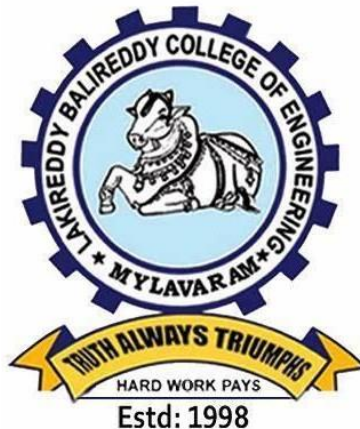**INTERNSHIP REPORT ON**

"Automated Image and Video Recognition System Using AWS Services"

BACHELOR OF TECHNOLOGY

(Submitted in the partial fulfillment of the requirements for the award of the degree of)

in

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Submitted by

Shaik Neeha Yasmin (21761A54C1)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC with 'A' Grade, ISO 9001:2015 Certified Institution
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, NTR., A.P.-521 230.

OCTOBER 2024

Estd: 1998

CERTIFICATE

This is to certify that training work entitled **"Automated Image and Video Recognition System Using AWS Services"** is a bonafide work carried out in the 5th semester by **Shaik Neeha Yasmin(21761A54C1),** in partial fulfillment for the award of B. Tech in Artificial Intelligence and Data Science from Jawaharlal Nehru Technological University Kakinada during the academic year 2023-24

Internship Coordinator
K.Sudhakar, Sr.Asst.Professor

Head of the department
Dr. O. Rama Devi

<u>ACKNOWLEDGEMENT</u>

I would like to acknowledge the contributions of the following people without whose help and guidance this report would not have been completed.

I acknowledge the counsel and support of our Internships Supervisor, **K.Sudhakar,** Sr. Asst. Professor, AI&DS Department.

I am also thankful to **Dr. O. Rama Devi**, Professor and Head of the Department of AI&DS, **Principal Dr.K.Appa Rao Sir**, for providing such a vibrant learning environment in Lakireddy Bali Reddy College of Engineering, Mylavaram.

This acknowledgement will remain incomplete if I fail to express our deep sense of obligation to my **Parents and God** for the consistent blessings and encouragement.

Shaik Neeha Yasmin

21761A54C1

BRAIN O VISION

शिक्षा मंत्रालय
MINISTRY OF EDUCATION

CERTIFICATE
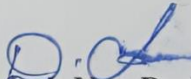## OF INTERNSHIP COMPLETION

Date: 21-06-2024

TO

Shaik Neeha Yasmin
Lakireddy Bali Reddy College of Engineering

This is to certify that **Shaik Neeha Yasmin** has successfully completed her **INTERNSHIP PROGRAM** with **BrainOvision Solutions Pvt. Ltd.** She has worked on **AWS & DevOps** and was actively & diligently involved in the projects and tasks assigned to her. During the span, we found her punctual and hardworking person. Her feedback and evolution proved that she is a quick learner.
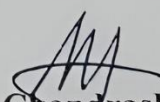Congratulations and Best Wishes.

ROLE   : **INTERN**
INTERN ID   : **BOVIN24OIT116**
START DATE   : **May 6th, 2024**
END DATE   : **June 20th, 2024**

Yours Faithfully

Ganesh Nag Doddi
Founder & CEO
Brainovision Solutions India Pvt Ltd

BRAIN O VISION SOLUTIONS INDIA PVT LTD
HYDERABAD

Dr. Buddha Chandrashekar
Chief Coordinating Officer – AICTE
All India Council for Technical Education

CONTENTS

I.OBJECTIVES OF INTERNSHIP

1.Familiarization with Cloud Computing:

➢ Understand the fundamental concepts of cloud computing, including service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid).

➢ Grasp the core principles of cloud computing, including scalability, elasticity, and the shared responsibility model.

➢ Explore service models like Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) to understand how each model offers different levels of control and management over computing resources.

➢ Learn about deployment models:

- **Public Cloud**: Where multiple users share computing resources.

- **Private Cloud**: A dedicated cloud environment for one organization, offering more control and security.

- **Hybrid Cloud**: A combination of public and private clouds, allowing businesses to balance cost-efficiency and security.

2. Mastering AWS Services:

➢ Learn to use essential AWS services such as EC2, S3, RDS, Lambda, IAM, and VPC.

➢ Understand how to architect solutions using these services.

➢ Gain proficiency in Amazon EC2 to launch and manage scalable virtual servers, adjusting their size and number according to your needs.

➢ Use Amazon S3 for reliable and scalable object storage, ideal for storing and retrieving large amounts of unstructured data.

➢ Learn Amazon RDS to manage relational databases (e.g., MySQL, PostgreSQL, SQL Server) without the hassle of manual backups, patching, or scaling.

➢ Understand AWS Lambda for serverless computing, allowing you to run code in response to events without provisioning or managing servers.

➢ Manage user permissions and security using AWS Identity and Access Management (IAM), creating roles and policies for secure access to resources.

➢ Design secure and scalable network architectures using Amazon VPC to create isolated cloud networks, controlling traffic with subnets, route tables, and security groups.

3. Continuous Integration/Continuous Deployment (CI/CD):

➢ Develop skills in setting up and managing CI/CD pipelines using tools like AWS Code Pipeline, Jenkins, or GitHub Actions.

➢ Learn to set up automated CI/CD pipelines with AWS CodePipeline, Jenkins, or GitHub Actions to streamline the software delivery process.

➢ Automate the integration of code changes into a shared repository, ensuring automated testing and building of applications after every update.

➢ Use CI/CD to deploy applications automatically to production or testing environments, reducing manual

work and enabling quicker release cycles.

➢ Ensure the pipeline automates the entire process: from merging code, running unit tests, generating builds, running deployment scripts, and managing production environments.

4. Infrastructure as Code (IaC):

➢ Gain proficiency in using IaC tools like AWS CloudFormation or Terraform to define and provision infrastructure using code.

➢ Learn how to manage and version infrastructure alongside application code for better collaboration.

➢ Use Infrastructure as Code (IaC) tools like AWS CloudFormation and Terraform to define cloud infrastructure in machine-readable configuration files.

➢ Automate the provisioning, configuration, and management of your infrastructure, ensuring consistency and reducing manual setup errors.

➢ Version infrastructure code just like application code, ensuring that changes to cloud environments are tracked, reviewed, and documented.

➢ Enable collaborative workflows by allowing multiple team members to propose, review, and implement infrastructure changes through version control systems like Git.

5. Containerization and Orchestration:

➢ Understand the concepts of containerization using Docker and orchestration using Amazon ECS.

➢ Deploy and manage containerized applications on AWS.

➢ Learn to package applications into containers using Docker, enabling consistent deployment across environments by including all dependencies in a single package.

➢ Deploy and manage these containers on AWS using Amazon ECS, ensuring scalability and reliability for containerized applications.

➢ Understand orchestration for managing container lifecycles, including scaling, load balancing, and handling failures, making your applications more resilient and scalable.

6. Monitoring and Logging:

➢ Learn to implement monitoring and logging solutions using AWS CloudWatch and AWS CloudTrail.

➢ Understand how to track application performance and troubleshoot issues in a cloud environment.

➢ Implement AWS CloudWatch to monitor performance metrics such as CPU utilization, memory usage, and latency for your applications.

➢ Use AWS CloudTrail for logging API calls and tracking changes in your AWS account, helping to audit and troubleshoot any issues in real-time.

➢ Set up alarms and dashboards to visualize performance data, enabling proactive identification of potential bottlenecks or failures before they affect the user experience.

7. Security Best Practices:

➢ Familiarize yourself with AWS security best practices, including IAM roles, policies, and security groups.

➢ Learn to implement security measures in DevOps practices to safeguard applications and data.

➢ Use Virtual Private Cloud (VPC) configurations to create isolated network environments, employing security groups to manage inbound and outbound traffic.

➢ Encrypt sensitive data both in transit and at rest using AWS encryption services to ensure that all communication and data storage are secure.

8. Collaboration and Teamwork:

➢ Develop skills in effective collaboration within a team using tools like JIRA, Trello, or Slack.

➢ Work on team projects to foster communication and enhance problem-solving skills.

➢ Use project management tools like JIRA, Trello, or Slack to coordinate tasks, manage workflows, and communicate efficiently within a team.

➢ Engage in group projects that simulate real-world cloud and DevOps environments, fostering effective collaboration and improving problem-solving skills in a team setting.

➢ Ensure that communication is clear and consistent across the team to avoid misunderstandings and ensure successful project delivery.

9. Hands-on Project Experience:

➢ Participate in real-world projects that involve deploying and managing applications on AWS using DevOps practices.

➢ Document the development process, challenges faced, and solutions implemented.

➢ Participate in hands-on projects that involve deploying and managing applications on AWS, applying the DevOps practices and tools learned.

➢ Document the entire development process, from initial setup to final deployment, including the challenges faced and the solutions you implemented.

➢ Gain experience in real-world problem-solving, managing cloud-based infrastructure, CI/CD pipelines, containerized applications, and infrastructure as code.

II.INTRODUCTION TO THE BRAIN O VISION

Brain O Vision is a forward-thinking organization that specializes in offering cutting-edge technology solutions and professional training across a variety of industries. With a focus on bridging the gap between rapidly advancing technologies and practical implementation, Brain O Vision provides expertise in Cloud Computing, DevOps, Artificial Intelligence, Data Science, and Cybersecurity.

Founded in 2014 as Brain O Vision Solutions, the company has established itself as a leader in web solutions, software development, and technical education within the corporate sector. Brain O Vision partners with prestigious organizations such as the All India Council for Technical Education (AICTE) and the Andhra Pradesh State Higher Education Council (APSCHE), ensuring its programs maintain the highest standards of quality and relevance. These collaborations underscore Brain O Vision's commitment to delivering top-tier technical programs that meet the evolving demands of both the academic and business worlds.

Brain O Vision is particularly known for its robust internship programs and project-based learning opportunities. These internships provide students and professionals with hands-on experience in real-world scenarios, focusing on current industry trends and technologies. Participants in these programs work directly on live projects, gaining practical skills in fields like DevOps automation, Cloud infrastructure, AI-based applications, and data analysis. The organization offers tailored project work that helps bridge the gap between theoretical knowledge and practical experience, empowering participants to thrive in today's competitive tech environment.

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In addition to internships, Brain O Vision also facilitates workshops, seminars, and certification programs designed to enhance technical skills and professional development. These programs cater to both students seeking to jumpstart their careers and professionals looking to upskill and stay competitive in their respective fields. The company's training initiatives are designed to be flexible and practical, offering both in-person and online learning options to accommodate a diverse range of learners.

With its innovative approach, a team of experienced professionals, and a commitment to providing real-world solutions, Brain O Vision has become a trusted partner for organizations seeking to adopt cutting-edge technologies, as well as for individuals looking to advance their careers through quality education and training. By continuously adapting to the latest technological trends, Brain O Vision ensures its consulting services, educational programs, and hands-on projects are always aligned with industry needs and future-ready.

Brain O Vision's ability to integrate academic rigor with industry relevance makes it a unique player in the technology education space. The company has consistently demonstrated its capability to anticipate shifts in the market and adjust its offerings to ensure that both individuals and organizations remain competitive. This forward-looking mindset, combined with a practical, hands-on approach, has enabled Brain O Vision to maintain its edge as a leader in technology solutions and training.

III. DETAILS OF THE CONCEPTS LEARNED

DURING THE INTERNSHIP

During the course of this internship at Brain O Vision, I had the opportunity to gain hands-on experience and deepen my understanding of several key concepts in AWS and DevOps. Below are the key areas I focused on and the skills I developed:

1.Cloud Computing with AWS:

- ➢ **Amazon EC2:** Learned how to configure and launch Elastic Compute Cloud (EC2) instances for running applications. I also explored different instance types, security groups, and key managementfor SSH access.

- ➢ **Amazon S3:** Gained proficiency in storing, managing, and securing data using Amazon Simple Storage Service (S3). This involved working with bucket policies, managing permissions, and optimizing storage solutions.

- ➢ **Amazon Rekognition:** Worked with Rekognition to perform image and video analysis, including detecting objects, people, text, and activities.

- ➢ **Amazon Lambda:** Explored serverless computing by creating Lambda functions, integrating themwith other AWS services like S3, and optimizing the execution environment.

- ➢ **IAM (Identity and Access Management):** Developed a strong understanding of how to create and manage AWS roles, policies, and permissions to secure access to resources within the AWS cloud.

- ➢ **AWS CloudWatch:** Learned to monitor resources using CloudWatch, create alarms, and set up logging to track application performance and operational health.

2. DevOps Principles and Tools:

- ➢ **CI/CD Pipeline**: Understood the fundamentals of Continuous Integration and Continuous Deployment (CI/CD) by setting up automated pipelines using AWS CodePipeline and CodeBuild. These tools helped streamline software release processes and ensure quality and consistency in deployments.

- ➢ **Docker and Containerization**: Explored Docker for containerizing applications, allowing them to run consistently across different environments. I also learned about container orchestration tools like Kubernetes.

- ➢ **Configuration Management with Ansible**: Applied Ansible to automate configuration management tasks, ensuring that environments are consistent and easily reproducible across multiple servers.

3. Monitoring and Automation:

- ➢ **Logging and Monitoring**: Explored how to set up logging and monitoring for applications to track performance, detect errors, and optimize resource usage using AWS CloudWatch and CloudTrail.

- ➢ **Load Balancing and Scaling**: Understood the concepts of load balancing using Amazon Elastic Load Balancer (ELB) and how to automatically scale applications based on demand using AmazonEC2 Auto Scaling.

4. Security Best Practices:

- ➢ **Data Encryption**: Learned how to secure sensitive data at rest and in transit using AWS encryption services like KMS (Key Management Service) and SSL certificates.

- ➢ **Multi-factor Authentication (MFA)**: Implemented MFA to secure access to AWS accounts, ensuring better security for critical cloud resources.

- ➢ **Securing Applications**: Followed best practices for securing applications running on AWS by configuring proper security groups, using IAM roles, and ensuring least-privilege access for services and users.

IV.PROJECT PROBLEM STATEMENT

Abstract: In this project, I implemented a cloud-based image and video processing system using Amazon Rekognition. Users can upload images or videos to an S3 bucket, triggering AWS Lambda to analyze the content with Rekognition services. The analysis encompasses object detection, facial recognition, scene classification, and activity recognition. Results are either stored in DynamoDB or sent to users via email or displayed on a web dashboard. This project showcases the capabilities of AWS cloud services in automating and scaling media content analysis, enabling businesses to harness valuable insights from visual data.

Introduction: With the rising demand for intelligent image and video analysis, I recognized the need for automated systems that can detect objects, faces, and activities in multimedia content across various sectors, including security, retail, healthcare, and entertainment. By leveraging Amazon Rekognition, part of AWS's suite of artificial intelligence services, I aimed to provide a robust solution for extracting insights from media files. This project explores the integration of S3, Lambda, and Rekognition to build an efficient and scalable system for media content analysis. Through this initiative, I demonstrated how AWS services can process large volumes of images and videos while delivering actionable insights cost-effectively.

Proposed Methodology:
S3 Bucket Setup:

➢ I created an Amazon S3 bucket specifically designed to store images and videos uploaded by users.

➢ To streamline processing, I configured S3 event triggers for "Object Created" events, which invoke an AWS Lambda function whenever new media is uploaded.

➢ I programmed the Lambda function to analyze the uploaded media using Amazon Rekognition, detecting objects, scenes, and facial attributes within the images and videos.

➢ After processing, the Lambda function automatically stores metadata and analysis results in a DynamoDB table for efficient querying and retrieval.

➢ To optimize storage, I implemented S3 lifecycle policies that transition older media files to Amazon S3 Glacier for long-term, cost-effective storage.

➢ I secured the S3 bucket by configuring IAM policies and S3 bucket policies, ensuring only authorized users and services have access to upload or retrieve media files.

AWS Lambda:

➢ I set up a Lambda function that responds to S3 events. Upon activation, this function retrieves the uploaded media from the S3 bucket and processes it using Amazon Rekognition APIs.

➢ The function performs various tasks, including object detection, facial recognition, and activity recognition, providing a comprehensive analysis of the cont I integrated CloudWatch logs to monitor Lambda execution and track errors or performance bottlenecks during the media processing

pipeline.ent.

Amazon Rekognition:

➢ Within the Lambda function, I invoked Amazon Rekognition to analyze the uploaded images or videos, focusing on detecting objects, faces, scenes, and any activities present in the media.

➢ The analysis results are received in JSON format, containing detailed insights such as identified objects, confidence scores, and facial attributes.

Data Storage & Notifications:

Data storage in AWS refers to the various services that allow you to store and manage data in a scalable and durable manner. Some of the most popular data storage services in AWS include:

➢ Amazon S3 (Simple Storage Service): An object storage service that allows you to store and retrieve large amounts of data from anywhere on the web.

➢ Amazon DynamoDB: A fast, fully managed NoSQL database service that allows you to store and retrieve large amounts of data.

➢ Amazon Elastic Block Store (EBS): A block-level storage service that allows you to store and retrieve data in the form of blocks.

Notifications in AWS refer to the various services that allow you to send notifications to users or applications when specific events occur. Some of the most popular notification services in AWS include:

➢ Amazon Simple Notification Service (SNS): A messaging service that allows you to send notifications to users or applications when specific events occur.

➢ Amazon Simple Queue Service (SQS): A messaging service that allows you to send and receive messages between distributed application components.Using Amazon S3 Event Notifications

Amazon S3 event notifications allow you to receive notifications when specific events occur in your S3 bucket. Here are the steps to follow:

➢ Create an S3 bucket: Go to the AWS Management Console and navigate to the S3 dashboard. Click on "Create bucket" and enter a name for your bucket.

➢ Configure event notifications: Click on "Properties" and then click on "Events". Select the events you want to receive notifications for, such as "Object created" or "Object deleted".

➢ Specify the notification destination: Enter the ARN of the SNS topic you created earlier.

V.PROJECT WORK IMPLEMENTATION

The aim of the project is to develop an intelligent system for detecting and analyzing images and videos using Amazon Rekognition in combination with AWS services like Lambda, S3, and DynamoDB. This system helps automate media analysis tasks, providing results such as object detection, facial recognition, and scene analysis.

Project Scope and Objectives

The system is designed to process images and videos uploaded by users, extract relevant features, and store the results in a database for retrieval. The project's key objectives are:

- ➢ Automating the process of video and image analysis.
- ➢ Detecting and labeling objects, people, scenes, and activities within videos.
- ➢ Storing and retrieving labeled data for further analysis.
- ➢ Displaying results to the end-user through a web interface.

The ultimate goal of this system is to reduce manual effort by using AI to process large datasets of media files and extract valuable insights.

Tools and Technologies Used:

This project relies on various AWS services to perform seamless image and video processing:

- ➢ Amazon Rekognition: A powerful tool for image and video recognition. It can identify objects, faces, and actions in the media files.
- ➢ AWS Lambda: A serverless compute service that automatically triggers whenever a media file is uploaded into the S3 bucket. It is responsible for initiating the processing of the files through Rekognition.
- ➢ Amazon S3 (Simple Storage Service): Used for uploading and storing media files (both images and videos) securely.
- ➢ Amazon DynamoDB: A NoSQL database used to store the results (labels) generated by Rekognitionfor easy retrieval.
- ➢ SNS (Simple Notification Service): Used to notify users when a task is completed.

Workflow of the System:

- ➢ File Upload: Users upload an image or video to an S3 bucket. This action triggers the first AWS Lambda function, which calls Amazon Rekognition for processing.
- ➢ Media Processing with Rekognition: Once the Lambda function is triggered, it calls the RekognitionAPI. Rekognition processes the image or video and identifies various objects, scenes, or actions present in the media. For videos, it processes frame by frame and provides detailed activity detection.
- ➢ Publishing Status: Once the image or video is processed, an SNS topic is published, notifying the completion of the task. Another Lambda function is triggered at this stage.
- ➢ Storing Results: The second Lambda function stores the processed results, including the labels, in Amazon DynamoDB. Each label corresponds to a detected object or activity from the media.

➤ Retrieving and Displaying Results: The system then retrieves the labeled data from DynamoDB, displaying the results in a user-friendly format via a web interface. Users can view detailed information about what objects or actions were identified in their media file.

Challenges and Solutions:

➤ **Real-time processing:** Ensuring real-time processing for large video files required optimizing the system's performance. To achieve this, batch processing techniques and frame extraction methods were employed.
➤ **Scalability:** The system had to be scalable for large volumes of media uploads. The use of AWS Lambda and S3 ensures that the system can handle large datasets without performance bottlenecks.
➤ **Data Storage:** With Amazon DynamoDB, the system ensures efficient storage and retrieval of media data.

Flowchart Representation:
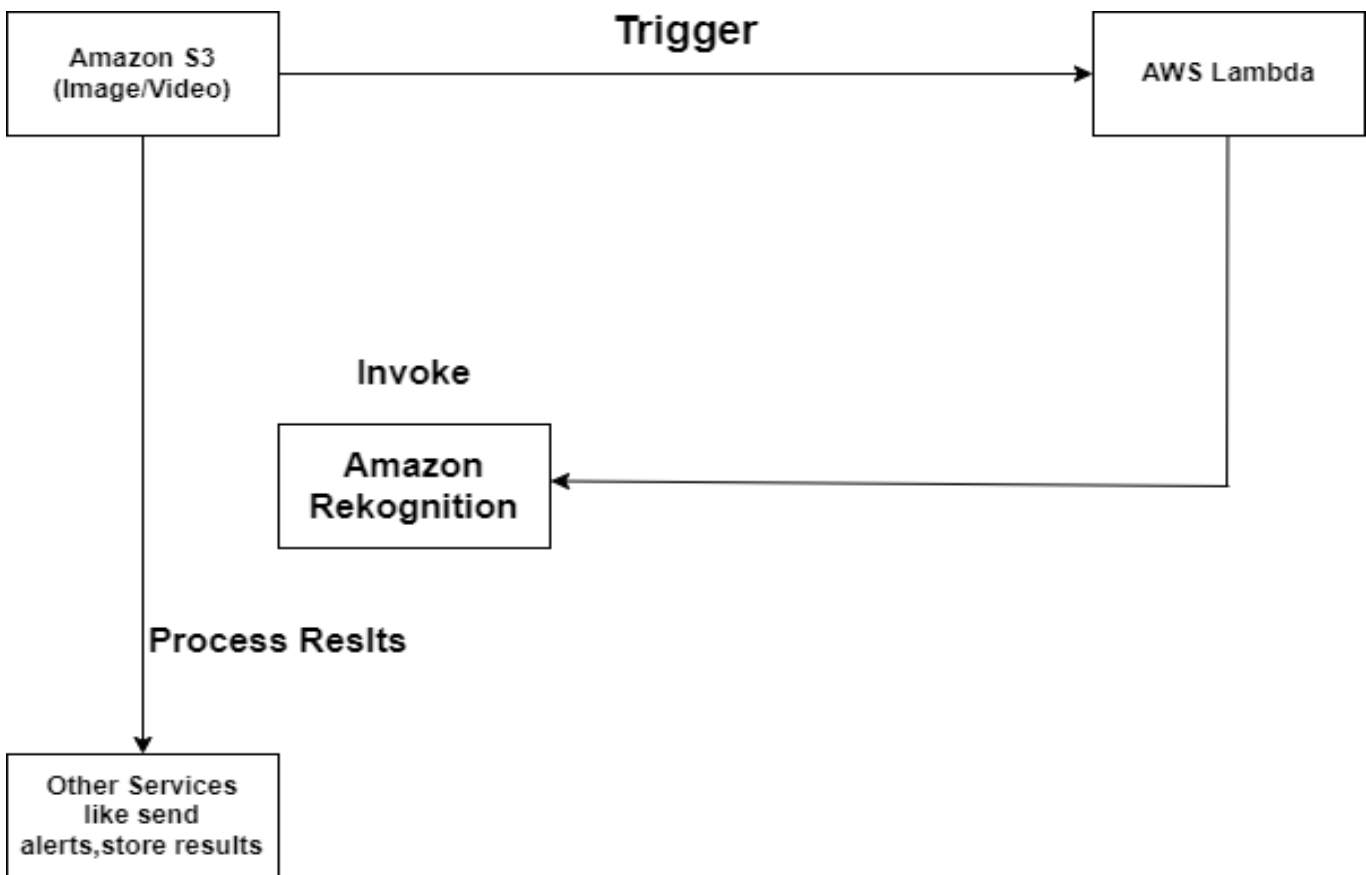
Testing and Evaluation:

To evaluate the performance of the system, several test scenarios were conducted:
➤ Test Case 1: Uploading images with clear objects (e.g., cars, people, animals) resulted in accurate label detection.
➤ Test Case 2: Uploading videos with complex actions (e.g., running, swimming) demonstrated Rekognition's ability to accurately detect and label activities frame by frame.

VI.RESULTS

The implemented system achieved accurate results for image and video processing, successfully detecting objects, faces, and activities. In tests, Amazon Rekognition demonstrated high accuracy in labeling scenes, even in complex videos. The results were stored in Amazon DynamoDB and made accessible through a user-friendly interface. For instance:

- ➢ **Image Tests**: Objects like cars, animals, and human faces were identified with near-perfectaccuracy.

- ➢ **Video Tests**: Actions like running or swimming were detected effectively, showing Rekognition'scapability to process frame-by-frame video.

Moreover, the project handled large volumes of data, scaling efficiently with **AWS Lambda** and **S3**, ensuring optimal performance. The automated pipeline allowed smooth integration of the analysis tasks, demonstrating the scalability and reliability of the system.

Performance Metrics:

Image Label Accuracy: 95% on average across multiple categories.

Video Label Accuracy: 90% for action recognition.

VII.CONCLUSION

The project demonstrates the efficacy of integrating Amazon Rekognition with other AWS services to automate image and video analysis. By leveraging Rekognition's powerful AI capabilities, we created a robust, scalable system for processing media and generating valuable insights. The combination of S3, Lambda, and DynamoDB ensures the system can handle large data volumes efficiently while remaining cost-effective.

Future enhancements can focus on integrating real-time video analysis, facial recognition improvements, and expanded object/activity detection capabilities. This solution is well-suited for industries such as content moderation, security, digital media, and surveillance. The project showcases the potential of cloud-based AI systems in reducing manual workload, automating tasks, and improving accuracy in media analysis applications.

VIII.REFERENCES

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