# DETECTING HEART PROBLEMS USING LRA

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***Abstract*—*Heart diseases are a leading cause of mortality worldwide, emphasizing the need for effective early detection methods. This study presents a novel approach to detect heart problems using Linear Regression Analysis (LRA) on a dataset of clinical and diagnostic parameters. The objective is to develop a predictive model that can identify individuals at risk of heart problems based on easily obtainable medical information. The dataset comprises a diverse range of features, including age, gender, blood pressure, cholesterol levels, and electrocardiogram (ECG) readings, collected from a large cohort of patients. After thorough preprocessing and feature selection, a linear regression model is trained to predict the likelihood of heart problems. The model's performance is evaluated using various metrics such as accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve (AUC-ROC). The results indicate that LRA can effectively identify individuals at risk of heart problems with high accuracy. Furthermore, the model's interpretability allows healthcare professionals to gain insights into the importance of different risk factors in predicting heart problems. This approach holds promise for early detection and intervention, potentially reducing the burden of heart diseases on healthcare systems and improving patient outcomes. In conclusion, this study demonstrates the feasibility and effectiveness of using Linear Regression Analysis as a tool for detecting heart problems. The model's transparency and predictive power make it a valuable addition to the arsenal of tools available for cardiovascular risk assessment and prevention. Further research and validation on larger and more diverse datasets will be essential to refine and generalize the approach for broader clinical use.*

## 1. Introduction

The World Health Organization estimates that heart disease kills 12 million people each year.Over the past few years, cardiovascular illness has been spreading quickly throughout the world. Mortality and overall outcome can be reduced by early detection of heart disease. Although it is not possible to properly care for and consult with patients every day, doctors cannot be reached 24 hours a day because this requires patience, effort and experience.

Our Heart Failure Prediction System's goal is to help patients identify their heart disease early and receive treatment earlier, enabling them to prevent any serious issues. This system was created using a machine learning model to forecast the likelihood of developing heart disease in the future using the Logistic Regression technique.

This project makes use of the Django framework.The front end uses JavaScript, CSS and HTML. The backend uses a MySQL database. Python makes the backend language.The front end uses JavaScript, CSS and HTML. The backend uses a MySQL database. Python makes the backend language.

### 1.1. Scope and Objective

Identification of those who are highly susceptible to developing heart failure or having worsening symptoms is the goal of a heart failure prediction system. The system analyzes the patient's medical history, lifestyle choices, and other relevant information to predict the likelihood of heart failure using various algorithms and machine learning. This method can help prevent or delay the onset of heart failure, improve patient outcomes, and lower healthcare costs by offering early identification and intervention.

An extensive patient group, from those with no known risk factors to those who are already exhibiting symptoms, is included in the scope of a heart failure prediction system. Healthcare professionals can use the system to support clinical decision-making in a variety of healthcare settings, including hospitals, clinics, and primary care physician offices.

### 1.2. Modules and their Description

This system consists of 1 main module and its submodules as follows:

**Register:**

- The user would need to register first to log in.

**Login:** - The user can log in using their credentials.

**Prediction:** The users have to provide the below inputs for the system to predict if there is any heart failure or not.

1. Age: [years]
2. Sex: [M: Male, F: Female]
3. Chest Pain Type: [TA: Typical Angina, ATA: Atypical Angina, NAP: Non-Anginal Pain, ASY: Asymptomatic]
4. Resting Blood Pressure: [mm Hg]
5. Serum Cholesterol: [mm/dl]
6. Fasting Blood Sugar: [1: if FastingBS ¿ 120 mg/dl, 0: otherwise]
7. Resting Electrocardiogram Results: [Normal: Normal, ST: having ST-T wave abnormality (T wave inversions and/or ST elevation or depression of ¿ 0.05 mV), LVH: showing probable or definite left ventricular hypertrophy by Estes' criteria]
8. Maximum Heart Rate Achieved: [Numeric value between 60 and 202]
9. Exercise-Induced angina: [Y: Yes, N: No]
10. Oldpeak: = ST [Numeric value measured in depression]
11. ST Slope: The slope of the peak exercise ST segment [Up:upsloping, Flat: flat, Down: downsloping] The system will predict if there is any heart disease. The output class will be [1: heart disease, 0: Normal] Chatbot: - The user can get to know the causes of heart failure and the diagnosis test required through the chatbot.

- It can also provide links to nearby hospitals/clinics that specialize in heart disease. View Free Checkup Camps:

### 1.3. PROPOSED SYSTEM

There are two modules in our Python-based Heart Failure Prediction System: User and Admin. To log into the system, the user would first need to register. The user would need to provide inputs in order for the system to determine whether or not there is heart failure. Age, gender, type of chest pain, resting

blood pressure, cholesterol, fasting blood sugar, resting electrocardiogram, maximum heart rate, exercise-induced angina, Oldpeak and peak exercise ST segment slope are some of the features. The system will determine if there is any cardiac illness when the user enters all of these data. The user will be informed about the causes of heart failure and the necessary diagnostic test by the chatbot in the system. Additionally, information to nearby hospitals and clinics that specialize in treating heart problems will be provided. Additionally, the customer can look at several free checkup camps

Using their credentials, the administrator can sign in. They are able to see who is utilizing the system. Details on the free checkup camp can also be added.

We created this system using logistic regression. Due to its ability to generate probabilities and categorize new data utilizing continuous and discrete data, this machine learning technique is crucial datasets

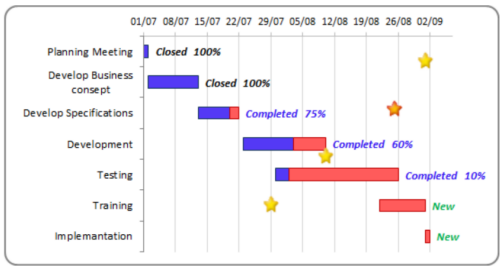


**Figure 1.** *Gantt Chart*

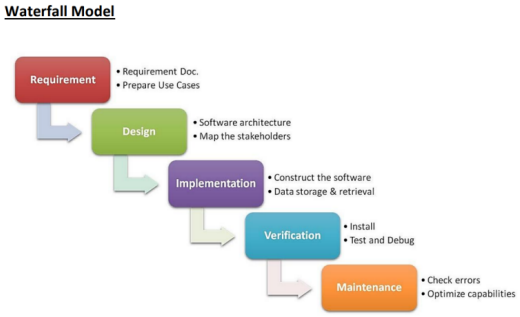


**Figure 2.** *Waterfall model*

## 2. PROJECT DESIGN AND PROJECT IMPLEMENTATION

### 2.1. PROJECT DESIGN

The Django Framework is used for the project's design and development. Django Framework was used to code the project. All databases on the MySQL Server were created and maintained. We wrote queries to store data and keep track of projects.

Python was developed by Guido van Rossum and is a potent, versatile programming language. Its easy-to-understand grammar makes it the ideal language for someone who is just starting to learn computer programming. This is a thorough tutorial on how to begin learning Python, why you should learn it, and how to do so. But if you are familiar with other programming languages and want to learn Python quickly. Python is a general purpose language. It has many applications, from desktop graphical user interfaces 'Pygame, Panda3' to web programming 'such as Django and Bottle', research and computing Orange, SymPy, NumPy and web development including Django and Bottle. Clean syntax and a manageable code length characterize the language. Working in Python is enjoyable because it enables you to concentrate on the subject at hand rather than the syntax.

a straightforward language that is simpler to learn Python's syntax is incredibly straightforward and beautiful. Python applications are easier to read and write than languages such as C++, Java and C. Python makes programming fun, allowing you to focus on answers rather than syntax. Python is an excellent place to start if you are a beginner.

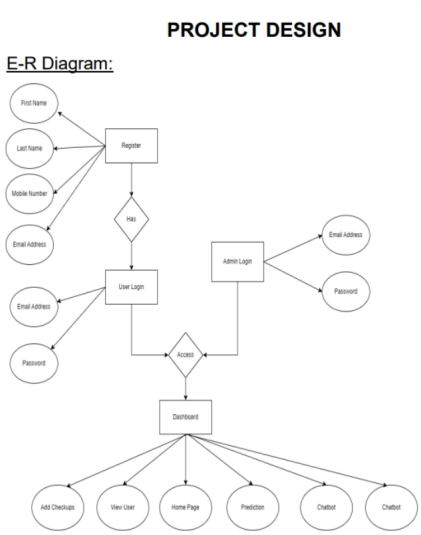


**Figure 3.** *E-R Diagram*

### 2.2. Data Flow Diagram (DFD's)

A data flow diagram is a tool used to describe and analyze how data moves through a system. They form the basis for the creation of other products. Data can be interpreted in terms of the physical body of the body by performing a transformation process from input to output. It is called a logical data flow diagram. The real tools and methods used to transfer data between individuals, offices, and workstations are depicted in the physical data flow diagrams. A collection of data flow diagrams serve as the complete description of a system. Using two symbols that are common The data flow diagrams are created using the Yourdon, Gane, and Sarson notation. Each element of a DFD is given a name that is illustrative. A number that will be used for identifying purposes is also utilized to better identify the process. DFD development takes place on a number of levels. Each process in the lower level diagrams can be further delineated in the higher level DFD. The context diagram is another name for the lop-level diagram. It only has one small process, but the small process is important in understanding how the current system works. In the first stage of DFD, the process in the content hierarchy diagram is decomposed into a process.

As the theory behind the process extends across multiple processes, understanding of information at one level breaks down into more detailed information at the next level. This

is carried out up until the point at which further explosion is required and sufficient information has been provided for analysts to comprehend the procedure.

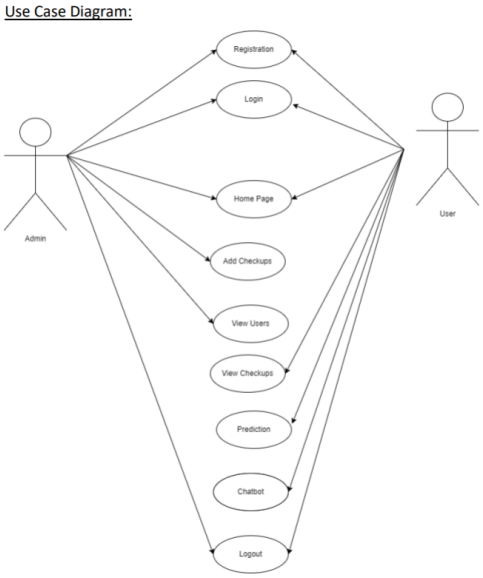


**Figure 4.** *Use Case Diagram*

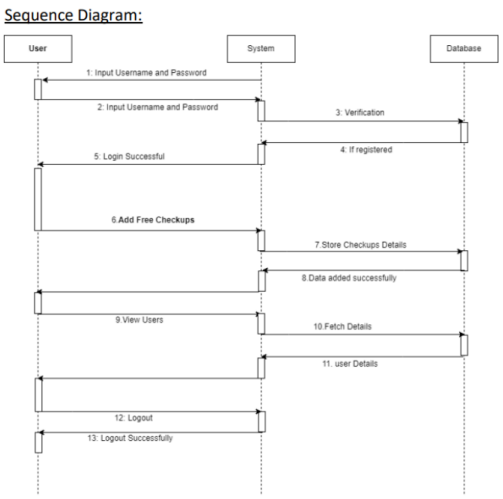


**Figure 5.** *Sequence Diagram of User*

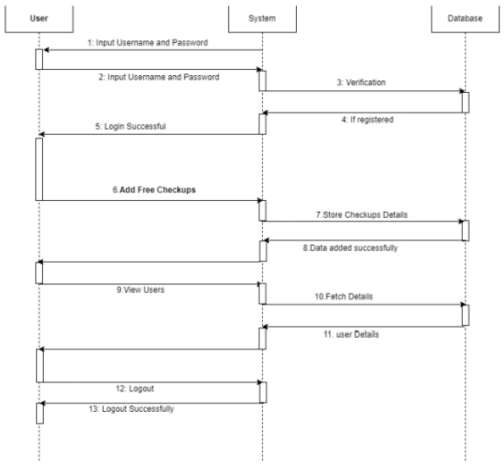


**Figure 6.** *Sequence Diagram of Admin*

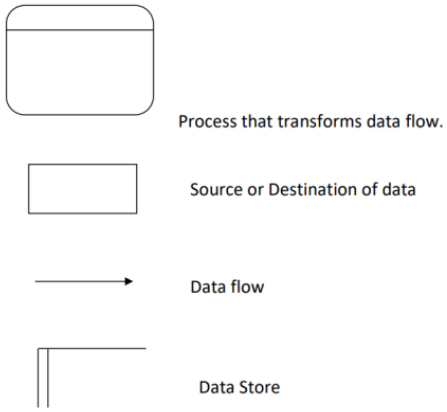


**Figure 7.** *Data Flow Diagram*

## 2.3. RULES GOVERNING THE DFD'S

**PROCESS**

1) The system cannot produce results.

2) No process can have only components. If an object has only inputs, then it must have a getter.

3) There are guide line labels in the process.

**DATA STORE**

1) Data cannot be transferred directly from one storage unit to another; There has to be a process.

2) Data cannot be sent directly to the database from an external source; instead, the data collection process must transfer the data from the source and store it in the database.

3) Archives contain tags.

**SOURCE OR SINK**

Location and or location of the goods.

1) Data cannot be sent directly from the source to the receiver; process must be used.

2) Origin and/or position of the noun phrase

**DATA FLOW**

1) There is only one character stream in a data stream. Reads can occur before updates to both the process's instructions and the stored data. The latter is typically denoted by two distinct arrows, though, because these occur at different types.

2) There is only one character stream in a data stream. Reads can occur before updates to both the process's instructions and the stored data.

3) There is only one character stream in a data stream. Reads can occur before updates to both the process's instructions and the stored data.

4) Updates (deletions or changes) are transferred from the data stream to the data store.

5) Data flows from data stores represent usage or yields.

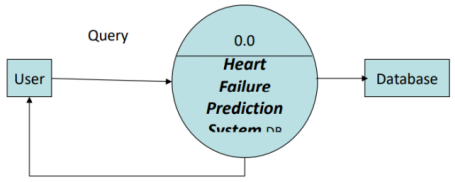


**Figure 8.** *DataBase Detail*

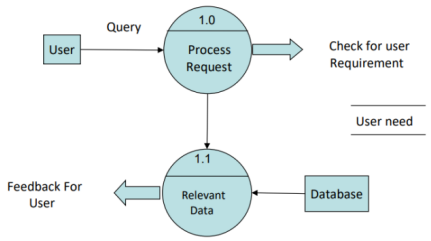


**Figure 9.** *Level 1 DFD*

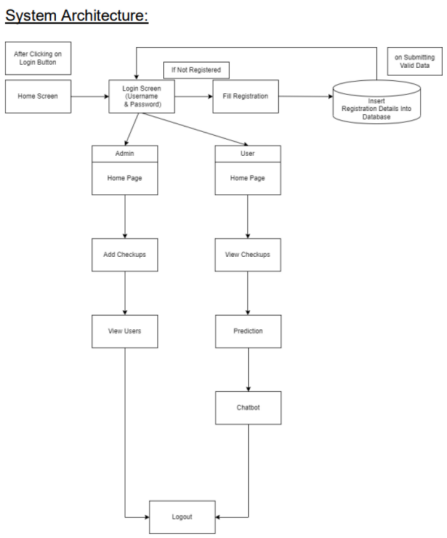


**Figure 10.** *System Architecture*

## 3. PROJECT IMPLEMENTATION

### *3.0.1. Project Implementation Technology*

The Django Framework is used for the project's design and development. Django Framework was used to code the project. All databases on the MySQL Server were created and maintained. We wrote queries to store data and keep track of projects.

### *3.0.2. Hardware Requirement*

Laptop or PC

1. Windows 7 os or higher
2. I3 processor system or higher
3. 4 GB RAM or higher
3. 100 GB ROM or higher

### 3.1. Software Requirement

Laptop or PC

1. Python
2. Sublime text Editor
3. XAMP Server

## 4. OVERVIEW OF TECHNOLOGIES USED

### 4.1. Features of Python Programming

A simple language that is easy to learn Python's syntax is very simple and beautiful. Python is easier to read and write than other programming languages such as C++ and Java. Python makes programming fun, allowing you to focus on answers rather than syntax. Starting with Python is a fantastic choice if you are a beginner.Free and open source Python is open source, so you are allowed to use it and share it, even commercially. You can modify the Python source code in addition to using and disseminating Python-written software. A sizable community is always working to make Python better with each version.

### 4.2. Django

A professional Python web framework called Django supports fast and efficient development. Designed by professional programmers, it eliminates many of the headaches associated with web development, allowing you to focus on building applications instead of building wheels. It is open and free.

### 4.3. Features of Django

Rapid Development
Secure
Scalable
Fully loaded
Versatile
Open Source
Vast and Supported Community

### 4.4. Rapid Development

Django was created with the goal of creating a framework that makes the development of web applications faster. Although the project implementation step takes a long time, Django develops it quickly.

### 4.5. Open Source

An open source web application framework is called Django. It is freely accessible to the general public. Source code can be downloaded from public repositories. The overall cost of developing applications using open source is lower.

### 4.6. WAMP Server

Apache web server, MySQL database server, PHP scripting language, phpMyAdmin (for managing MySQL databases) and SQLiteManager (for managing SQLite databases) are all installed and configured by the Windows OS based application WAMP. WAMP aims to provide an easy alternative to the installation and configuration of Apache, PHP and MySQL packages by offering a simple installation process. WAMP is very simple and can be used immediately after installation. To get it working, you don't need to modify any configuration files or perform any additional settings. Two factors are typically at play when someone decides to install WAMP. To run their own server or for development purposes, they want to install WAMP

### 4.7. WAMP Server Contains

allows you to create new databases, edit or add users, etc. Free PHP-coded software called phpMyAdmin is designed to manage MySQL administration over the Internet. An extensive range of MySQL operations are supported by phpMyAdmin. The user interface supports the most popular tasks, but you can still run any SQL expression manually.


Figure 3.13: My SQL

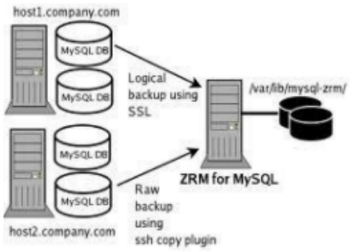


**Figure 11.** *SQL Server and Database System*

### 4.8. SQL Server and Database System

Microsoft's relational database management system, SQL Server, is designed for use in office environments. Computer language T-SQL (Transact-SQL), developed by Sybase and Microsoft, underpins SQL Server and adds a number of capabilities to regular SQL, Examples include transaction management, exceptions and errors, queue processing, and reporting variables.

Generally speaking, any database management system (DBMS) that can respond to SQL-formatted client queries. When capitalized, the phrase typically refers to one of two Microsoft and Sybase database management products. Both businesses sell SQL Server client-server DBMS systems.

### 4.9. Using WAMP as a Development Server

You can use WAMP to build and test your website directly on your computer, without needing a web hosting account. WAMP is mostly used by users for development projects such as learning to create websites using HTML, PHP and MySQL.

WAMP was not intended to be a real production server; rather, it was created as a testing and development server. Since WAMP lacks any meaningful security measures, it provides no defense against attacks of any kind. Your WAMP server is readily hackable by any 10-year-old with internet connection.

Consider this before posting any information online If your website contains sensitive information. Do not use WAMP with a built-in server unless you are an expert administrator and can configure it to be more secure. MySQL configuration Download the most recent version of Essentials as an MSI package first before starting the MySQL installation. When installing MySQL, choose Typical Installation and keep the default configuration settings, with the possible exception of To register, you must select the "Skip registration" option. Once the installation wizard is complete, make sure you select the Configure MySQL server now option. Choose Standard Configuration under MySQL Server Instance Configuration. The next step is to change the Windows PATH option to Include Bin Directory. This setting is essential; otherwise, Apache won't start since it won't be able to find the necessary library, libMySQL.dll.

Finally, enter the correct root password. You don't need to enable remote root access or create an anonymous account.

Please check the notifications sent out during MySQL startup to ensure that MySQL was launched successfully. The system must then be restarted. Otherwise, Apache will complain (perhaps get a little confused) that PHP cannot load the MySQL library php mysql.dll and cannot find the appropriate function.libMySQL.dll when Apache tries to load the PHP module during Apache startup. At this point, restarting the system is required before continuing with PHP configuration.

### 4.10. PHP Configuration

Because the installer does not set up the configuration files correctly, PHP for Windows must be installed directly from the zip package. Get the latest Windows binary for the 5.x series. Create the C: Program Files PHP5 folder and unzip the downloaded package there. You should then copy the php.in file in the C: Program Files PHP5 folder (php.ini is recommended) and make two changes to the php.ini file.

All that is required for PHP configuration is that. Adding the installation path of PHP to Windows PATH might be helpful If you want to run PHP from the command line, but it is not necessary for WAMP to function. Once Apache is set up and tested, PHP setup can be checked as well.

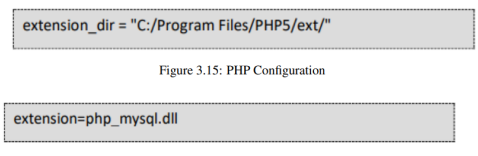


Figure 3.15: PHP Configuration

**Figure 12.** *PHP Configuration*

## 5. FEASIBILITY REPORT

The feasibility study is a high-level summary of the complete procedure meant to respond to several queries, such as: What is the issue? Exists a workable solution to the stated issue? Is the issue really worth addressing? As soon as the issue is well identified, a feasibility study is done. A feasibility study is required to evaluate the technical, operational, and economic aspects of the proposed system in order to determine its viability. A thorough feasibility assessment will give management a clear understanding of the suggested system.

In order to make sure that the project is flexible and free of significant obstacles, the following possibilities are taken into account. In a feasibility study, the following are included:

1. Technical Feasibility
2. Economic Feasibility
3. Operational Feasibility

In this stage, we examine the viability of every system that has been suggested and select the most viable one. The following three primary considerations form the basis of the feasibility study.

### 5.1. Technical Feasibility

At this stage we check the effectiveness of the planning process. Is all technology necessary to create an accessible environment? Technical feasibility of the project evaluates whether theorganization has the necessary technology and skills to complete the process and how this will be achieved. The following reasons may cause the system to fail:

1. Technology to create the system already exists.
2. This system can be expanded further because it is too versatile.
3. This system can provide assurances on data security, usability, accuracy, and reliability.
4. This system answers questions instantly.

Our project is technically possible because all the machines needed for our project can be easily obtained

Operating System = Windows 7 os or higher

Languages = python

Database System = My SQL 5.6

Documentation Tool = MS - Word

### 5.2. Economic Feasibility

Due to the fact that it doesn't necessitate any more funding and can be finished in six months, this project is totally doable economically

This process involves determining which plan is most cost-effective. We contrast the new system's financial gains with the investment. Only when the financial gains outweigh the investments and expenses is the new system economically viable. Economic viability establishes whether or not the project goal can be achieved within the resources allotted to it. He needs to decide whether the benefits of the new system will outweigh the costs or whether it is worth pursuing the entire project. Benefits to the economy must match or surpass costs. In this case, we should take into account:

1. The cost of conducting a full survey.
2. Hardware and software costs for the application category are included.
3. The development tool.
4. Treatment costs etc...

Our proposal is economically viable because the development costs are very low compared to the financial benefits of implementation.

### 5.3. Operational Feasibility

The best operationally practicable solution is determined by which of the proposed systems consumes the least amount of operational resources, such as manpower, time, etc., during this step.

Additionally, the solution must be operationally doable. Operational Feasibility assesses whether the suggested solution may be integrated into the functioning of the current system while still meeting user objectives.

1. The clients fully accept the processing and presentation techniques because they can satisfy all user needs.
2. The system's planning and development included input from the clients.
3. In any case, there won't be any issues with the proposed system.

Due to the fulfillment of the time and personnel criteria, our project is operationally possible. Our team of four people worked on this project for a total of three months.

## 6. TESTING

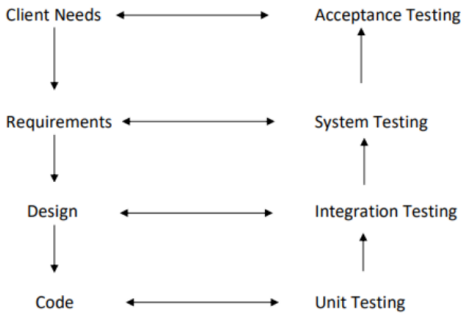


**Figure 13.** *Levels of Testing*

Because a project is so large, testing is required to ensure its success. A project is deemed successful if every component operates flawlessly and produces the required results for every type of input. As a result, the project must be tested for it to be successful.

Here it is tested whether the system meets the customer's needs. While Python is mainly used to create the code for the new system, Django is used to do the front-end design. The new system has been extensively tested, with each application reviewed by users from every angle.

Despite the fact that certain programs had errors, these applications have been fixed before being used. Flow on paper has been shown to be very similar to real flow data.

### 6.1. Levels of Testing

We have the idea of testing phase to find the bug present in different phases. The basic steps of the test are:

The proposed system goes through various tests before it is ready for user acceptance.

### 6.2. Unit Testing

Unit testing focuses on the implementation of modules, which are the smallest components in a software architecture. "Module Testing" is another name for this. Each module is tested independently. This testing was done right during the programming phase. According to the expected output from each module, it was discovered throughout this testing that each module was functioning successfully.

### 6.3. Integration Testing

Information can be transmitted through interactions, and the operation of one module may negatively affect the operation of another module. Convergence testing is a testing process used to design programs and also detect possible bugs. Building a software structure out of unit-tested modules is the goal. The integrated components are tested together. In this case, correction is challenging since the high cost of the overall program makes it difficult to isolate the problem. Therefore, all bugs found during text testing were fixed during integration testing.

### 6.4. System testing

After using the system, it needs to be tested first to ensure that it is accurate and valid before use. The success of the system depends on the tests. The principle of the evaluation system is that if everything about the system is correct, the goal will be achieved successfully.

### 6.5. Validation Testing

The software is fully tested after integration testing. Interfacing mistakes have been found and fixed after being put together as a package. Certification testing (the final process of software testing) begins. testing for validity has several different definitions. However, the clearest explanation is that validation succeeds when the software performs as can be reasonably anticipated by the client. Following a validation test, one of two potential circumstances exist.

The first is when the function or performance qualities meet the criteria and are approved, and the second is when a divergence from the specifications is found and a list of deficiencies is made. Validation testing has been used to test the proposed system under consideration, and it was discovered to be functioning satisfactorily.

### 6.6. Output Testing

It is recommended to perform the output test of the system after checking its accuracy, because any system that cannot produce the required products in the desired form will not work. Examining the output produced by the system in question will ask the user which format should be used. Here consider output data in two different ways: on the screen and in printed form. The output displayed on the screen is guaranteed to be accurate because it was created with the user's needs in mind during the design process. The result meets the users' specifications for the physical copy as well. As a result, output testing does not lead to system corrections.

### 6.7. User Acceptance Testing

The success of any system is largely dependent on user acceptability. The system under investigation is put to the test for user approval by regularly communicating with potential system users while it is being developed and making changes as needed.

### 6.8. Test Cases

Registration: Before logging in, a user must first complete a simple registration form. On the registration page, there are numerous fields that users must fill out. The login id field is character-free for the user. Login: If the user name or password used during login does not match, an error message will be displayed.

### 6.9. VALIDATION CRITERIA

1. No field that cannot be null should be left empty on any form.
2. Non-numeric values should be examined in all numeric fields. Similar to this, no numeric characters should be used in text fields like names.
3. All master keys must be generated to prevent users from using existing keys.
4. Each Save, Edit, Delete, and other significant activities use error handling.
5. The information should be checked as the user enters it from each tab or text box, and if it is incorrect, the focus should be returned to the text box and the appropriate message displayed.

## 7. ADVANTAGES OF PROJECT

### 7.1. Advantages:

1. The system is easy to maintain.
2. It is user-friendly.
3. Users can search for a doctor's help at any point in time.
4. Very useful in case of emergency.
5. They can also look for free check-up camps.

### 7.2. Limitations:

1. To make a complete diagnosis, the system requires data from the user; it is not entirely automated.
2. The system will generate inaccurate results if a user enters any incorrect information.

## 8. Conclusion

This was our "Heart Failure Prediction System" system design project, which was created in Python using Django. We need to work hard to improve this system. We all feel that this system has given us a great deal of satisfaction. Even though no task in the development industry will ever be considered ideal, there may be room for improvement in this application. We discovered a great deal about the topic of development and learned a great deal. We anticipate success from this.

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THANKYOU 😄

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