



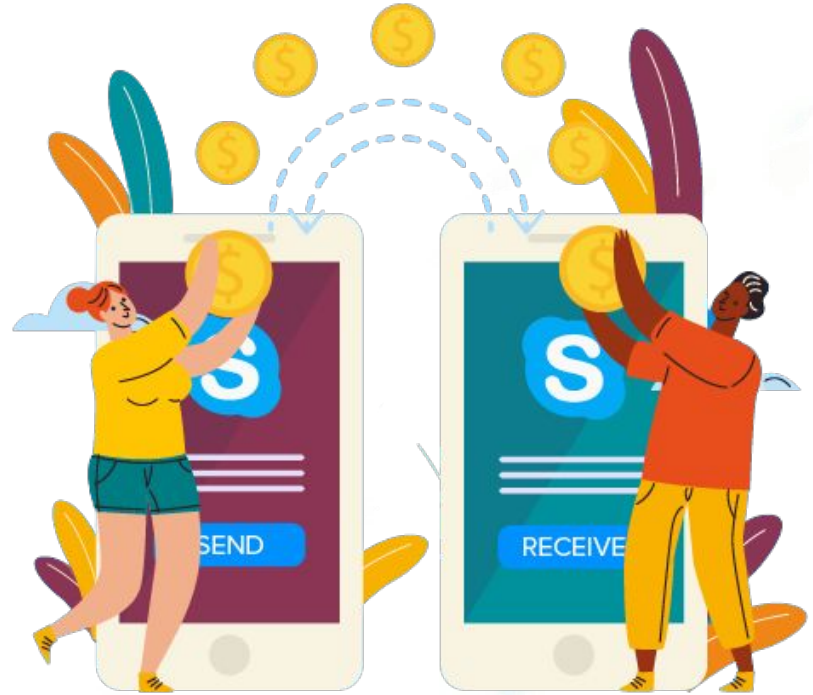
Flex Payment Application

FlexPay

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Motivation

- Many conventional payment applications of various banks and its integration with third-party supporting apps provide transaction options.
- A need to create an application that offers **Santa Clara University** students a convenient way to load and transfer flex points peer-to-peer through the application for internal use would aid them in easy usage in dining and places where flex points are utilized.





Problem Statement

Build a user-friendly application that can handle smooth flex points transactions which includes:

- SCU User Authentication
- Flex point deposits
- Peer-to-Peer (P2P) transfer
- Register for Multi-factor Authentication (MFA) along with maintaining data security via authentication and data protection in the cloud.

Background Information

- **Frontend: Flutter SDK:**

<https://docs.flutter.dev/development/tools/sdk/overview>

- Flutter is an Google-developed open source framework used to build high-quality hybrid applications (Android, IOS, Web) using Dart language.
- **Pub packages:** <https://pub.dev/>
 - **Http:** A collection of high-level classes and functions that make it simple to receive HTTP services are included in this package.
 - **Shared Preferences:** Information can be saved and retrieved using Shared Preferences as key/value pairs in a file on the phone's memory.

- **Backend:**

- **JavaScript:** Language used to write server-side code.
- **User authentication (MFA):** In order to gain access to a service like an application, a netbanking, or a Network, the user must submit two or more verification criteria, which is known as multi-factor authentication.



Background Information

- **Oracle Cloud Infrastructure (OCI):** Oracle Cloud Infrastructure (OCI) makes it possible to develop and operate a number of different applications in an exposure to elevated setting with high availability and scalability.. <https://www.oracle.com/cloud/>
- **Compute Instances:** A customizable compute service, provided by OCI, that helps users create and run virtual machines and manage their resources (CPUs required, memory, network resources. etc). Oracle Cloud Infrastructure's IaaS offers these Compute Instances for the server. . <https://www.oracle.com/cloud/compute/>
- **Load Balancer:** Users can use load balancing to automatically send packets between regions, availability zones, fault areas, resulting in high reliability and functionality for all application or sources. <https://www.oracle.com/cloud/networking/load-balancing/>
- **Internet Gateway:** It is a node that connects two different networks. Used for communication between the VPC and internet.

ORACLE
Cloud Infrastructure



Background Information

- **Nginx:** NGINX is an open-source program that can be used for multimedia applications, caching, inverse proxies, web serving, and other functions. It first began as a web server created for stability and optimum performance. <https://www.nginx.com/>
- **pm2:** PM2 is a production process manager for Node.js applications with a built-in load balancer. It allows you to keep applications alive forever, to reload them without downtime. We are using pm2 to monitor processes run by NGINX. <https://pm2.keymetrics.io/>
- **MongoDB:** A non-relational file database, MongoDB supports storage that is similar to JSON. It's database has full querying capabilities, duplication, and a configurable schema that makes it possible to handle complex data. <https://www.mongodb.com/atlas>
- **ExpressJS:** Express is a dynamic online application framework for Node.js that offers a strong range of features for both mobile and website applications. <http://expressjs.com/en/guide/routing.html>



Related Work

A Study on Usage of Online Payment Apps by Customers -

<https://ijcrt.org/papers/IJCRT2105774.pdf>

- The survey looks at customer behavior on using online payment apps, examine the problems that clients have with online transactions, identify the problems and propose potential improvements to online payment apps.
- The paper doesn't investigate the advantages and security of utilizing online payment apps, and also the problems users are having with online payment apps, concerning how users will use online transactions.

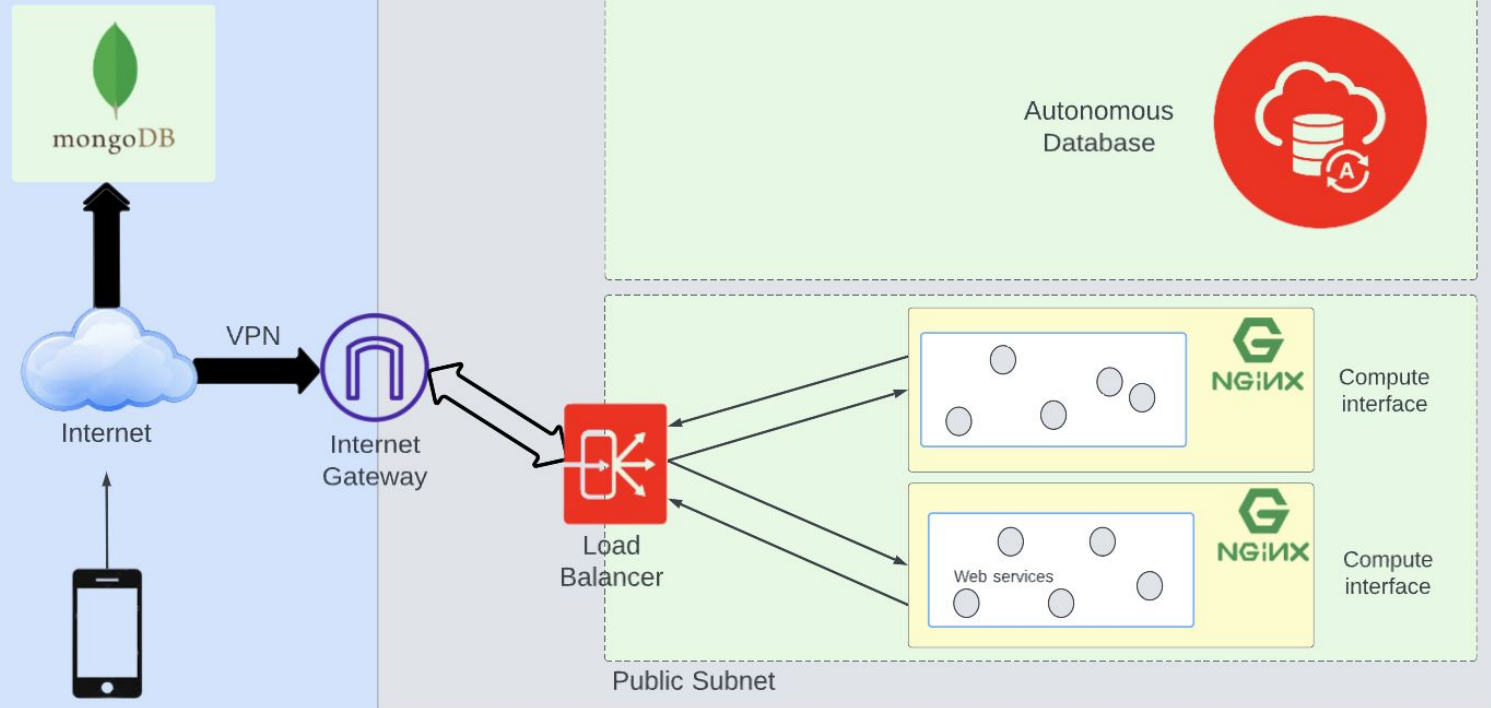
A Review on Electronic Payments Security -

[https://www.researchgate.net/publication/343598898 A Review on Electronic Payments Security](https://www.researchgate.net/publication/343598898_A_Review_on_Electronic_Payments_Security)

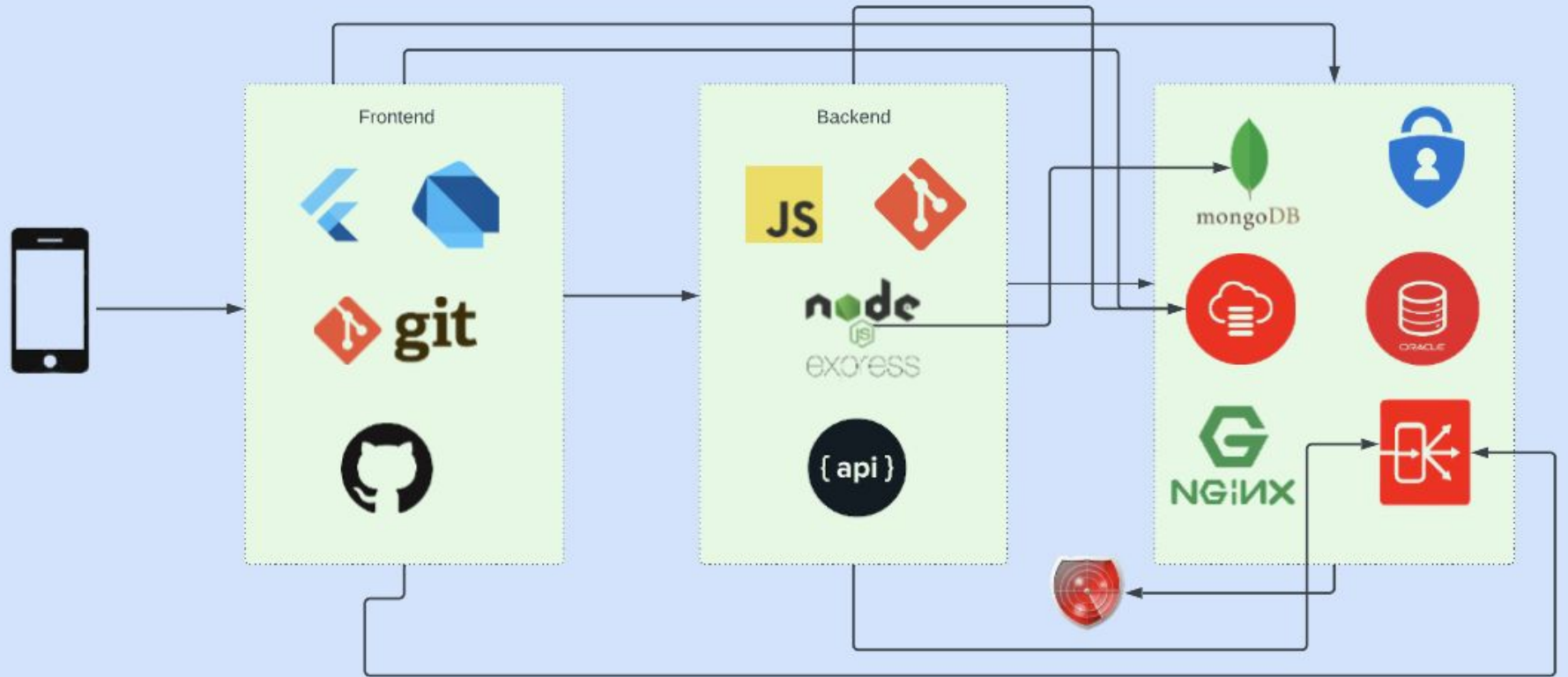
- The research paper gives an overview on two different categories of electronic payment involving e-wallet and digit payment methods which elaborates on the security issues of user's data.
- Data protection and scalability using digital payment methods have raised various concerns with respect to various banks using third-party networking applications.

System Architecture

VPC



Software Architecture



Outcome

- Learning a new cloud technology: OCI with implementation of its necessary services needed in our application.
- Successfully built an application that can handle multiple transactions with peer-to-peer transfer of flex points, maintaining security and data protection using cloud computing technologies.
- Built a server that is connected to MongoDB Atlas Clusters.
- For additional security and encryption for SCU only, Multi-Factor Authentication (MFA) has been enabled which provides offline TOTP service.



Possible Future Work

- Allow institutions to add their wallets and enable transfers between their users.
- Deposit money directly into their personal wallet.
- Withdraw money from your Student account.
- Get the automatic generated statement.
- Push notifications for transaction success.

Demo



Thank You!