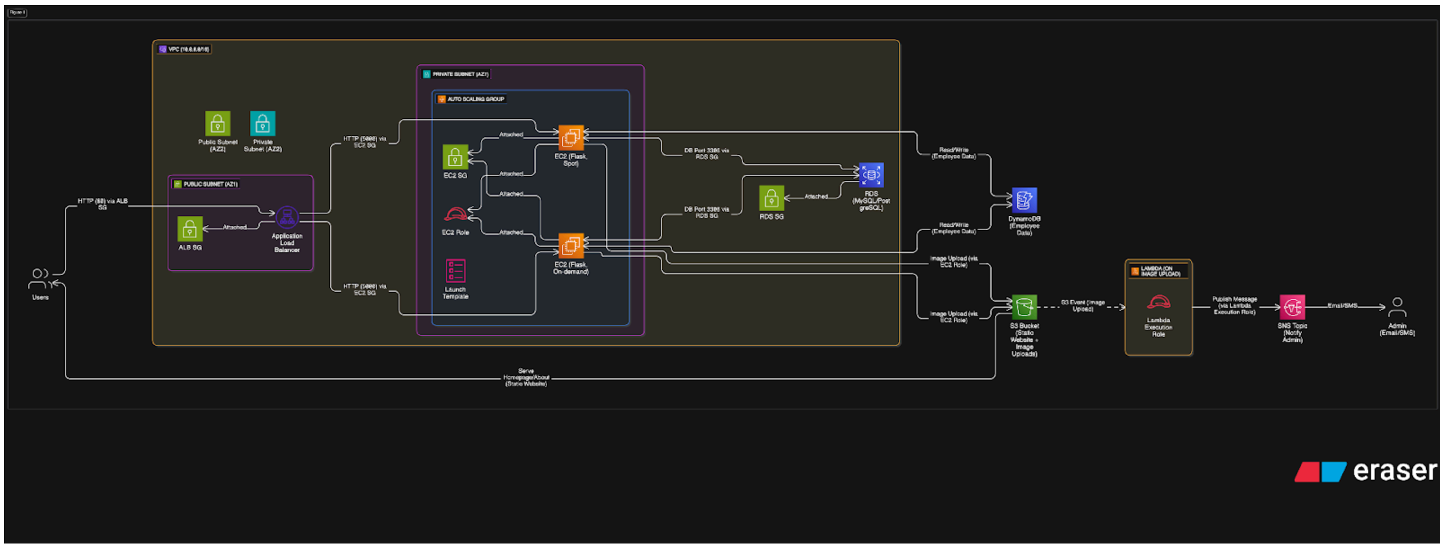
🚀 AWS Cloud-Native Employee Management Platform



A scalable, cloud-native employee management web application built on AWS infrastructure with cost optimization strategies and enterprise-grade security.

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🎯 Overview

This project demonstrates a production ready employee management system built completely on AWS cloud infrastructure. The application show modern cloud architecture patterns, cost optimization techniques, and security best practices.

Key Highlights:

- 🌐 **Multi-AZ Deployment** for high availability
- 💰 **70% Cost Reduction** using spot instances
- 🔒 **Enterprise Security** with VPC and IAM
- 📈 **Auto-Scaling** for dynamic workload handling
- 🗄️ **Hybrid Database** approach for optimal performance

🏗️ Architecture

Infrastructure Components:

- **VPC**: 1 Public + 2 Private Subnets
- **Compute**: EC2 with On-Demand + Spot instances
- **Database**: RDS MySQL + DynamoDB
- **Storage**: S3 for static hosting and file storage
- **Load Balancing**: Application Load Balancer
- **Scaling**: Auto Scaling Groups
- **Notifications**: SNS for upload alerts

✨ Features

Core Functionality

- 👥 **Employee Management**: Add, view, and manage employee records
- 📸 **Photo Upload**: S3-integrated image storage with metadata tracking
- 🔍 **Employee Search**: Retrieve employee information by ID

Cloud Features

- 🚀 **Auto-Scaling**: Automatic resource allocation based on demand
- 💾 **Hybrid Storage**: Relational data in RDS, metadata in DynamoDB
- 📧 **Notifications**: Email alerts on successful uploads via SNS
- 🔐 **Security**: VPC isolation, IAM roles, and security groups

🛠️ Technology Stack

Backend

- **Framework**: Python Flask
- **Database**: AWS RDS (MySQL) + DynamoDB
- **Storage**: Amazon S3
- **Compute**: Amazon EC2

Frontend

- **Languages**: HTML5, CSS3, JavaScript
- **Styling**: Bootstrap/Custom CSS
- **Responsive**: Mobile-friendly design

AWS Services

- **Networking**: VPC, Subnets, Internet Gateway, NAT Gateway
- **Compute**: EC2, Auto Scaling Groups, Application Load Balancer
- **Database**: RDS MySQL, DynamoDB
- **Storage**: S3
- **Messaging**: SNS
- **Security**: IAM, Security Groups, NACLs

📋 Prerequisites

- AWS Account with appropriate permissions
- Python 3.8+
- Basic knowledge of AWS services
- MySQL client (for database setup)

🚀 Installation & Setup

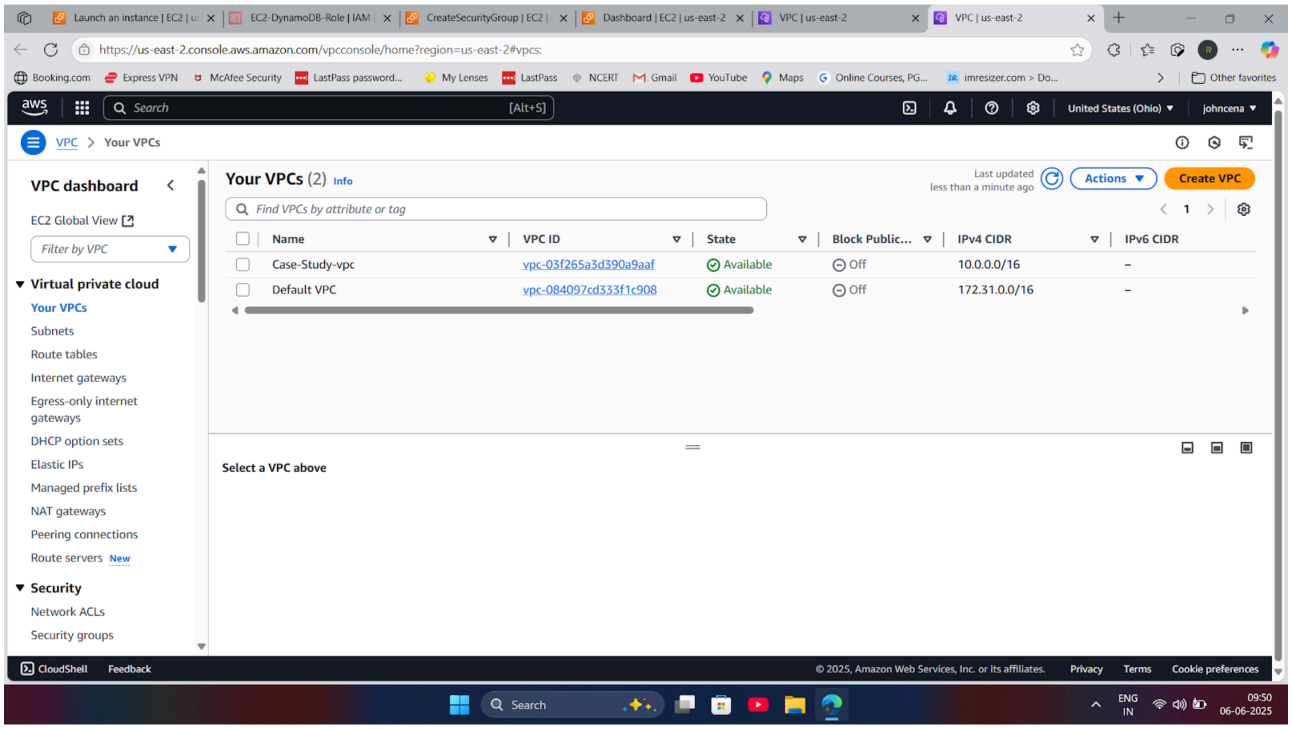
1. Clone Repository

```
git clone https://github.com/Rakshitsen/Three-Tier-Aws-arch.git
cd Three-Tier-Aws-arch
```

2. AWS Infrastructure Setup

Step 1: Create VPC and Subnets

```
# Create VPC
aws ec2 create-vpc --cidr-block 10.0.0.0/16
```


Your VPCs (2)

Name	VPC ID	State	Block Public...	IPv4 CIDR	IPv6 CIDR
Case-Study-vpc	vpc-03f265a3d390a9aaf	Available	Off	10.0.0.0/16	–
Default VPC	vpc-084097cd333f1c908	Available	Off	172.31.0.0/16	–

Select a VPC above

```
# Create Public Subnet
aws ec2 create-subnet --cidr-block 10.0.1.0/24 --availability-zone us-east-1a
aws ec2 create-subnet --cidr-block 10.0.2.0/24 --availability-zone us-east-1b

# Create Private Subnets
aws ec2 create-subnet --cidr-block 10.0.3.0/24 --availability-zone us-east-1b
aws ec2 create-subnet --cidr-block 10.0.4.0/24 --availability-zone us-east-1c
```

Step 2: Security Groups

# Create Security Group for Alb
- Inbound = allow at port 80 anywhere from world

# Create Security Group for Web Servers
- Inbound = allow at port 5000 from Alb-Sg

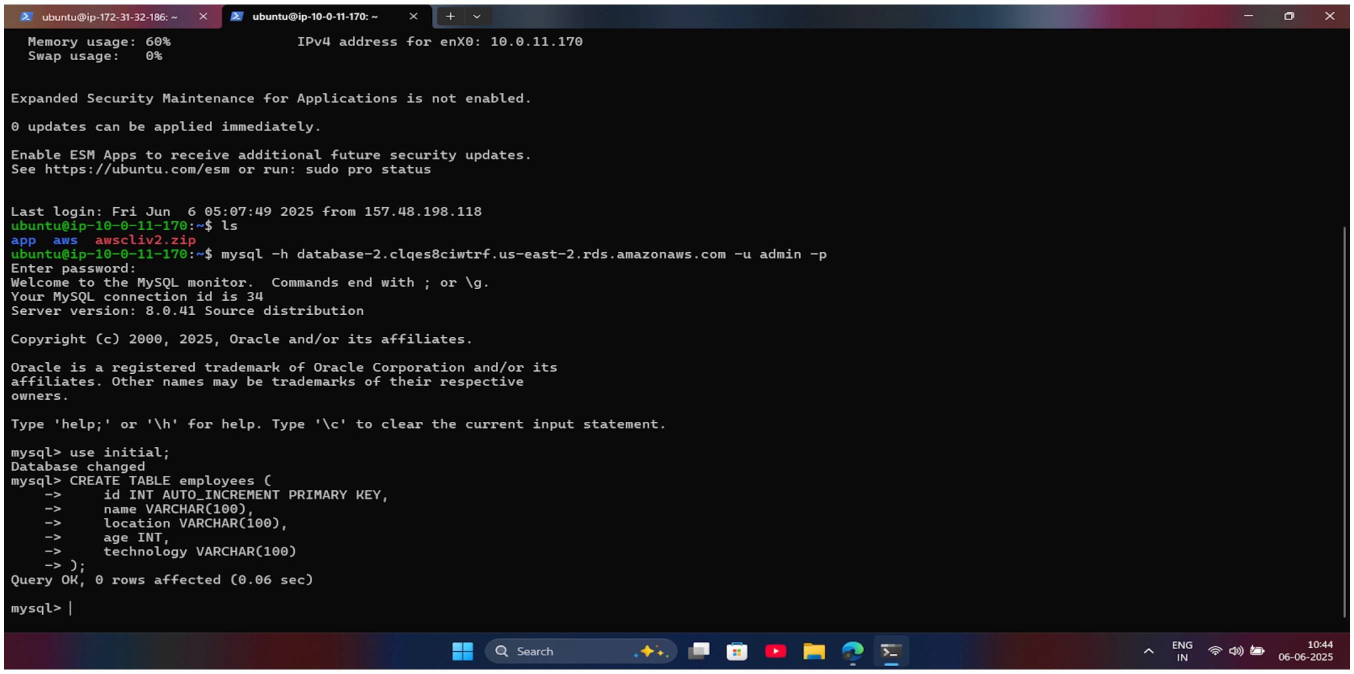
# Create Security Group for RDS
- Inbound = allow from web-server-sg

Step 3: Launch EC2 Instances

4. Database Setup

RDS MySQL

-- Create employee table



```
  Memory usage: 60%               IPv4 address for enX0: 10.0.11.170
  Swap usage:   0%


Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


Last login: Fri Jun  6 05:07:49 2025 from 157.48.198.118
ubuntu@ip-10-0-11-170:~$ ls
app  aws  awscliv2.zip
ubuntu@ip-10-0-11-170:~$ mysql -h database-2.clqes8ciwtrf.us-east-2.rds.amazonaws.com -u admin -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 34
Server version: 8.0.41 Source distribution

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> use initial;
Database changed
mysql> CREATE TABLE employees (
    ->     id INT AUTO_INCREMENT PRIMARY KEY,
    ->     name VARCHAR(100),
    ->     location VARCHAR(100),
    ->     age INT,
    ->     technology VARCHAR(100)
    -> );
Query OK, 0 rows affected (0.06 sec)

mysql> |
```
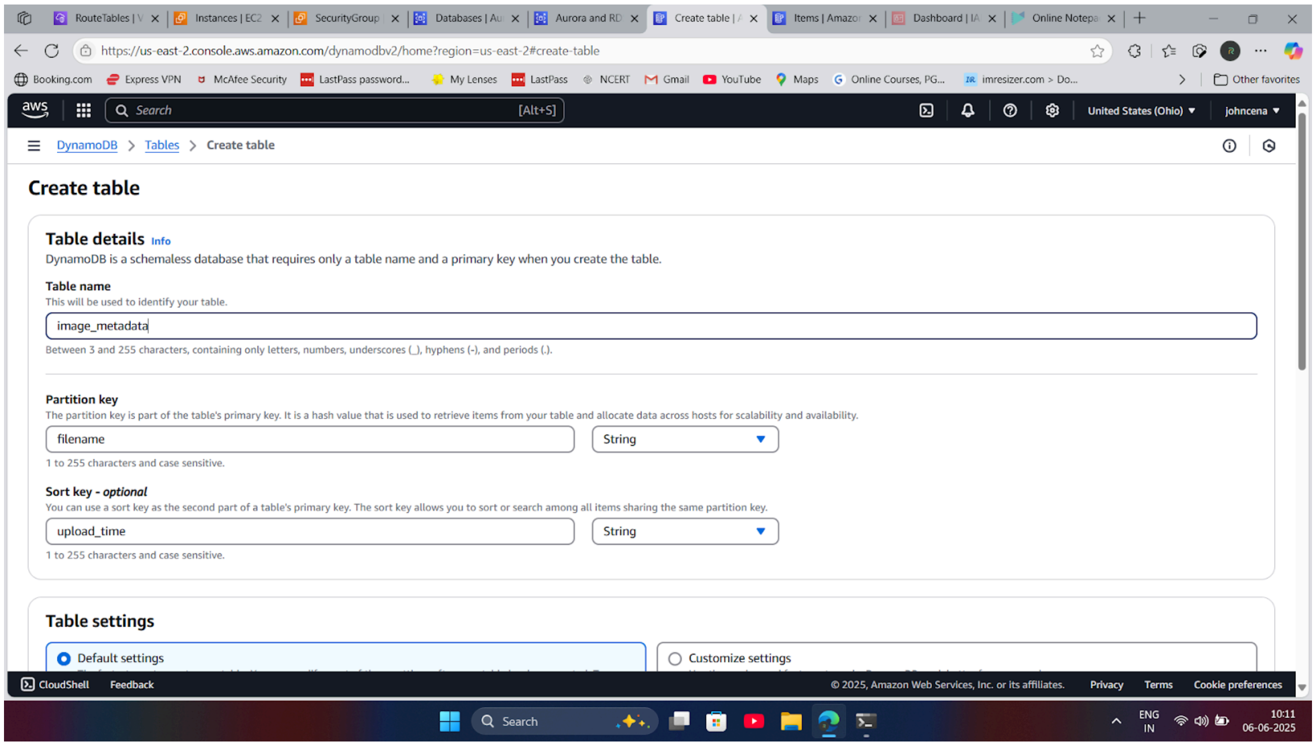

DynamoDB Table:



DynamoDB > Tables > Create table

Create table

Table details Info

DynamoDB is a schemaless database that requires only a table name and a primary key when you create the table.

Table name
This will be used to identify your table.
image_metadata
Between 3 and 255 characters, containing only letters, numbers, underscores (_), hyphens (-), and periods (.).

Partition key
The partition key is part of the table's primary key. It is a hash value that is used to retrieve items from your table and allocate data across hosts for scalability and availability.
filename | String
1 to 255 characters and case sensitive.

Sort key - *optional*
You can use a sort key as the second part of a table's primary key. The sort key allows you to sort or search among all items sharing the same partition key.
upload_time | String
1 to 255 characters and case sensitive.

Table settings

[✓ Default settings] Customize settings

5. Configure Application

```
# config.py
import os

class Config:
    SECRET_KEY = os.environ.get('SECRET_KEY') or 'your-secret-key'
    MYSQL_HOST = os.environ.get('MYSQL_HOST') or 'your-rds-endpoint'
    MYSQL_USER = os.environ.get('MYSQL_USER') or 'admin'
    MYSQL_PASSWORD = os.environ.get('MYSQL_PASSWORD') or 'password'
    MYSQL_DB = os.environ.get('MYSQL_DB') or 'employees'
    S3_BUCKET = os.environ.get('S3_BUCKET') or 'your-s3-bucket'
    AWS_REGION = os.environ.get('AWS_REGION') or 'us-east-1'
```

💻 Usage

Running Locally

```
python app.py
```

Access the Application

- **Main Page**: `http://your-alb-dns-name/`
- **Add Employee**: `http://your-alb-dns-name/`
- **Get Employee**: `http://your-alb-dns-name/getemp`
- **About Us**: `http://your-alb-dns-name/about`

API Endpoints

- `POST /` - Add new employee
- `GET /getemp` - Get employee by ID
- `GET /about` - Company information
- `POST /upload` - Upload employee photo

💰 Cost Optimization

Spot Instances Strategy

- **Mixed Instance Types**: Combination of On-Demand and Spot instances
- **Cost Savings**: Up to 70% reduction in compute costs
- **Availability**: Maintained through Auto Scaling Groups

Resource Optimization

- **Auto Scaling**: Dynamic scaling based on demand
- **S3 Storage Classes**: Appropriate storage class selection
- **Database Optimization**: Connection pooling and query optimization

🔒 Security Features

Network Security

- **VPC Isolation**: Private subnets for databases
- **Security Groups**: Restrictive inbound/outbound rules
- **NACLs**: Additional network-level security

Access Control

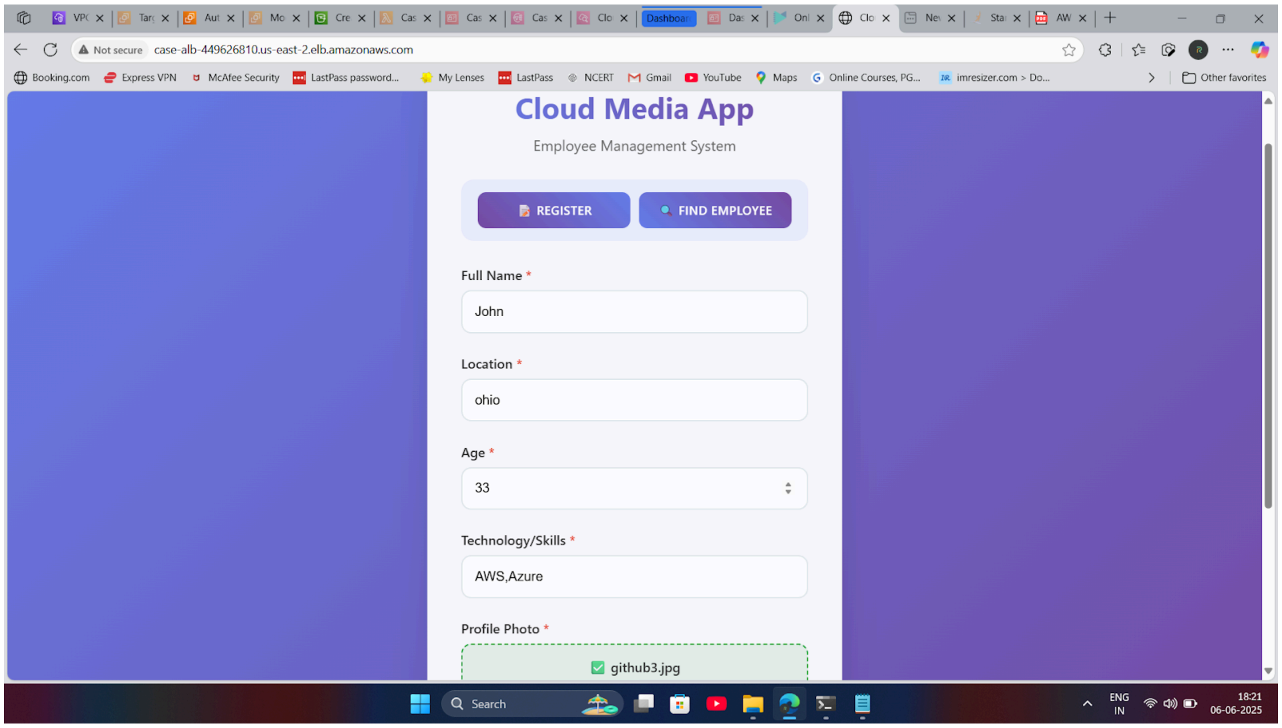
- **IAM Roles**: Least privilege access principles
- **Instance Profiles**: Secure service-to-service communication
- **Encryption**: Data encryption in transit and at rest

📊 Performance Metrics

- **Availability**: 99.9% uptime with multi-AZ deployment
- **Response Time**: < 2 seconds for database operations
- **Scalability**: Supports 100+ concurrent users
- **Cost Efficiency**: 70% cost reduction with spot instances

📸 Screenshots

Main Dashboard



Not secure case-alb-449626810.us-east-2.elb.amazonaws.com

Cloud Media App

Employee Management System

Full Name *

John

Location *

ohio

Age *

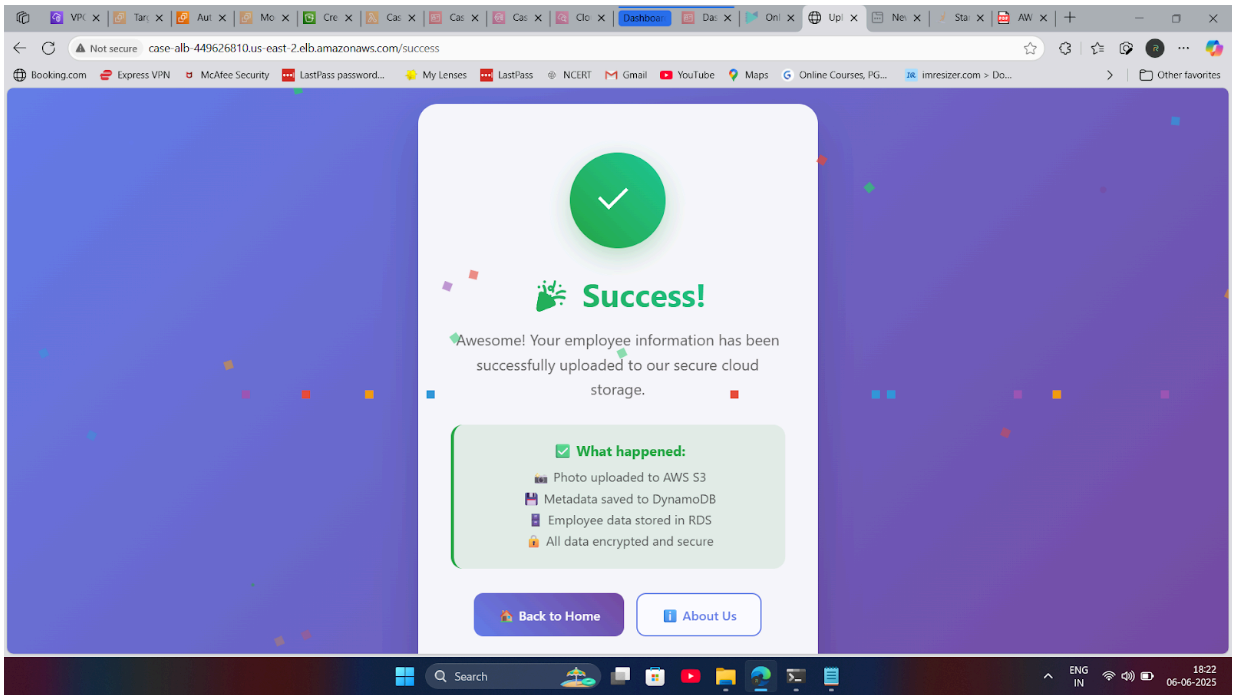
33

Technology/Skills *

AWS,Azure

Profile Photo *

github3.jpg



Not secure case-alb-449626810.us-east-2.elb.amazonaws.com/success

Success!

Awesome! Your employee information has been successfully uploaded to our secure cloud storage.

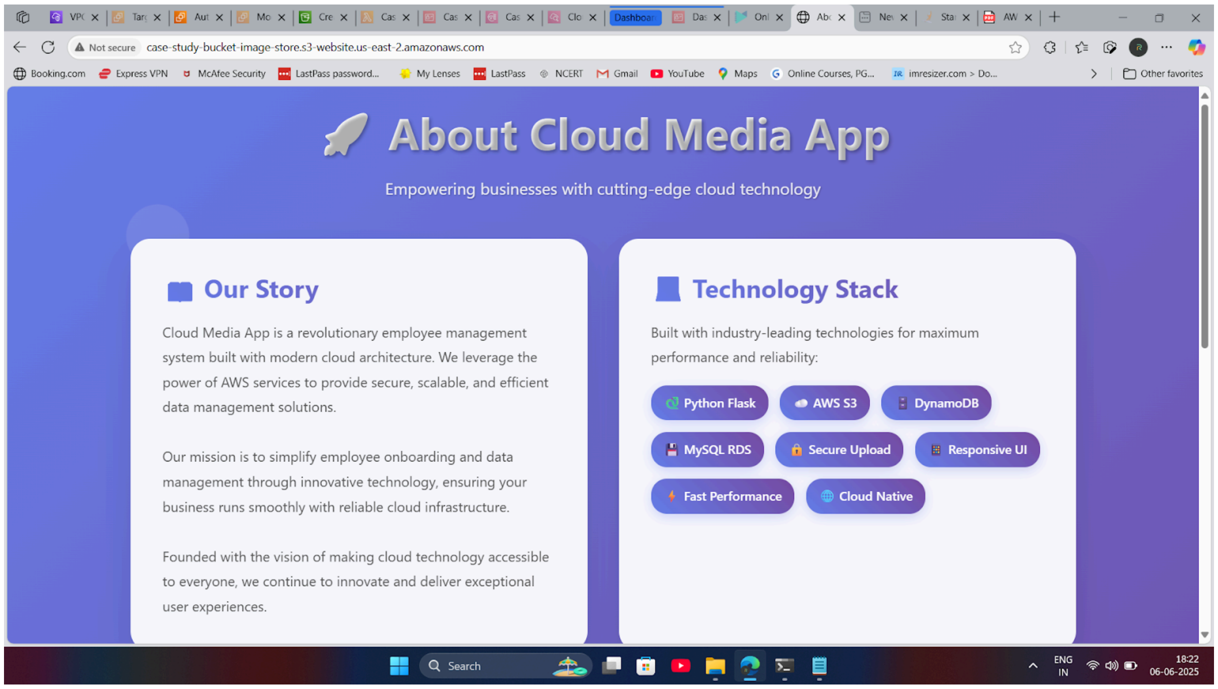
What happened:

Photo uploaded to AWS S3

Metadata saved to DynamoDB

Employee data stored in RDS

All data encrypted and secure


case-study-bucket-image-store.s3-website.us-east-2.amazonaws.com

About Cloud Media App

Empowering businesses with cutting-edge cloud technology

Our Story

Cloud Media App is a revolutionary employee management system built with modern cloud architecture. We leverage the power of AWS services to provide secure, scalable, and efficient data management solutions.

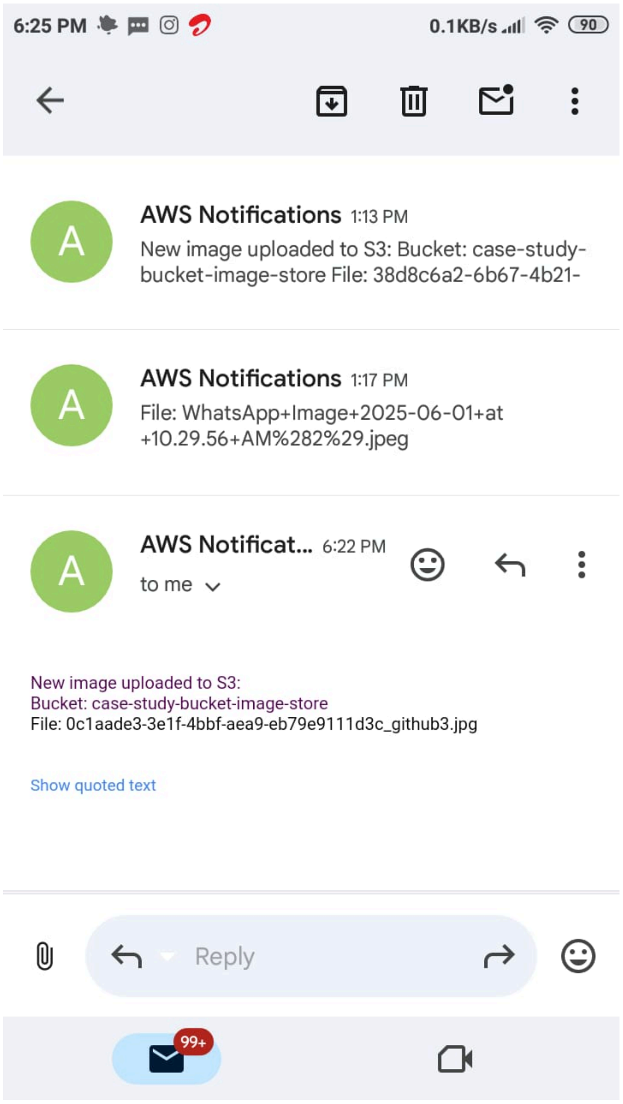
Our mission is to simplify employee onboarding and data management through innovative technology, ensuring your business runs smoothly with reliable cloud infrastructure.

Founded with the vision of making cloud technology accessible to everyone, we continue to innovate and deliver exceptional user experiences.

Technology Stack

Built with industry-leading technologies for maximum performance and reliability:

- Python Flask
- AWS S3
- DynamoDB
- MySQL RDS
- Secure Upload
- Responsive UI
- Fast Performance
- Cloud Native


6:25 PM 0.1KB/s 90

AWS Notifications 1:13 PM
New image uploaded to S3: Bucket: case-study-bucket-image-store File: 38d8c6a2-6b67-4b21-

AWS Notifications 1:17 PM
File: WhatsApp+Image+2025-06-01+at +10.29.56+AM%282%29.jpeg

AWS Notificat... 6:22 PM
to me

New image uploaded to S3:
Bucket: case-study-bucket-image-store
File: 0c1aade3-3e1f-4bbf-aea9-eb79e9111d3c_github3.jpg

🎯 Future Enhancements

- [ ] CI/CD pipeline with AWS CodePipeline
- [ ] CloudWatch monitoring and alerting
- [ ] Docker containerization
- [ ] Infrastructure as Code (CloudFormation/Terraform)

⭐ Star this repository if you found it helpful!
