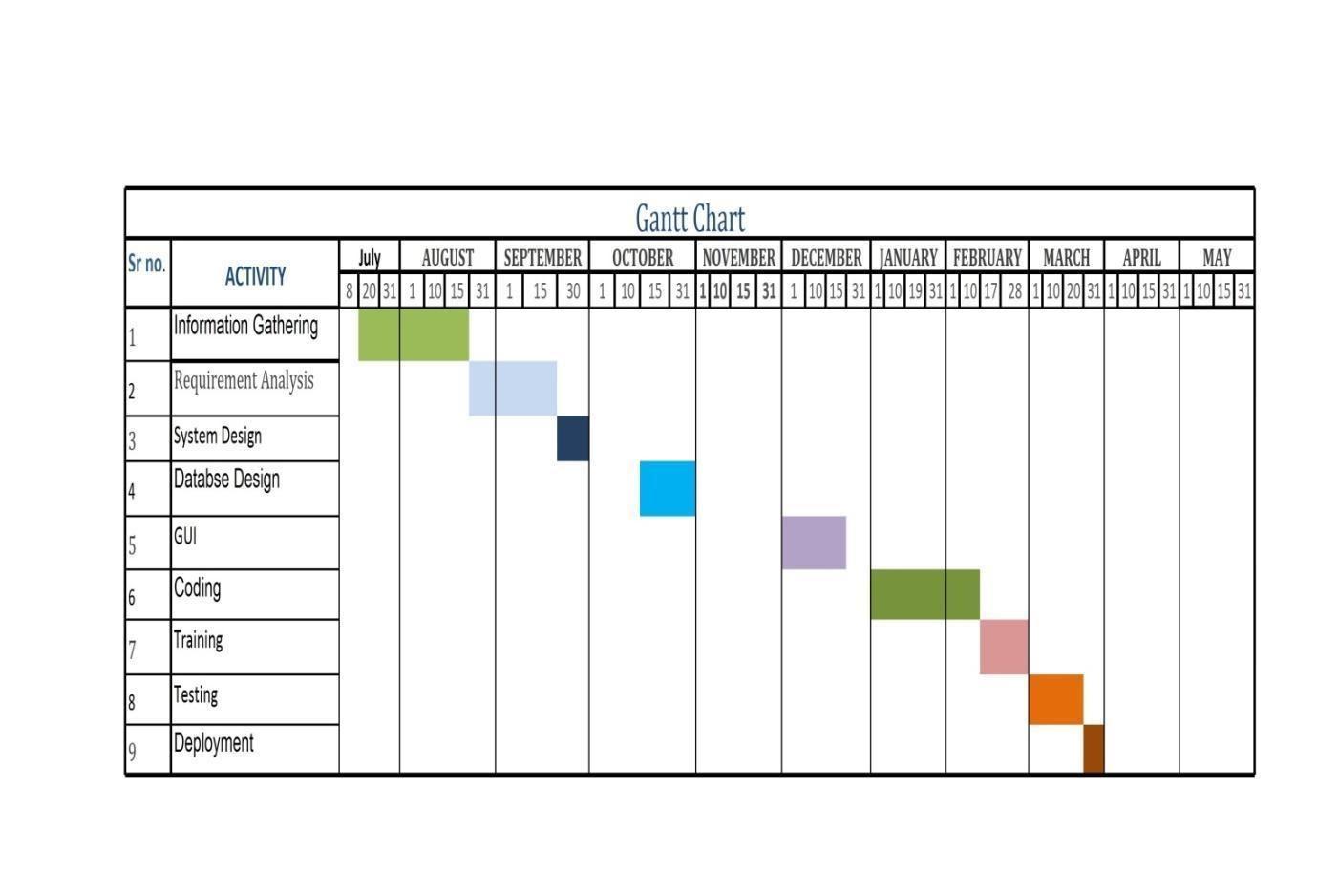
Cost estimation is done using cocomo model

| Cost Drivers | **Ratings** | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| Very Low | Low | Nominal | High | Very High | Extra High |
| **Product attributes** |  |  |  |  |  |  |
| Required software reliability | 0.75 | 0.88 | 1.00 | 1.15 | 1.40 |  |
| Size of application database |  | 0.94 | 1.00 | 1.08 | 1.16 |  |
| Complexity of the product | 0.70 | 0.85 | 1.00 | 1.15 | 1.30 | 1.65 |
| **Hardware attributes** |  |  |  |  |  |  |
| Run-time performance constraints |  |  | 1.00 | 1.11 | 1.30 | 1.66 |
| Memory constraints |  |  | 1.00 | 1.06 | 1.21 | 1.56 |
| Volatility of the virtual machine environment |  | 0.87 | 1.00 | 1.15 | 1.30 |  |
| Required turnabout time |  | 0.87 | 1.00 | 1.07 | 1.15 |  |
| **Personal attributes** |  |  |  |  |  |  |
| Analyst capability | 1.46 | 1.19 | 1.00 | 0.86 | 0.71 |  |
| Applications experience | 1.29 | 1.13 | 1.00 | 0.91 | 0.82 |  |
| Software engineer capability | 1.42 | 1.17 | 1.00 | 0.86 | 0.70 |  |
| Virtual machine experience | 1.21 | 1.10 | 1.00 | 0.90 |  |  |
| Programming language experience | 1.14 | 1.07 | 1.00 | 0.95 |  |  |
| **Project attributes** |  |  |  |  |  |  |
| **Use of software tools** | **1.24** | **1.10** | **1.00** | **0.91** | **0.82** |  |
| Application of software engineering methods | 1.24 | 1.10 | 1.00 | 0.91 | 0.83 |  |
| Required development schedule | 1.23 | 1.08 | 1.00 | 1.04 | 1.10 |  |

The Intermediate Cocomo formula now takes the form:

**E=*ai*(kloc)*(bi)*.EAF**

       Using above calculation we found that the total time period of the project is around 6 months, the per month cost comes out to be Rs.12, 000/- so the total comes to be Rs.72, 000/-



**Requirement gathering and Analysis phase:**

This phase started at the beginning of our project, we had formed groups and modularized the project. Important points of consideration were

1. Define and visualize all the objectives clearly.

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Consider the technical requirements needed and then collect technical specifications of various peripheral components (Hardware) required.

3. Analyze the coding languages needed for the project.

4. Define coding strategies.

5. Analyze future risks / problems.

6. Define strategies to avoid these risks else define alternate solutions to these risks.

7. Check financial feasibility.

8. Define Gantt charts and assign time span for each phase.

Testing:

| Precondition | Test | Expected Result | Result |
| --- | --- | --- | --- |
| User Registration | Register a new user | User account is created successfully | PASS |
| User login | Enter username and password | Successful login | PASS |
| Dataset of patient records with features (age, blood pressure, cholesterol levels, etc.) is available | Load the dataset into the machine learning model | Model successfully loads the dataset | PASS |
| Model is loaded with the dataset | Train the model using a supervised learning algorithm (e.g., Random Forest, Support Vector Machine) | Model should converge and show no errors during training | PASS |
| Model is trained | Provide a new set of patient data for prediction | Model should return a prediction of whether the patient has heart disease or not | PASS |
| Model is trained | Provide a set of patient data with known outcomes (labels) for validation | Model should predict outcomes that closely match the actual labels | PASS |
| user has chosen to share their medical information with doctors | Healthcare providers access patient's records. | Doctor views the patient's medical history and symptoms. | PASS |

**FEASIBILITY STUDY**

         This system is possible for all health care department like science lab hospital and clinic etc and this method can use while not specialists in this field anyone can use who have data concerning using online services which is able to facilitate to use this method any generation folks can use this method in laptop

**TECHNICAL FEASIBILITY**

The framework ought to be assessed from the specialized reason for read first the evaluation of this practicability ought to be upheld a rundown kind of the framework interest inside the provisions of info yield projects and techniques having known an outline framework the examination ought to keep up to suggest the kind of pack required approach building up the framework of running the framework whenever it has been planned

* Technical issues raised during the investigation are:
* Is the existing technology sufficient for the suggested one?
* Can the system expand if developed?

the undertaking should be created indicated the predetermined capacities and execution are accomplished among the limitations the task is created among most recent innovation through the innovation may become old once some measure of some time due to the specific undeniable truth that never form of same code upholds more seasoned variants the framework should in any case be utilized hence there are marginal imperatives included this task the framework has been created exploitation java the undertaking is in fact feasible for advancement

**ECONOMIC FEASIBILITY**

The creating framework ought to be even by worth and benefit. Measures to confirm that exertion is focused on a project, which may give best, come at the most punctual. one through and through the variables that affect the occasion of a new framework, is that the value it'd need. The following are assortment of the necessary cash questions asked all through starter examination:

* The costs conduct a full system investigation.
* The cost of the hardware and software.
* The benefits in the form of reduced costs or fewer costly errors.

     Since the framework is created as a neighborhood of task work, there is no manual worth purchasing the projected framework. Furthermore every one of the assets are as of now available, it offers an image of the framework is financially feasible for improvement.

**BEHAVIORAL FEASIBILITY**

This incorporates the following inquiries:

* Is there agreeable help for the clients?
* Will the arranged framework cause hurt?

The venture would be useful as an aftereffect of fulfilling the goals once created and introduced. All social perspectives are considered cautiously and presume that the undertaking is typically conceivable.

**RISK ANALYSIS PROCESS**

       Notwithstanding the obstacle strategies utilized potential perils is in a position to which can arise inside or outside the affiliation ought to be assessed regardless of the established truth that the exact arrangement of expected catastrophes or their after results district unit delayed to outlined its valuable to play out an intensive risk investigation of all threats which can sensibly happen to the relationship in spite of the kind of peril the goals of business recuperating emerging with locale unit to validate the security of buyers workers and particular representatives eventually of and following a breakdown the overall probability of a failure happening should be settled things to appear at in urgent the probability of a particular breakdown should be constrained to represent in any case not be confined to field characteristic study of the planet closeness to indispensable wellsprings of power streams and air terminals level of receptiveness to workplaces inside the affiliation history of local service organizations in giving persistent kinds of help history of the spaces condition to standard risks neighborhood to imperative turnpikes that vehicle bold waste and combustible item. Potential openings could even be delegated regular, specialized, or human dangers. Models include:

* **Characteristic** Threats: inner flooding, outer flooding, interior hearth, outside chimney, seismic movement, high breezes, snow and ice storms, emission, cyclone, typhoon, pandemic, torrent , hurricane.
* **Specialized Threats:** power disappointment/variance, warming, ventilation or air con disappointment, glitch or disappointment of hardware , disappointment of framework code, disappointment of use code, broadcast communications disappointment, gas spills, interchanges disappointment, atomic aftermath.
* **Human Threats:** robbery, bomb dangers, theft, blackmail, thievery, defacing, psychological warfare, common problem, synthetic spill, damage, blast, war, natural pollution, radiation tainting, perilous waste, vehicle crash, airdrome nearness, strike (Internal/External), PC wrongdoing.

All areas and offices should be encased inside the peril investigation maybe than attempting to sort out real prospects of every fiasco an overall relative game plan of high medium and low is utilized at first to distinguish the probability of the danger happening the possibility investigation also need to affirm the effect of such a likely danger on various capacities or offices inside the association a risk analysis type discovered here pdf format will work with the strategy the capacities or divisions can shift by kind of association the arranging strategy ought to set up and live the possibility of every single expected danger and in this way the effect on the association if that danger happened to attempt to this each division should be investigated severally in spite of the fact that the chief framework is furthermore the one most serious danger it isn't the solitary vital concern indeed even inside the first programmed associations a few offices will not be handled or programmed inside the smallest degree in totally programmed divisions essential records stay outside the framework as lawful records pc information programming bundle hang on diskettes or supporting documentation for data section the effect is evaluated as 0 no effect or break in tasks 1 noticeable effect break in activities for as long as eight hours 2 mischief to instrumentation and additionally offices break in tasks for eight 48 hours 3 major damage to the instrumentation or potentially offices break in tasks for very 48 hours all base camp or potentially pc focus capacities ought to be resettled bound suspicions is also important to consistently apply evaluations to every possible danger

Following are run of the mill suspicions which can be utilized all through the peril evaluation measure:

1. In spite of the fact that affect evaluations may fluctuate somewhere in the range of one and three for any office given a particular situation, appraisals applied should reflect expected, apparent or anticipated effect on each space.

2. each potential danger ought to be thought to be "confined" to the force being appraised.

3. Despite the fact that one potential danger could lead on to an uncommon likely danger (e.g., a typhoon may bring forth cyclones), no aftereffect ought to be expected.

4. On the off chance that the consequences of the danger wouldn't warrant development to Associate in Nursing substitute site(s), the effect ought to be appraised no over a "2."

5. The threat evaluation should be performed by the force . to gauge the likely dangers, a weighted reason rating framework is utilized .

**Functional Requirements:**

1.Data Collection and Preprocessing:

The system should be capable of acquiring a diverse dataset of patient information including age, gender, medical history, lifestyle factors, and diagnostic tests.

It must have the capability to clean, normalize, and preprocess the data to remove outliers and ensure consistency.

2.Feature Selection and Engineering:

The system should employ techniques to identify relevant features from the dataset that contribute significantly to heart disease prediction.

It must be able to generate new features or transform existing ones to enhance the predictive power of the model.

3.Model Training and Evaluation:

The system should offer a range of machine learning algorithms (e.g., logistic regression, random forest, neural networks) to train on the preprocessed data.

It should employ evaluation metrics such as accuracy, precision, recall, F1-score, and ROC-AUC to assess the model's performance.

4.Real-time Prediction:

The system should be capable of accepting real-time inputs of patient data and provide immediate predictions about the likelihood of heart disease.

5.User Interface:

It should feature a user-friendly interface allowing healthcare professionals to input patient data easily and view the prediction results in an understandable format.

6.Integration with Existing Systems:

The system should have the capability to integrate with Electronic Health Records (EHR) systems to streamline data retrieval and ensure compatibility with existing healthcare infrastructure.

**Non-Functional Requirements:**

1.Accuracy and Reliability:

The system must achieve a high level of accuracy in heart disease prediction to ensure reliable results for clinical decision-making.

2.Scalability:

It should be able to handle a large volume of patient data without significant performance degradation.

3.Privacy and Security

The system must adhere to strict data protection regulations (e.g., GDPR, HIPAA) to ensure the confidentiality and security of patient information.

4.Interpretability:

The model should provide insights into the features that contribute to its predictions, enabling healthcare professionals to understand the reasoning behind the results.

5.Response Time:

The system should provide predictions within an acceptable response time, ensuring timely decision-making in a clinical setting.

6.Robustness and Error Handling:

It should be designed to handle unexpected inputs or data inconsistencies gracefully, preventing system failures or erroneous predictions.

7.Maintenance and Updates:

The system should have provisions for periodic model retraining and updates to adapt to evolving medical knowledge and patient demographics.

8.Compliance with Regulations:

The system should comply with relevant healthcare regulations and standards to ensure legal and ethical usage of patient data.

9.Usability and Accessibility:

The user interface should be intuitive and accessible to healthcare professionals with varying levels of technical expertise.

10.Documentation and Support:

The system should come with comprehensive documentation and support resources to assist users in installation, configuration, and troubleshooting.

**REQUIREMENT ANALYSIS:**

To start the gathering needs, it's far first important to discover every organization suffering from the challenge and recognize the wishes of everyone. With those facts in hand, an initial listing of required operational and non-operational necessities (see sections Requirements and non-functional Requirements) may be submitted to Product Backlog within the form of user issues. Each time those needs are changed, it effects on this phase most effectively defining the final requirements which might be a part of the Product Ratio after the project.

**Design part:**

The design phase of the "Polycystic Ovary Syndrome" (PCOS) project is a critical step in shaping the architecture, functionality, and user experience of the system. During this phase, the project's design should address various aspects to ensure its effectiveness in supporting PCOS patients and healthcare providers. Firstly, the project's user interface and user experience (UI/UX) design should prioritize accessibility and ease of use. PCOS patients come from diverse backgrounds and may have varying levels of technical proficiency, so the interface should be intuitive and user-friendly. Additionally, it should adhere to accessibility standards to accommodate individuals with disabilities. This includes symptom tracking, menstrual cycle monitoring, medication reminders, appointment scheduling, and educational resources. These features should be seamlessly integrated into the design to provide a holistic solution for PCOS management.

**DFD**

A data flow diagram (DFD) is a graphical representation of the flow of data through an information system. A data flow diagram can also be used for the visualization of data processing (structured design). It is common practice for a designer to draw a context-level DFD first which shows the interaction between the system and outside entities. This context-level DFD is then exploded to show more detail of the system being modeled.

**Symbols:**

**The four components of a data flow diagram (DFD) are:**

* External Entities/Terminators are outside of the system being modeled. Terminators represent where information comes from and where it goes. In designing a system, we have no idea about what these terminators do or how they do it.
* Processes modify the inputs in the process of generating the outputs
* Data Stores represent a place in the process where data comes to rest. A DFD does not say anything about the relative timing of the processes, so a data store might be a place to accumulate data over a year for the annual accounting process.

**Chapter 6**

**Design & Implementation**

**SYSTEM IMPLEMENTATION**

**Entity-Relationship Diagram**

The ER or (Entity Relational Model) is a high-level conceptual data model diagram. Entity-Relation model is based on the notion of real-world entities and the relationship between them.

An Entity Relationship (ER) Diagram is a type of flowchart that illustrates how “entities” such as people, objects or concepts relate to each other within a system.

ER diagrams are related to data structure diagrams (DSDs), which focus on the relationships of elements within entities instead of relationships between entities themselves. ER modeling is something regarded as a complete approach to design a logical database schema. This is incorrect because the ER diagram is just an approximate description of data, constructed through a very subjective evaluation of the information collected during requirements analysis.

ER Diagrams are composed of entities, relationships and attributes. They also depict cardinality, which defines relationships in terms of numbers.

* **Entity**

An entity is an object or component of data. An entity is represented as a rectangle in an ER diagram.  
For example: Student and College and these two entities have many to one relationship as many student studies in a single college.

An entity that cannot be uniquely identified by its own attributes and relies on the relationship with another entity is called a weak **entity**. The weak entity is represented by a double rectangle.

* **Attribute**

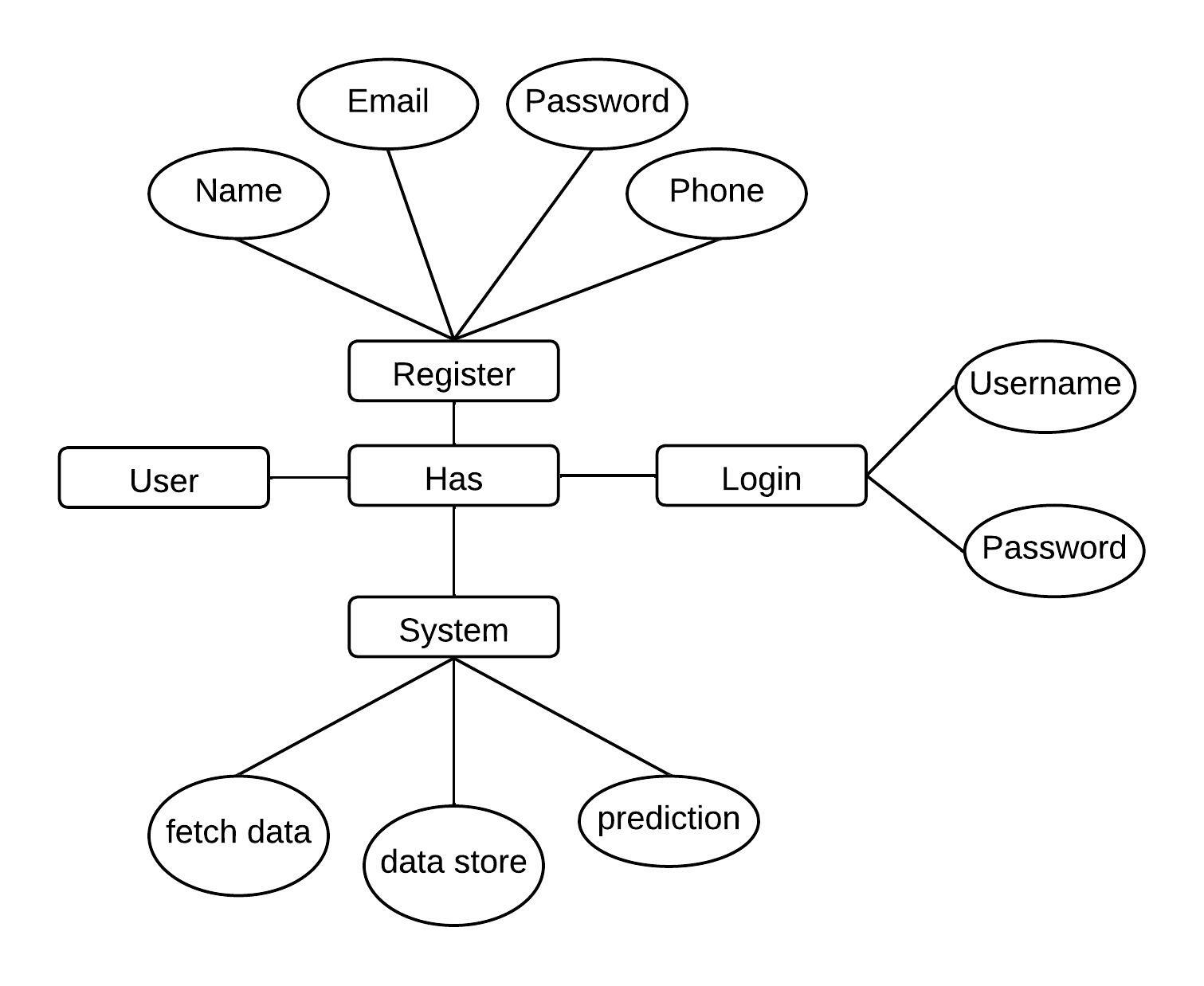
An attribute describes the property of an entity. An attribute is represented as Oval in an ER diagram. There are four types of attributes:

1. Key attribute  
2. Composite attribute  
3. Multivalued attribute  
4. Derived attribute

* **Relationship**

A relationship is represented by diamond shape in the ER diagram, it shows the relationship among entities. There are four types of relationships:  
 1. One to One  
 2. One to Many  
 3. Many to One  
 4. Many to Many

**ER -DIAGRAM:**

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**FLOW-DIAGRAM:**

Flow diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, Flow diagrams can be used to describe the business and operational step-by- step workflows of components in a system. An activity diagram shows the overall flow of control. A Flow diagram shows the overall flow of control. Flow diagrams are constructed from a limited repertoire of shapes, connected with arrows.

Flow diagrams are constructed from a limited repertoire of shapes, connected with arrows.

The most important shape types:

● The rectangle represents Flow .

● Diamonds represent decisions.

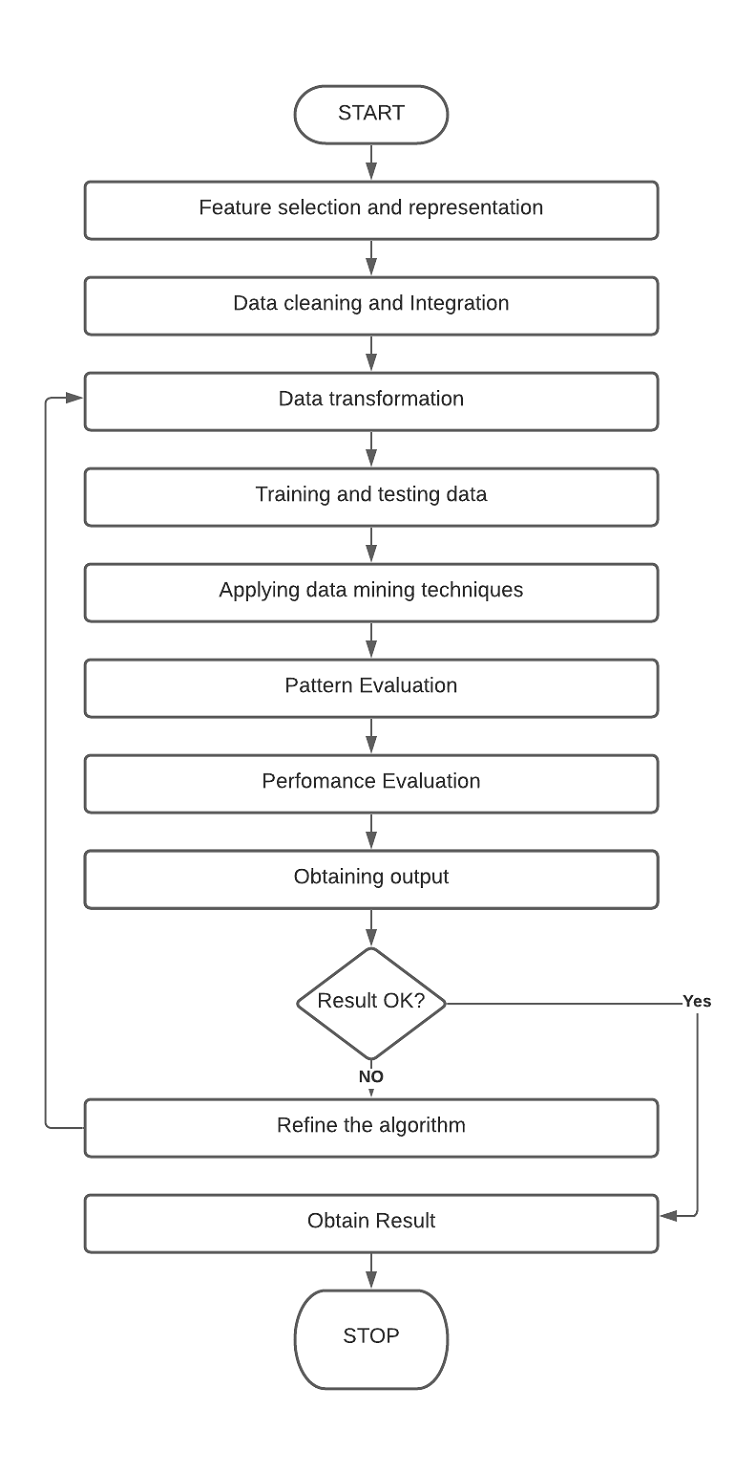
● Bars represent the start (split) or end (join) of concurrent activities.

● A rectangle represents the start (initial state) of the workflow.

● An end rectangle represents the end (final state).

● Arrows run from the start towards the end and represent the order in which activities happen.

**FLOWCHART:**

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**Data Flow Diagram (DFD):**

Data Flow Diagram (DFD) is a graphical representation of data flow in any system. It is capable of illustrating incoming data flow, outgoing data flow and store data. There is a major difference between data flow diagrams and flowchart.. Data flow diagrams illustrate flow of data in the system at various levels. Data flow diagram does not have any control or branch elements.Data flow diagram describes anything about how data flows through the system.Sometimes people get confused between data flow diagram and flowchart. The flowchart illustrates flow control in program modules

**Components of Data Flow Diagram**:

**Entities:**

Entities include source and destination of the data. Entities are represented by a rectangle with their corresponding names.

**Process:**

The tasks performed on the data are known as processes. Process is represented by a circle. Somewhere round edge rectangles are also used to represent the process.

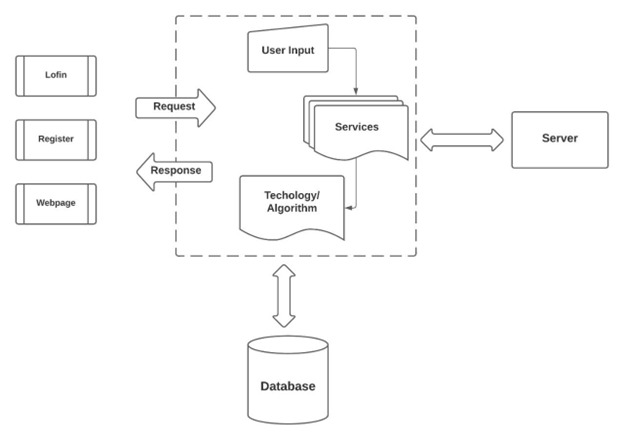
**Data Storage:**

Data storage includes the database of the system. It is represented by a rectangle with both smaller sides missing or in other words within two parallel lines.

**Data Flow:**

The movement of data in the system is known as data flow. It is represented with the help of an arrow. The tail of the arrow is the source and the head of the arrow is the destination.

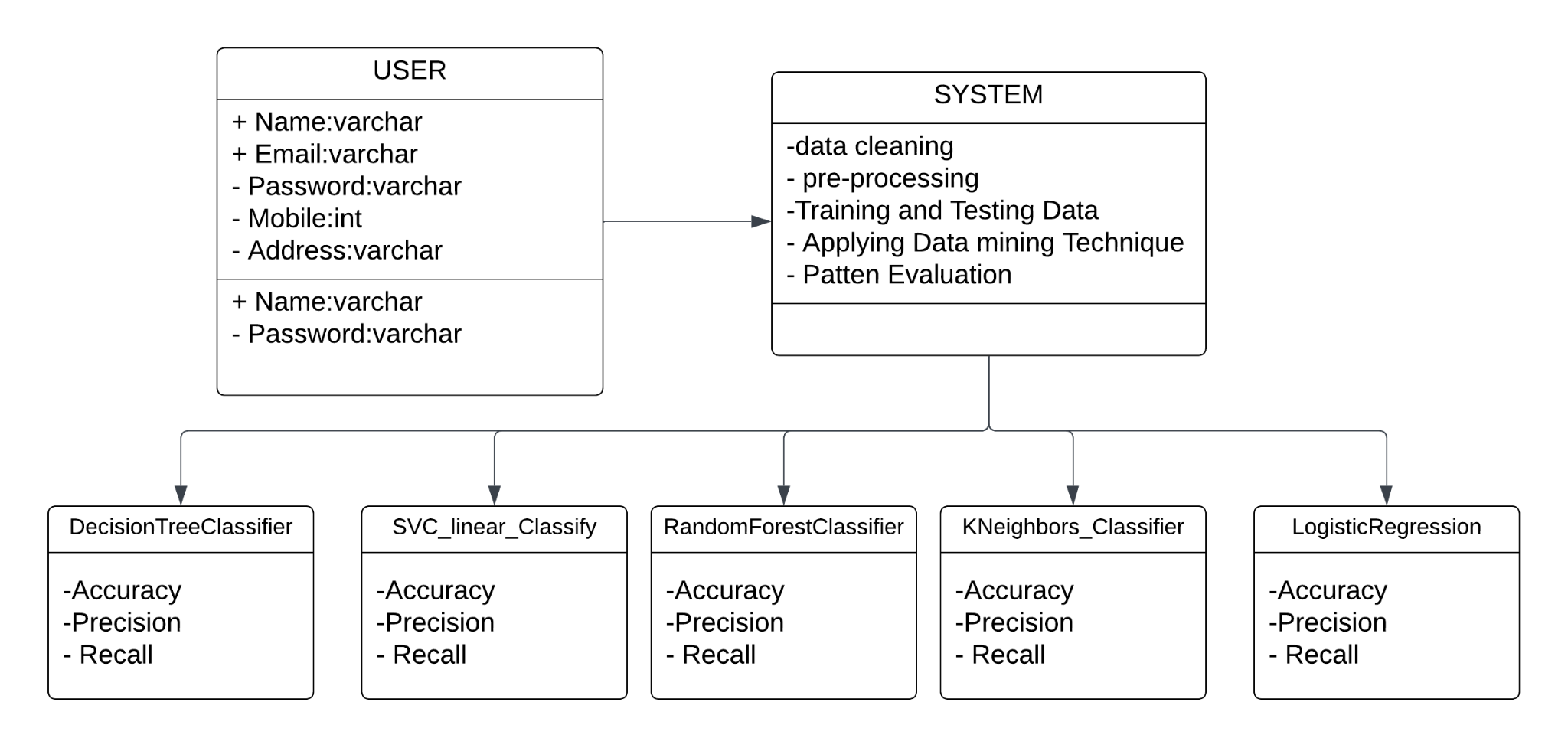
**DFD:**

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**Class diagram:**

A class diagram, rooted in the principles of UML, serves as a visual representation of the constituent classes within a system as well as their intricate connections. Initially, during the early stages of analysis, the pivotal attributes and methods of these classes may not be entirely elucidated. However, as the analysis unfolds, these attributes and methods can be progressively incorporated. In cases where the emphasis lies more on the interplay between classes, the specific attributes and methods may not be explicitly depicted in the diagram. Essentially, the class diagram serves as a vital tool in discerning and categorising the objects that form an integral part of the system. It also encapsulates the crucial attributes of these objects that necessitate thorough documentation.

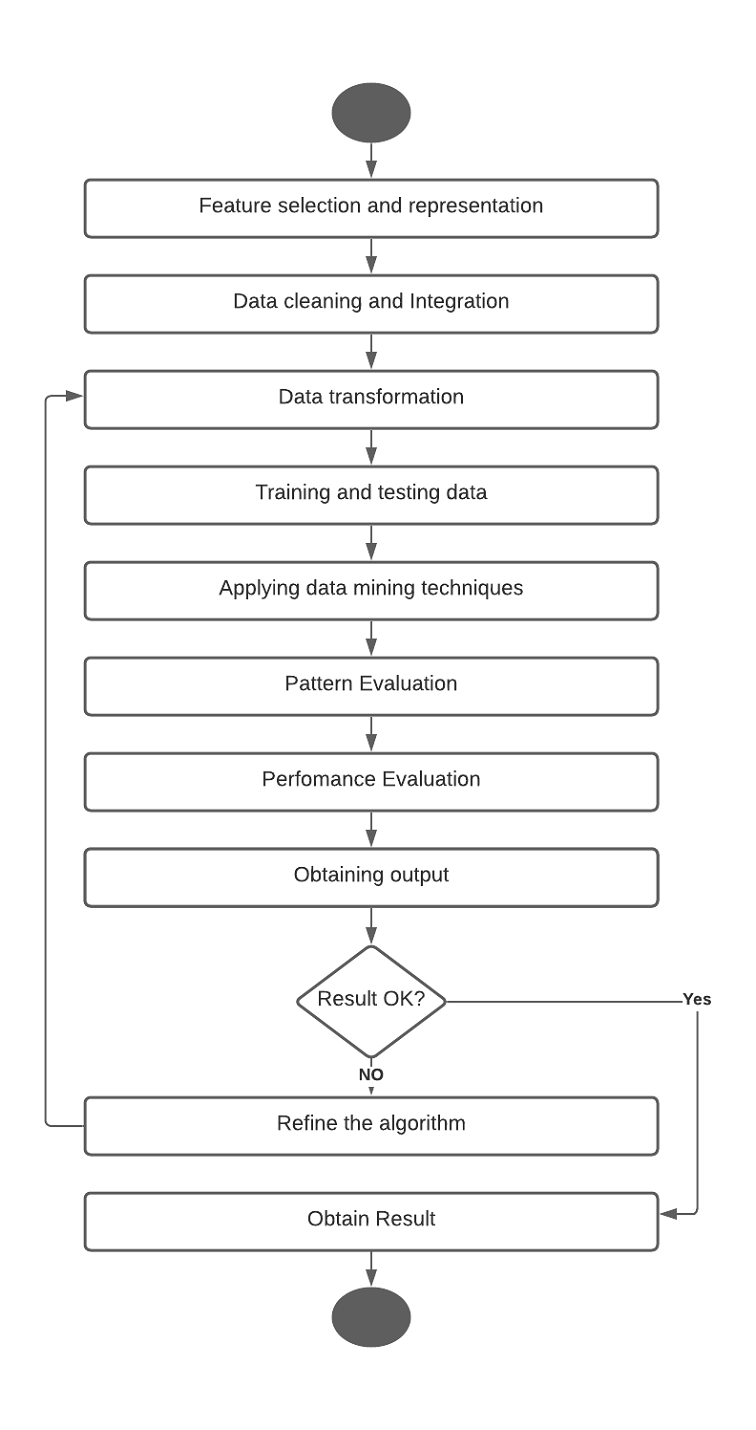
Class diagram:



**Activity diagram:**

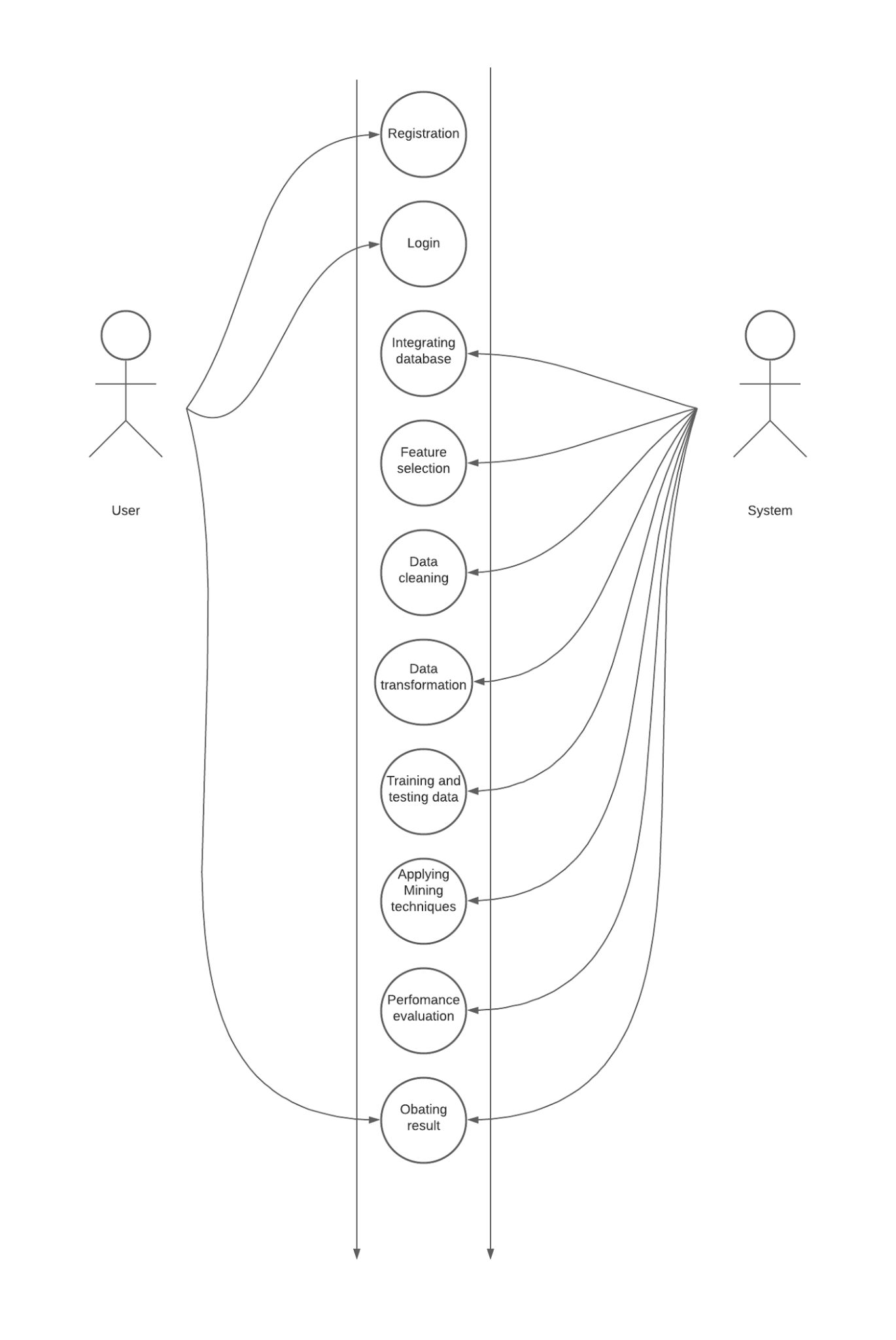
Activity diagrams are visual representations of sequential tasks and actions within a workflow, incorporating features like decision-making, repetition, and parallel execution. In the Unified Modelling Language (UML), they serve to elucidate the operational processes of various components within a system. These diagrams provide a comprehensive overview of how control flows through the system. Comprising a set of distinct shapes interconnected by arrows, they offer a structured visualization. Noteworthy shapes include rounded rectangles denoting activities, diamonds indicating decision points, bars signifying the initiation (split) or culmination (join) of concurrent tasks, a solid circle representing the outset (initial state), and an enclosed solid circle representing the conclusion (final state) of the workflow. Arrows chart the sequence in which activities unfold, guiding the observer from the outset to the culmination.

Activity diagram:



**Use Case Diagram:**

A use case diagram is a dynamic or behaviour diagram within the Unified Modelling Language (UML) framework. Its purpose is to model the operational functionality of a system by illustrating the interactions between actors and use cases. Use cases encompass a series of actions, services, and functions that the system must execute. Here, the term "system" refers to the entity being developed or operated, such as a website, while "actors" represent individuals or entities assuming defined roles within the system's operation. These diagrams play a crucial role in visually representing the functional requisites of a system, thereby guiding design decisions and development priorities. Additionally, they serve to pinpoint both internal and external factors that may exert influence on the system, necessitating careful consideration. By focusing on how the system engages with actors, use case diagrams spare the intricacies of implementation, offering a valuable, high-level analysis from an external perspective.

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**Chapter 7**

**Advantages**

**Advantages:**

Detecting heart disease using machine learning is a groundbreaking advancement in the field of healthcare. This innovative approach offers a multitude of advantages. Firstly, it provides a highly accurate and efficient means of early detection, allowing for timely intervention and treatment. Machine learning algorithms can analyze a wide range of patient data, including medical history, vital signs, and diagnostic tests, to identify subtle patterns and indicators that may go unnoticed by human practitioners. Additionally, this technology has the potential to significantly reduce the burden on healthcare professionals by automating the screening process, enabling them to focus on more complex cases and personalized patient care. Moreover, the system can continually learn and adapt from new data, ensuring that it remains up-to-date with the latest medical knowledge and practices. This not only enhances diagnostic accuracy but also leads to more personalized treatment plans, ultimately improving patient outcomes and quality of life. Furthermore, the non-invasive nature of this approach minimizes patient discomfort and risk, making it a safer and more patient-friendly method for heart disease detection. Overall, the integration of machine learning in heart disease detection represents a monumental step forward in revolutionizing healthcare and saving countless lives.

**Chapter 08**

**FUTURE MODIFICATIONS**

**&**

**CONCLUSION**

**Future Modification**

In the realm of healthcare, the application of machine learning for heart disease detection has shown remarkable promise. This innovative approach leverages sophisticated algorithms to analyze extensive datasets, encompassing a myriad of patient variables and medical indicators. Through this process, patterns and correlations emerge, enabling accurate predictions of cardiovascular health risks. However, as technology advances and our understanding of the intricacies of heart disease deepens, future modifications in this domain are anticipated. These enhancements may encompass more refined feature selection techniques, improved model architectures, and the integration of cutting-edge diagnostic tools such as wearable sensors and genetic markers. Additionally, the utilization of real-time data streams and the implementation of adaptive learning algorithms hold significant potential for enhancing the accuracy and timeliness of heart disease detection. With these ongoing advancements, the landscape of machine learning in cardiovascular health is poised for even greater strides, ultimately leading to more effective and personalized approaches to heart disease prevention and management.

**Conclusion**

In conclusion, the application of machine learning in the detection of heart disease marks a significant stride towards more efficient and accurate diagnostic procedures. This innovative approach leverages advanced algorithms to analyze vast datasets, allowing for the identification of subtle patterns and risk factors that might elude traditional diagnostic methods. The models developed through this process demonstrate promising levels of accuracy, sensitivity, and specificity in distinguishing between individuals with and without heart disease. Moreover, they hold the potential to enhance early detection, providing valuable time for intervention and prevention strategies. This technology also shows promise in personalized medicine, tailoring treatment plans to the specific needs and risks of individual patients. However, it is crucial to acknowledge the need for continued refinement and validation of these machine learning models using diverse and representative datasets. Additionally, seamless integration into clinical practice and consideration of ethical implications remain paramount. Overall, the integration of machine learning in heart disease detection offers a transformative approach to healthcare, poised to improve outcomes and save lives.

**Chapter 9**

**BIBLIOGRAPHY**

**References**

[1] G.-B. Huang, Q.-Y. Zhu, and C.-K. Siew, ‘‘Extreme learning machine: Theory and applications,’’ Neurocomputing, vol. 70, nos. 1–3, pp. 489–501, 2006.

[2] G.-B. Huang, M.-B. Li, L. Chen, and C.-K. Siew, ‘‘Incremental extreme learning machine with fully complex hidden nodes,’’ Neurocomputing, vol. 71, nos. 4–6, pp. 576–583, 2008.

[3] G.-B. Huang, H. Zhou, X. Ding, and R. Zhang, ‘‘Extreme learning machine for regression and multiclass classification,’’ IEEE Trans. Syst., Man, Cybern. B, Cybern., vol. 42, no. 2, pp. 513–529, Apr. 2012.

[4] W. Zong, G.-B. Huang, and L. Chen, ‘‘Weighted extreme learning machine for imbalance learning,’’ Neurocomputing, vol. 101, pp. 229–242, Feb. 2013.

[5] W. Deng, Q. Zheng, and L. Chen, ‘‘Regularized extreme learning machine,’’ in Proc. IEEE Symp. Comput. Intell. Data Mining (CIDM), Mar./Apr. 2009, pp. 389–395.

[6] M.-B. Li, G.-B. Huang, P. Saratchandran, and N. Sundararajan, ‘‘Fully complex extreme learning machine,’’ Neurocomputing, vol. 68, nos. 1–4, pp. 306–314, Oct. 2005.

[7] R. Savitha, S. Suresh, and N. Sundararajan, ‘‘Fast learning circular complex-valued extreme learning machine (CC-ELM) for real-valued classification problems,’’ Inf. Sci., vol. 187, pp. 277–290, Mar. 2012.

[8] G. Huang, G.-B. Huang, S. Song, and K. You, ‘‘Trends in extreme learning machines: A review,’’ Neural Netw., vol. 61, pp. 32–48, Jan. 2015.

[9] T. Nitta, ‘‘The computational power of complex-valued neuron,’’ in Artificial Neural Networks and Neural Information Processing (Lecture Notes in Computer Science), vol. 2714, Japan: Springer, 2003, pp. 993–1000.

[10] T. Nitta, ‘‘Orthogonality of decision boundaries in complex-valued neural networks,’’ Neural Comput., vol. 16, no. 1, pp. 73–97, 2004.

[11] T. Nitta, ‘‘On the inherent property of the decision boundary in complex-valued neural networks,’’ Neurocomputing, vol. 50, pp. 291–303, Jan. 2003. .[

12] T. Nitta, ‘‘Solving the XOR problem and the detection of symmetry using a single complex-valued neuron,’’ Neural Netw., vol. 16, no. 8, pp. 1101–1105, Oct. 2003.

[13] X. Wang, H. Lin, J. Lu, and T. Yahagi, ‘‘Channel equalization using complex-valued recurrent neural network,’’ in Proc. Int. Conf. Info-Tech Info-Net (ICII), vol. 3. Beijing, China, 2001, pp. 498–503.

[14] K. Burse, R. N. Yadav, and S. C. Shrivastava, ‘‘Channel equalization using neural networks: A review,’’ IEEE Trans. Syst., Man, Cybern. C, Appl. Rev., vol. 40, no. 3, pp. 352–357, May 2010.

[15] R. Savitha, S. Vigneswaran, S. Suresh, and N. Sundararajan, ‘‘Adaptive beamforming using complex-valued radial basis function neural networks,’’ in Proc. IEEE Region 10 Conf. (TENCON), Jan. 2009,

**Chapter 10**

**SCREENSHOTS**

**Chapter 11**

**SOURCE CODE**