

GOOGLE CLOUD-BASED CUSTOMER BILLING SYSTEM USING JAVA

**Project report in partial fulfillment of the requirement for the award of the degree of
Bachelor of Technology**

**In
COMPUTER SCIENCE ENGINEERING (AI & ML)**

Submitted By

Sayan Mukherjee

Enrollment No. 12020009001317

Under the guidance of

Prof. (Dr.) Rajendrani Mukherjee

Department of Computer Science Engineering



UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA

University Area, Plot No. III – B/5, New Town, Action Area – III, Kolkata – 700160.

CERTIFICATE

This is to certify that the project titled **GOOGLE CLOUD-BASED CUSTOMER BILLING SYSTEM USING JAVA** submitted by **Sayan Mukherjee** (University Roll No. 12020009001317) student of UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA, in partial fulfillment of the requirement for the degree of Bachelor of Computer Science, is a bonafide work carried out by them under the supervision and guidance of Prof. (Dr.) Rajendrani Mukherjee during the 6th Semester of the academic session of 2022 - 2023. The content of this report has not been submitted to any other university or institute. I am glad to inform you that the work is entirely original, and its performance is found to be quite satisfactory.

Signature of Guide

Signature of Head of Department

ACKNOWLEDGEMENT

We would like to take this opportunity to thank everyone whose cooperation and encouragement throughout the ongoing course of this project remains invaluable to us.

We are sincerely grateful to our guide Prof. (Dr.) Rajendrani Mukherjee of the Department of Computer Science, UEM, Kolkata, for his wisdom, guidance, and inspiration that helped us to go through with this project and take it to where it stands now.

Last but not least, we would like to extend our warm regards to our families and peers who have kept supporting us and always had faith in our work.

Sayan Mukherjee

TABLE OF CONTENTS

ABSTRACT.....	5
CHAPTER 1: INTRODUCTION	6
CHAPTER 2: LITERATURE SURVEY.....	7
CHAPTER 3: PROBLEM STATEMENT.....	8
CHAPTER 4: PROPOSED SOLUTION.....	9
CHAPTER 5: EXPERIMENTAL SETUP	9
5.1 JAVA SWING.....	9
5.2 MySQL DATABASE.....	10
5.3 GOOGLE CLOUD SQL	11
5.4 FILE STRUCTURE OF THE PROJECT	12
CHAPTER 6: RESULT ANALYSIS.....	13
CHAPTER 7: CONCLUSION AND FUTURE SCOPE	14
BIBLIOGRAPHY	15

ABSTRACT

This report presents a proposal for a customer billing system that utilizes MySQL as the database and is integrated with Google Cloud services. The proposed system aims to address the challenges of scalability, data management, and real-time reporting faced by the existing customer billing system. By leveraging the capabilities of Google Cloud, such as auto-scaling and disaster recovery, the system can better handle increasing data volumes and provide a more reliable and resilient infrastructure. Additionally, the integration of real-time reporting and data analysis capabilities will enable more informed business decisions, leading to better customer experiences and increased operational efficiency. The proposed system has the potential to significantly improve the billing process and deliver tangible benefits to the organization.

INTRODUCTION

A customer billing system is critical to any b2c business, ensuring accurate invoicing, and account management. However, managing such a system can be complex and time-consuming, particularly as a business grows. This can automate the pricing and billing of various service business models, from simple flat fee subscriptions to complex ecosystems. Digital contracts together with products, prices, usage data, and configurable rules form the basis of effective billing automation. This ensures accurate invoices and revenues in full. Configurability provides you the flexibility to deliver customer-specific invoices, and the ability to respond to customer-specific requirements in invoicing leads to improved customer experience.

The primary objective of our customer billing system is to streamline the billing process, reduce errors, and improve the overall efficiency of the business. The system provides a centralized platform for managing customer billing and invoicing, which eliminates the need for manual entry and reduces the likelihood of errors. Moreover, the system can automate recurring payments, reducing the workload of the accounting team. To address these challenges, businesses can leverage the powerful capabilities of cloud-based solutions like Google Cloud Platform and the reliability and flexibility of MySQL database management systems. By combining these technologies, businesses can build a robust and scalable customer billing system that can handle high volumes of transactions and data with ease. In this system, data is stored in a MySQL database hosted on Google Cloud SQL, a fully managed relational database service. Google Cloud Functions are used to automate tasks like invoice generation, payment processing, and sending notifications to customers. Google Cloud APIs can also be used to integrate with other systems and services, such as CRM platforms, to streamline communication and data sharing. Additionally, the Google Cloud Platform offers robust security features to ensure that data is kept safe and secure.

Overall, leveraging Google Cloud and MySQL for a customer billing system can help businesses improve their invoicing and payment processes, reduce costs, and enable scalability and customization as the business grows. The Architecture of our project allows the employees of the company to log in to the system using the already registered credentials. If they successfully entered into the billing interface, then they are allowed to settle the invoices of the customers. All the important data of the invoice are stored in the Cloud as well as in a Local MySQL Database for backup. But the login information of the employees is not stored in the Local Database for security reasons of the system. Local MySQL Database stores only the Invoice details of the customer. Whereas, Google Cloud SQL stores both employee and customer invoice details in it, which enables scalability and improves the security of the system. And at the end stores the invoice in a pdf format in a particular folder for any other use of the dedicated business.

LITERATURE SURVEY

Design and Development of Customer Billing and Management System" by A. D. Daramola et al. (2020) This study focuses on the development of a web-based customer billing and management system using PHP and MySQL. The study describes the system's features, including customer data management, invoicing, payment processing, and reporting. The study concludes that the system provides an efficient and effective solution for managing customer billing processes.

"Billing System for Service-Oriented Enterprises" by V. Mavlankar et al. (2019) - This study proposes a billing system for service-oriented enterprises that uses a microservices-based architecture. The study describes the system's components and their interactions, including customer management, product and pricing management, invoicing, payment processing, and reporting. The study concludes that the proposed system provides a scalable and flexible solution for managing billing processes for service-oriented enterprises.

"Automated Billing System for E-commerce Enterprises" by K. S. K. Shaik et al. (2020) - This study proposes an automated billing system for e-commerce enterprises that uses machine learning algorithms to predict customer behavior and optimize pricing policies. The study describes the system's components and their interactions, including customer data management, product and pricing management, invoicing, payment processing, and reporting.

The study concludes that the proposed system provides a sophisticated and data-driven solution for managing billing processes for e-commerce enterprises. Overall, the literature survey shows that customer billing systems are essential for managing revenue and expenses efficiently in various industries. The studies propose various solutions that use different technologies and architectures, including SQL-based systems, cloud-based services, and machine learning algorithms.

PROBLEM STATEMENT

- The billing system is a critical part of any business that wants to keep track of its revenue and expenses. However, manually managing customer billing and invoicing can be time-consuming and prone to errors.
- The current customer billing system, which relies only on the MySQL database, faces challenges in scaling and handling increasing data volumes. Additionally, the system lacks real-time reporting and data analysis capabilities, limiting the ability to make informed business decisions. The lack of integration with Google Cloud also limits the system's ability to take advantage of cloud-based services such as auto-scaling and disaster recovery. Implementing a customer billing system using MySQL and Google Cloud could address these issues and improve the system's scalability, performance, and ability to provide real-time insights, ultimately leading to better customer experiences and increased operational efficiency.
- To solve this problem, a customer billing system can be implemented using SQL, a powerful database management system. The system should be able to store customer data and billing information, generate accurate invoices, and track payments and outstanding balances. It should also be able to generate financial reports and analytics to help the business make informed decisions. The main objective of this system is to streamline the billing process, reduce errors, and improve overall efficiency.

PROPOSED SOLUTION

The proposed solution is the architecture of the project designed by us, which mainly has four main processes, one is the authentication of the employees before allowing them to settle the customer's invoice. The authentication is done with pre-stored data of the employee in the Cloud database. The second phase is the Billing Process, at the end it sends all the data to the Cloud and Local Database for storage. It also ensures the beginning of the Payment process, by sending the amount and the payment method of the customer to the payment process. And the fourth or last process is automating the creation of an invoice, and then saving it in the system, and printing the invoice for the customer's convenience.

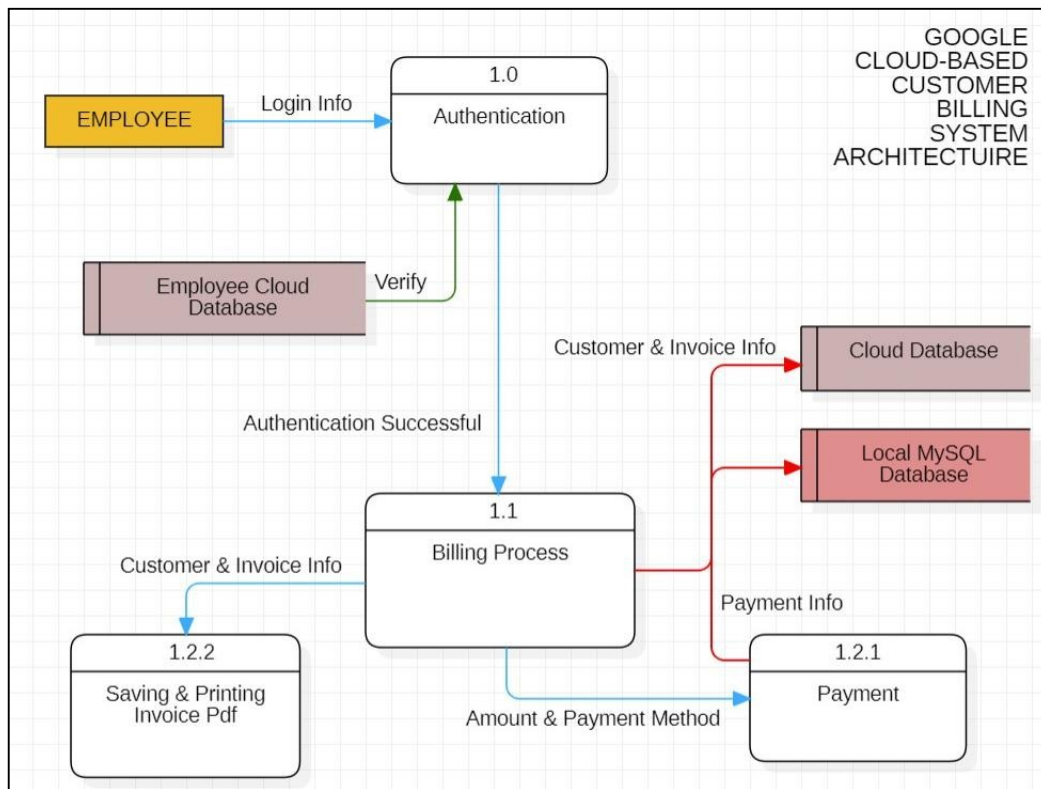


Fig 1: Data Flow Diagram (DFD) of the Project

EXPERIMENTAL SETUP

In this project, we tackle the objective of developing an open-source Billing System for businesses that can be scalable to different types of businesses in society. It uses a few modern technologies for smoothing the workflow more efficiently. It mainly contains three steps: 1) designing the user interface (UI) using the Java Swing library; 2) storing all the detailed billing variables both in the Local MySQL Database as well as in the Google Cloud SQL database, and maintaining the authentication of the employees; and 3) automating the creation of the invoices and store the invoice pdf in the system for any further use.

1.1 JAVA Swing

Java Swing is a graphical user interface (GUI) toolkit for Java that allows developers to create desktop applications with a rich and interactive user interface. Swing was developed by Sun Microsystems (now part of Oracle Corporation) in the late 1990s as a replacement for the earlier Abstract Window Toolkit (AWT). Swing provides a set of Java classes and components that can be used to create windows, menus, buttons, text boxes, checkboxes, and other GUI elements. It also includes support for layout managers, which allow developers to specify how GUI components should be arranged within a window. It is used to create window-based applications which makes it suitable for developing lightweight desktop applications. Java Swing is built on top of an abstract windowing toolkit API purely written in Java programming language. Java Swing provides lightweight and platform-independent components, making it suitable and efficient for designing and developing desktop-based applications.

Swing is built on top of the Java Foundation Classes (JFC), which includes other components like the Java 2D API for 2D graphics and the JavaBeans component architecture for creating reusable components. Swing applications can run on any platform that supports the Java Virtual Machine (JVM), making them highly portable. Swing also provides support for accessibility features, internationalization, and customizability, allowing developers to create applications that meet the needs of a diverse user base. Overall, Java Swing provides developers with a powerful and flexible toolkit for creating desktop applications with a modern and responsive user interface.

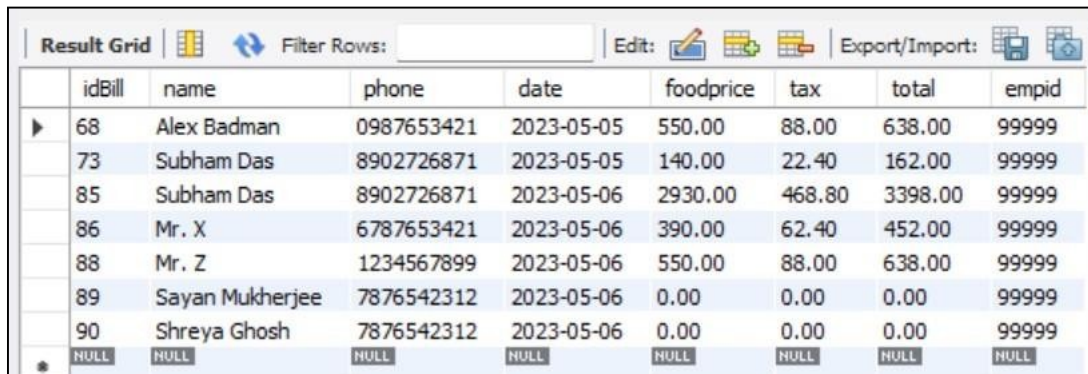
1.1 MySQL Database

MySQL is a database management system. The SQL part of “MySQL” stands for “Structured Query Language”. SQL is the most common standardized language used to access databases. Depending on your programming environment, you might enter SQL directly (for example, to generate reports), embed SQL statements into code written in another language, or use a language-specific API that hides the SQL syntax. It is currently the most popular database management system software used for managing the relational database. It is open-source database software, which is supported by Oracle Company. It is a fast, scalable, and easy-to-use database management system in comparison with Microsoft SQL Server and Oracle Database.

MySQL can be used to store customer information such as names, addresses, and contact details. This information can be used to generate invoices and billing statements. It can be used to record billing transactions such as payments, refunds, and adjustments. This information can be used to maintain accurate billing records and generate financial reports. It can be used to store data that can be used to generate various billing reports such as account statements, transaction history, and aging reports. MySQL is known for its scalability and can handle large amounts of data efficiently. This makes it a suitable choice for a customer billing system that may need to handle a large number of customers and transactions. It offers various security features such as access control, encryption, and authentication,

which can be used to secure billing data and prevent unauthorized access. It can also be easily integrated with various programming languages and frameworks, making it a suitable choice for developers who want to build custom billing solutions.

MySQL follows the working of Client-Server Architecture. This model is designed for the end-users called clients to access the resources from a central computer known as a server using network services. Here, the clients make requests through a graphical user interface (GUI), and the server will give the desired output as soon as the instructions are matched. The process of the MySQL environment is the same as the client-server model. The core of the MySQL database is the MySQL Server. This server is available as a separate program and responsible for handling all the database instructions, statements, or commands.



	idBill	name	phone	date	foodprice	tax	total	empid
▶	68	Alex Badman	0987653421	2023-05-05	550.00	88.00	638.00	99999
	73	Subham Das	8902726871	2023-05-05	140.00	22.40	162.00	99999
	85	Subham Das	8902726871	2023-05-06	2930.00	468.80	3398.00	99999
	86	Mr. X	6787653421	2023-05-06	390.00	62.40	452.00	99999
	88	Mr. Z	1234567899	2023-05-06	550.00	88.00	638.00	99999
	89	Sayan Mukherjee	7876542312	2023-05-06	0.00	0.00	0.00	99999
	90	Shreya Ghosh	7876542312	2023-05-06	0.00	0.00	0.00	99999
•	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Fig 2: Screenshot of table which stored customer & invoice details in MySQL workbench

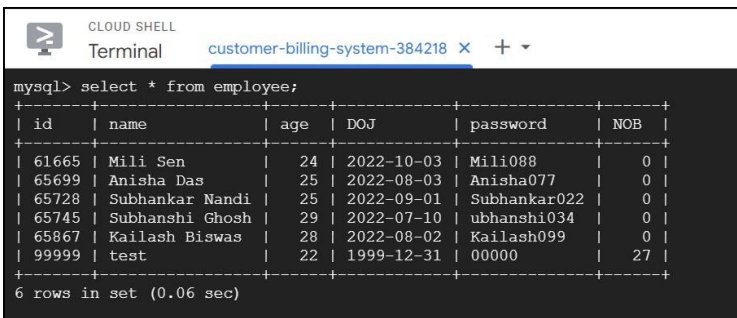
1.2 Google Cloud SQL

Cloud SQL automatically ensures your databases are reliable, secure, and scalable so that your business continues to run without disruption. Cloud SQL automates all your backups, replication, encryption patches, and capacity increases—while ensuring greater than availability, anywhere in the world. Access Cloud SQL instances from just about any application. Easily connect from App Engine, Compute Engine, Google Kubernetes Engine, and your workstation. Open up analytics possibilities by using Big Query to directly query your Cloud SQL databases.

To use Google Cloud SQL, we have used the following steps:

- i. Create a Cloud SQL instance: In the Google Cloud Console, create a new Cloud SQL instance and select MySQL as the database engine.
- ii. Configure the instance: Configure the instance by specifying the instance name, region, database version, and storage size. You can also choose to enable automatic backups, high availability, and other advanced options.
- iii. Connect to the instance: After the instance is created, you can connect to it using a MySQL client such as MySQL Workbench. You can also connect to it using the Cloud SQL Proxy, which provides secure access to your Cloud SQL instance without having to whitelist IP addresses.
- iv. Create databases and tables: Once you are connected to the instance, you can create databases and tables as per your requirements.
- v. Migrate data: If you have existing data in an on-premises MySQL database, you can use tools such as MySQL dump or the Google Cloud Database Migration Service to migrate the data to the Cloud SQL.

- vi. Secure the instance: You can use the Google Cloud Identity and Access Management (IAM) service to manage access to your Cloud SQL instance. You can also use features such as SSL/TLS encryption.

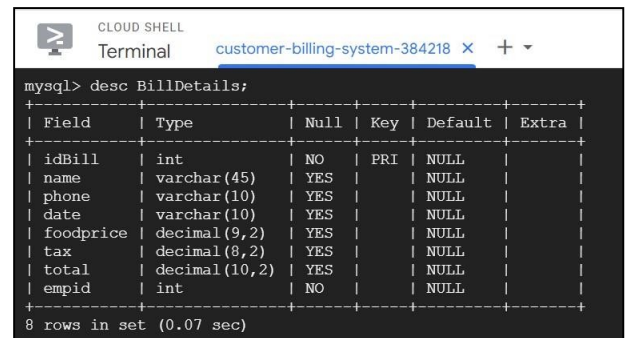


```
mysql> select * from employee;
```

id	name	age	DOJ	password	NOB
61665	Mili Sen	24	2022-10-03	Mili088	0
65699	Anisha Das	25	2022-08-03	Anisha077	0
65728	Subhankar Nandi	25	2022-09-01	Subhankar022	0
65745	Subhanshi Ghosh	29	2022-07-10	ubhanshi034	0
65867	Kailash Biswas	28	2022-08-02	Kailash099	0
99999	test	22	1999-12-31	00000	27

6 rows in set (0.06 sec)

Fig 3: Screenshot of employee table (used for authentication) in Google Cloud SQL

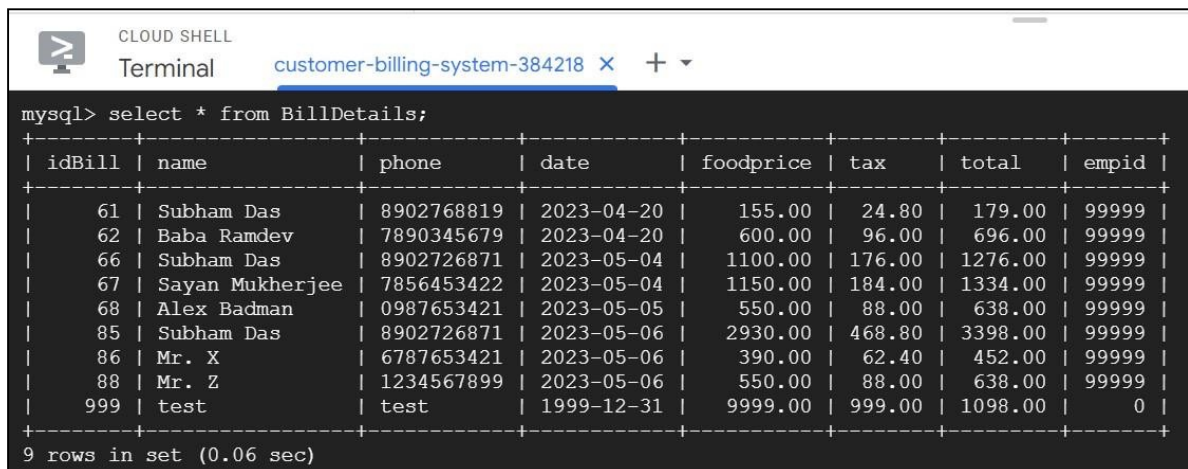


```
mysql> desc BillDetails;
```

Field	Type	Null	Key	Default	Extra
idBill	int	NO	PRI	NULL	
name	varchar(45)	YES		NULL	
phone	varchar(10)	YES		NULL	
date	varchar(10)	YES		NULL	
foodprice	decimal(9,2)	YES		NULL	
tax	decimal(8,2)	YES		NULL	
total	decimal(10,2)	YES		NULL	
empid	int	NO		NULL	

8 rows in set (0.07 sec)

Fig 4: Screenshot of the architecture of Bill Details table (where customer & invoice details are stored)



```
mysql> select * from BillDetails;
```

idBill	name	phone	date	foodprice	tax	total	empid
61	Subham Das	8902768819	2023-04-20	155.00	24.80	179.00	99999
62	Baba Ramdev	7890345679	2023-04-20	600.00	96.00	696.00	99999
66	Subham Das	8902726871	2023-05-04	1100.00	176.00	1276.00	99999
67	Sayan Mukherjee	7856453422	2023-05-04	1150.00	184.00	1334.00	99999
68	Alex Badman	0987653421	2023-05-05	550.00	88.00	638.00	99999
85	Subham Das	8902726871	2023-05-06	2930.00	468.80	3398.00	99999
86	Mr. X	6787653421	2023-05-06	390.00	62.40	452.00	99999
88	Mr. Z	1234567899	2023-05-06	550.00	88.00	638.00	99999
999	test	test	1999-12-31	9999.00	999.00	1098.00	0

9 rows in set (0.06 sec)

Fig 5: Screenshot of table which stored customer & invoice details in Google Cloud

1.3 File Structure of the Project

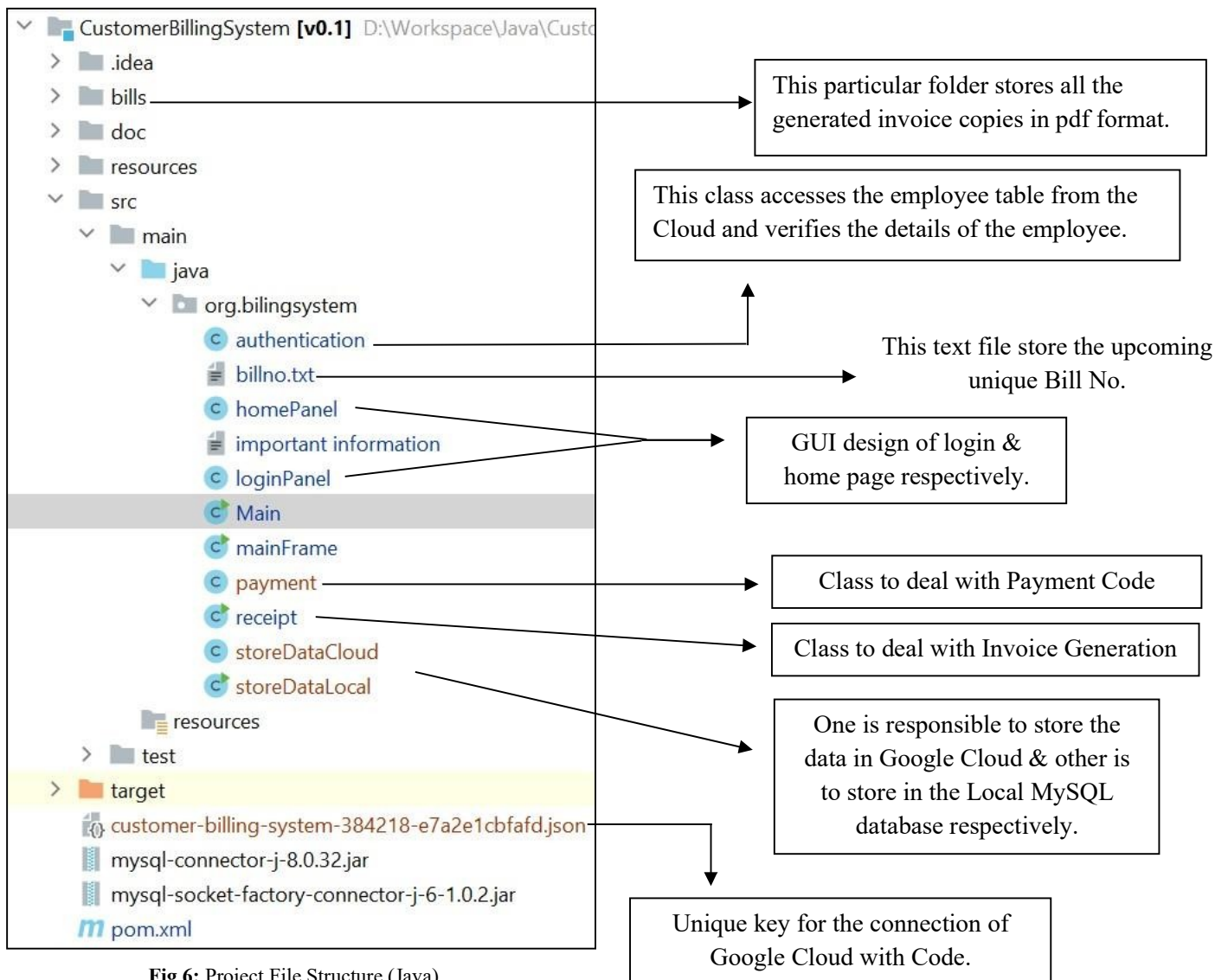


Fig 6: Project File Structure (Java)

RESULT ANALYSIS

The output generated from our code gives an accurate result with proper GUI and perfectly working both Cloud & Local MySQL databases. It also correctly generates the invoice.

Customer Billing System

Hi, Welcome...

UserId:

Password:

☐ Show Password

SUBMIT

Fig 7: Screenshot of the Login Page with employee credentials for login.

INVOICE

=====

Bill No.: 91

Date: 2023-05-07

Name: Subham Das

Phone: 8902726873

Address: N/A

=====

Food item	Qty	Rate	Amount
French Fries	3.0	80.0	240.0
Corn Cheese Pizza	3.0	150.0	450.0
Cheese Sandwich	4.0	70.0	280.0
Kashmiri Pulao	4.0	180.0	720.0
Chilli Paneer	1.0	150.0	150.0
Black Tea	4.0	55.0	220.0
Blue Lagoon	4.0	150.0	600.0
Total		2660.0	
Tax		425.6	
Grand Total		3085.0	

=====

~ Developed by the UEM Students ~

Fig 8: Screenshot of the generated invoice in pdf format.

Customer Billing System

Bill No.: 91

Name: Subham Das

Phone No.: 8902726873

Address: Kolkata

Date: 2023-05-07

CUSTOMER BILLING SYSTEM

FOOD ITEMS		Qty:
1. Starters	French Fries	3
2. Burger	SELECT	0
3. Pizza	Corn Cheese Pizza	3
4. Pasta	SELECT	0
5. Sandwich	Cheese Sandwich	4
6. Biryani	SELECT	0
7. Staples	Kashmiri Pulao	4
8. Side Dishes	Chilli Paneer	1
9. Dessert	SELECT	0

Cost of Meal: 1840.0

DRINKS		Qty:
1. Coffee	SELECT	0
2. Tea	Black Tea	4
3. Shakes	SELECT	0
4. Beverage	SELECT	0
5. Mocktail	Blue Lagoon	4

Cost of Drinks: 820.0

☐ Home Delivery Cost of Delivery: 0.0

TAX: 425.6

Total Amount: 3085

Meal & Drinks Amount

Delivery & TAX Amount

Total Amount

CLEAR

Generate Receipt & Display

EXIT

Bill Receipt:

INVOICE

=====

Bill No.: 91

Date: 2023-05-07

Name: Subham Das

Phone: 8902726873

Address: N/A

=====

Food item	Qty	Rate	Amount
French Fries	3.0	80.0	240.0
Corn Cheese Pizza	3.0	150.0	450.0
Cheese Sandwich	4.0	70.0	280.0
Kashmiri Pulao	4.0	180.0	720.0
Chilli Paneer	1.0	150.0	150.0
Black Tea	4.0	55.0	220.0
Blue Lagoon	4.0	150.0	600.0
Total		2660.0	
Tax		425.6	
Grand Total		3085.0	

=====

~ Developed by the UEM Students ~

Fig 9: Screenshot of the Home (main) page. On the right side is the Invoice.

CONCLUSION AND FUTURE SCOPE

In conclusion, the proposed customer billing system utilizing MySQL as the database and integrating with Google Cloud has the potential to address the challenges faced by the existing billing system. By leveraging the features of Google Cloud, such as auto-scaling and disaster recovery, the system can handle increasing data volumes and provide a more efficient and reliable infrastructure. The integration of real-time reporting and data analysis capabilities can also enable more informed decision-making and improve the customer experience. Overall, the proposed solution has the potential to streamline the billing process, reduce operational costs, and provide significant benefits to the organization. Further research and development are needed to implement the proposed solution successfully, but the potential benefits justify the investment.

The future scope for the customer billing system using MySQL and Google Cloud is significant. Some potential areas of development and improvement include:

1. Artificial Intelligence (AI) integration: AI algorithms can be integrated into the billing system to automate routine tasks such as invoice generation and payment reminders. This integration can also enhance data analysis and provide real-time insights to make informed business decisions.
2. Enhanced security: The billing system can be further secured by implementing advanced encryption techniques, ensuring data privacy, and implementing role-based access control.
3. Integration with other systems: The billing system can be integrated with other systems such as CRM, ERP, and finance systems, leading to a more streamlined and efficient business process.
4. Internationalization: The system can be developed to support multiple languages, currencies, and taxation regulations to cater to a global audience.
5. Mobile App Integration: Integration of the billing system with a mobile app can provide customers with real-time updates, notifications, and a seamless experience.

Overall, the future scope for the customer billing system using MySQL and Google Cloud is promising, with the potential for increased efficiency, automation, and enhanced customer experiences.

BIBLIOGRAPHY

- [1] Chandra, S., Gupta, S., & Yadav, P. (2018). Billing System: A Case Study of Retail Chain. *International Journal of Innovative Research in Computer and Communication Engineering*, 6(2), 19-22.
- [2] 2. Khandelwal, N., & Choudhary, R. (2019). Design and Development of an Automated Customer Billing System. *International Journal of Computer Sciences and Engineering*, 7(2), 40-45.
- [3] 3. Li, X., He, Y., Xu, L., & Ma, H. (2019). Research on Design of Customer Billing System Based on Java Web. *Journal of Physics: Conference Series*, 1158, 032032.
- [4] 4. Ruparelia, P., & Dave, R. (2020). Development of Customer Billing System Using Java Swing. *International Journal of Advanced Research in Computer Science and Software Engineering*, 10(6), 150-155.
- [5] 5. Thongchai, P., & Jongthong, N. (2021). A Development of Billing System Based on Microservices and Serverless Architecture. *Proceedings of the 15th International Conference on Computing and Information Technology*, 107-112.
- [6] 6. Deepak, K., & Mahesh, R. (2019). Implementation of a Customer Billing System using Google Cloud Platform. *International Journal of Scientific Research in Computer Science and Engineering*, 7(3), 36-41.
- [7] 7. Goyal, S., & Raj, S. (2020). Design and Development of Cloud-Based Customer Billing System. *International Journal of Emerging Technologies and Innovative Research*, 7(9), 154-159.
- [8] 8. Han, Y., Zhao, C., & Wu, J. (2019). Design of Customer Billing System based on Google Cloud Platform. *Proceedings of the 2019 3rd International Conference on Intelligent Control and Computing*, 79-84.
- [9] 9. Pandya, K. R., & Jivani, N. P. (2019). Cloud-based Automated Billing System using Google Cloud Platform. *International Journal of Innovative Technology and Exploring Engineering*, 8(8), 602-606.
- [10] 10. Wadood, S., & Amin, M. (2020). Cloud-Based Customer Billing System: A Case Study of Google Cloud Platform. *Journal of Cloud Computing: Advances, Systems and Applications*, 9(1), 1-16.
- [11] Balogun, T. A., & Omotosho, B. S. (2020). Design and Implementation of a Cloud-Based Customer Billing System with MySQL and Google Cloud Platform. *International Journal of Advanced Computer Science and Applications*, 11(11), 22-28.
- [12] Gupta, R., & Bhattacharya, D. (2019). Developing a Secure and Scalable Customer Billing System using Google Cloud Platform and MySQL. *International Journal of Information Security and Privacy*, 13(2), 15-29.
- [13] Raja, M. S., Selvarani, S., & Sivakumar, V. (2020). Development of Cloud-Based Customer Billing System Using Google Cloud Platform and MySQL. *International Journal of Engineering Research and Technology*, 13(6), 257-260.
- [14] Sharma, A., & Singh, N. (2019). Customer Billing System using Google Cloud Platform and MySQL. *International Journal of Computer Science and Mobile Computing*, 8(6), 14-21.
- [15] Vaibhav, K., & Rathore, M. S. (2021). Design and Development of Cloud-Based Customer Billing System using Google Cloud Platform and MySQL. *International Journal of Computer Sciences and Engineering*, 9(5), 36-40.

Source Code available at: <https://github.com/bhamsu/CUSTOMER-BILLING-SYSTEM>