Abstract

Data sharing and access are capabilities businesses and organizations require the most these days. Remote working and mobile access to resources and collaboration platforms made it easier to access data and resources from anywhere, anytime. Employees want to access documents and email from different devices, and from various locations at a time. Access from untrusted networks is always a threat to businesses. This might result in data loss and overexposure of critical data. To mitigate the deficiencies of logical security mechanisms, and coinciding with the trend of cyber-physical systems, security mechanisms have been proposed that integrate with the physical environment. To ensure that business's data and resources are safe. In this project we propose an innovative **Virtual Fence** that uses location data and geospatial intelligence. Geospatial data analysis enhances understanding, insight, decision-making, and prediction. Location intelligence (LI) is achieved via visualization and analysis of geospatial data. Then we improve the security of data access in Data Server for a company or any other specific locations using the location-based cryptosystem. Virtual Fence provides a means to secure sensitive information within an organization. It can be set to Off, On, Restricted View or Read Only. Once a geo-fenced boundary is defined, the opportunities that businesses can do are limited by only their creativity. The main benefit of setting up such a geofence is in avoiding data leakage. Once defined the trusted network locations, no one can access data from a different network location/device. The experiment shows that our scheme is feasible in practical applications.

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CHAPTER 1

INTRODUCTION

1.1 Overview

Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software. Cloud computing can be both public and private. Public cloud services provide their services over the Internet for a fee. Private cloud services, on the other hand, only provide services to a certain number of people. These services are a system of networks that supply hosted services. There is also a hybrid option, which combines elements of both the public and private services. Cloud Computing is a combination of the use of computer technology (computing) and Internet-based development (cloud).

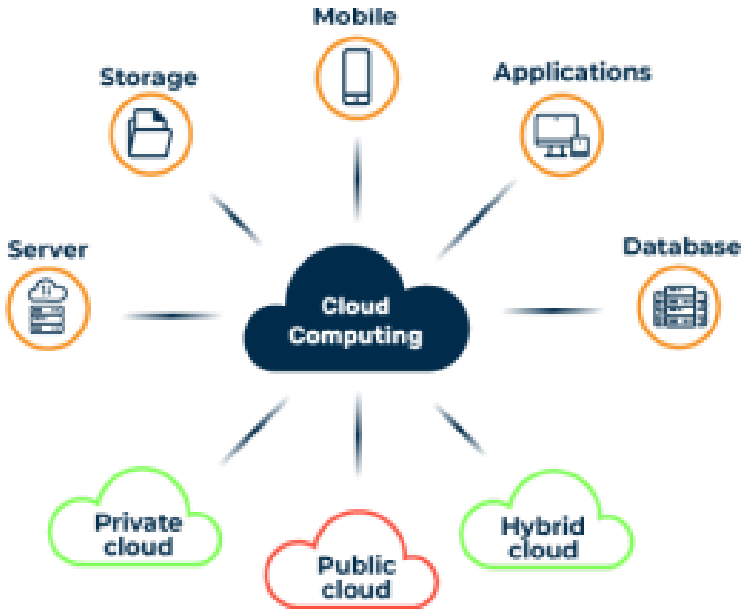


Figure 1.1. Cloud Services

Cloud is a metaphor of the internet, as is the cloud that is often depicted in computer network diagrams.

Cloud computing is a general concept of other recent technological trends that are widely known to include SaaS, Web 2.0 with the general theme of being dependent on the Internet to provide users with computing needs. For example, Google Apps provides general business applications online that are accessed through a web browser with software and data stored on the server. Cloud Computing is also an abstraction of the complex infrastructure that is hidden. It is a computational method in which information technology-related capabilities are presented as a service, so that users can access them via the Internet without knowing what is inside, being expert with them, or having control over the technological infrastructure that helps them.

Types of Cloud Computing

Cloud computing is not a single piece of technology like a microchip or a cellphone. Rather, it's a system primarily comprised of three services: software-as-a-service (SaaS), infrastructure-as-a-service (IaaS), and platform-as-a-service (PaaS). **Software-as-a-service (SaaS)** involves the licensure of a software application to customers. Licenses are typically provided through a pay-as-you-go model or on-demand. This type of system can be found in Microsoft Office's 365. **Infrastructure-as-a-service (IaaS)** involves a method for delivering everything from operating systems to servers and storage through IP-based connectivity as part of an on-demand service. Clients can avoid the need to purchase software or servers, and instead procure these resources in an outsourced, on-demand service. Popular examples of the IaaS system include IBM Cloud and Microsoft Azure. **Platform-as-a-service (PaaS)** is considered the most complex of the three layers of cloud-based computing. PaaS shares some similarities with SaaS, the primary difference being that instead of delivering software online, it is actually a platform for creating software that is delivered via the Internet. This model includes platforms like Salesforce.com and Heroku.

Types of Cloud Services

Regardless of the kind of service, cloud computing services provide users with a series of functions including:

- Email
- Storage, backup, and data retrieval
- Creating and testing apps
- Analyzing data
- Audio and video streaming
- Delivering software on demand

Cloud computing is still a fairly new service but is being used by a number of different organizations from big corporations to small businesses, nonprofits to government agencies, and even individual consumers.

With all of the speed, efficiencies, and innovations that come with cloud computing, there are, naturally, risks.

Security has always been a big concern with the cloud especially when it comes to sensitive medical records and financial information. While regulations force cloud computing services to shore up their security and compliance measures, it remains an ongoing issue. Encryption protects vital information, but if that encryption key is lost, the data disappears.

Servers maintained by cloud computing companies may fall victim to natural disasters, internal bugs, and power outages, too. The geographical reach of cloud computing cuts both ways: A blackout in California could paralyze users in New York, and a firm in Texas could lose its data if something causes its Maine-based provider to crash.

As with any technology, there is a learning curve for both employees and managers. But with many individuals accessing and manipulating information through a single portal, inadvertent mistakes can transfer across an entire system.

1.2 Problems Identified

The advantages of cloud computing are frequently touted as cost-efficient, reliable, manageable, and more secure than legacy computing. Yet cloud computing possesses security risks despite it being more secure than legacy computing. And the security disadvantages of cloud computing remain worrisome. Most cloud service providers implement relevant security standards and industry certifications to ensure that their cloud environment remains safe. However, storing data and business-critical files in virtual data centers can potentially open you up to risks.

Unexpected but Most Serious Security Risk: World experience shows that internal security risks began to prevail over external ones. Now the main source of threats to the company's IT systems is not hackers or malware at all, but the company's employees. Leaks can be caused both by unintentional, erroneous actions, and deliberate wrecking by staff. For example, it could be selling information to competitors, seizing confidential information, or sabotaging administrative security policies. This trend is confirmed by numerous studies around the world.

Loss of Control: The enterprise’s loss of control in enhancing the network’s security is the most significant disadvantage of cloud computing security. The responsibility of securing the network is shared between the cloud service provider (CSP) and the enterprise. Depending on which server model an enterprise uses, the enterprise may have little to almost no control over the cloud security. Infrastructure-as-a-Service (IaaS) allows the enterprise to have the most control as the CSP only provides the infrastructure. It falls under the enterprise’s jurisdiction to build the remainder of the stack and maintain its security. A stack built, operated, and managed entirely by the CSP is known as the cloud service offering, Software-as-a-Service (SaaS). The enterprise has the least amount of control over cloud security in a SaaS environment.

Vendor Lock-in: Describes the "an anticipated fear of difficulty in switching from one alternative to another." Lock-in often happens when enterprises neglect to read the CSP's SLA.

Data Loss: Can occur via a natural disaster or company error.

Insider Theft: When an employee intentionally steals data with mal-intent.

Vulnerability to attack: In cloud computing, every component is online, which exposes potential vulnerabilities. Even the best teams suffer severe attacks and security breaches from time to time. Since cloud computing is built as a public service, it's easy to run before you learn to walk. After all, no one at a cloud vendor checks your administration skills before granting you an account: all it takes to get started is generally a valid credit card.

Data Breaches: Forcepoint lists consequences of data breaches in the cloud in its white paper, "Deploying and Managing Security in the Cloud." It states that "while cloud providers generally have better security capabilities than most organizations and suffer fewer data breaches as a result, a successful data breach can open an organization to stiff financial penalties, regulatory fines, loss of customer confidence, and declining competitive market positioning, among other significant consequences."

1.3 Geospatial Intelligence

A Geo-fence is a feature that defines a virtual boundary around a real-world geographic area. Every time the user enters or exits the boundary of a particular area, actions are often triggered during a location-enabled device. Usually, the user will receive a notification with certain information that supports its location in real-time.

The main advantage of this technology is that it creates a fusion between the virtual world and the real one. We make use of Geofencing in several projects, particularly within the health industry.

What is geofencing?

Geofencing is a location-based service in which an app or other software uses GPS, RFID, Wi-Fi or cellular data to trigger a pre-programmed action when a mobile device or RFID tag enters or exits a virtual boundary set up around a geographical location, known as a geofence. Depending on how a geofence is configured it can prompt mobile push notifications, trigger text messages or alerts, send targeted advertisements on social media, allow tracking on vehicle fleets, disable certain technology or deliver location-based marketing data. Some geofences are set up to monitor activity in secure areas, allowing management to see alerts when anyone enters or leaves a specific area. Businesses can also use geofencing to monitor employees in the field, automate time cards and keep track of company property.

How geofencing works

To make use of geofencing, an administrator or developer must first establish a virtual boundary around a specified location in GPS- or RFID-enabled software. This can be as simple as a circle drawn 100 feet around a location on Google Maps, as specified using APIs when developing a mobile app. This virtual geofence will then trigger a response when an authorized device enters or exits that area, as specified by the administrator or developer. A geofence is most commonly defined within the code of a mobile application, especially since users need to opt-in to location services for the geofence to work. If you go to a concert venue, they might have an app you can download that will deliver information about the event. Or, a retailer might draw a geofence around its outlets to trigger mobile alerts for customers who have downloaded the retailer’s mobile app. In these cases, a geofence that is managed by the retailer is programmed into the app, and users can opt to decline location access for the app.

A geofence can also be set up by end-users using geofencing capabilities in their mobile apps. These apps, such as iOS Reminders, allow you to choose an address or location where you want to trigger a specific alert or push notification. This is called an "if this, then that" command, where an app is programmed to trigger an action based off another action. For example, "If I'm five feet from my front door, turn on my lights." Or you might ask a reminder app to send you an alert once you reach a specific location. Geofencing isn't just for mobile apps – it's used to control and track vehicles in the shipping industry, cattle in the agriculture industry and – you'll see this topic pop up in drone discussions. Nearly every drone is pre-programmed to accommodate geofencing, which are usually set up around airports, open-air venues and even the White House. The FAA can set up these drone-resistant geofences upon request – some barriers will stop a drone in mid-air, while others will trigger a warning message to the user. Some drone geofences will ask for a users' authorization – a process that ties the user's identity to their drone – so that law enforcement can keep track of unmanned drones.

Geofencing applications

With the rising popularity of mobile devices, geofencing has become a standard practice for plenty of businesses. Once a geographic area has been defined, the opportunities are seemingly endless for what companies can do, and it has become especially popular in marketing and social media.

Some retail and hospitality businesses will set up geofences around their competition, so when you approach the boundary, you'll get a push notification prompting you to visit the other establishment. Or, you might walk into a retail store and see a coupon pushed to your device. If you download a grocery app, chances are it will register when you drive by to prompt an alert, trying to get you to stop in.

Here are other common geofencing applications:

- **Social networking**: One of the most recognizable uses for geofencing comes in the form of popular social networking apps — most notably, Snapchat. Location-based filters, stickers and other shareable content are all made possible with geofencing. Whether you're using a promoted filter at a concert, using a custom-made filter for a friend's birthday or uploading to public, location-based stories, it's all thanks to these virtual perimeters.
- **Marketing**: Besides social networking, geofencing is also a popular way for businesses to deliver in-store promotions, alerting you right as you step in range of the store. Geofencing also helps businesses target ads to a specific audience to figure out what strategies work best based off user's location-data.
- **Audience engagement**: Geofencing is used to engage crowds of people at organized events, like concerts, festivals, fairs and more. For example, a concert venue might use a geofence to crowdsource social media posts or deliver information about the venue or event.
- **Smart appliances**: As more of our appliances get "smart," with Bluetooth capabilities, it's easier than ever to program your fridge to remind you that you're out of milk the next time you pass by the grocery store. Or you can make sure the thermostat is set to the perfect temperature when you get home from work by using a geofence.
- **Human resources**: Some companies rely on geofencing for monitoring employees, especially workers who spend time off-site doing field work. It's also an easy way to automate time cards, clocking employees in and out as they come and go.
- **Telematics**: Geofencing can also be helpful with telematics, allowing companies to draw virtual zones around sites, work areas and secure

areas. They can be triggered by a vehicle or a person and send alerts or warnings to the operator.

- **Security**: Geofencing might seem invasive — and it certainly has the potential to sometimes feel like an overreach depending on how it's used. However, geofencing can also be used to bring more security to your mobile device. For example, you can set your phone to unlock when you're home using a geofence or to get alerts when someone enters the house or leaves.
- **Defense, Research & Finance:** By assigning geo-fences to devices deployed in finance, defense, or research, IT can ensure that the device is non-operational outside of the designated geo-fence. Using an MDM tool IT can define multiple geofences for various areas of operation and can make the device obsolete outside of the geo-fences. Every time the device enters or leaves the geofence, it's notified and that they can track the situation of the device and check for compliance violations if any. This ensures that critical data on the device is secure at all times and cannot be accessed outside of designated premises.
- **Delivery Executives:** Assigning particular areas to particular delivery executives. By assigning geo-fences to delivery executives, optimum efficiency is often achieved by avoiding multiple delivery executives being assigned to equivalent geographical areas.
- **Schools:** More and more schools are implementing e-learning to enhance the training experience for college kids. Setting geofences on devices owned by the school eliminates the threat of students taking the device home and misusing it for any other purpose. Geo-fences ensure device security also as enforces intended usage.
- **Remote / Travelling Employees:** IT can enforce multiple device policies for various geo-fences. These device policies include Wi-Fi configurations and other settings specific to office location. This facilitates the workers to plug and work from multiple office locations

without expecting IT support.

- **Fleet Management:** In logistics and transport, devices with geo-fence can help track the situation of vehicles in the least times. This ensures timely support in case of a breakdown as well as device and vehicle security. Geofencing is used to assist the algorithm in performing decisions to reroute cargo when detours or slowdowns arise.

The future of geofencing

There are some cautions with geofencing, especially when it comes to privacy with marketing. Just this past year, Massachusetts was one of the first states to enact a consumer protection law that objected to the use of location-based advertising. The Attorney General blocked an ad campaign from Copley Advertising, which was hired by a Christian organization to set up a geofence around women's health clinics that would target women in the waiting room or nearby with anti-abortion ads.

Data Privacy in A Digital Age

Privacy has always been a crucial aspect of human existence. But as more data becomes digitized, and more information is shared online, data privacy is becoming more important. Data privacy denotes how information should be managed based on its perceived importance. It isn't just a business concern; individuals have a lot at stake when it comes to the privacy of their data. The more you are aware of it, the better you'll be able to shield yourself from multiple risks. In this digital age, the concept of data privacy is mainly applied to critical personal information, also referred to as personally identifiable information (PII) and personal health information (PHI). This typically includes financial data, medical and health records, social security numbers, and even basic yet sensitive information like birth dates, full names, and addresses.

It’s a Data Driven Economy

User data is an extremely valuable asset in this information age. It not only helps organizations understand their customers, but also enables them to ‘track’ customers and target them with ‘relevant’ ads. Marketing is just one of the ways companies leverage user data to strengthen their position in the market and increase their revenues. There are other more harmful ways. In 2018, Facebook founder Mark Zuckerberg was called to testify before the United States Congress, following the Cambridge Analytica Scandal. Questioning during the hearings unearthed several details of a data privacy crisis for companies like Facebook that are dependent on data manipulation and harvesting.

More and more user groups, regulators and non-profits have begun demanding for a legally enforceable ‘right to privacy’. Speaking at a privacy conference in Brussels, Apple CEO, Tim Cook, called for improved privacy laws. At a time when the data practices of industry titans like Facebook and Google are being put into question, Cook is pushing Apple in the opposite direction, by not only talking up data privacy, but also embracing new regulations. Cook has also criticized companies that base their business models on the harvesting of personal data for advertising, while highlighting that his company tries to collect as little of it as possible.

The Service Affordability Trade-off

Many in the tech industry are disinclined to support privacy regulations due to its potential to hold back innovation. Mark Zuckerberg defended his company’s advertising-based model by pointing out that it enabled its services to “be affordable to everyone”. “Instead of charging users, we charge the advertisers”, he added. Google’s Senior VP for Global Affairs, Kent Walker, echoed the same sentiment by saying ads allow them to deliver search to users of all income levels across the globe for free. However, both executives also acknowledged that security and privacy have to be a principal consideration, even if it impacts profitability.

Data Privacy Should be a Basic Human Right

Though the US has relatively few regulations that govern the gathering and use of personal data, in several other places around the globe, data privacy is considered a basic human right. Within the European Union, the recently enacted General Data Protection Regulation (GDPR), sets stringent legal standards for the handling of personal data. While 'privacy' may sound like a nebulous concept, it's not a new idea in human rights law. The right to privacy safeguards an individual's dignity by protecting their personal information from public scrutiny. This right is typically protected by statutory law.

The UN's human rights office inferred that governments should respect the right to privacy by regulating how private organizations – not just intelligence agencies and the police – treat personal data. Human rights courts have also acknowledged that the collection, use, storage, and sharing of personal data can balk privacy. Those actions should therefore be limited to what is unquestionably necessary and relative to a justifiable goal.

Role in Data Privacy

However, there are concerns raised about data privacy in the use of geo-fencing. When you track users in a specific fence, you are collecting information about them which they may not otherwise be wanting to share. In a world where social profiles are built using digital identities, this could be dangerous. For example, a user may not want people to know why he visited a certain clinic, a religious place, a club, or an event. These could be individual preferences, which were meant to be kept private, but, the geo-fence would have collected information about this.

The legal aspect of the use of geo-fence depends on the privacy laws of the land. In Europe, user consent is a must before this service can be activated. Once specific permission is obtained, then the location-specific data being collected will come under the ambit of the GDPR, which is meant to protect the privacy of the users.

Unless all the personally identifiable information is masked by the device ID and the IP addresses that are being collected, it will be treated as a violation. This is because Personally Identifiable Information (PII) also pertains to IP targeting, email targeting, and phone number detection under the GDPR.

Even the CCPA follows these ethics for its privacy laws applicable in the state of California. And it is expected that companies across the US will be affected by the CCPA, to give consumers new rights and protection almost equal to GDPR and that includes geofencing as well.

There is also the concern that geo-fencing may cause an overdose of unwanted notifications which is a disturbance for an individual. An individual may walk into a coffee shop at the end of a morning walk every day and be bombarded with offers. Or, one may just be passing by a shop with a geo-fence and get messages as a result. This can prove to be quite annoying and may even, ultimately put the customer off. There have been a few cases in the US wherein advertising firms have had to deal with legal cases as a result of their geofencing ads. Especially when the information collected is around health care, children, religious preferences, etc., which come under sensitive personal information, the privacy concerns around geo-fencing takes a serious turn.

Interestingly, even the banking industry is exploring options with geo-fencing to provide improved customer experiences and fraud detection. People walking into a branch are provided inputs on customized services and offers for them to be able to make better choices. Some banks have enabled their ATMs with geo-fencing, so customers are provided with information about the nearest ATM.

Geo-Fencing and Data Governance

Let’s dive deeper, and differentiate between geo-location and geo-fencing. Because geo-location uses your IP it can be easily spoofed or fooled and is not geographically accurate. However, geo-fencing is predicated on GPS coordinates from satellites tracking latitude and longitude.

GPS can be spoofed; it requires loads of expensive scientific equipment and certain features to validate the signal. Using geo-coordinates enables new sets of policies and controls to make sure security and enforce seamless verification. Geofencing is often used as a tool to defend and also to support risk management. By using it as a source of data collection, decisions are often implemented to notify and manage the danger of devices entering and leaving a specified geographic area. Geofencing can provide data that falls into Personally Identifiable Information (PII) which should make it regulated under most privacy laws. Geofencing and location tracking can be utilized to help identify risk to an organization. By tracking and understanding the physical patterns of devices coming and going from an organization, a risk profile can be established. Questioning why and when it is appropriate for a work device to leave company property or personal devices to be brought in, is one concept. It could prevent lost/stolen work devices and discourage unsecured personal devices from being introduced to the network. A geofence could be set to alert administrators to strange devices that have crossed into a virtual barrier. It also can alert administrators when devices that ought to never leave the premises have crossed the barrier. Although this has not prevented the intrusion, it may alert the organization of an imminent threat, giving them a head start in the race. Any collection of data is at risk. As an administrator, the risk of this data getting into the wrong hands must weigh with the benefits of trend analysis and the intelligence that can come from it. At this time, most functionalities require this to be on an application with pre authorized approval on the device, however, this can change. If a “master key” could be created to fit any application and allow administrators to take over control of devices in secured locations. Administrators could see what trespassers are seeing, pack up cameras and audio to stop information leaks

GeoFencing in File Cloud

Geopolitics and government cost-cutting combined have added urgency to moving files and sharing them in the cloud: cost-cutting because the cloud is perceived to be cheaper than on-premises, and geopolitics because greater scrutiny of where files are located and who they are shared with is accelerating the need to geofence data.

With File Cloud Online, you get the complete flexibility and choice to decide where your organization's data is stored. File Cloud Online is hosted in secure, world-class data centers in the US, EU, Canada, Australia, and Asia. You can select a region that is right for your business. File Cloud also enables administrators to discover and manage sensitive data. DPOs and administrators can now search for common data types using built-in pattern identifiers including email addresses, and phone numbers.There is also the concern that geo-fencing may cause an overdose of unwanted notifications which is a disturbance for an individual. An individual may walk into a coffee shop at the end of a morning walk every day and be bombarded with offers. Or, one may just be passing by a shop with a geo-fence and get messages as a result. For example, "If I'm five feet from my front door, turn on my lights." Or you might ask a reminder app to send you an alert once you reach a specific location. Geofencing isn't just for mobile apps – it's used to control and track vehicles in the shipping industry, cattle in the agriculture industry and – you'll see this topic pop up in drone discussions. Nearly every drone is pre-programmed to accommodate geofencing, which are usually set up around airports, open-air venues and even the White House.

CHAPTER 2
SYSTEM ANALYSIS

2.1. Existing System

Spatial-Temporal provenance Assurance with Mutual Proofs (STAMP) scheme. STAMP is designed for ad-hoc mobile users generating location proofs for each other in a distributed setting. However, it can easily accommodate trusted mobile users and wireless access points. STAMP ensures the integrity and non-transferability of the location proofs and protects users' privacy. A semi-trusted Certification Authority is used to distribute cryptographic keys as well as guard users against collusion by a light-weight entropy-based trust evaluation approach.

- **xAd:**

This tool eliminates every form of assumption in marketing, because it serves messages based on your potential consumer's location. xAd has a proprietary platform that automatically creates boundaries around places often visited by a consumer. For example, a Restaurant, shopping mall. It's with these insights that marketers can target ads to their customers when they're within those location

- **Koupon Media:**

This tool prompts a targeted offer to shoppers when they're within the store. Koupon Media has features that study the behavioral attribute of buyers within the geofenced locations, and uses it to present the buyer with offers they can't resist while they are shopping.

- **NinthDecimal:**

This helps marketers to target consumers near their own stores or competitor's locations, with tangible media ads through phone calls, appointment requests, and couponing.

● **Wal-Mart**

It is another brand making it really big with geofencing. Their app comes with a store mode that picks up signals when a buyer is within the store, and delivers coupons and e-receipts.

2.1.1 Existing Application

- **Rideshare** - Geofences are a key component of Uber's service. For example, the app assigns rides to the drivers closest to the user's perimeter or location.
- **Ski resorts** - Operators can notify skiers when they are approaching off-limits areas and prevent accidents.
- **National parks** - Hikers download a geofencing-enabled app that tells park rangers where they are at any given time. This way, they can act faster in case of an emergency.
- **Assisted Living** - Nursing homes can set up a perimeter around their facilities and know if a resident wanders off. They can also track patients when they go to medical checkups, for example.
- **Warehouses** - Workers receive push notifications when trucks enter the geofence. This way they can have everything ready before it reaches the loading area.
- **Pet tracking** - This is a no-brainer. By fitting your pet with a GPS collar, you can know in real-time when your furry one leaves your property.
- **Movers** - Some movers don't rent their trucks for long-distance hauls. Geofencing allows them to charge extra if a client takes a vehicle outside city limits.
- Real time cab booking service like Uber, Lyft, Bolt.
- Real time hotel / restaurant search like Yelp.
- Hyper-local delivery system — dispatch delivery agents for restaurant orders like Uber Eats.

2.1.2 Disadvantages

- It requires the key for authentication.
- It only protects data access.
- It does not wipe out the data.

2.2. Proposed System

This project will provide an introduction to GeoServer own authentication and authorization subsystems. such as from basic/digest authentication and CAS support, check through the various identity providers, such as Geo fence boundaries, MAC (Media Access Control), IP (Internet Protocol), as well as providing examples of custom authentication plug-in for GeoServer, integrating it in a home-grown security architecture. This system creates the victim file to wipe out the data, when the data is attempted to open outside of the geo fence.

2.2.1 Virtual Fence

The project proposes a Geo-fencing (geofencing) is a feature in a software program that uses the global positioning system (GPS) to define geographical boundaries. To check whether a person is within a geofence range we can make use of different algorithms such as Ray-casting, Winding Number, TWC (Triangle Weight Characterization) and Circular Geofencing using Haversine Formula. Geofencing is security, when anyone enters or leaves a particular area, an alert passes to the server. This system creates the victim file to wipe out the data, when the data is attempted to open outside of the geo fence.

2.2.2 Geospatial Intelligence Technology

Geo-fencing (geofencing) is a feature in a software program that uses the global positioning system (GPS) or radio frequency identification (RFID) todefine geographical boundaries'-fencing allow an administrator to set up triggers so when a device enters (or exits) the boundaries defined by the administrator, an alert is issued. Geofence virtual barriers can be active or passive.

Active geofences require an end user to opt-in to location services and a mobile app to be open. Passive geofences are always on; they rely on Wi-Fi and cellular data instead of GPS or RFID and work in the background. Geofences can be set up on mobile, tablet, and even desktop devices anywhere in the world.

Advantages

- It is used to wipe out the files of unauthorized access found.
- It gets the system information of the malicious user.
- Geofencing can also be used to provide an additional layer of access control to company resources.
- Geofencing can also be used as part of a data loss prevention strategy.
- Data protection done on time and more efficiently
- Email Security: It provides user-friendly email security with high-level access control to protect and control entire emails: message, attachments and files.
- Document Security: It protects files when sharing, at rest and in storage, irrespective of type and size. Letting you protect your confidential data in a compliant way
- Cloud Security: It secures your files before you upload them to the cloud. Even if an attacker were to gain access to your secured files, they are unusable to them.

CHAPTER 3

SYSTEM REQUIREMENTS

3.1 Hardware specification

- Processors: Intel® Core™ i5 processor 4300M at 2.60 GHz or 2.59 GHz (1 socket, 2 cores, 2 threads per core), 8 GB of DRAM ● Disk space: 320 GB
- Operating systems: Windows® 10, macOS*, and Linux*

3.2 Software specification

- Server Side : Python 3.7.4(64-bit) or (32-bit)
- Client Side : HTML, CSS, Bootstrap
- IDE : Flask 1.1.1
- Back end : MySQL 5.
- Server : WampServer 2i
- VF DLL : geopandas, geopy, SiKit Learn

3.3 Software Description

3.3.1 PHP 8.1

The PHP Hypertext Preprocessor (PHP) is a programming language that allows web developers to create dynamic content that interacts with databases. PHP is basically used for developing web-based software applications. This tutorial helps you to build your base with PHP.

PHP is a flexible, dynamic language that supports a variety of programming techniques. It has evolved dramatically over the years, notably adding a solid object-oriented model in PHP 5.0 (2004), anonymous functions and namespaces in PHP 5.3 (2009), and traits in PHP 5.4 (2012).

- **Object-oriented Programming**

PHP has a very complete set of object-oriented programming features including support for classes, abstract classes, interfaces, inheritance, constructors, cloning, exceptions, and more.

- **Functional Programming**

PHP supports first-class functions, meaning that a function can be assigned to a variable. Both user-defined and built-in functions can be referenced by a variable and invoked dynamically. Functions can be passed as arguments to other functions (a feature called Higher-order Functions) and functions can return other functions.

- **Meta Programming**

PHP supports various forms of meta-programming through mechanisms like the Reflection API and Magic Methods. There are many Magic Methods available like __get(), __set(), __clone(), __toString(), __invoke(), etc. that allow developers to hook into class behavior. Ruby developers often say that PHP is lacking method missing, but it is available as __call() and __callStatic().

- **PHPoC (PHP on Chip): a programming language and an IoT hardware platform.**

PHPoC is a programming language developed based on the widely-used PHP language, that makes it become not only a Web development language but also the general-purpose programming language for IoT. The syntax is almost the same as PHP, but adapted for the embedded system. PHPoC inherits almost all core functions from PHP. PHPoC adds new functions, which are used to interact with hardware peripherals such as I/O, UART, I2C, SPI, ADC, TIMER/COUNTER, RTC and so on.

In other words, PHPoC is an expansion of PHP on a small chip. It takes advantage of the powerful features of PHP and adds extra features to become a powerful programming language for IoT development. PHPoC can be used to not only develop dynamic Web pages, but also to monitor and control PHPoC is the IoT hardware platform that is equipped with a PHPoC interpreter and uses PHPoC language for programming.

- **Standard PHP Library**

The Standard PHP Library (SPL) is packaged with PHP and provides a collection of classes and interfaces. It is made up primarily of commonly needed data structure classes (stack, queue, heap, and so on), and iterators which can traverse over these data structures or your own classes which implement SPL interfaces.

- **Command Line Interface**

PHP was created to write web applications, but is also useful for scripting command line interface (CLI) programs. Command line PHP programs can help automate common tasks like testing, deployment, and application administration.

3.3.2 MySQL

MySQL is a relational database management system based on the Structured Query Language, which is the popular language for accessing and managing the records in the database. MySQL is open-source and free software under the GNU license. It is supported by Oracle Company.

MySQL 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 fast, scalable, and an easy to use database management system in comparison with Microsoft SQL Server and Oracle Database. It is commonly used in conjunction with PHP scripts for creating powerful and dynamic server-side or web-based enterprise applications. It is developed, marketed, and supported by MySQL AB, a Swedish company, and written in C programming language and C++ programming language. The official pronunciation of MySQL is not the My Sequel; it is My Ess Que Ell. However, you can pronounce it your way. Many small and big companies use MySQL. MySQL supports many Operating Systems like Windows, Linux, MacOS, etc. with C, C++, and Java languages.

MySQL is a Relational Database Management System (RDBMS) software that provides many things, which are as follows:

- It allows us to implement database operations on tables, rows, columns, and indexes.
- It defines the database relationship in the form of tables (collection of rows and columns), also known as relations.
- It provides the Referential Integrity between rows or columns of various tables.
- It allows us to update the table indexes automatically.
- It uses many SQL queries and combines useful information from multiple tables for the end-users.

3.3.3 WampServer

WampServer is a Windows web development environment. It allows you to create web applications with Apache2, PHP and a MySQL database. Alongside, PhpMyAdmin allows you to manage your database easily.

WAMPServer is a reliable web development software program that lets you create web apps with MYSQL database and PHP Apache2. With an intuitive interface, the application features numerous functionalities and makes it the preferred choice of developers from around the world. The software is free to use and doesn't require a payment or subscription

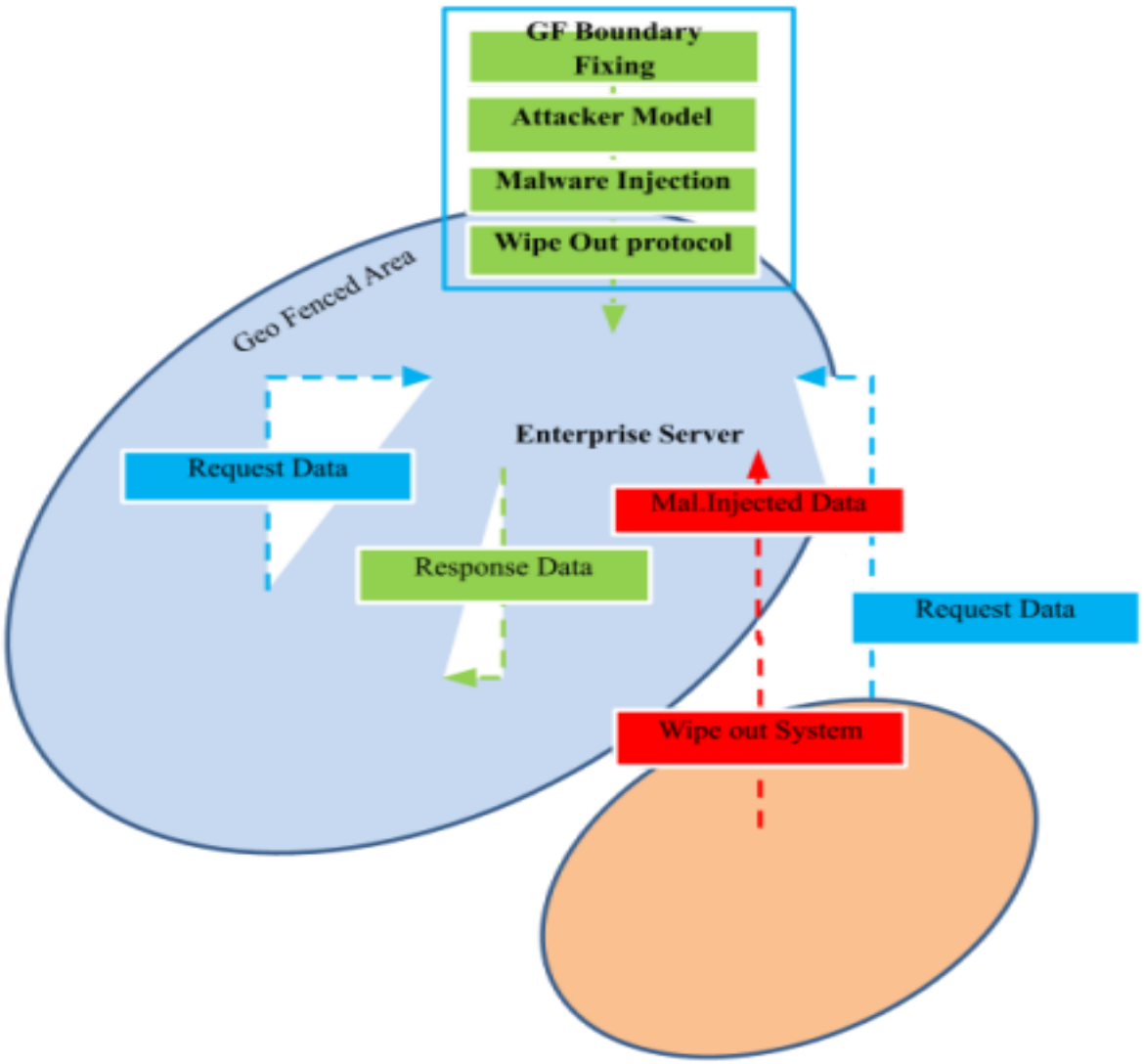
3.3.4 Bootstrap 4

Bootstrap is a free and open-source tool collection for creating responsive websites and web applications. It is the most popular HTML, CSS, and JavaScript framework for developing responsive, mobile-first websites. It solves many problems which we had once, one of which is the cross-browser compatibility issue. Nowadays, the websites are perfect for all the browsers (IE, Firefox, and Chrome) and for all sizes of screens (Desktop, Tablets, Phablets, and Phones).

CHAPTER 4

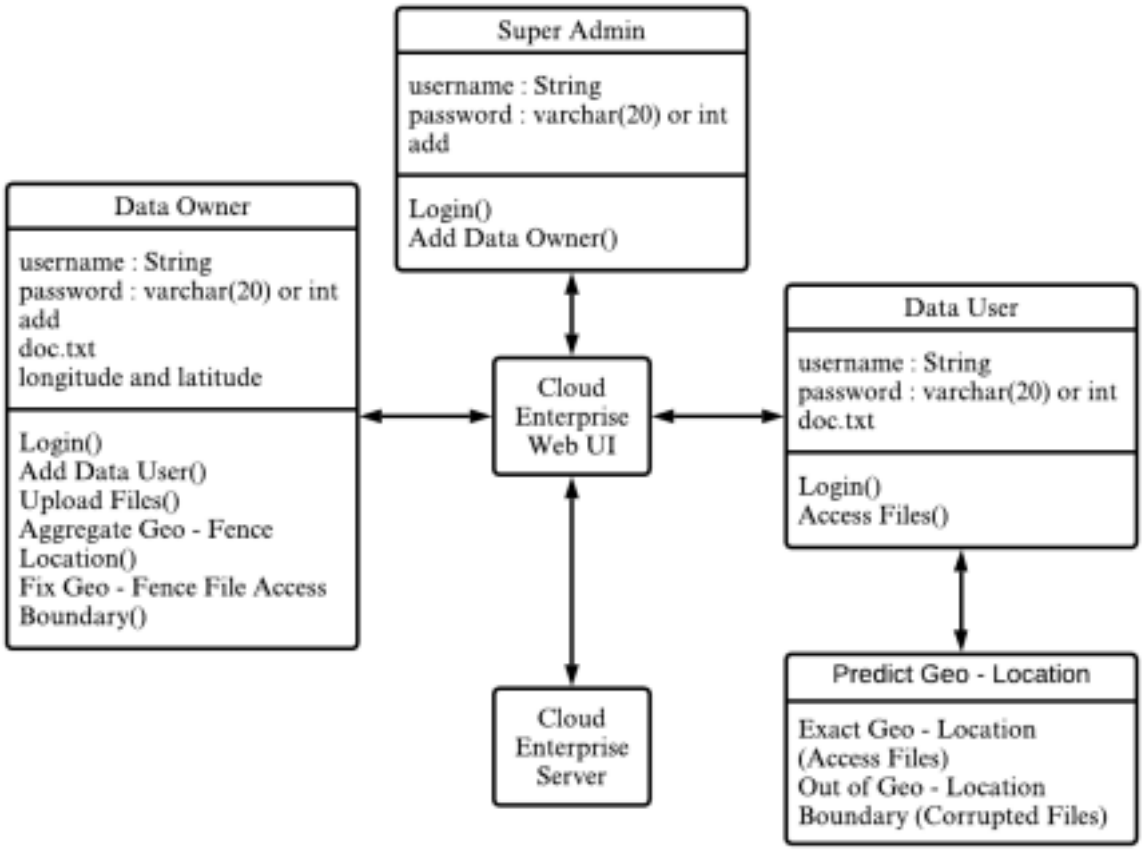
SYSTEM DESIGN

4.1 System Architecture



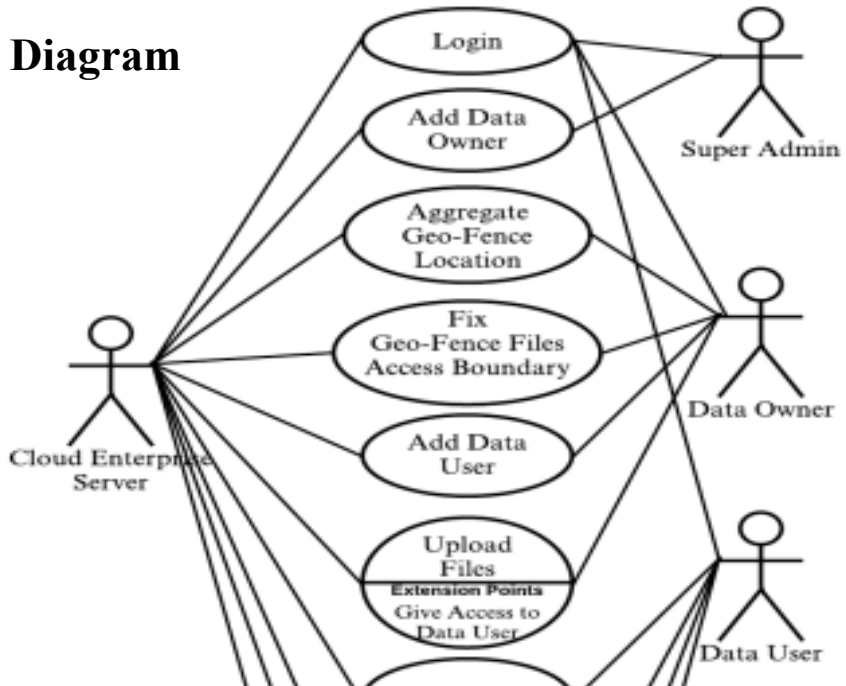
4.2 UML

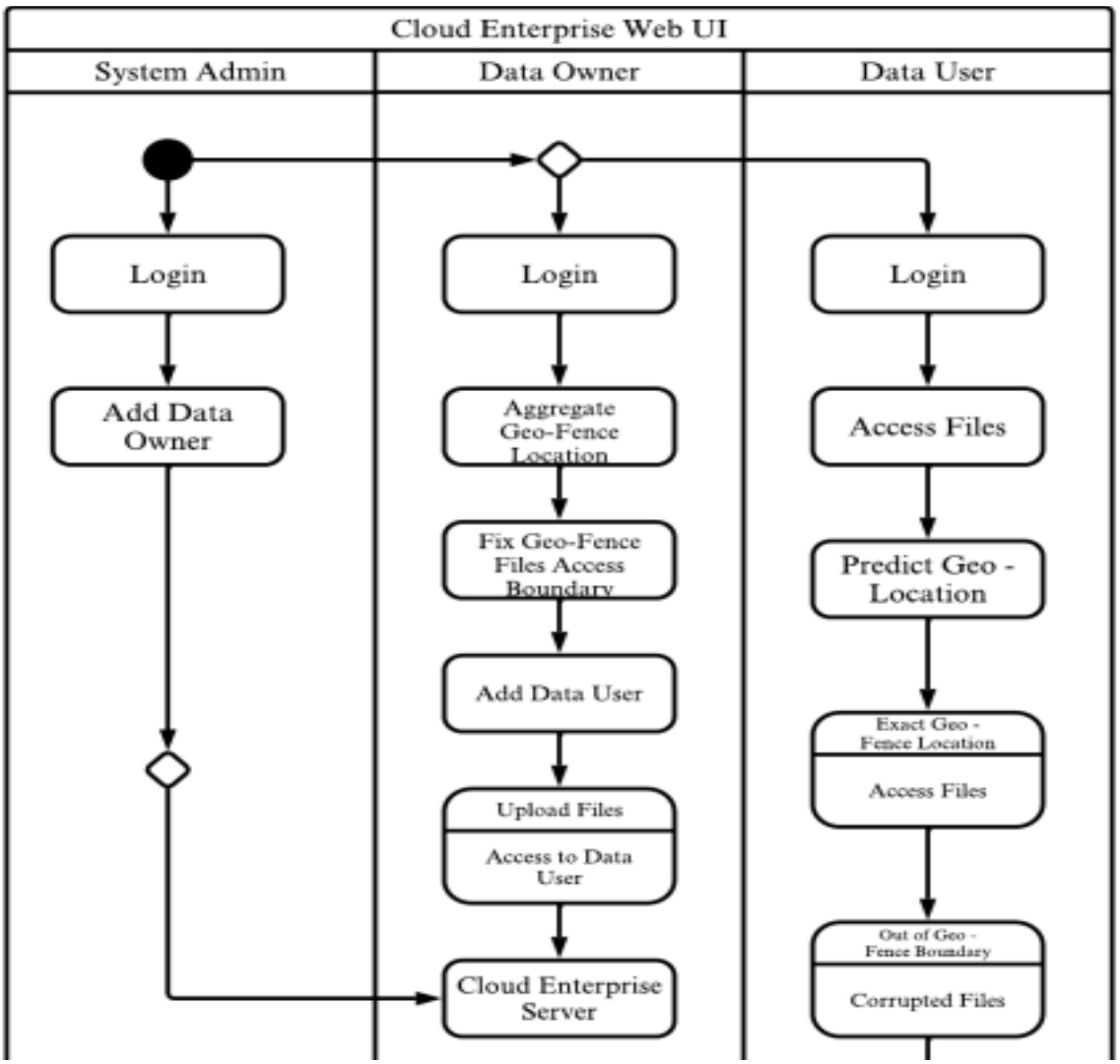
4.2.1 Class Diagram



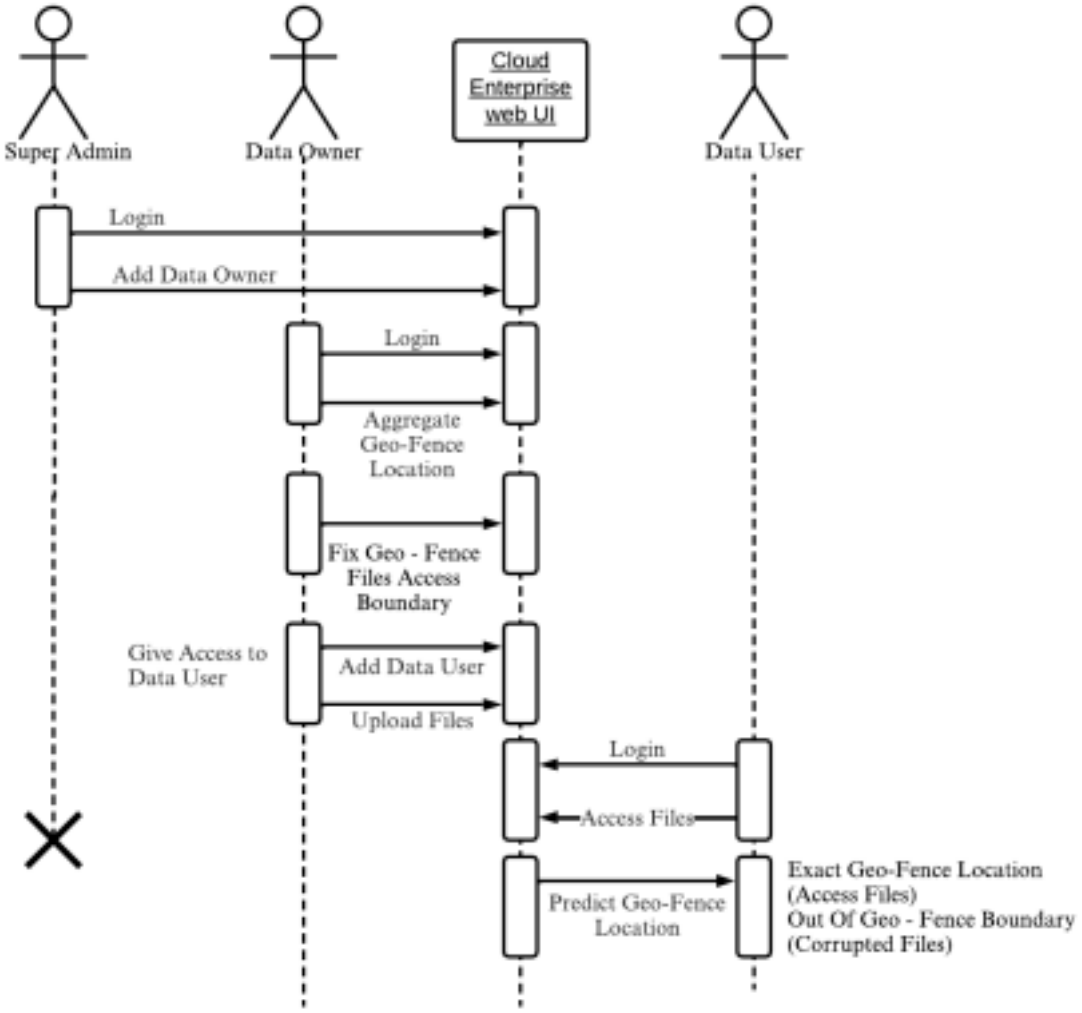
4.2.2 Use Case Diagram

4.2.3 Activity Diagram

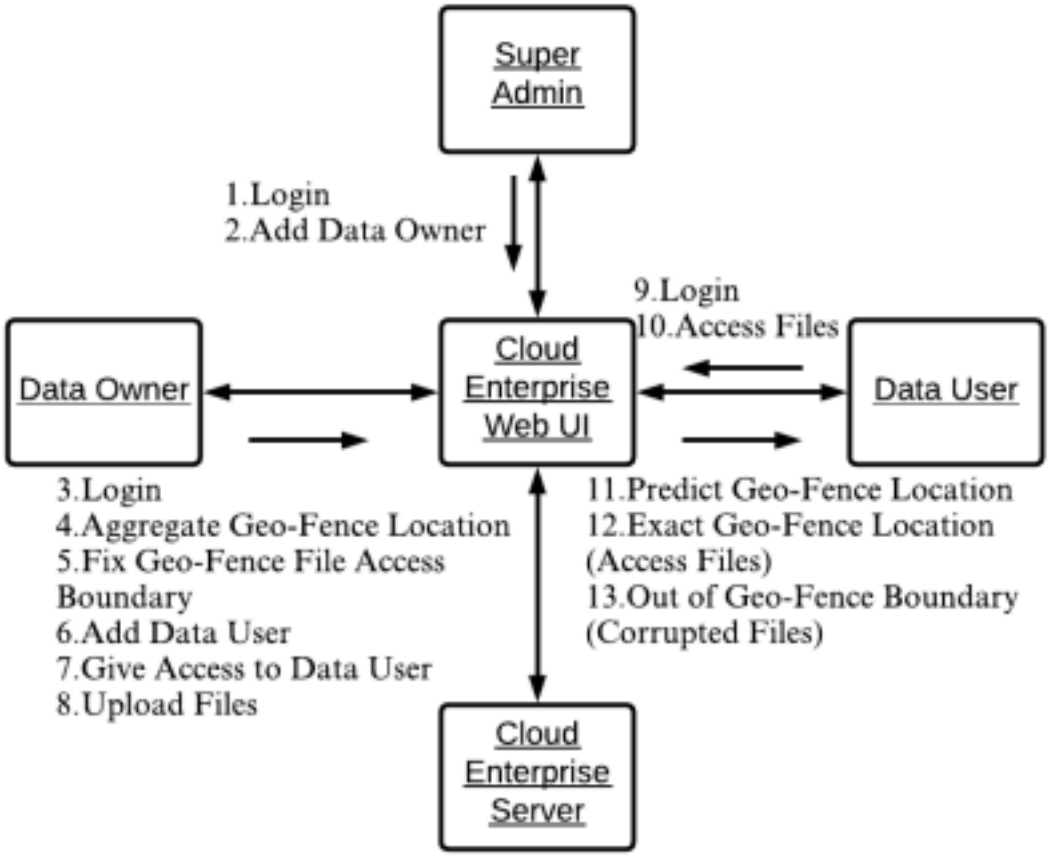




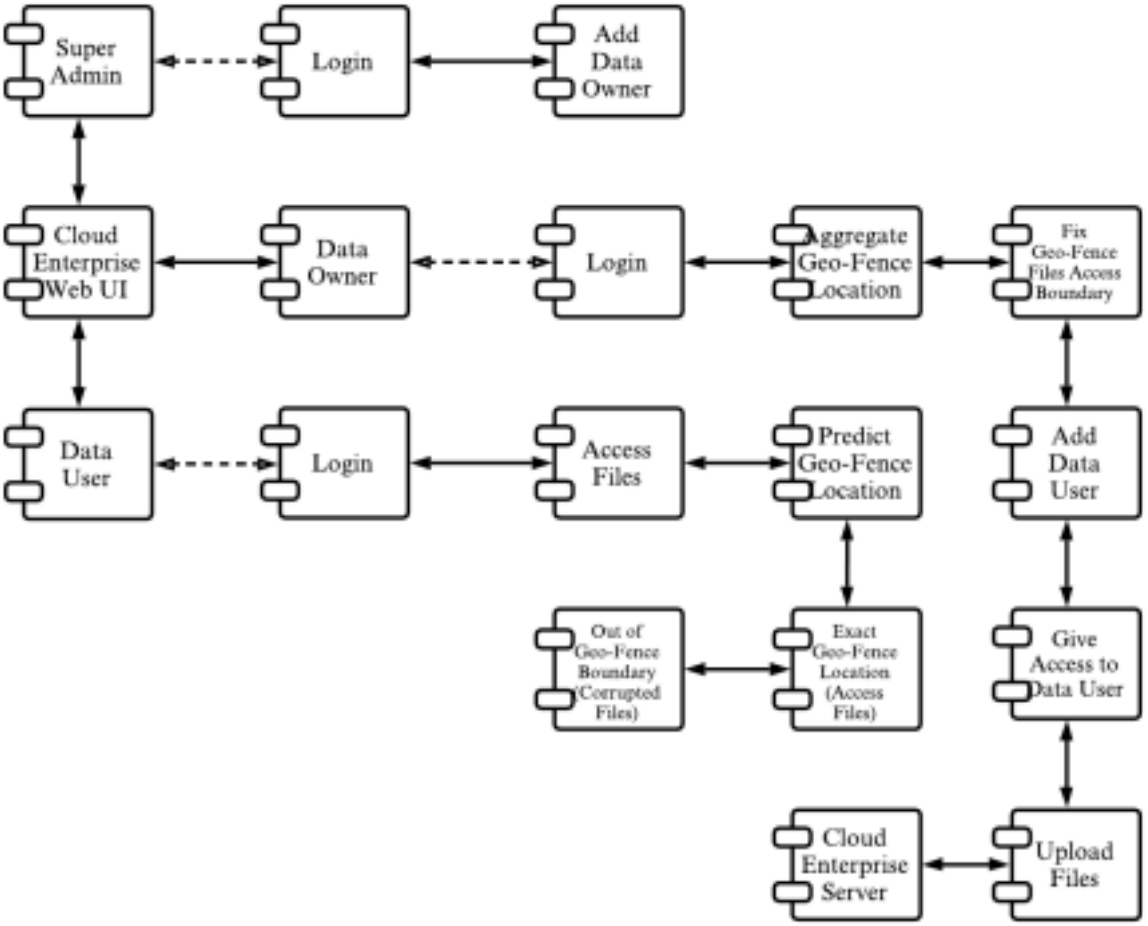
4.2.4 Sequence Diagram



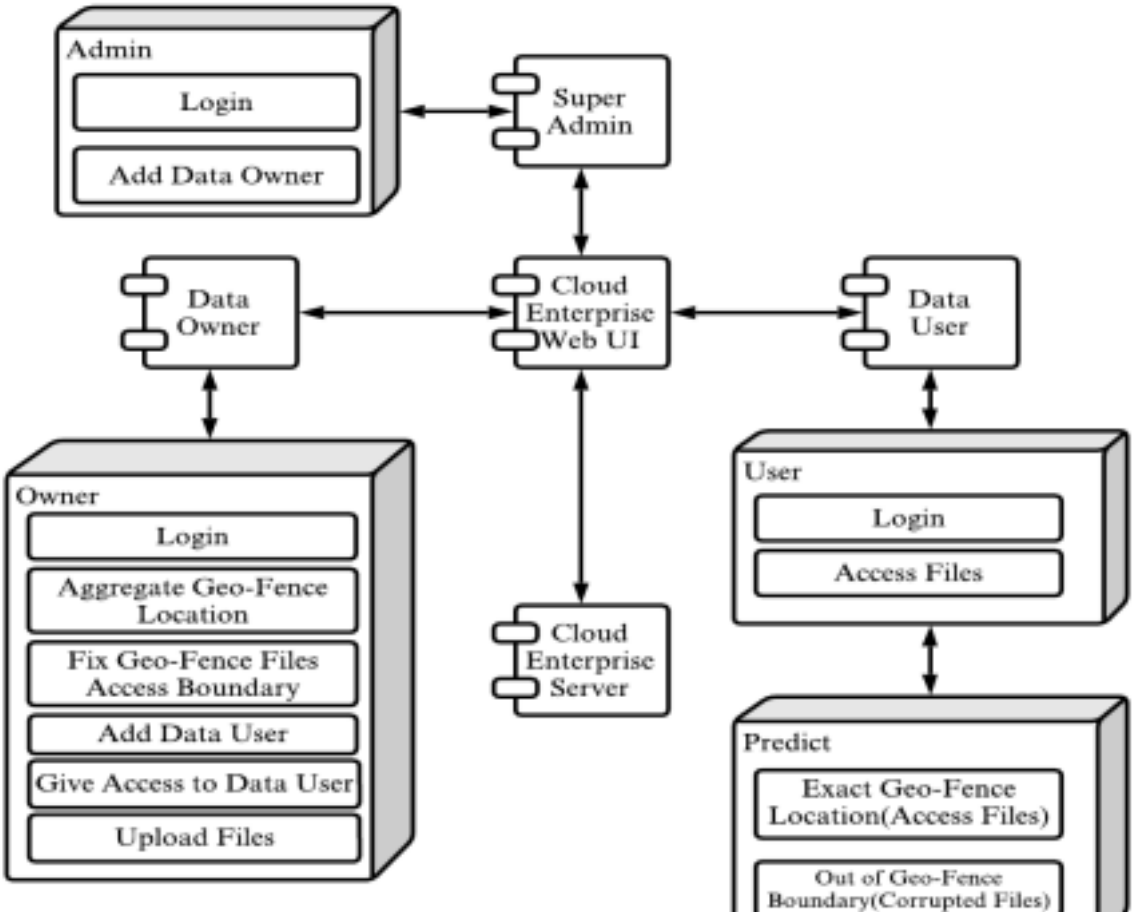
4.2.5 Collaboration Diagram

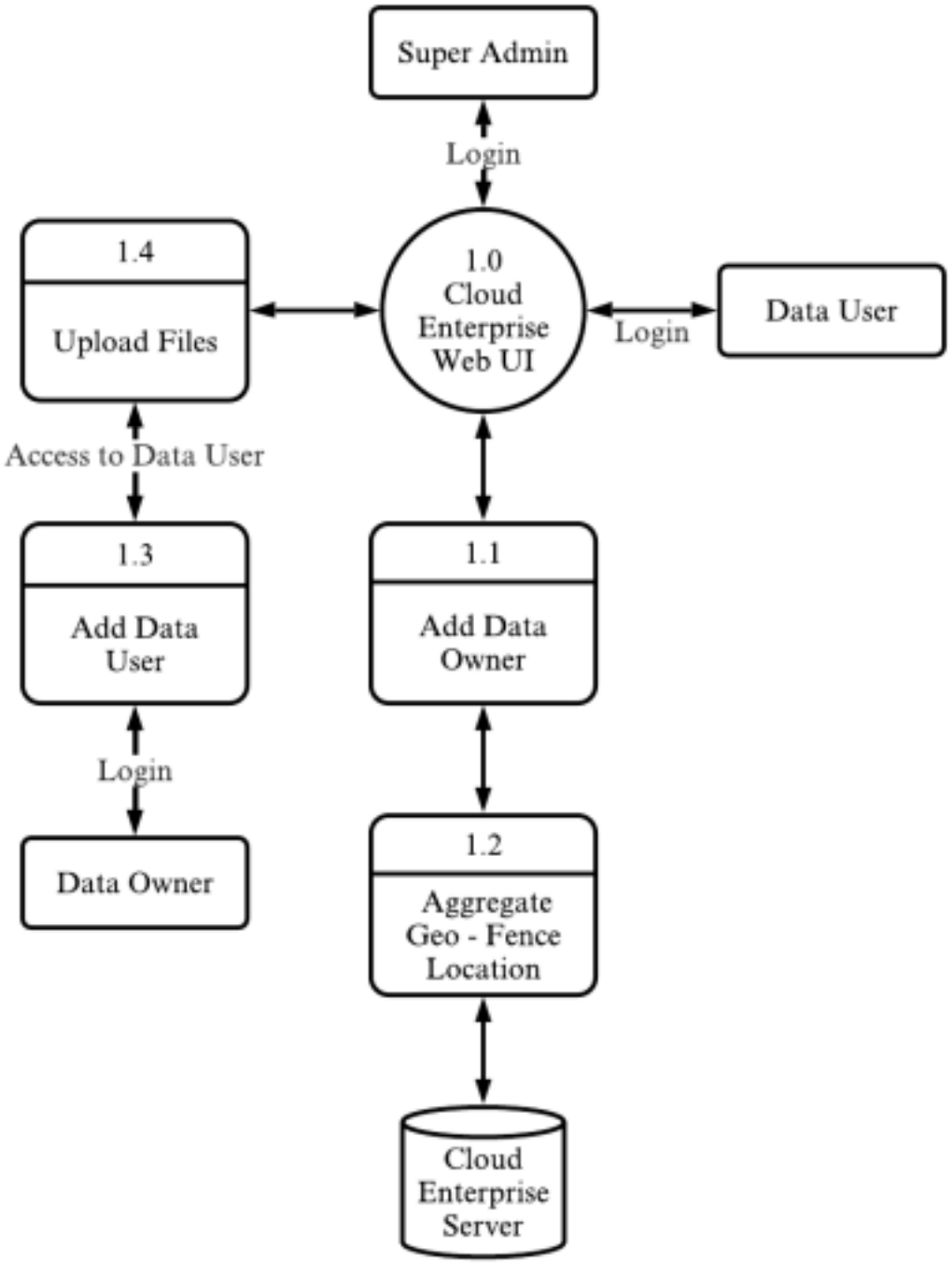


4.2.6 Component Diagram

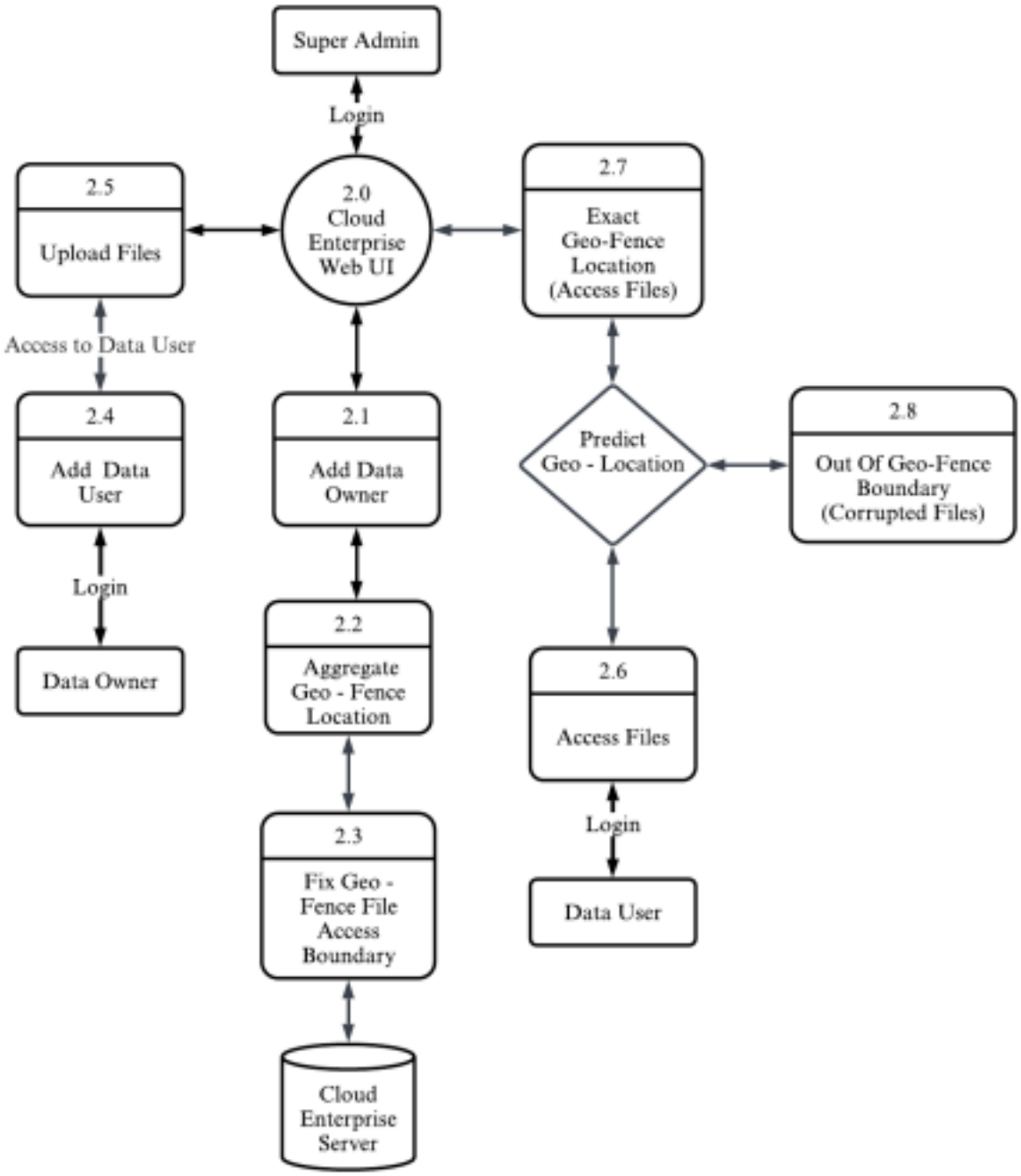


4.2.7 Deployment Diagram




Super Admin
Login
1.4
Upload Files
1.0
Cloud
Enterprise
Web UI
Login
Data User
Access to Data User
1.3
Add Data
User
1.1
Add Data
Owner
Login
Data Owner
1.2
Aggregate
Geo - Fence
Location
Cloud
Enterprise
Server

Level – 2



4.3 Database

Database: geo_fence

Table 4.3.1 structure for table admin

Field	Type Null	Default
username	varchar(20) Yes	NULL
password	varchar(20) Yes	NULL

Table 4.3.2 structure for table geo_city

Field	Type	Null Default
id	int(11)	Yes NULL
location	varchar(30)	Yes NULL
detail	text	Yes NULL

Table 4.3.3 structure for table geo_emp

Field	Type
id	int(11)
name	varchar(20)
empid	varchar(20)
gender	varchar(20)
dob	varchar(20)
email	varchar(40)

mobile	bigint(20)
pass	varchar(20)

Null Default Yes NULL
Yes NULL Yes NULL Yes
NULL Yes NULL Yes
NULL Yes NULL Yes
NULL

branch varchar(30) Yes NULL

Table 4.3.4 structure for table geo_location

Field	Type
id	int(11)
location	varchar(30
branch	varchar(30

detail	text

Null Default Yes NULL Yes
NULL Yes NULL Yes
NULL

Table 4.3.5 structure for table geo_message

Field
id
sender
receiver

subject
message
filename
rdate

rtime
month
year
read_st
status

Yes NULL varchar(50) Yes NULL varchar(50) Yes NULL varchar(100) Yes NULL varchar(200) Yes NULL varchar(200) Yes NULL varchar(20) Yes NULL varchar(20) Yes NULL varchar(20) Yes NULL int(11) Yes NULL int(11) Yes NULL int(11) Yes NULL

Type Null Default int(11)

CHAPTER 5

IMPLEMENTATION

5.1 Proposed Algorithms

5.1.1 Algorithms

1. Point in Geofence Framework and Algorithm:

Input: **r** is the radius of the geofence. **g** = [go, gi]
gi is the position of the interest, go is the position of the user. Output: true if **r** does not violate **g**, otherwise false

```
1: if pointInGeofence (gi, r) then
2:return true
3: end if
4: for all go(i) in go do
5:if pointInGeofence(r, go(i)) then
6:return false
7:end if
8: end for
9: return true
```

The above algorithm consists of the input parameters r and g. r = (x, y) is the current position to check for geofence violation. The geofence is specified by g = [gi, go] where gi is the keep-in geofence boundary polygon and Go = {go1, ..., g0n} is the set of keep-out boundaries. go_j is the j^{th} of n keep-out geofence boundary polygons. The PointInGeofence () function can be implemented by any of the algorithms like Ray Casting, Winding Number, TWC and Circular Geofencing using Haversine formula.

2. Ray Casting

The Ray Casting algorithm determines whether or not the position of interest, Gi, is inside a given polygon p, by projecting an infinite ray from Gi. If the infinite ray intersects an odd number of polygon edges, then r is contained in p, otherwise, r is outside of p. As the Ray Casting algorithm iterates over all edges of p and does not have an initialization step, if the geofence boundaries change from one time step to the next, code execution and results of the Ray Casting algorithm are not impacted.

Algorithm:

Input: p is a simple polygon

Gi is the position of interest buf is a buffer distance.

Output: true if p contains **Gi**, otherwise false

1: count = 0
2: s is an infinite ray in the +y direction, originating at **Gi**
3: for all edges e in p do
4: if **Gi_x** is within buf of ex then
5: ex,buf = ex -2 * buf
6: else
7: ebuf = e
8: end if
9: if **Gi** is within buf of e or ebuf then
10: return false

Winding Number:

The winding number accurately determines if a point is inside a non-simple closed polygon. It does this by computing how many times the polygon winds around the point. The point is outside only when this "winding number" wn = 0; otherwise, the point is inside.

Algorithm for Winding Number:

Input:

Gi = a point of Interest,

V [] = vertex points of a polygon V[n+1] with V[n] = V[0]

n = number of vertices Output:

winding_number

(when the winding_number =0, P is outside

```
and winding_number is non-zero if P is
inside)
PIP_windingNumber (Point Gi, Point V [],
int n)
  {
 Wn=0:
 1: int// the winding number counter
  2: for each edge E[j]: V[j] V[j+1] of the Polygon Do
3: if (E[j] crosses upward)
4: if (P is strictly left of E[j])
5: ++winding_number;
6: end if
7: else if (E[j] crosses downward)
8: if (P is strictly right of E[j])
9: - -winding_number;
10: end if
11: end if
12: end for
13: return winding_number;}
```

3. Triangle Weight Characterization (TWC):

Triangle Weight Characterization, consists of an initialization step and a run-time step as shown in Algorithm of TWC [4]. The initialization step must be executed for all keep-in and keep-out geofences when the system first activates. If there are any changes to any of the geofence boundaries after the original initialization, each keep-in or keep-out geofence that is changed must be initialized again [4].

The initialization step subdivides each of the original geofences from simple polygons to y- monotone polygons and then to triangles [4]. The run-time step checks whether the position of interest is within each triangle. If the position of interest is inside any of the triangles, then it is within that polygon. Otherwise, it

is outside the polygon [4].

Algorithm for TWC:

Input:

p is a simple polygon
Gi is the position of interest Output:
true if p contains **Gi**, otherwise false

Initialization:

1: Divide p to m y-monotone polygons

2: for all y-monotone polygons M in p do
3: Divide polygon M to n triangles
4: end for

Run-Time:

5: for all N triangles in p do 6: if N contains **Gi** then
7: return true
8: end if
9: end for
10: return false

4. Circular Geofencing Using Haversine Formula [7]: In the below algorithm, geofence of radius 'r' is created around the point Go. The distance between Go and Gi is calculated using the Haversine formula. The Haversine formula determines the great-circle distance between two points on a sphere given their longitudes and latitudes.

Algorithm:

Input: Gi the position of the interest. Gi = [lati, longi] Go
is the current position of the user. Go [lato, longo] r is the radius of the geofence.

Output:

True if the Gi is within Geofence range of Go

checkWithInGeofenceRange ()
{
1: Distance = 0
2: Distance = getDistanceFrom Location (Go, Gi);

```
3: If (d < r)
4: Return true
5: Else
6: Return false
7: End if
    }
   Get DistanceFromLocation (Go, Gi)
   {
8: radius =6371; //radius of earth
9: dlat = deg2rad (lati, -lato);
10: dlong = deg2rad (longi, -longo);
11: a = Math.sin (dlat / 2) * Math. sin (dlat/2)
      + Math. cos (deg2rad(lato))
       *Math. cos (deg2rad(lati))
       *Math. sin (dlong/2) *Math. sin (dlong/2);
12: c= 2 * Math.atan2 (math. sqrt (a), Math.sqrt (1-a));
13: D= R* c;14: Return d;}
```

So, after calculating the distance, if the distance is greater than radius then the point of interest Gi will be discarded and if the distance is less than radius then the point of interest Gi is highlighted with marker within geofence. **5.2**

Module Description

5.2.1Cloud Service Provider Dashboard

In this module we develop a cloud application, or cloud app, it is a software program where cloud-based and local components work together. This model relies on remote servers for processing logic that is accessed through a web browser with a continual internet connection. Cloud application servers typically are located in a remote data center operated by a third-party cloud services infrastructure provider. Cloud-based application tasks may encompass email,

file storage and sharing. Third-party data sources and storage services can be accessed with an application programming interface (API). Cloud applications can be kept smaller by using APIs to hand data to applications or API-based back-end services for processing or analytics computations, with the results handed back to the cloud application. Vetted APIs impose passive consistency that can speed development and yield predictable results. Data stored on cloud services is instantly available to authorized users.

- **Cloud Storage Server**

Cloud storage servers are virtual storage facilities provided by cloud service providers that help to store and access multiple files without the requirement of any direct physical device. Web storage servers can be accessed via the internet. File Cloud offers the cloud storage at an affordable cost and without any downtime. The cloud storage servers continuously run with the help of these data centers and are maintained by the cloud service providers. Data centers secure your files from any kind of damage and make those files available whenever you want to access it via the internet. Applications access cloud storage through traditional storage protocols or directly via an API. Many vendors offer complementary services designed to help collect, manage, secure and analyze data at massive scale. There are three types of cloud data storage: object storage, file storage, and block storage. Each offers their own advantages and has their own use cases:

- **Object Storage**

Applications developed in the cloud often take advantage of object storage's vast scalability and metadata characteristics. Object storage solutions like Amazon Simple Storage Service (S3) are ideal for building modern applications from scratch that require scale and flexibility, and can also be used to import existing data stores for analytics, backup, or archive.

File Storage - Some applications need to access shared files and require a file system. This type of storage is often supported with a Network Attached Storage (NAS) server. File storage solutions like Amazon Elastic File System (EFS) are ideal for use cases like large content repositories, development environments,

media stores, or user home directories.

Block Storage - Other enterprise applications like databases or ERP systems often require dedicated, low latency storage for each host. This is analogous to direct-attached storage (DAS) or a Storage Area Network (SAN). Block-based cloud storage solutions like Amazon Elastic Block Store (EBS) are provisioned with each virtual server and offer the ultra-low latency required for high performance workloads.

Home directories - The use of home directories for storing files only accessible by specific users and groups is useful for many cloud workflows. Businesses that are looking to take advantage of the scalability and cost benefits of the cloud are extending access to home directories for many of their users. Since cloud file storage solutions adhere to required file system semantics and standard permissions models, customers can easily lift-and-shift applications to the cloud that need this capability.

5.2.2Geo-Fencing Boundary Fixing

Geo-fencing enables an executive to set up triggers so when a gadget enters (or leaves) the limits characterized by the chairman, an alarm is issued. Numerous geo-fencing applications consolidate Google Earth, enabling chairmen to characterize limits over a satellite perspective of a particular land territory.

5.2.3Attacker Module

In the Adversary module, the user can use the data outside of the geo-fence area. It contains two types of attackers involving the system: one is the attacker can use an external device to copy the data in the defense area, and another one is sending the data to the email. It is an one type of cyber-attacks, because an attempt by hackers to damage or destroy whole computer networks or systems.

5.2.4Victim File Injection whole

This module is used to automatically inject the malware file to the original file. The victim file performs the main role of our system, it is an .exe file format. Auto exe is automatically copying the external devices. Suppose the user attaches a file to the mail, it automatically converts the file to .zip format for

preview blocking.

5.2.5Wipe out System

In the wipe out module, it wipes out the files and destroys the system when an exe finds the system is an adversary system. Auto exe is first checking the adversary system having internet connection, if it is having an internet connection, the victim file reading the current system MAC, IP and Geo Location and compare with the server it doesn't match to send the adversary system information to the mail and wipeout the files and system. Otherwise, it does not care about scrapping the system and data.

5.2.6 Performance Evaluation

A geo- fencing system is usually used for location-based service. First, we will use data security in defense. This system provides more security for essential data.

CHAPTER 6

SYSTEM TESTING

6.1 Types of Testing

6.1.1 Unit Testing

Unit testing is a software testing method by which individual units of source code are put under various tests to determine whether they are fit for use (Source). It determines and ascertains the quality of your code.

Generally, when the development process is complete, the developer codes criteria, or the results that are known to be potentially practical and useful, into the test script to verify a particular unit's correctness. During test case execution, various frameworks log tests that fail any criterion and report them in a summary.

The developers are expected to write automated test scripts, which ensures that each and every section or a unit meets its design and behaves as expected. Though writing manual tests for your code is definitely a tedious and time-consuming task, Python's built-in unit testing framework has made life a lot easier.

The unit test framework in Python is called unittest, which comes packaged with Python.

Unit testing makes your code future proof since you anticipate the cases where your code could potentially fail or produce a bug. Though you cannot predict all of the cases, you still address most of them.

A unit could be bucketed into various categories:

• An entire module,

• An individual function,

• A complete interface like a class or a method.

The best ways to write unit tests for your code is to first start with a smallest testable unit your code could possibly have, then move on to other units and see how that smallest unit interacts with other units, this way you could build up a comprehensive unit test for your applications.

Python's unit testing framework was inspired by java's JUnit and has similar features as major unit testing frameworks in other languages. Python's unit testing framework offers various features like (Source: TutorialsPoint) • Test automation

• Sharing of setup and shutdown code for tests

• Aggregating tests into collections

• Independence of the tests from the reporting framework

6.1.2 Integration Testing

Integration testing exercises two or more parts of an application at once, including the interactions between the parts, to determine if they function as intended. This type of testing identifies defects in the interfaces between disparate parts of a codebase as they invoke each other and pass data between themselves.

6.1.3 Integration testing resources

- Integration testing with Context Managers gives an example of a system that needs integration tests and shows how context managers can be used to address the problem.

- Integration testing, or how to sleep well at night explains what integration tests are and gives an example. The example is coded in Java but still relevant when you're learning about integration testing.
- What is an integration test exactly? is an awesome Stack Exchange thread that defines the differences in testing approaches like unit tests versus integration and other tests. There is also some practical advice like "It's not important what you call it, but what it does" which as a pragmatic programmer I am keen to agree on.
- Consistent Selenium Testing in Python gives a spectacular code-driven walkthrough for setting up Selenium along with SauceLabs for continuous browser-based testing.
- Where do our flaky tests come from? presents Google's data on where their integration tests fail and how the tools you use can sometimes lead to higher incidence of failed tests than other testing tools.
- Unleash the test army covers the author's first impressions of using Hypothesis for testing the properties of a system under test.

6.1.4 System Testing

System Testing is a level of testing that validates the complete and fully integrated software product. The purpose of a system test is to evaluate the end-to-end system specifications. Usually, the software is only one element of a larger computer-based system. Ultimately, the software is interfaced with other software/hardware systems. System Testing is actually a series of different tests whose sole purpose is to exercise the full computer-based system.

Two Category of Software Testing

- Black Box Testing
- White Box Testing

White box testing is the testing of the internal workings or code of a software application. In contrast, black box or System Testing is the opposite. System test

involves the external workings of the software from the user's perspective.

6.1.5 Different Types of System Testing

There are more than 50 types of System Testing. For an exhaustive list of software testing types click here. Below we have listed types of system testing a large software development company would typically use

1. mainly focuses on the user's ease to use the application, flexibility in handling controls and ability of the system to meet its objectives 2. **Load Testing**– is necessary to know that a software solution will perform under real-life loads.
3. **Regression Testing**– involves testing done to make sure none of the changes made over the course of the development process have caused new bugs. It also makes sure no old bugs appear from the addition of new software modules over time.
4. **Recovery testing** – is done to demonstrate a software solution is reliable, trustworthy and can successfully recoup from possible crashes. 5. **Migration testing-** is done to ensure that the software can be moved from older system infrastructures to current system infrastructures without any issues.
6. **Functional Testing** – Also known as functional completeness testing, Functional Testing involves trying to think of any possible missing functions. Testers might make a list of additional functionalities that a product could have to improve during functional testing.
7. **Hardware/Software Testing** – IBM refers to Hardware/Software testing as "HW/SW Testing". This is when the tester focuses his/her attention on the interactions between the hardware and software during system testing.

6.1.6 Module testing

Module testing is defined as a software testing type, which checks individual subprograms, subroutines, classes, or procedures in a program. Instead of testing the whole software program at once, module testing

recommends testing the smaller building blocks of the program. Module testing is largely a white box oriented. The objective of doing Module, testing is not to demonstrate proper functioning of the module but to demonstrate the presence.

How to do Module Testing?

For Module Testing, designing a Test Case is an important segment. While designing test cases for a module test, a tester has to take two things into consideration.

- Specification for the module
- The module's source code

Analyze the module's logic by using one or more of the white box methods, and then supplement these test cases by applying black box methods to the modules specification

- Once the test case is designed, the next step is to combine the module for testing. For this, the method used is either an **Incremental or non-Incremental method**.
- Non-incremental method- all modules are tested independently. First, it combines all modules and then test the whole program
- Incremental Testing, there are two approaches – Top down and Bottom Up testing

6.2Validation Testing

The definition of validation testing in software engineering is in place to determine if the existing system complies with the system requirements and performs the dedicated functions for which it is designed along with meeting the goals and needs of the organization. This mode of testing is extremely important especially if you want to be one of the best software testers. The software verification and validation testing is the process after the validation testing stage is secondary to verification testing.

CHAPTER 7

APPENDIX

7.1 Conclusion

In this project, we introduced a novel location-aware framework for providing data security, which enables the participation of workers without compromising their location privacy. We identified geo fencing as a needed step to ensure that data privacy is protected prior to workers consenting to a task. We provided heuristics and optimizations for determining effective geo fencing regions that achieve high task assignment rate with low overhead. It also generates the victim files; it automatically checks the geo - fencing boundary values and wipeout the system and files when geo - fencing and MAC Address is mismatched.

7.2 Future Scope

In the future, we plan to take into account more complicated policies to capture other privacy requirements other than the location. And also we insist this method to popular EMail Service Providers too.

a.1 Source Code

Login

```
<?php
session_start();
include("include/dbconnect.php");
extract($_REQUEST);
if(isset($btn))
 {
$qry=mysqli_query($connect,"select * from geo_emp where
empid='$uname' && pass='$pass'");
$num=mysqli_num_rows($qry);
        if($num==1)
         {
        $_SESSION['lat']=$lat;
```

```
        $_SESSION['lon']=$lon;
        $_SESSION['uname']=$uname;
        ?>
<script language="javascript">
window.location.href="home.php";
</script>
<?php
        }
        else
        {
        ?>
<script language="javascript">
window.location.href="index.php?act=wrong";
</script>
<?php
        }

}
?>
<form name="form1" method="post">
        <?php
        if($act=="wrong")
        {
        ?>
<div class="alert-danger">Username or Password Incorrect!</div>
           <?php
             }
            ?>
                                                    <div class="form-group">
                                <label>Employee ID</label>
```

```
                        <input type="text" name="uname" class="form-control"
placeholder="Employee ID">
                    </div>
                    <div class="form-group">
                        <label>Password</label>
                        <input type="password" name="pass"
class="form-control" placeholder="Password">
                                                    <input type="text"
name="lat">
                                                    <input type="text"
name="lon">
                    </div>
                    <div class="checkbox">
                        <label>
                                                        <input
type="checkbox"> Remember Me
                                                    </label>
                        <label class="pull-right">
                                                        <a
href="#">Forgotten Password?</a>
                                                    </label>

                    </div>
                    <button type="submit" name="btn" class="btn btn-primary
btn-flat m-b-30 m-t-30">Sign in</button>
                    <div class="social-login-content">
                        <div class="social-button">
                            <input type="submit" name="btn2" class="btn
btn-primary btn-flat btn-addon m-b-10" value="Data Server">
                            </div>
                    </div>
                    <div class="register-link m-t-15 text-center">
```

```
                    <p>Don't have account ? <a href="register.php"> Sign
Up Here</a></p>
                </div>
            </form>
```

Add Employee

```
<?php
session_start();
include("include/dbconnect.php");
extract($_REQUEST);

$max_qry = mysqli_query($connect,"select max(id) maxid from
    geo_emp"); $max_row = mysqli_fetch_array($max_qry);
    $id=$max_row['maxid']+1;
    $rdate=date("d-m-Y");

    $str=str_pad($id,3,'0',STR_PAD_LEFT);
    $empid="E".$str;
if(isset($btn))
 {
$ins=mysqli_query($connect,"insert into
geo_emp(id,name,empid,gender,dob,email,mobile,pass,branch)
values($id,'$name','$empid','$gender','$dob','$email','$mobile','','$branch')");
    if($ins)
    {
$message="Dear $name, <br>Your Account has created<br>Employee
ID: $empid";
echo '<iframe
src="http://iotcloud.co.in/testmail/sendmail.php?message='.$message.'&email='
. $email.'" style="display:none"></iframe>';
    ?>
    <script language="javascript">
    window.location.href="add_emp.php?act=success";
```

```
        </script>
        <?php
        }
        else
        {
        ?>
        <script language="javascript">
        window.location.href="add_emp.php?act=wrong";
        </script>
        <?php
        }
}
?>
<form name="form1" method="post">
                        <div class="form-group">
                            <label>Employee ID</label>
                             <label>: <?php echo $empid; ?></label>
                        </div>
                                                    <div class="form-group">
                            <label>Employee Name</label>
                            <input type="text" name="name" class="form-control"
placeholder="">
                        </div>
                                                    <div class="form-group">
                            <label>Gender</label>
                             <input type="radio" name="gender" value="Male">
<label>Male</label>
                                                        <input type="radio"
name="gender" value="Female"> <label>Female</label>
                        </div>
                                                    <div class="form-group">
```

```
                    <label>Date of Birth</label>
                    <input type="text" name="dob" class="form-control">
                </div>
                <div class="form-group">
                    <label>Email address</label>
                    <input type="email" name="email" class="form-control"
placeholder="">
                </div>
                <div class="form-group">
                    <label>Mobile No.</label>
                    <input type="text" name="mobile" class="form-control"
placeholder="">
                </div>
                                                    <div class="form-group">
                    <label>Branch</label>
                    <select name="branch" class="form-control">
                                                        <option
value="">-Branch-</option>
                                                        <?php

$bq1=mysqli_query($connect,"select * from geo_location");

while($br1=mysqli_fetch_array($bq1))
                                                        {
                                                        ?>
                                                        <option value="<?php
echo $br1['branch']; ?>"><?php echo
$br1['location']."-".$br1['branch']; ?></option>
                                                        <?php
                                                        }
                                                        ?>
                                                        </select>
```

```
                    </div>

                    <button type="submit" name="btn" class="btn btn-primary
btn-flat m-b-30 m-t-30">Add New</button>
                                                    <p align="center"><a
href="admin.php">Back</a></p>
                    </form>
```

Add Geo Fence

```
                                                    <h3>Drag or re-shape for
coordinates to display below</h3>
  <h3><a
href="http://codepen.io/jhawes/blog/creating-a-real-estate-polygon-tool">Geo
Fence Location</a></h3>
  <form name="form1" method="post">
  <select name="city" class="form-control" onChange="this.form.submit()">
  <option value="">-Select City-</option>
  <?php
  $ctq=mysqli_query($connect,"select * from geo_city");
  while($ctr=mysqli_fetch_array($ctq))
  {
  ?>
  <option <?php if($city==$ctr['location']) echo "selected"; ?>><?php echo
$ctr['location']; ?></option>
  <?php
  }
  ?>
  </select>
  </form>
  <div id="map-canvas"></div>
  <div class="lngLat"><span class="one">Lat</span><span
```

```
class="two">,Lng</span></div>

  <button id="clipboard-btn"
onClick="copyToClipboard(document.getElementById('info').innerHTML)">C
opy to Clipboard</button>

  <form name="form1" method="post">

  <textarea id="info" name="detail"></textarea>

  <input type="text" name="location" class="form-control"
placeholder="Location" value="<?php echo $city; ?>">
  <input type="text" name="branch" class="form-control" placeholder="Branch
Name">

        <input type="submit" name="btn" class="form-control" value="Add">

        </form>

        <?php

        if($gid!="")

        {

        $q1=mysqli_query($connect,"select * from geo_location where
id=$gid");

        $r1=mysqli_fetch_array($q1);

        }

        else if($city!="")

        {

        $q1=mysqli_query($connect,"select * from geo_city where
location='$city'");

        $r1=mysqli_fetch_array($q1);

        }

        else

        {

        $q1=mysqli_query($connect,"select * from geo_location where

        id=1"); $r1=mysqli_fetch_array($q1);

        }

        $det=explode(")",$r1['detail']);

        $det1=$det[0].")";
```

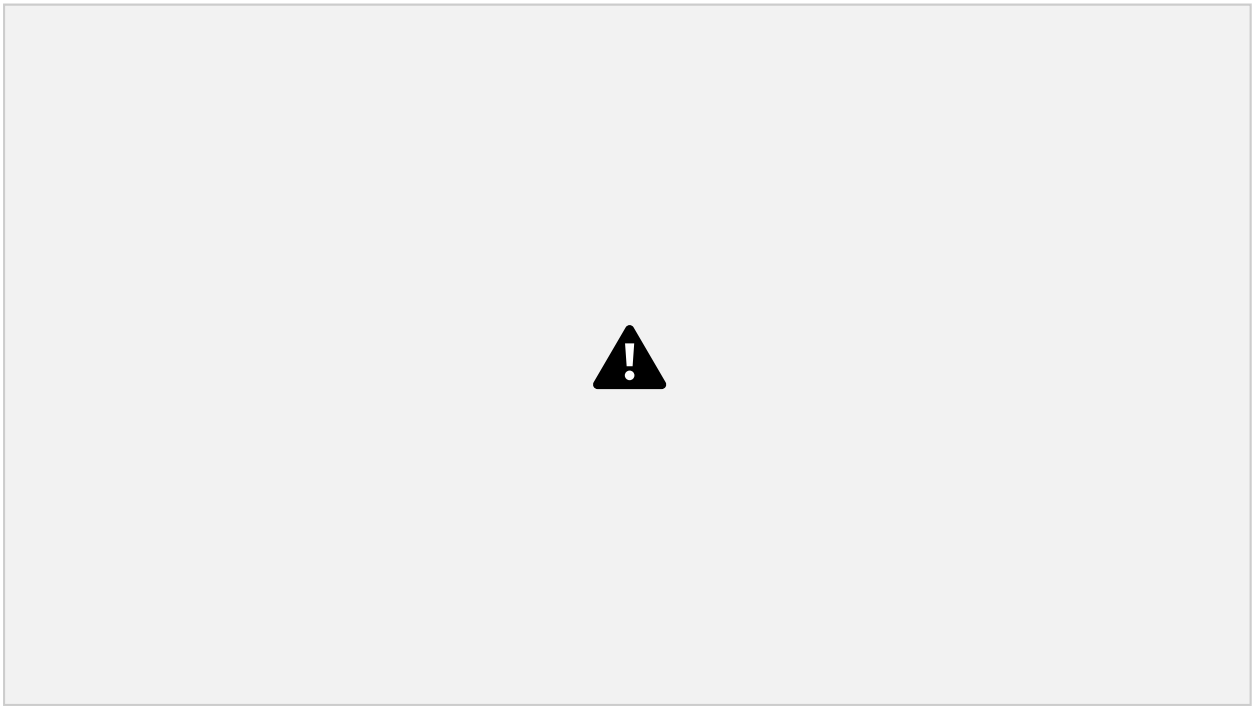
```
        ?>
 <script
src='https://maps.googleapis.com/maps/api/js?v=3.exp&sensor=false'></script>
 <!--<script src="js/index.js"></script>-->
 <script>
 //var myPolygon;
function initialize() {
 // Map Center
 var myLatLng = <?php echo $det1; ?>;
 // General Options
 var mapOptions = {
   zoom: 18,
   center: myLatLng,
   mapTypeId: 'satellite' //google.maps.MapTypeId.RoadMap

 };

 var map = new
google.maps.Map(document.getElementById('map-canvas'),mapOptions);

 // Polygon Coordinates
 var triangleCoords = [
        <?php echo $r1['detail']; ?>

 ];
 // Styling & Controls
 myPolygon = new google.maps.Polygon({
   paths: triangleCoords,
   draggable: true, // turn off if it gets annoying
```

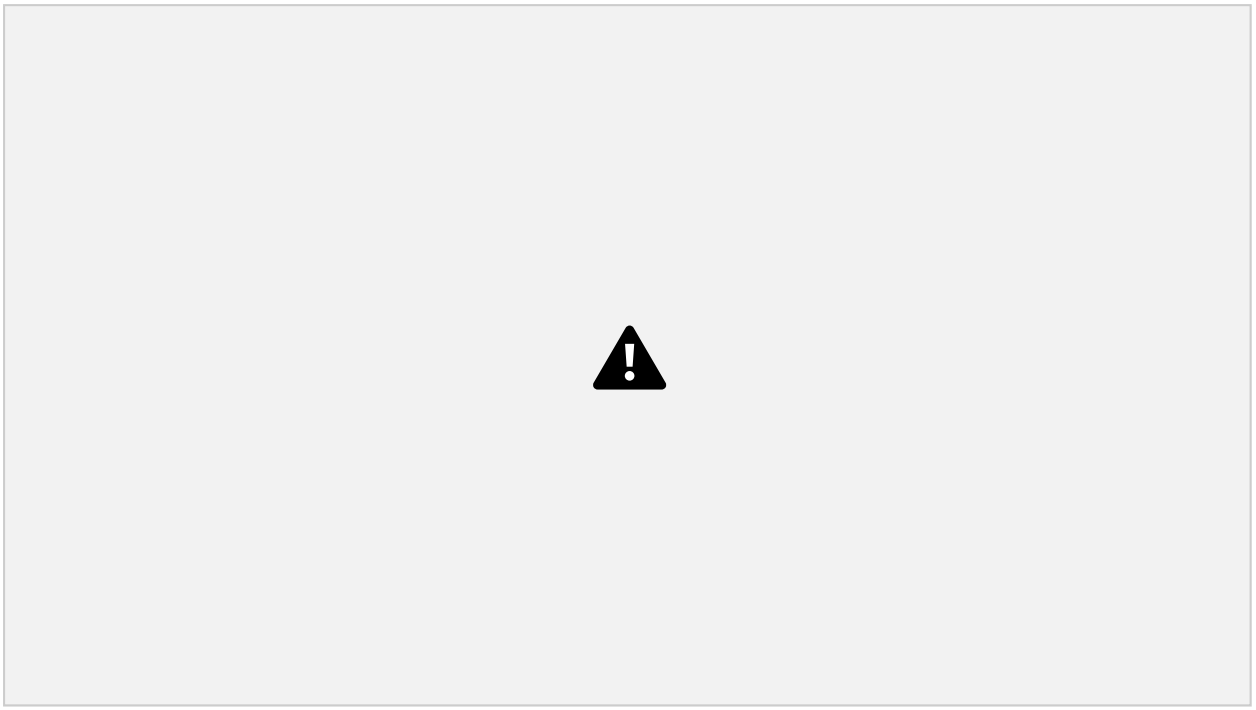
```
    editable: true,
    strokeColor: '#FF0000',
    strokeOpacity: 0.8,
    strokeWeight: 2,
    fillColor: '#FF0000',
    fillOpacity: 0.35
  });

  myPolygon.setMap(map);
  //google.maps.event.addListener(myPolygon, "dragend", getPolygonCoords);
  google.maps.event.addListener(myPolygon.getPath(),
"insert_at", getPolygonCoords);
  //google.maps.event.addListener(myPolygon.getPath(), "remove_at",
getPolygonCoords);
  google.maps.event.addListener(myPolygon.getPath(), "set_at",
getPolygonCoords);
}

//Display Coordinates below map
function getPolygonCoords() {
  var len = myPolygon.getPath().getLength();
  var htmlStr = "";
  for (var i = 0; i < len; i++) {
    htmlStr += "new google.maps.LatLng(" +
myPolygon.getPath().getAt(i).toUrlValue(5) + "), ";
    //Use this one instead if you want to get rid of the wrap > new
google.maps.LatLng(),
    //htmlStr += "" +
  myPolygon.getPath().getAt(i).toUrlValue(5); }
  document.getElementById('info').innerHTML = htmlStr;
}
function copyToClipboard(text) {
```

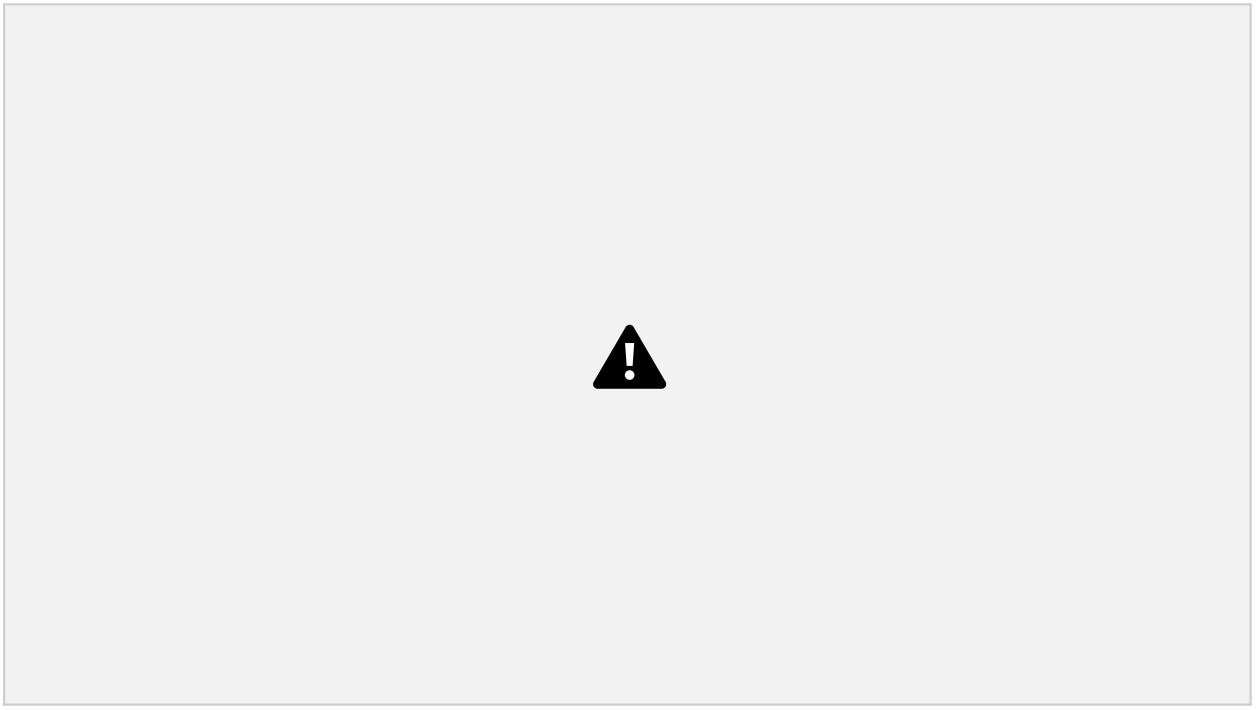
```
  window.prompt("Copy to clipboard: Ctrl+C, Enter", text);
}
  </script>
                        </div>
                        <!-- /# card -->
                    </div>
                    <!-- /# column -->
                </div>
                <!-- /# row -->

                <div class="row">
                    <div class="col-lg-12">
                        <div class="footer">
                            <p>Geo Fence<a href="#"></a></p>
                        </div>
                    </div>
                </div>
            </section>
        </div>
    </div>
  </div>


<?php
        if(isset($btn))
        {
        //echo $detail;
        $max_qry = mysqli_query($connect,"select max(id) maxid from
geo_location");
        $max_row = mysqli_fetch_array($max_qry);
        $id=$max_row['maxid']+1;
        $ins=mysqli_query($connect,"insert into
```

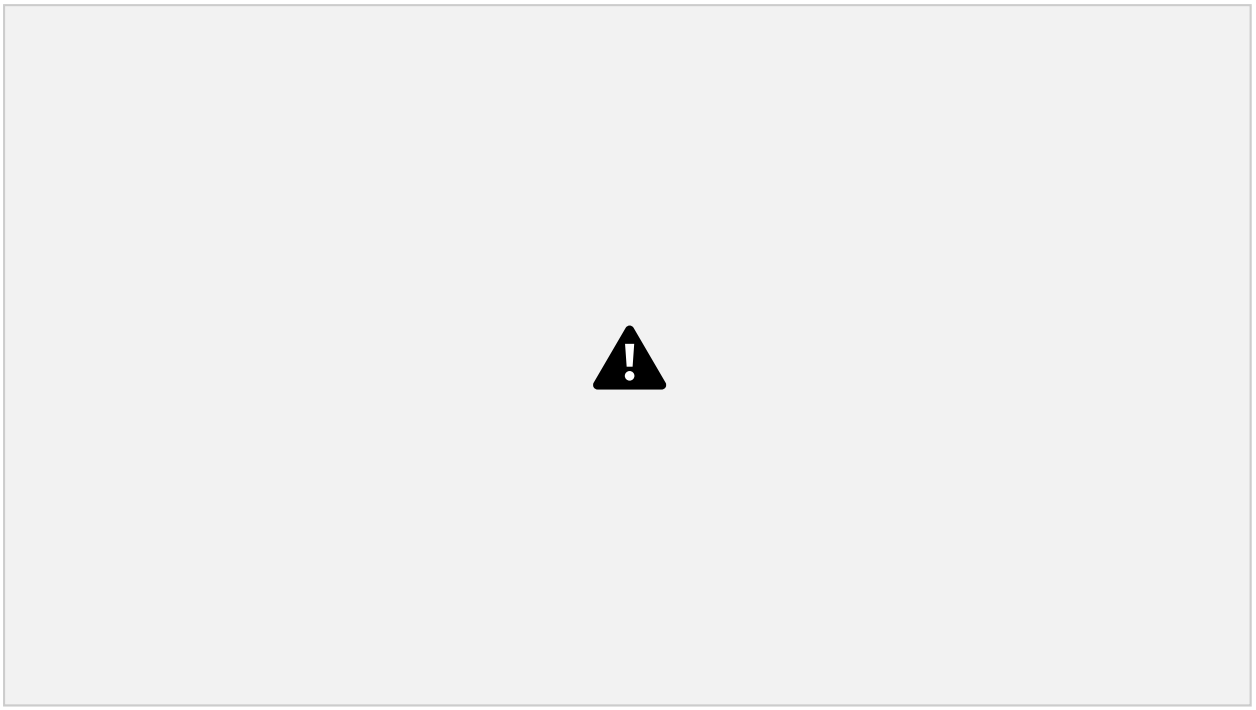
```
geo_location(id,location,branch,detail)
values($id,'$location','$branch','$detail')");
                if($ins)
                {
                ?>
                <script language="javascript">
                window.location.href="admin.php?act=success";
                </script>
                <?php
                }
        }
        ?>
```

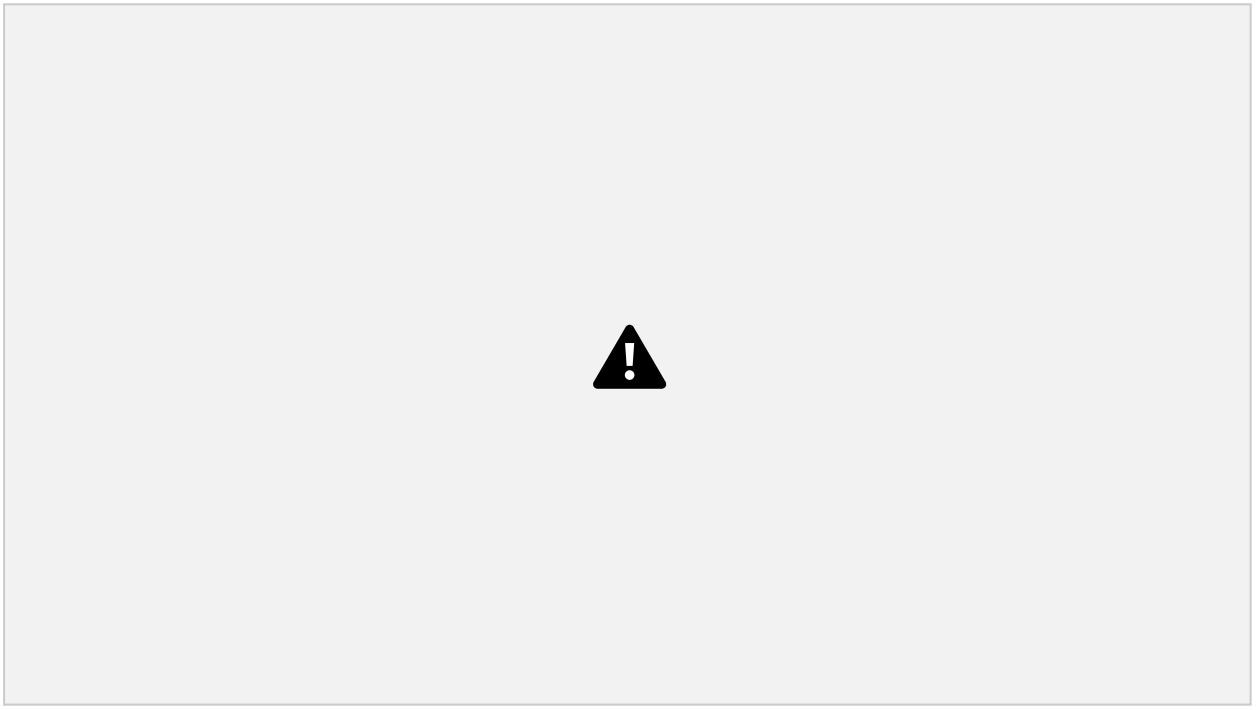
a.2 Screenshot

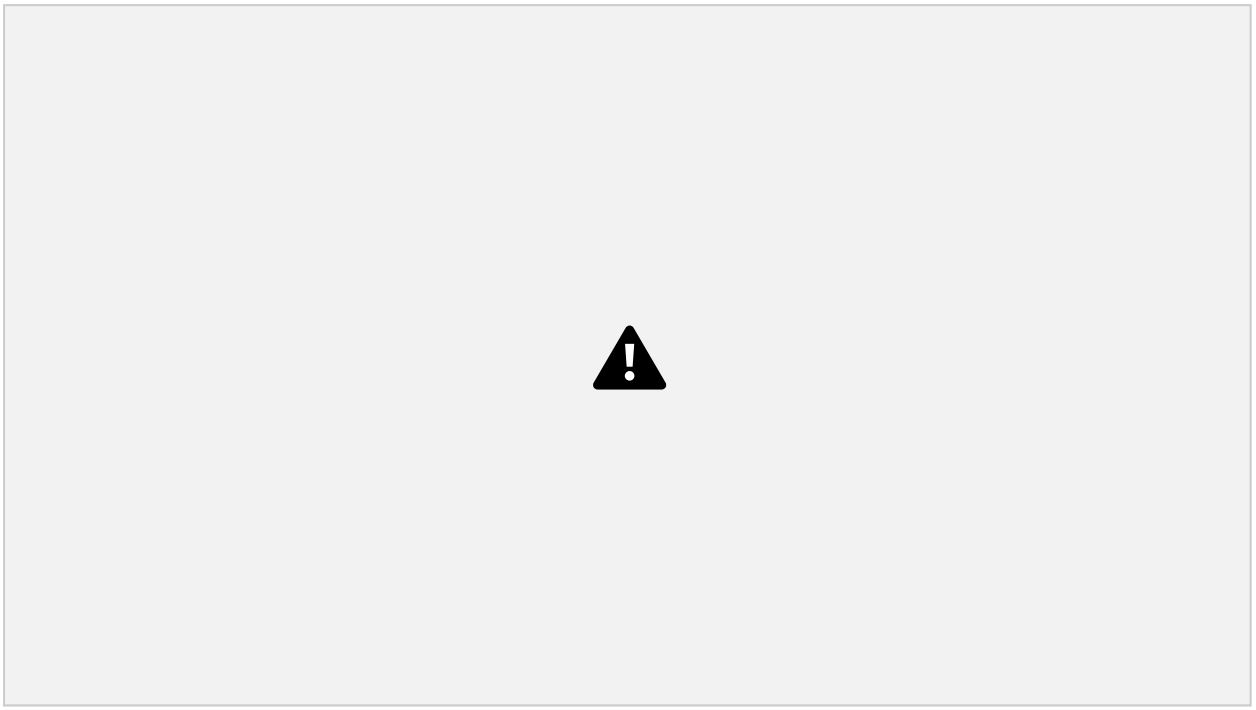


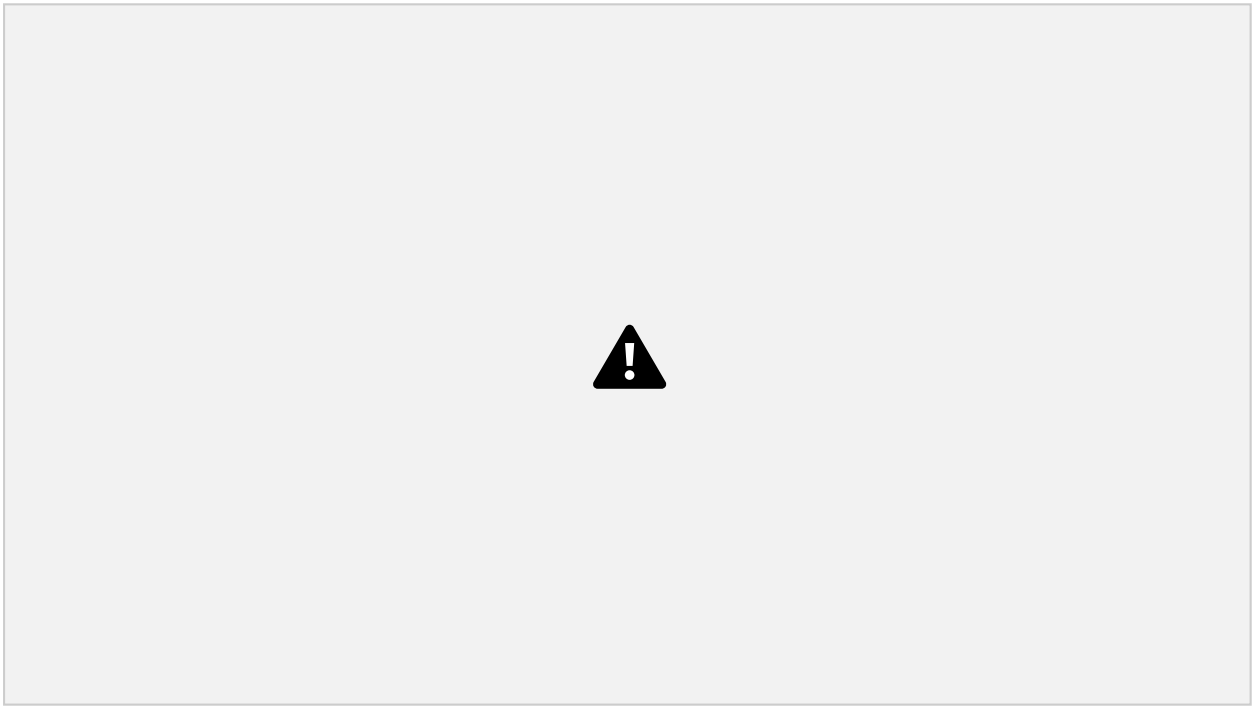


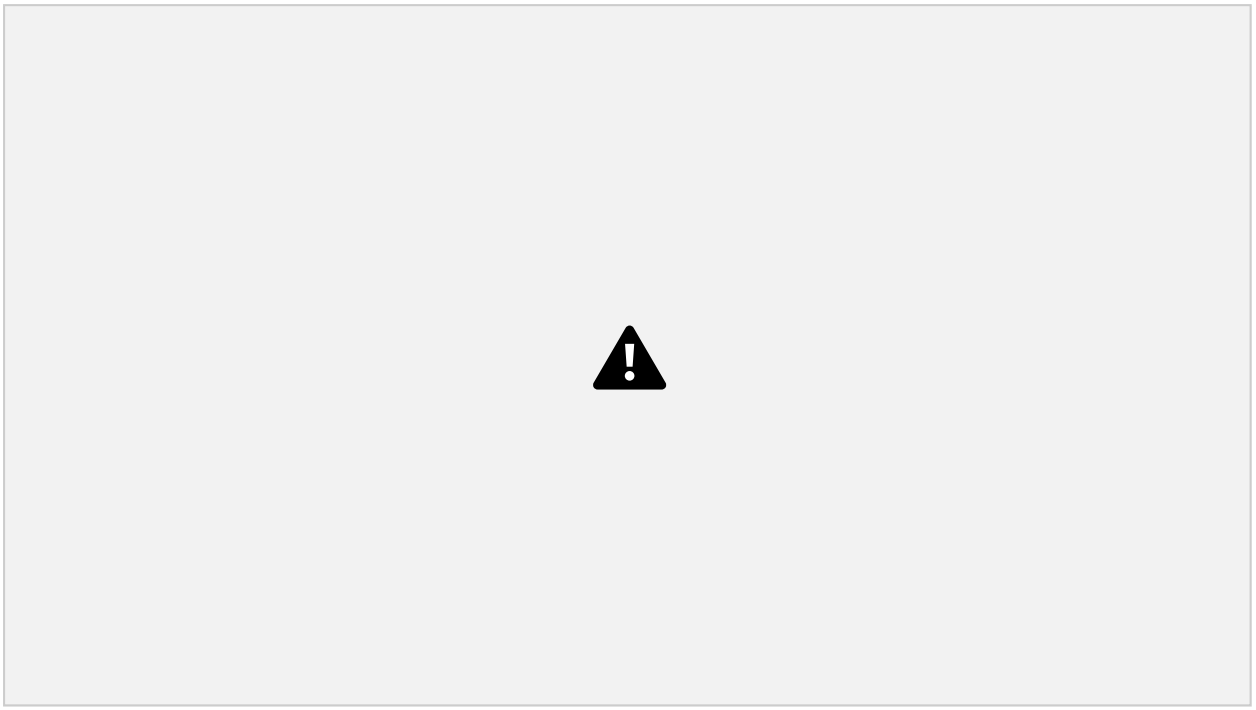


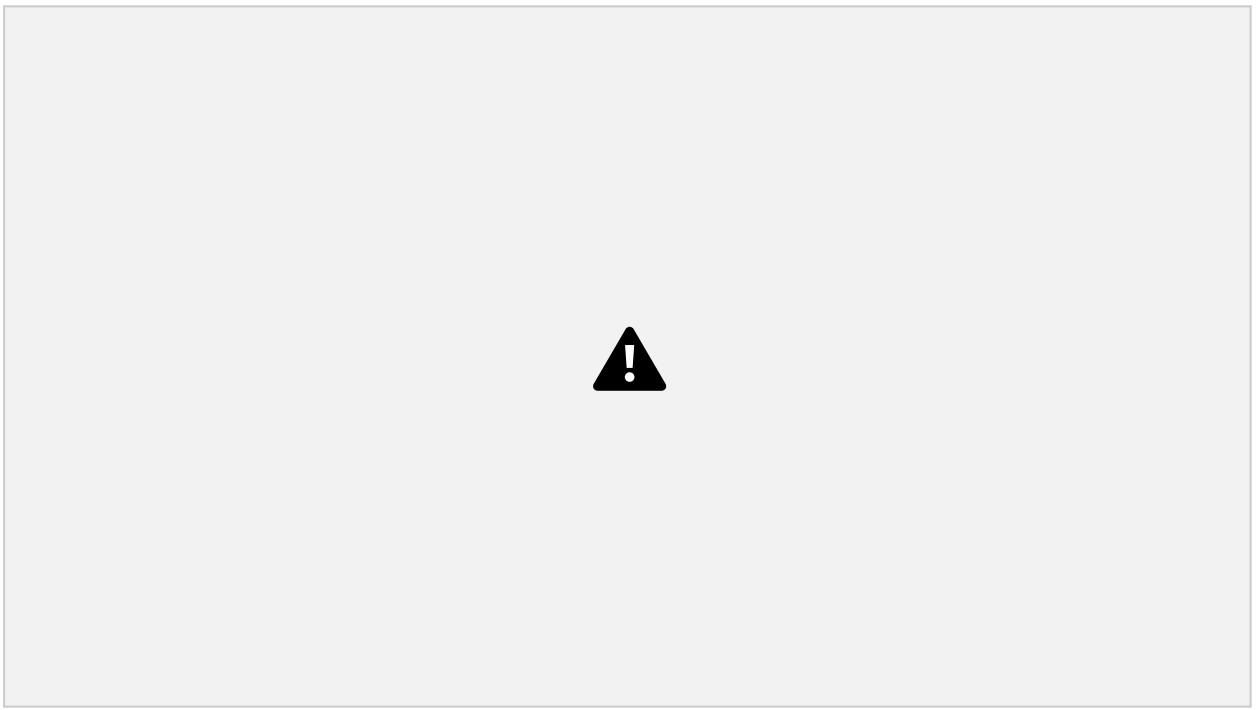


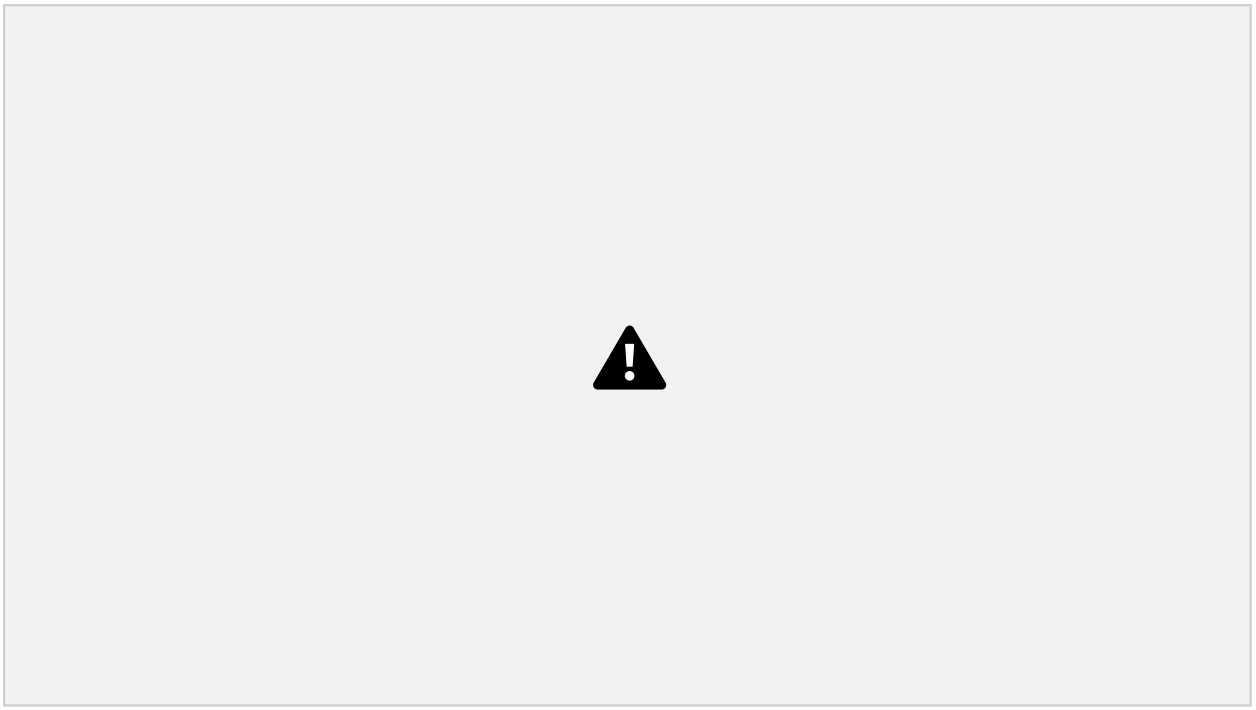


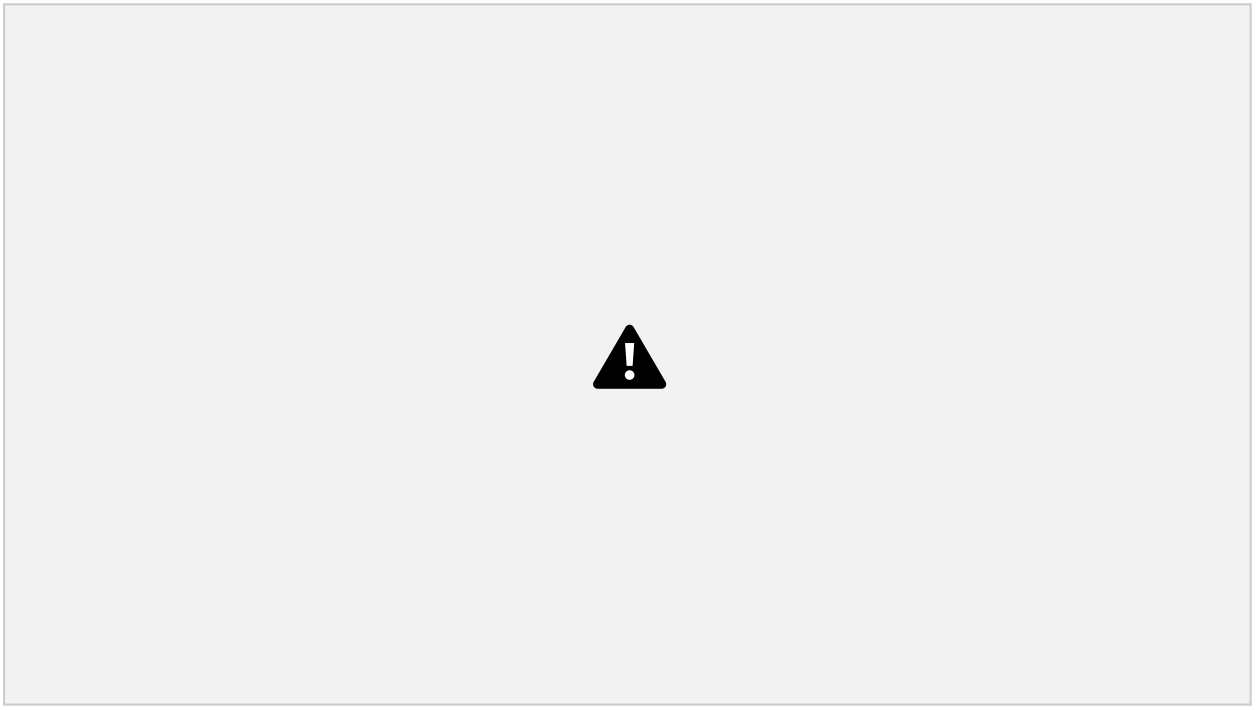


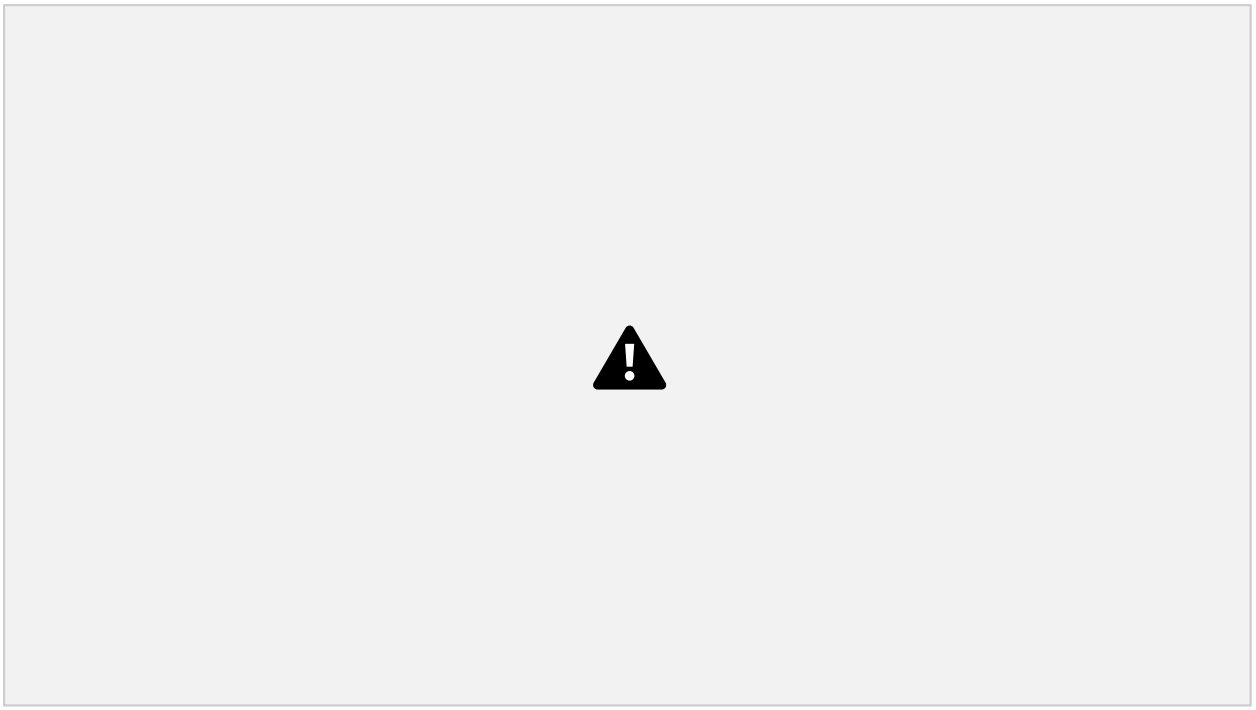


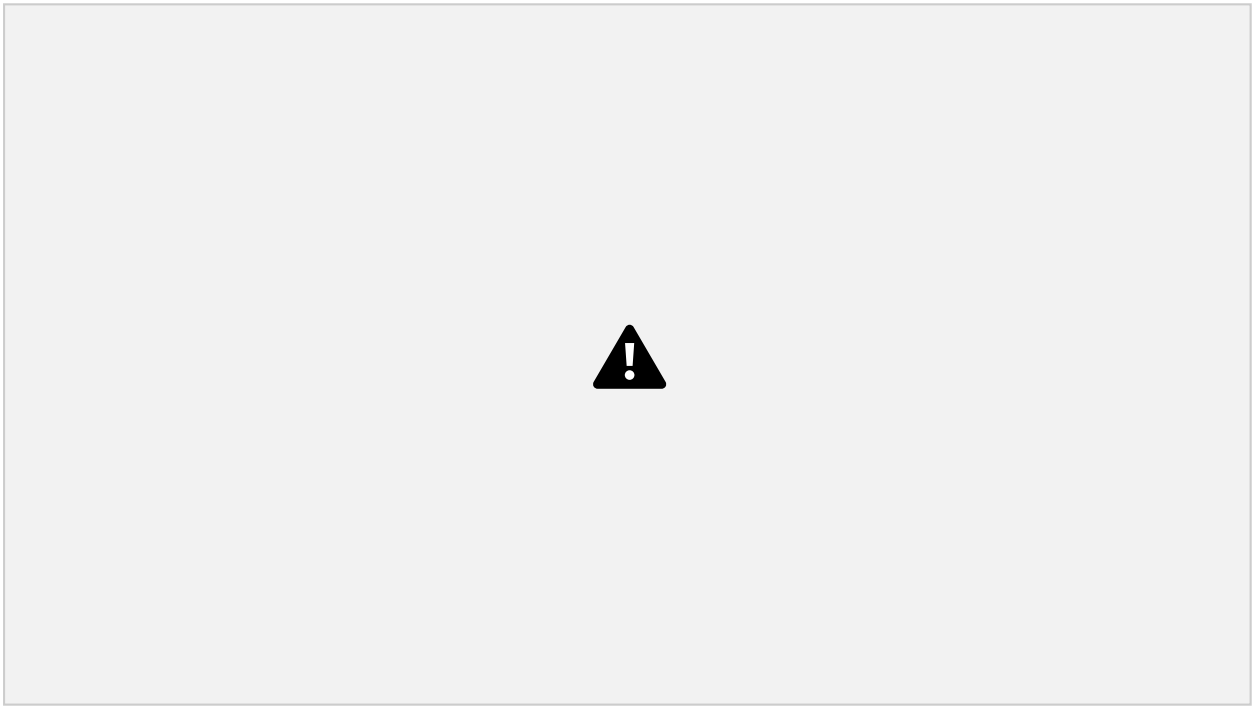


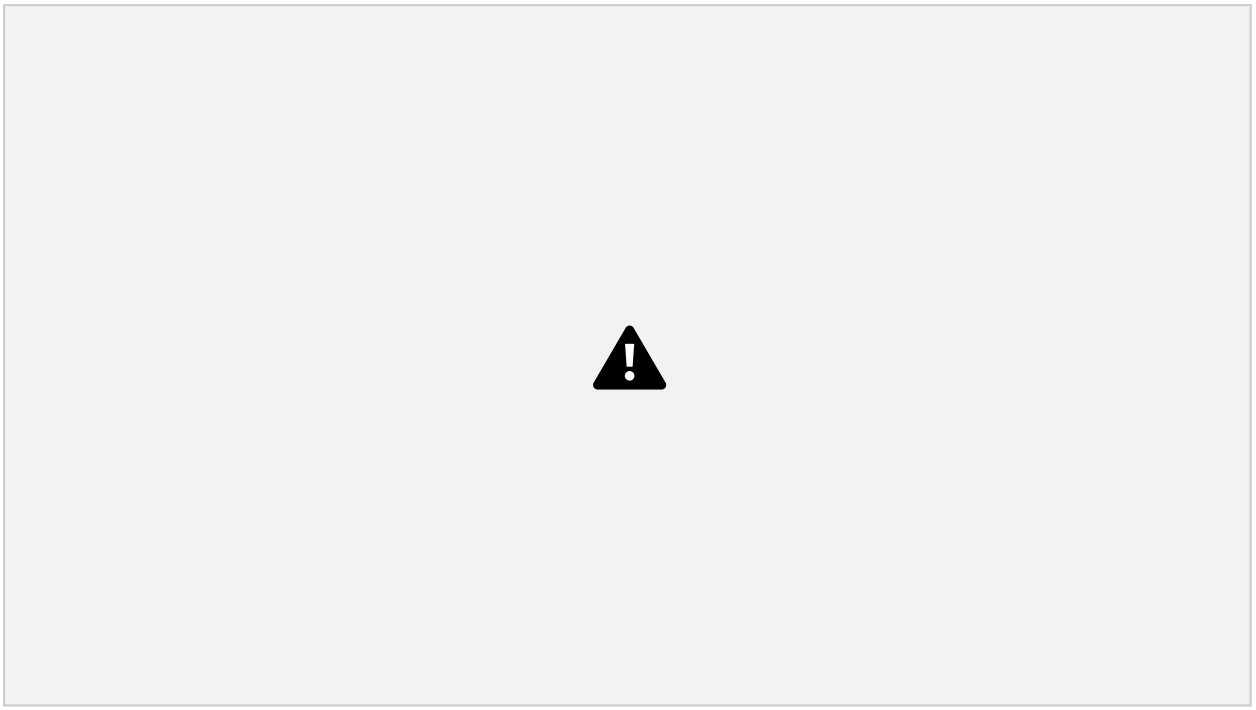


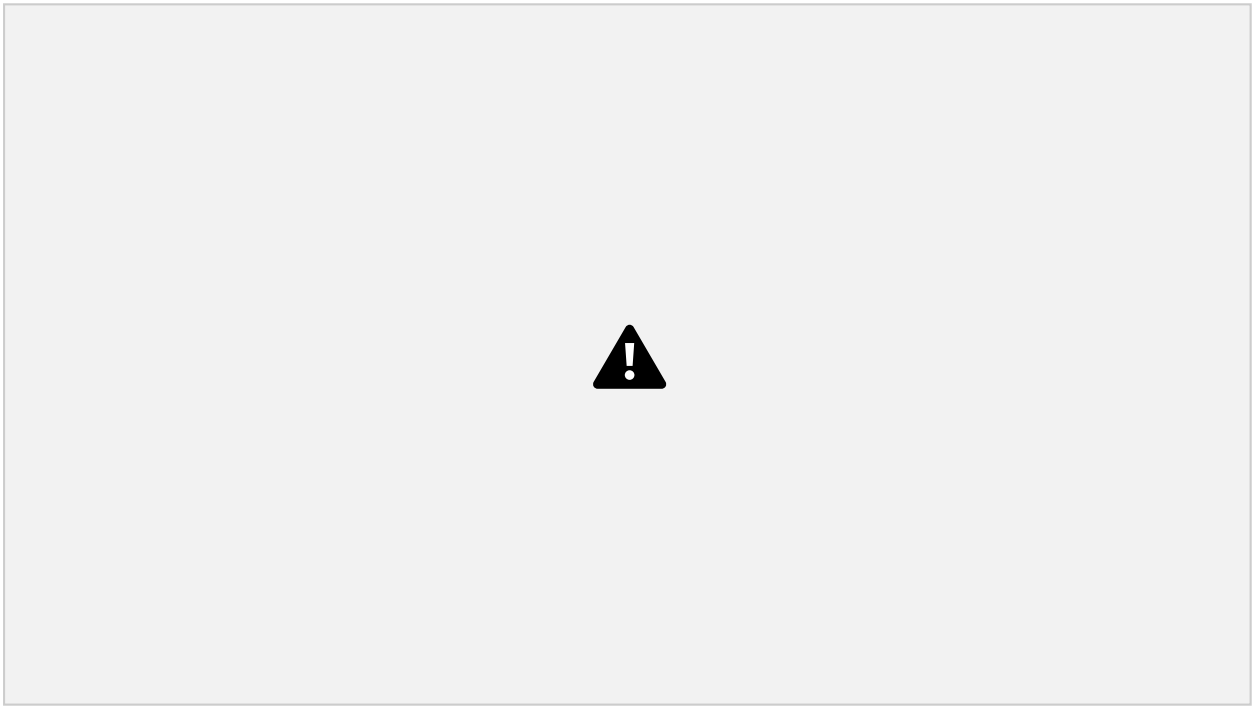


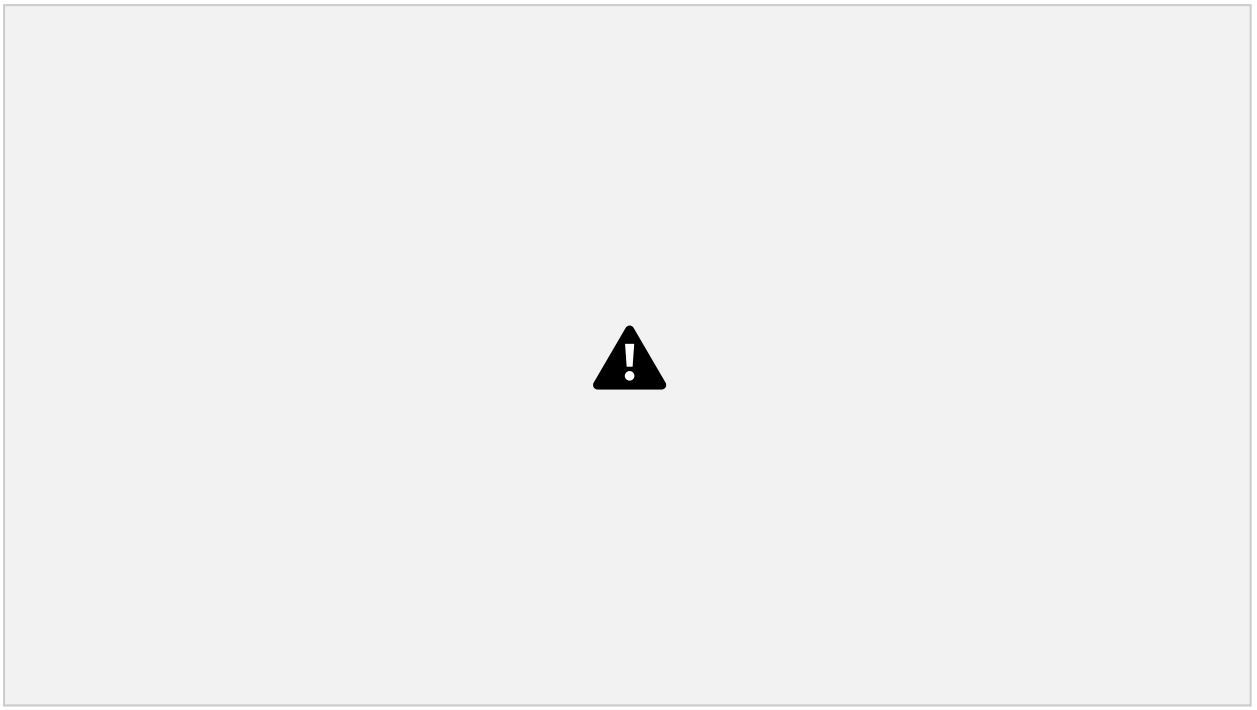












REFERENCES

1. V. Rampérez, J. Soriano, D. Lizcano, and J. A. Lara, ``FLAS: A combination of proactive and reactive auto-scaling architecture for distributed services," Future Gener. Comput. Syst., vol. 118, pp. 56-72, May 2021.
2. R. Mokadem and A. Hameurlain, ``A data replication strategy with tenant performance and provider economic prot guarantees in cloud data centers," J. Syst. Softw., vol. 159, Jan. 2020, Art. no. 110447.
3. Y. Mansouri, A. N. Toosi, and R. Buyya, ``Cost optimization for dynamic replication and migration of data in cloud data centers," IEEE Trans. Cloud Comput., vol. 7, no. 3, pp. 705718, Jul. 2019.
4. A. E. Abdel Raouf, N. L. Badr, and M. F. Tolba, ``Dynamic data reallocation and replication over a cloud environment," Concurrency Comput., Pract. Exper., vol. 30, no. 13, Jan. 2018, Art. no. e4416.
5. N. Mansouri, M. K. Rafsanjani, and M. M. Javidi, ``DPRS: A dynamic popularity aware replication strategy with parallel download scheme in cloud environments," Simul. Model. Pract. Theory, vol. 77, pp. 177-196, Sep. 2017.
6. C. Liao, A. Squicciarini, and L. Dan, “Last-hdfs: Location-aware storage technique for hadoop distributed file system,” in IEEE International Conference on Cloud Computing (CLOUD), 2016.
7. N. Paladi and A. Michalas, ““one of our hosts in another country”:

Challenges of data geolocation in cloud storage," in International Conference on Wireless Communications, Vehicular Technology, Information Theory and Aerospace & Electronics Systems (VITAE), 2014, pp. 1–6.

8. Z. N. Peterson, M. Gondree, and R. Beverly, "A position paper on data sovereignty: The importance of geolocating data in the cloud." In HotCloud, 2011.
9. J. Li, A. Squicciarini, D. Lin, S. Liang, and C. Jia, "Secloc: Securing location-sensitive storage in the cloud," in ACM symposium on access control models and technologies (SACMAT), 2015.
10. AL beshri, C. Boyd, and J. G. Nieto, "Enhanced geoproof: improved geographic assurance for data in the cloud," International Journal of Information Security, vol. 13, no. 2, pp. 191–198, 2014.
11. G. J. Watson, R. Safavi-Naini, M. Alimomeni, M. E. Locasto, and S. Narayan, "Lost: location based storage," in Proceedings of the 2012 ACM Workshop on Cloud computing security workshop. ACM, 2012, pp. 59–70.
12. Y. Mansouri and R. Buyya, ``To move or not to move: Cost optimization in a dual cloud-based storage architecture," J. Netw. Comput. Appl., vol. 75, pp. 223-235, Nov. 2016.