

ALLIANCE COLLEGE OF ENGINEERING AND DESIGN



**ALLIANCE
UNIVERSITY**
Private University established in Karnataka State by Act No.34 of year 2010
Recognized by the University Grants Commission (UGC), New Delhi

Alliance College of Engineering and Design

ELECTRICITY METER DATA DISCREPANCY DETECTING SYSTEM USING OCR

A PROJECT REPORT

SUBMITTED BY

AKSHITA SINGH

REG NO: 2022BCSE07AED832

SEMESTER: 4TH

SESSION: 2022-2024

Under The Supervision Of

Mr. KISHOR KUNAL

In partial fulfillment for the award of the degree

Bachelor's of Technology in Computer Science (B.TECH CSE)

2024

ALLIANCE COLLEGE OF ENGINEERING AND DESIGN

ALLIANCE UNIVERSITY

Alliance University - Central Campus, Chikkahadage Cross Chandapura-Anekal, Main Road, Bengaluru,
Karnataka 562106

Project Report
On
ELECTRICITY METER DATA DISCREPANCY
DETECTING SYSTEM USING OCR
OF
BIHAR STATE POWER HOLDING COMPANY LIMITED

Submitted to the Alliance University, Bangalore



In partial fulfillment of the requirement for the award of the degree
Bachelor's of Technology in Computer Science (B.TECH CSE)

2024

GUIDED BY:

MR. KISHOR KUNAL

SUBMITTED BY:

AKSHITA SINGH

ALLIANCE COLLEGE OF ENGINEERING AND DESIGN

ALLIANCE UNIVERSITY

Alliance University - Central Campus, Chikkahadage Cross Chandapura-Anekal, Main Road, Bengaluru,
Karnataka 562106



PROJECT REPORT

Submitted in partial fulfillment of the requirement for the award of the degree

Bachelor's of Technology in Computer Science (B.TECH CSE)

4th semester

SESSION:2022-2024

CERTIFICATE OF ORIGINALITY

This is to certify that the project report entitled "**Electricity Meter Data Discrepancy Detecting System Using OCR**" Submitted to Alliance College Of Engineering and Design, Alliance University in partial fulfillment of the requirement for the award of the degree of **Bachelor's of Technology in Computer Science (B.TECH CSE)** is an authentic and original work carried out by Miss Akshita Singh with Reg.No. 2022BCSE07AED832 Under my guidance for the duration of 25 days (21st June'24 to 15th July'24).

The matter embodied in this project is genuine work done by the student and has not been submitted whether to this university or to any other university/Institute for the fulfillment of the requirements of any course of study.

.....

Signature of the Student:

Date:

Name of the student

AKSHITA SINGH

.....

Signature of the Guide:

Date:

Name, Designation and

Address of Guide:

MR. KISHOR KUNAL

BIHAR STATE POWER GENERATION
COMPANY LIMITED (BSPGCL),Vid�t
Bhawan, Bailey Road, Patna, Bihar, Patna-
800001

ALLIANCE COLLEGE OF ENGINEERING AND DESIGN



Alliance College of Engineering and design is a constituent unit of Alliance University, Bangalore. It was established in the year 2010 to foster the cause of education for both men and women in the state of Karnataka. The college possesses a campus of 60 + acres with the student strength of around 5000 students and 200 strong core faculty members along with some visiting/guest faculties. This institution is a multi faculty college imparting teaching up to Degree Honours stage in Science, Commerce and Arts.

As an Institution of learning it has a commanding presence both in the University as well as in the capital of the state the college while maintaining its exemplary record in University examination has also emerged as a serious contender in the Inter University competition winning last number of prices.

Objective of the College:-

Our primary objective is to import higher education for everyone. At the same time, we strive to provide the students an opportunity for self-expression, innovation, initiative and wide exposure to facilitate the all-round development. While fostering a stimulating academic environment, the college attempts at instilling in the student values and attitude which recognise the human imperatives of strife free community.

BIHAR STATE POWER HOLDING COMPANY LIMITED



Bihar State Power Holding Company Limited (BSPHCL), formerly Bihar State Electricity Board (BSEB) is a state-owned electricity regulation board operating within the state of Bihar in India. BSEB was established in 1958 as a statutory corporation under the Electricity (Supply) Act 1948. As of November 2012, BSEB has nearly 1,700 officers and 14,850 employees. The derated capacity comes to just 530 MW. The BSEB was unbundled on 2ND August 2011. Power Finance Corporation was the main Consultant for BSEB's restructuring.

BSEB formally started functioning as five companies on 1st November 2012 namely:

- Bihar State Power generation Company Limited (generation business)
- Bihar State Power Transmission Company Limited (transmission business)
- North Bihar Power Distribution Company Limited (distribution business)
- South Bihar Power Distribution Company Limited (distribution business)
- Bihar State Power Holding Company Limited (apex holding company)

The duties of the company have been defined in the Section 18 of the Electricity Supply Act, 1948. It has been charged with the responsibility of promoting a coordinated development of generation, supply and distribution of electricity in the state of Bihar on an efficient and economic basis of Management.

Though BSPHCL deals in only one product, i.e., electrical power, its significance and utility value is enormous for the state. Almost all aspects of modern life style are dependent on it in one way or another.

- In order to ensure that its responsibilities are discharged effectively and efficiently, the Company has engaged nearly 1,700 officers and 14,850 on various posts to

generate its own power and to maintain proper distribution system. It arranges to supply the electricity properly to the consumers and maintain the equipment .

- The responsibility of catering to entire state means BSPHCL must always be able to understand present as well as future trends of power consumption. It has to formulate and implement schemes for power generation so that growth in demand can be met successfully in time.
- The company has its full-fledged Accounts and Adult Department for proper keep-up of its financial transaction as also to ensure efficient financial management on the commercial line.
- The company has also its personnel wing to safeguard the interest of all its employees. The bio-data and the service records of the employee have been computerized in its Headquarters.
- The entire organization of the Bihar State Power Holding Company Limited has been set up keeping in view the function entrusted to it, i.e., coordinated development of generation, transmission and distribution of electricity in the State.

SYNOPSIS

Title of the Project: Electricity Meter Data Discrepancy Detecting System using OCR

Aim:

This project is being developed for Bihar State Power (Holding) Company Limited (BSPHCL). This Electricity Meter Data Discrepancy Detecting System detects mismatch instantly. We aim to

Design and Build an effective model that will help us to do many things like:

- . It minimizes errors.
- . Quick and easy mismatch detection.

The main objective of the project:

For the successful implementation of this new mismatch detecting system, the following steps should be taken:

- * Research and choose the right mismatch detecting system.
- * Define goal and set target dates.
- * Create an implementation plan.
- * Execute the plan efficiently.

Methodology:

The flow chart and n-tier architecture will be used in this project using MySQL.

The minimum hardware and software requirements:-

- Processor: Intel core i5 or equivalent processor
- Ram: 8GB
- hard disc: 1TB
- frontend: PyQt
- back end: Python

Submitted by: -
Akshita Singh
Reg.No.: 832
Session:- 2022-2024

Acknowledgement

I express thanks and gratitude to almighty god, my parents and other family members and friends without whose uncontained support, I could not have made this career in BTech computer science.

I wish to place on my record my deep sense of gratitude to my project guide DBA Mr. Kishor Kunal, BSPGCL, Bihar. I express my gratitude to (Dr) A. Ezil. Sam Leni, HOD, B. TECH (CSE & IT), Alliance College of Engineering and design, Bangalore for her valuable suggestions and advises throughout the BTECH course. I also extend my thanks to other faculties for their cooperation during my course.

It was memorable experience for me to visit the Office/Company. I am grateful to Bihar State Power generation company (BSPGCL), Bihar for providing me with an opportunity to work with them.

AKSHITA SINGH

INDEX

Content

page no.

1) Introduction	1-2
• Objectives	
• Purpose of the project	
2) System analysis	2- 7
• Identification of need	
• Preliminary Investigation	
• Feasibility Study	
• Project Planning & Project Scheduling	
PERT Chart	
GANTT Chart	
3) Software Requirement Specifications (SRS)	8-15
4) Software Engineering Paradigm Applied	16-17
5) Entity Relationship Model (ER-Model)	18-19
6) MySQL Coding	20-22
7) The Hypothesis	23
8) Conclusion	24
9) Limitations	25
10) Future Enhancement	26
11) Beneficial For BSPHCL	27

ELECTRICITY METER DATA DISCREPANCY DETECTING SYSTEM USING OCR

INTRODUCTION

The purpose of this project is to design and create an effective model that will help us to identify the discrepancy in the electricity meter bill readings.

Basically, it is a programming model that will pop a notification every time there is a mismatch in the scanned reading of the electricity meter and the manual typed reading. This will help us to reduce the loss of both the company as well as the customer and it will also help to generate the correct bill.

This project will handle the following sections:

- maintaining the record of the client.
- maintaining the details of the software and application developed by the company.
- maintaining the bill related information.

Objectives:

The main or the general objective of this proposed system is to develop a new computerised or automated system which is known as ELECTRICITY METRE DATA DISCREPANCY DETECTING SYSTEM USING OCR which is effective easy to manage maintainable and reliable.

The project will achieve the following specific objectives:

- Used to create well organize database.
- Easy to manage, operate and control.
- Used to improve the reliability, maintainability and integrity.
- To make accurate work done within short period of time.
- Used to secure all information which is related to electricity bill.
- Used to access the condition and functionality of electricity bill.
- Used to classify bill by their category.

Purpose of the project:

The specifications listed below are mandatory and must be met in order to be the proposal to gain a valid acceptance after the completion of ELECTRICITY METRE DATA DISCREPANCY DETECTING SYSTEM USING OCR.

Some of the evaluation of ELECTRICITY METRE DATA DISCREPANCY DETECTING SYSTEM USING OCR includes:

- It must have a secure database after the completion of the project.
- It must have a bill breakdown period into two-time intervals for the guarantee of the system.

- The evaluation should be participated the concern body of the organisation employee experience once and the application team.

System Analysis:

The first step of analysis process involves the identification of need. The success of a system depends largely on how accurately a problem is defined, thoroughly investigated and satisfying the customer needs by providing user friendly environment.

This system has been developed in order to overcome the difficulties encountered while keeping the track of electricity meter reading. Providing user friendly communication channel, to maintain and monitor the electricity metre reading details are motivating factors for the development of the system.

Identification of the need:

After analyzing the requirements of the task to be performed, the next step is to analyse the problem and understand its context. The first activity in the phase is studying the existing system and other is to understand the requirement and domain of new system. Both the activities are equally important, but the first activities serves as a basis of giving the functional specifications and then successful design of the proposed system. Understanding the properties and requirements of the new system is more difficult and requires creative thinking and understanding of a existing running system is also difficult, improper understanding of present system can lead diversion from solution.

Preliminary investigation:

Existing system:

The existing system works on manually therefore accessing services easily by the admin/employee is not possible. All the processes are performed manually; thus, it takes more time when the process is performed manually.

Limitation of existing system:

- Time consumption is very high.
- It is difficult to generate correct bill.
- It causes discrepancies sometimes.
- Chances of having a loss is more.

Proposed system:

The proposed system solves the drawback of the existing system and work satisfactorily. The proposed system is a good management information system. The proposed system is supposed to handle as many numbers of electricity metre readings details and customer and employee request as possible in any particular time.

Advantages:

- Data manipulation is easily done.
- Separate tables are used to store separate information.
- Identifies the discrepancies preventing revenue loss.
- Enhances the accuracy of the system.

Feasibility Study:

a) Non- Functional:

Preliminary investigation examines the project's feasibility, the likelihood of the system will be useful to the organization. The main objective of the feasibility study is to test the technical, operational and economical feasibility for adding new models and debugging the old running system. All system is feasible if they have unlimited resources and infinite time. There are aspects in the feasibility study portion of the preliminary investigation:

- technical feasibility
- operational feasibility
- economical feasibility

Technical feasibility:

The technical issue usually raised during the feasibility stage of the investigation includes the following:

- Does then necessary Technology exist to do what is suggested?
- Are there technical guarantees of accuracy, reliability, ease of access and data security?
- Can the system be upgraded if developed? will the proposed system provide adequate response to enquiry regardless of the number or location of users?
- Do the proposed equipments have the technical capacity to hold the data required to use the new system?

Earlier no system existed to cater to the needs of “secure electricity metre reading system”. The current system developed is technically feasible, it is a electricity metre data descreipency detecting system using ocr. Thus, it provides an easy access to the users. The database's purpose is to create, establish and maintain a work flow among various entities in order to facilitate all concerned users in their various capacities or roles. Permission to the users would be granted based on the roles. Specified.

Therefore, it provides the technical guarantee of accuracy, reliability and security. The Software and Hardware requirements for the development of this project are not many and are already available. The work for the project is done with the current equipment and existing software technology.

Operational feasibility:

Proposed projects are beneficial only if they can be turned out into information system. That will meet the organization's operating requirements. Operational feasibility aspects of the project are to be taken as an important part of the project implementation. Some of the important issues raised are to test the operational feasibility of a project includes the following:

- Is there sufficient support for the management from the users?
- Will the system be used and work properly if it is being developed and implemented?
- Will there be any resistance from the user that will undermine the possible application benefits?

This system is targeted to be in accordance with the above-mentioned issues. Beforehand, the management issues and user requirements have been taken into consideration. So there is no question of resistance from the user that can undermine the possible application benefits.

The well-planned design would ensure the optimal utilization of the computer resources and would help in the improvement of performance status.

Economical feasibility:

A system can be developed technically and that will be used if installed must still be a good investment for the organization. In the economical feasibility, the development cost in creating the system is evaluated against the ultimate benefit derived from the new systems. Financial benefits must be equal or exceed the costs.

The system is economically feasible. It does not require any additional hardware or software. Since the system is developed using the existing resources and technologies available, there is nominal expenditure and economical feasibility.

b) Functional requirements:

In the flexibility of the uses the interface has been developed a graphics concept in mind, associated through a browser interface. The GUIs at the top level have been categorized as

- Administrative user interface
- The operational or generic user interface

The administrative user interface concentrates on the consistent information that is practically, part of the organizational activities and which needs proper authentication for the data collection. The interfaces help the administration with all the reading states like data insertion, data deletion and data updating along with the extensive data search capabilities.

The operational or generic user interface helps the users upon the system in reading through the existing data and required services. The operational user interface also helps the ordinary users in managing their own information in a categorized manner as per the assisted flexibilities.

Number Of Modules:

The system after careful analysis has been identified to be presented with the following modules:

1. Administrator
2. Employees
3. Customers
4. Services
5. Reports
6. Authentication

Administration:

Administration is the chief of the ELECTRICITY METRE DATA DESCRIPTOR SYSTEM USING OCR. He can have all the privileges to do anything in this system. Administrator can register new employees/departments into the system. Admin can keep track of team employees and their performance. For every request admin receives the feedback report. New services are introduced by the administrator into the ELECTRICITY METRE DATA DISCREPANCY DETECTING SYSTEM USING OCR. For every request the admin captures the information of employee ID, customer ID, date, time, meter reading, etc.

Electricity Meter Data Discrepancy Detecting System Using ocr employees:

Here a team of employees means they are maintaining the **Electricity Meter Data Discrepancy Detecting System Using OCR**. The major responsibility for the employees is they have to receive the request from the employee and process the employee queries. The challenging issue is here that they can give necessary answer of employee queries because different employees are posting various service queries.

Services

Employee Service also known as client service is the provision of service to employee before, during and after purchase. Employee service is a series of activities designed to enhance the level of employee satisfaction. Here employee services may be provided by an online Call Centre person. Employee services is integral part of a company employee value proportions. Service in the sense of

- Clarifying the employee doubts.
- Process the employee queries.
- Assign new services to employees.

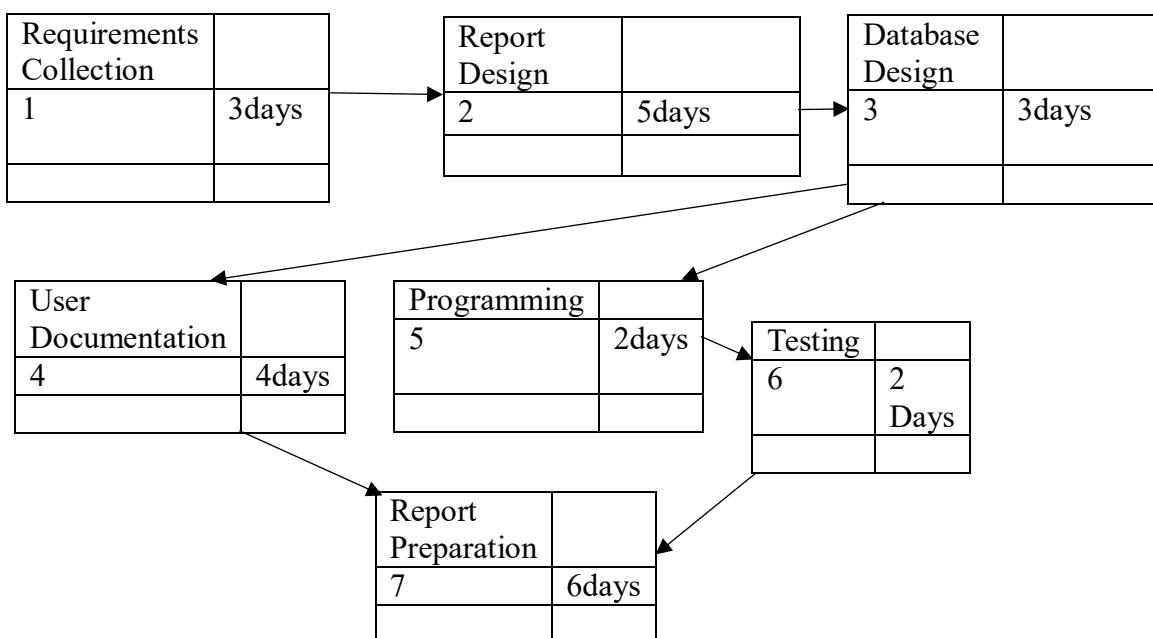
Project planning and scheduling:

Project planning is a part of project management, which relates to the use of schedules such as Gantt charts to plan and subsequently report progress within the project environment. At this stage, the project plan may be optimized to achieve the appropriate balance between resource uses and project duration to comply with the Project objective. Once established and agreed, the plan becomes what is known as the baseline. Progress will be measured against the baseline, throughout the life of the project. Analyzing progress compare to the baseline is known as earned value management.

The project schedule is the calendar that links the task to be done with the resources that will do them. Before a project schedule can be created, the project manager must have a work breakdown structure (WBS), an effort estimate for each task and resource list with availability for each resource. If these are not yet available, it may be possible to create something that looks like a schedule, but it will essentially be a work of fiction.

Pert Chart:

A PERT chart is a graphic representation of a project schedule, showing the sequence of tasks, which task can be performed simultaneously, and the critical path of task that must be completed on time and order for the project to meet its completion deadline.



Gantt chart:

Gantt chart is also called timeline chart. There are several tools on the basis of which the entire functioning of the system can be represented. There are some graphical tools which help in displaying the information regarding the several phases of the system developing life cycle. One of the major tools is GANTT charts with the help of this chart time scheduling is performed through which the system will pass through that is it emphasizes on the schedule or the calendar time during which any individual phase of the project is completed. This tool is helpful in evaluating the performance of any team during the development of the system.

GANTT chart related to the project on below:

Sr. No	Tasks	Duration
1	Planning	5days
2	Analysis & Design	5days
3	Implementation	7days
4	Testing	4days
5	Documentation	4days

Software Requirements Specification:

Purpose:

The main purpose for preparing this document is to give a General inside into the analysis and requirements of the existing system or situation and for determining the operating characteristics of the system.

Scope:

This document plays a vital role in the development and describes the complete requirement of the system. It is meant for use by the developers and will be the basic during testing phase. Any changes made to the requirements in the future will have to go through formal change approval process.

Developer's responsibilities overview:

The developer is responsible for:

- Developing the system which meet the SRS and solving all the requirements of the system.
- Demonstrating the system and installing the system at lines location after the acceptance testing is successful.
- Submitting the required user manual describe in the system interfaces to work on it and also the documents of the system.
- Conducting any user training that might be needed for using the system.
- Maintaining the system for a period of one year after installation.

System specification:

Hardware requirements:

- **Processor:** Intel core i5
- **Ram:** 8GB
- **Hard Disc:** 1TB

software requirements:

- **Frontend:** PyQt
- **Database:** my SQL
- **Querying language:** my SQL
- **Backend:** python

Selected Software:

MySQL:

MySQL is an open-source relational database management system (RDBMS) based on Structured Query Language (SQL). It is one of the most popular databases in the world, used by organizations to store and manage data efficiently.

Key Features:

- Open-Source: MySQL is available as an open-source software under the GNU General Public License (GPL). There is also a commercial version provided by Oracle Corporation, which owns MySQL.
- Relational Database: MySQL is a relational database, meaning data is stored in tables and can be related based on data types and relationships.
- SQL Compliance: MySQL supports SQL (Structured Query Language) for querying and managing the database.
- Scalability: MySQL can handle large databases and supports both small and large applications.
- Performance: It is known for its fast performance in terms of data retrieval and manipulation.
- Security: MySQL provides robust security features including data encryption, user authentication, and access control.
- Replication: Supports master-slave replication, allowing data from one MySQL database server to be copied to another.
- Storage Engines: MySQL supports multiple storage engines like InnoDB, MyISAM, etc., allowing users to choose the best engine for their specific needs.
- Cross-Platform: MySQL can run on various operating systems including Windows, Linux, and macOS.

Components:

- Server: The MySQL server manages databases and handles database operations such as querying and updating data.
- Client: MySQL provides a client program that allows users to interact with the server to perform database operations.
- Connectors: MySQL connectors enable applications written in different programming languages (e.g., Java, C++, Python) to interact with MySQL.

- Workbench: MySQL Workbench is a graphical tool for database architects, developers, and DBAs to design, develop, and administer MySQL databases.

Common Use Cases:

- Web Applications: Many web applications use MySQL for storing user data, content management, and other purposes.
- Data Warehousing: MySQL can be used for data warehousing and analytics.
- E-commerce: E-commerce platforms use MySQL to manage product inventories, customer information, and transactions.
- Logging Applications: MySQL is used to store logs generated by applications for monitoring and analysis.

Basic SQL Operations in MySQL:

Creating a Database:

```
CREATE DATABASE example_db;
```

Creating a Table:

```
CREATE TABLE users (
    id INT AUTO_INCREMENT PRIMARY KEY,
    username VARCHAR (50) NOT NULL,
    email VARCHAR (100) NOT NULL
);
```

Inserting Data:

```
INSERT INTO users (username, email) VALUES ('john_doe', 'john@example.com');
```

Querying Data:

```
SELECT * FROM users;
```

Updating Data:

```
UPDATE users SET email = 'john_new@example.com' WHERE id = 1;
```

Deleting Data:

```
DELETE FROM users WHERE id = 1;
```

Administration:

- Backup and Restore: Using tools like MySQL dump for backup and restoring data.
- User Management: Creating and managing user accounts and permissions using SQL commands or MySQL Workbench.
- Performance Tuning: Optimizing queries, indexing, and configuring MySQL settings for better performance.
- Community and Support
- Community Edition: Free and open-source version with community support.
- Enterprise Edition: Paid version with additional features and official support from Oracle.
- Documentation: Comprehensive official documentation available online.
- Community Forums: Active community forums and user groups.

Relational Databases:

Relational databases are a type of database management system (DBMS) that store and manage data in tables. These tables are organized into rows and columns, where each row represents a unique record and each column represents a field of the record. The core concept of a relational database is the relationship between different tables, which is managed through the use of keys.

Key Concepts of Relational Databases:

- Tables: The fundamental storage structure in a relational database, where data is stored in rows and columns. Each table typically represents an entity, such as customers, orders, or products.
- Rows: Also called records or tuples, each row in a table represents a single, unique entry of data. For example, a row in a customer table might contain the name, address, and contact information for a single customer.

- Columns: Also known as fields or attributes, columns in a table define the type of data stored. For example, columns in a customer table might include CustomerID, Name, Address, and PhoneNumber.
- Primary Key: A unique identifier for each row in a table. The primary key ensures that each record can be uniquely identified. For example, CustomerID might be the primary key in a customer table.
- Foreign Key: A field in a table that creates a relationship between two tables. It is a reference to the primary key in another table. For example, an Order table might have a CustomerID column that refers to the CustomerID in the Customer table, establishing a relationship between orders and customers.
- Indexes: Structures that improve the speed of data retrieval operations on a database table. Indexes are created on columns to allow quick search and retrieval.
- Normalization: The process of organizing the fields and tables of a relational database to minimize redundancy and dependency. Normalization involves dividing large tables into smaller ones and defining relationships between them to improve data integrity.
- SQL (Structured Query Language): The standard programming language used to manage and manipulate relational databases. SQL commands can be used to create tables, insert data, update data, delete data, and query data.

Advantages of Relational Databases:

- Data Integrity: Ensured through the use of primary and foreign keys and constraints that enforce rules on the data.
- Flexibility: SQL provides powerful querying capabilities, allowing for complex queries and data manipulation.
- Scalability: Relational databases can handle large volumes of data and complex transactions.
- Security: Advanced security features, such as user permissions and access controls, protect data.

Popular Relational Database Management Systems (RDBMS):

- MySQL: An open-source RDBMS that is widely used for web applications.
- PostgreSQL: An advanced open-source RDBMS known for its robustness and support for complex queries.
- Microsoft SQL Server: A comprehensive RDBMS from Microsoft, often used in enterprise environments.
- Oracle Database: A powerful RDBMS used in various large-scale and enterprise applications.

WHY PYTHON ?

Python is a high-level, interpreted programming language known for its simplicity, readability, and versatility. Developed by Guido van Rossum and first released in 1991, Python has since become one of the most popular programming languages worldwide. Here's a detailed look at its features, applications, and benefits:

Key Features:

1. Readability and Simplicity

Syntax: Python's syntax is clear and intuitive, resembling natural language. This makes it easy to learn and understand, even for beginners.

Indentation: Python uses indentation to define code blocks, which enhances readability and enforces a clean coding style.

2. Interpreted Language

Execution: Python code is executed line-by-line by the Python interpreter, which means you can run your program directly without a compilation step. This facilitates rapid development and testing.

3. Dynamically Typed

Dynamic Typing: In Python, you don't need to declare the type of a variable explicitly. The type is determined at runtime, which adds flexibility to coding.

4. Extensive Standard Library

Built-in Modules: Python comes with a comprehensive standard library that supports a wide range of tasks, from file handling and regular expressions to web development and data analysis.

5. Support for Multiple Programming Paradigms

Paradigms: Python supports procedural, object-oriented, and functional programming styles, giving developers the flexibility to choose the best approach for their projects.

6. Community and Ecosystem

Open Source: Python is open-source, which means its source code is freely available. A large and active community contributes to its development and provides extensive support through forums, documentation, and tutorials.

Third-party Libraries: There are numerous third-party libraries and frameworks available for Python, such as NumPy, pandas, Django, Flask, and TensorFlow, which extend its capabilities.

Applications:

1. Web Development

Frameworks: Python is used for web development with frameworks like Django and Flask, which facilitate rapid development and scalable applications.

2. Data Science and Machine Learning

Libraries: Libraries like NumPy, pandas, Matplotlib, Scikit-learn, and TensorFlow make Python a powerful tool for data analysis, visualization, and machine learning.

3. Automation and Scripting

Scripts: Python is often used for writing scripts to automate repetitive tasks, such as file manipulation, data extraction, and system administration.

4. Scientific Computing

Research: Python is widely used in scientific research for simulations, data analysis, and visualization due to its simplicity and the availability of scientific libraries like SciPy.

5. Software Development

Prototyping: Python is an excellent choice for prototyping and developing applications quickly due to its rapid development capabilities.

6. Game Development

Libraries: Libraries like Pygame allow for the creation of games and multimedia applications.

Benefits:

1. Ease of Learning

Beginner-friendly: Python's simple syntax and readability make it an excellent language for beginners.

2. Versatility

Wide Use: Python's ability to handle different programming paradigms and applications makes it versatile for various types of projects.

3. Community Support

Resources: The extensive community support provides ample resources for learning and troubleshooting.

SOFTWARE ENGINEERING PARADIGM APPLIED:

Software engineering is the establishment and use of engineering principles in order to obtain economically sound software that is reliable and works efficiently on real machine. Software engineering is a layered Technology. An Engineering approach (including software engineering) must rest on an organizational commitment to quality. The foundation for software engineering is a process layer. Software engineering process is the Glue that holds the technology layers together and enables rational and timely development of software.

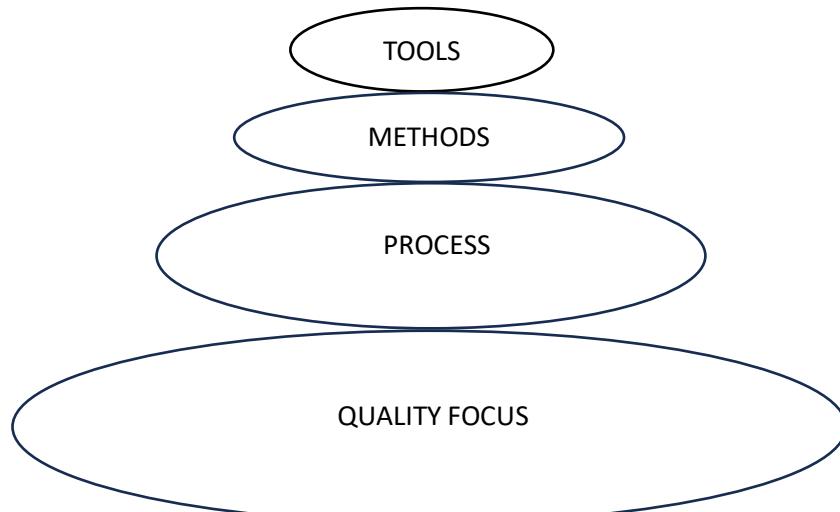


FIG: Software Engineering Layers

A process model for software engineering is chosen based on the nature of the project and application, the methods and tools to be used and the controls and deliverables that are required. There are so many software engineering paradigms suggested by expert for software development. Software Paradigms are used on the nature of project. These are:

- Linear sequential model
- The prototype model
- The RAD Model
- The incremental model
- The spiral model
- The WINWIN model

from the above all software paradigm I have suggested the “linear sequential model” as the requirement of the project for choosing this model I have scan the characteristics of the project.

This document plays a vital role in the development of life cycle as it describes the complete requirement of the system. It means for use by developers and will be the basic during testing phase, any changes made to the requirement in future will have to go through formal change approval process.

SPIRAL MODEL:

Spiral model was designed by Barry Boehm in his 1988 article, “A spiral model of Software Development and Enhancement”. This model was not the first model to discuss iterative development but it was the first model to explain why the iteration models.

As originally and envisioned, the iterations were typically 6 months to 2 years long. Each phase starts with the design goal and ends with a client reviewing the progress so far. Analyzing and Engineering efforts are applied at each phase of the project, with an eye toward the end goal of the project.

The steps for spiral model can be generalized as follows:

- The new system requirements are defined in as much details as possible, this usually involves interviewing a number of users representing all the external or internal users and other aspects of the existing system.
- A preliminary design is created for the new system.
- A first prototype of the new system is constructed for the preliminary design, this is usually a scaled down system and represents an approximation of the characteristics of the final product.
- A second prototype is evolved by a fourfold procedure.
 - a) Evaluating the first prototype in terms of its strengths, weaknesses and risk.
 - b) Defining the requirements of the second prototype.
 - c) Planning and designing the second prototype.
 - d) Constructing and testing the second prototype.
- At the employee's option, the entire project can be aborted if the risk is deemed too great. Risk factors might involve development cost overruns, operating cost miscalculation or any other factor that could in the employee's judgement result in a less than satisfactory final product.
- The existing prototype is evaluated in the same manner as was the previous prototype, and if necessary, another prototype is developed from it according to the fourfold procedure outline above.
- The preceding steps are iterated until the employees satisfied that the refined prototype represents the final product desired.
- The final system is constructed, based on the refined prototype.
- The final system is thoroughly evaluated and tested. Routine maintenance is carried on a continuing basis to prevent large scale failures and to minimize down time.

ER DIAGRAM:

An Entity-Relationship (ER) diagram is a visual representation of data that describes how entities (or objects) relate to each other within a system. Here's a detailed explanation of the components and purpose of an ER diagram:

Components of an ER Diagram:

- Entities: Entities are objects or concepts that are represented in the database and can be distinguished from each other. For example, in a university database, entities could include Student, Course, and Professor.
- Attributes: Attributes are properties or characteristics of entities that help describe them. For instance, a student entity may have attributes like StudentID, Name, and DateOfBirth.
- Relationships: Relationships illustrate how entities interact with each other. They show the associations between entities. For example, a relationship between Student and Course can indicate that a student enrolls in a course.
- Primary Key: A primary key is a unique identifier for each record in a table. It uniquely identifies a row in the database table. In an ER diagram, it's represented using an underline.
- Foreign Key: A foreign key is a column or group of columns in a relational database table that provides a link between data in two tables. It acts as a cross-reference between tables because it references the primary key of another table.

Purpose of an ER Diagram:

- Design Clarity: ER diagrams help in visualizing the database structure and design before the actual implementation. They provide a clear understanding of the entities, their attributes, and how they relate to each other.
- Communication Tool: They serve as a communication tool between stakeholders, including database designers, developers, and end-users. ER diagrams help in discussing and refining the database structure based on requirements.
- Database Construction: ER diagrams serve as a blueprint for constructing the actual database. They guide the creation of tables, relationships, and constraints in the database management system.
- Normalization: ER diagrams aid in the normalization process, ensuring that the database design follows best practices for minimizing redundancy and maintaining data integrity.

THE HYPOTHESIS:

To develop an electricity meter data discrepancy detecting system using OCR with Python as backend, PyQt as frontend, and MySQL as database, we can do these things like:

Backend (Python with OCR):

- **OCR Implementation:** We can choose an OCR library suitable for reading text from images. Tesseract OCR (pytesseract) is a popular choice in Python.
- **Data Extraction:** We can capture images of electricity meters using a camera or by reading pre-captured images. We can also process these images using OpenCV to extract the digits or text representing meter readings.
- **Data Storage:** We can establish a connection to MySQL using mysql-connector-python and define a schema for storing meter readings, timestamps, and other relevant data.
- **Discrepancy Detection:** We can implement algorithms to compare current meter readings with previous readings stored in the database. And define thresholds or rules to detect discrepancies (e.g., sudden jumps in readings beyond a certain limit).

Frontend (PyQt):

- **User Interface Design:** We can use PyQt to design a graphical user interface (GUI) for interacting with the system and create forms for displaying meter readings, detected discrepancies, and historical data.
- **Integration with Backend:** We can connect PyQt widgets to backend functions for capturing images, processing OCR, and storing data in MySQL and implement buttons or triggers for initiating image capture, OCR processing, and discrepancy detection.
- **Real-time Updates:** We can implement real-time updates of meter readings and detected discrepancies on the GUI using PyQt signals and slots.

Database (MySQL):

- **Database Schema:** We can design MySQL tables to store meter readings, timestamps, and discrepancy logs and ensure efficient indexing and normalization of the database schema.
- **Integration with Python:** We can use mysql-connector-python to establish connections from Python backend to MySQL database and execute SQL queries to insert new data (readings and discrepancies) and retrieve historical data when required.
- **Overall System Integration**
- **Testing and Debugging:** We can also test the system with simulated meter readings and varying conditions to ensure robustness and handle exceptions and errors gracefully, especially during OCR processing and database operations.
- **Deployment:** Package the application for deployment, ensuring all dependencies are included and consider deployment options such as standalone executable (using tools like PyInstaller), Docker containers, or cloud-based hosting.

CONCLUSION

We can conclude that by following these steps, we can build a comprehensive “ELECTRICITY METER DATA DISCREPANCY DETECTION SYSTEM USING OCR” with Python as backend, PyQt as frontend, and MySQL as database. There will be adjustments needed based on specific OCR requirements or additional features desired for the application. It has been a great pleasure for me to work on this exciting and challenging project. This project proved good for me, as it provided practical knowledge of not only programming but also about the working environment. It also provides knowledge about the latest technology and its great demand in future. This will provide better opportunities and guidance in future in developing projects independently.

Benefits:

The project is identified by the merits of the system offered to the user. The merits of this project are as follows:

- It is a web enable project. This project offer user to enter the data through simple and interactive forms.
- This is very helpful for the client to enter the desired information through so much simplicity. The user is mainly more concerned about the validity of the data whatever he or she is entering, there are checks on every single stage of any new creation or updation so that the user cannot enter the invalid data which can create problems at later date.
- User is provided the option of monitoring the records he or she has entered earlier, he/she can see the desired records with the variety of options provided by him/her.
- Data storage and retrieval will become faster and easier to maintain because data is stored in a systematic manner and in a single database.
- This making process would be greatly enhanced because of faster processing of information since data collection from information available on computer takes much less time than manual system allocating of sample results become much faster because at a time.
- The user can see the records of last year and faster data transfer through latest technology associated with the computer and communication through these features, it will increase the efficiency accuracy and transparency.

LIMITATIONS

1. The size of the database increases day by day, increasing the load on the database back up and the data maintenance activity.
2. Training for simple computer operator is necessary for the users working on the system.
3. Current system is basically an old type of Bill generating system, the new system will help to overcome the limitations of the old system.

FUTURE ENHANCEMENT

The project features can be beneficial with all authentication and information by encrypting the data when transmitted over customer and the organization website and addition it can be configured on Windows Server networking for security so that all data that passes between a client and server is secure properly, this would help in avoiding the non-authenticated user modifying the data and improperly.

SCOPE:

Scope of this project is very broad in terms of other manually provided services. Few of them are:

This can be used in organization.

Can be used to save customer and the company from losses.

No restriction that service provider has to present when the user takes the service.

BENEFICIAL FOR BSPHCL

Using the **electricity meter data descriptive system** can easily provide the services and also set the time limits so that the employee gets the solution of the request queries within the time limit.

This is the system which is beneficial for the organization employees over all the use of these applications can save money on implementation on going platform and service cost and employee task time.

ABOUT MYSELF

My name is Akshita Singh. I am in B.Tech(CSE), 4th semester from Alliance College of Engineering and Design, Alliance University. In this semester there is requirement of internship therefore I am doing this project in Bihar State Power Holding Company Limited and my project title is **Electricity Meter Data Discrepancy Detecting System Using OCR**. This project is under the guide Mr. Kunal Kishor, who helped me to adjust in the environment and the Database used in this project is MySQL.

These are the following subjects which I will be learning for the project these are:

- MySQL
- Python
- Database management system
- System analysis and design