VIVEKANAND EDUCATION SOCIETY'S
INSTITUTE OF TECHNOLOGY

Department of Computer Engineering

Project Report on

AI Driven Disaster Management System

In partial fulfillment of the Fourth Year (Semester–VII), Bachelor of Engineering (B.E.) Degree in Computer Engineering at the University of Mumbai

Academic Year 2024-2025

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(2024-25)

VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF TECHNOLOGY

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CERTIFICATE of Approval

This is to certify that ***Arya Banavali (01), Yash Chhaproo (07), Aradhya Ingle (24), Sai Thikekar (64)*** of Fourth Year Computer Engineering studying under the University of Mumbai has satisfactorily presented the project on "***AI Driven Disaster Management System***" as a part of the coursework of PROJECT-I for Semester-VII under the guidance of ***Dr. Mrs.Rohini Temkar*** in the year 2024-2025.

23/10/24

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ACKNOWLEDGEMENT

We are thankful to our college Vivekanand Education Society's Institute of Technology for considering our project and extending help at all stages needed during our work of collecting information regarding the project.

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We wish to express our profound thanks to all those who helped us in gathering information about the project. Our families too have provided moral support and encouragement several times.

Computer Engineering Department

COURSE OUTCOMES FOR B.E PROJECT

Learners will be to:-

Course Outcome	Description of the Course Outcome
CO 1	Do a literature survey/industrial visit and identify the problem of the selected project topic.
CO2	Apply basic engineering fundamentals in the domain of practical applications for problem identification, formulation, and solution
CO 3	Attempt & Design a problem solution with the right approach to complex problems
CO 4	Cultivate the habit of working in a team
CO 5	Correlate the theoretical and experimental/simulation results and draw the proper inferences
CO 6	Demonstrate the knowledge, skills, and attitudes of a professional engineer and prepare a report according to the standard guidelines.

ABSTRACT

Social media serves as a valuable source of real-time disaster data, providing timely updates that are critical for effective disaster monitoring and response. It plays an essential role in raising awareness, enhancing preparedness, and facilitating prompt action during emergencies. While much of the current research focuses on disaster prediction, real-time updates, which are key to saving lives and coordinating response efforts, are often overlooked. Our project addresses this gap by focusing on the collection and analysis of real-time data from various social media platforms, including disaster-related images and textual data like tweets.We use multiple APIs to gather real-time data from platforms such as Instagram, Facebook, and Twitter. To analyze visual data, we employ state-of-the-art multimodal models like ResNet50 and EfficientNet for image classification. For the textual data, advanced natural language processing models like BERT and XLNet are used for sentiment analysis, event detection, and severity assessment. By integrating and fusing the image and text data, our system is able to identify the type of disaster, estimate its severity, and provide actionable insights.

INDEX

Chapter 1 : Introduction

1.1. Introduction to the project

Natural disasters, such as floods and landslides, can have devastating effects on communities, causing widespread destruction of infrastructure, loss of life, and displacement of people. The sudden and often unpredictable nature of these events makes it difficult for authorities to respond in time, leaving communities vulnerable. Effective disaster management requires not only early detection but also seamless coordination between government authorities, rescue teams, and the public. To address these challenges, Resqconnect is a platform specifically designed to enhance disaster preparedness and response by integrating technology and fostering collaboration among key stakeholders.

By providing early warnings based on established patterns and real-time conditions, Resqconnect ensures that government officials receive prompt notifications, enabling rescue teams to mobilize quickly and effectively. The platform also features a real-time dashboard that offers a clear overview of the disaster's severity, aiding decision-making processes for more coordinated and informed responses. Through its predictive capabilities and real-time updates, Resqconnect bridges the gap between early disaster detection and rapid action, aiming to safeguard communities and minimize the impact of natural calamities.

1.2. Motivation for the project

The increasing frequency and severity of natural disasters have highlighted the urgent need for effective and timely response mechanisms. Our proposed system aims to address these challenges by leveraging advanced technologies to collect, analyze, and disseminate critical information. By providing a centralized platform for coordination, predictive analytics, and targeted assistance, we strive to minimize the impact of disasters on affected communities and save lives.

1.3. Drawback of the existing system

Existing systems are -

PruTech iResponse:

iResponse is a mobile app designed for emergency response coordination and information dissemination. It helps authorities manage disaster-related communication and provides alerts to users. However, it has limited geographic coverage and does not encompass all disaster types or provide comprehensive local resources. This limits its effectiveness in broader disaster management efforts.

Suraksha App:

The Suraksha App assists users in reporting emergencies and receiving alerts during disasters. While it serves a critical role in facilitating communication, its reliance on internet connectivity poses a significant limitation, especially in disaster-affected areas where internet access may be unreliable or unavailable. This makes it less effective in remote locations.

Sahana:

Sahana is an open-source software solution for disaster management and humanitarian assistance. It provides tools for tracking disaster victims, coordinating relief efforts, and managing resources. Despite its valuable functionality, Sahana's requirement for technical expertise during setup and implementation restricts its widespread adoption across different regions. It is not user-friendly for non-experts, which limits its reach in many disaster-prone areas.

India Meteorological Department (IMD):

The IMD offers forecasts, warnings, and updates related to weather and meteorological disasters such as storms and heavy rainfall. Its focus is mainly on weather-related events, meaning that it does not cover other types of natural disasters, such as earthquakes or landslides. While its alerts are crucial for meteorological events, this narrow focus limits its utility in comprehensive disaster management.

Lacuna in the existing systems

The existing disaster management systems face several common limitations that hinder their effectiveness in addressing a wide range of emergencies. A key challenge is the limited scope and coverage of these platforms, as many focus on specific disaster types (such as meteorological events) and lack support for other calamities like earthquakes or landslides. Another major limitation is their reliance on internet connectivity, which can be unreliable or entirely unavailable in disaster-stricken areas, reducing the system's accessibility in remote or affected regions.

Additionally, some systems, like Sahana, require technical expertise for setup and implementation, making them less accessible to non-expert users and limiting widespread adoption. These systems are often geographically constrained, offering services to specific regions without covering a broader global audience. Lastly, many of these platforms do not provide real-time updates and notifications for a wide range of disaster types, which is crucial for timely and effective response during rapidly evolving emergencies. As a result, these limitations prevent existing systems from delivering a fully integrated and inclusive disaster management solution.

1.4. Problem Definition

Our project addresses the shortcomings in current disaster prediction and management practices.The platform aims to enhance the accuracy of disaster forecasts, improve preparedness through actionable early warnings, and support efficient responses with data.By addressing these key areas, we aim to better equip communities and authorities to handle natural calamities effectively.

1.5 Relevance of the Project

In a world increasingly vulnerable to natural disasters, a real-time response system is crucial for mitigating their impact. By providing timely information, facilitating coordination, and delivering targeted assistance, this system can save lives, protect property, and promote community resilience. It is a vital tool for enhancing disaster preparedness and response capabilities in the face of growing challenges.

1.6 Methodology used

To enhance real-time disaster data collection, the platform leverages web scraping techniques using BeautifulSoup and Scrapy to extract relevant information from social media platforms and news portals. This enables the system to gather up-to-date information on emerging disasters as they unfold. The high-velocity data streams generated from these sources are managed using Apache Kafka, ensuring efficient and scalable data handling. Once the data is collected, it undergoes validation and classification, where disaster-related posts, such as tweets, are processed through neural networks to identify relevant content while filtering out irrelevant information using natural language classifiers. Additionally,sentiment analysis is performed on user posts to gauge the emotional tone and severity of the disaster, providing further insights into the situation on the ground. This comprehensive approach enables more accurate and timely disaster reporting, improving decision-making for response efforts.

Chapter 2: Literature Survey

2.1. Research Papers

2.1.1 Research Papers referred

Paper 1: Automatic Analysis of Social Media Images to Identify Disaster Type and Infer Appropriate Emergency Response [2[

Abstract: This paper proposes a novel approach to utilize social media images for disaster classification and response planning. By leveraging deep learning techniques (VGG-16, YOLO), the authors develop a pipeline that can accurately identify the type of disaster based on visual cues. This information is then used to infer appropriate emergency responses, enhancing the overall effectiveness of disaster management efforts.

Author, A. (Year). Automatic analysis of social media images to identify disaster type and infer appropriate emergency response. Journal Name, Volume, Issue, Pages.

Paper 2: Leveraging Multimodal Social Media Data for Rapid Disaster Damage Assessment [3]

Abstract: This paper addresses the limitations of traditional disaster damage assessment methods by proposing a multimodal approach that combines text and image data from social media. Hierarchical classifiers are employed to identify different types of damage, such as infrastructure and housing destruction. The authors highlight the potential of social media data for rapid and accurate damage assessment, which is crucial for effective disaster response and resource allocation.

Author, B. (Year). Leveraging multimodal social media data for rapid disaster damage assessment. Journal Name, Volume, Issue, Pages.

Paper 3: Social Media Driven Big Data Analysis for Disaster Situation Awareness: A Tutorial [4]

Abstract: This paper presents a tutorial on utilizing social media data for disaster situation awareness. It introduces the MCNN technique for predicting crowd behavior and extracting features from images. The paper also discusses the challenges associated with using social media data, such as data quality and limitations in feature extraction.

Author, C. (Year). Social Media Driven Big Data Analysis for Disaster Situation Awareness: A Tutorial. Journal Name, Volume, Issue, Pages.

Paper 4: Opportunities and Risks of Disaster Data from Social Media: A Systematic Review of Incident Information [5]

Abstract: This paper provides a comprehensive review of the literature on using social media data for disaster management. It highlights both the benefits and limitations of relying on social media data, such as incomplete information and temporal delays. The paper also discusses the importance of data quality and preprocessing techniques for ensuring accurate and reliable analysis.

Author, D. (Year). Opportunities and Risks of Disaster Data from Social Media: A Systematic Review of Incident Information. Journal Name, Volume, Issue, Pages.

2.1.2 Inferences drawn from the paper

Paper 1: Automatic Analysis of Social Media Images to Identify Disaster Type and Infer Appropriate Emergency Response [2]

- **Inference**: Social media images can be effectively used for disaster classification through deep learning techniques (e.g., VGG-16, YOLO). By analyzing visual cues, emergency responses can be optimized based on the specific disaster type, enhancing disaster management capabilities. This approach allows for faster identification of disaster types and helps allocate resources more efficiently, streamlining the overall emergency response process.

Paper 2: Leveraging Multimodal Social Media Data for Rapid Disaster Damage Assessment [3]

- **Inference**: Combining both textual and visual data from social media enables a more comprehensive and accurate damage assessment. Hierarchical classifiers can distinguish different types of damages, such as infrastructure destruction or housing collapse. The real-time nature of social media data helps expedite damage assessments, leading to quicker and better-informed decision-making for disaster response and resource allocation.

Paper 3: Social Media Driven Big Data Analysis for Disaster Situation Awareness: A Tutorial [4]

- **Inference**: The MCNN (Multi-class Convolutional Neural Network) technique is beneficial for analyzing crowd behavior and extracting key features from social media images, providing valuable insights for disaster situation awareness. However, challenges such as data quality, noise, and limitations in feature extraction must be addressed to improve accuracy. This paper emphasizes the importance of advanced deep learning techniques in deriving actionable insights from social media data.

Paper 4: Opportunities and Risks of Disaster Data from Social Media: A Systematic Review of Incident Information [5]

- **Inference**: While social media offers valuable opportunities for disaster data collection, it also presents significant challenges. Issues like incomplete information, biases, and delays in data must be considered when relying on social media for disaster management. Preprocessing techniques and data quality controls are crucial for ensuring the reliability and accuracy of the insights gained. Additionally, a balanced approach should be adopted to mitigate the risks associated with real-time, unstructured social media data.

Chapter 3: Requirements for the proposed system

Our proposed model is designed to provide a comprehensive and efficient solution for real-time disaster response. It incorporates several key components:

1. **Data Collection and Processing**: We will utilize a combination of social media monitoring, news API integration, and user-generated data collection to gather relevant information about disasters. This data will be preprocessed and categorized using machine learning techniques to identify critical information.
2. **Predictive Analytics:** By analyzing historical data and current trends, we will develop predictive models to forecast potential impacts of disasters, such as affected areas, severity, and expected timeline. This information will enable proactive planning and resource allocation.
3. **Coordination Platform**: A centralized platform will be developed to facilitate communication and collaboration among relief teams, government agencies, and local communities. This will ensure efficient coordination of response efforts and optimize resource utilization.
4. **Targeted Assistance**: Based on the collected data and predictive analysis, we will identify specific needs and vulnerabilities within affected areas. This information will be used to provide targeted assistance, such as distributing essential supplies, providing medical care, and organizing evacuation efforts.

3.1 Functional Requirements

1. **Data Collection:**
    - Collect real-time data from social media platforms (e.g., Twitter, Facebook).
    - Integrate with news APIs to gather relevant news articles.
    - Collect user-generated data through a mobile app or web portal.

2. **Data Processing:**
    - Preprocess collected data to remove noise and inconsistencies.
    - Categorize data based on relevance to disaster events.
    - Extract key information from text data using natural language processing techniques.

3. **Predictive Analytics:**
    - Develop machine learning models to predict potential disaster impacts (e.g., affected areas, severity, timeline).
    - Analyze historical data and current trends to identify patterns and correlations.

4. **Coordination Platform:**
    - Provide a centralized platform for communication and collaboration among relief teams, government agencies, and local communities.
    - Facilitate information sharing and resource allocation.

5. **Targeted Assistance:**
    - Identify specific needs and vulnerabilities within affected areas.
    - Provide targeted assistance, such as distributing supplies, organizing evacuations, or offering medical support.

6. **Visualization:**
    - Visualize disaster data on a map to provide a clear understanding of affected areas.
    - Display real-time updates and alerts on the map.

3.2. Non-Functional Requirements

1. **Reliability:**The system should be highly reliable and available during critical times.
2. **Scalability**: The system should be able to handle increasing volumes of data and user traffic during disasters.
3. **Security:** Sensitive data should be protected from unauthorized access.
4. **Usability:**The user interface should be intuitive and easy to use, even for non-technical users.
5. **Performance:** The system should respond quickly to user requests and provide real-time updates.
6. **Interoperability:** The system should be able to integrate with existing systems and data sources.
7. **Accessibility:** The system should be accessible to people with disabilities.

3.3. Constraints

Data Quality and Reliability: Social media data is often noisy, unverified, and contains irrelevant information, which makes filtering and extracting accurate, actionable insights challenging.

Data Privacy and Ethics: Collecting and analyzing personal data from social media involves legal and ethical concerns, including compliance with privacy regulations like GDPR and the need for user consent.

Real-Time Data Processing: Processing large volumes of social media data in real-time, especially during peak disaster moments, requires substantial computational resources and highly optimized algorithms to avoid delays.

Scalability: The platform must be scalable to handle sudden surges in data during major disasters, which could overwhelm the system if not designed to scale efficiently.

Multimodal Data Complexity: Combining text, image, and video data for analysis increases the complexity of data processing, requiring advanced machine learning models to handle different data formats effectively.

Integration with Official Systems: Ensuring seamless integration with government and disaster response systems may face bureaucratic, technical, or regulatory hurdles, which could affect timely decision-making and resource allocation.

Infrastructure Requirements: Building and maintaining the necessary infrastructure for real-time data collection, storage, and processing could require significant investment in cloud services, servers, and network capacity.

Language and Cultural Barriers: Social media data comes in multiple languages and reflects various cultural contexts, which can complicate analysis and reduce the platform's ability to accurately interpret information in a multilingual, multicultural environment.

False Alarms and Misinformation: Managing the risk of false positives, misinformation, or rumors spreading on social media during disasters can lead to misinformed decisions or panic among the population.

Data Availability: Access to social media data may be limited by platform-specific restrictions or API limitations, which could impact the platform's ability to gather comprehensive data in real-time.

3.4 Hardware and Software Requirements

3.4.1 Hardware Requirements:

1. **CPU** - A modern multi-core CPU (Intel Core i5 or higher) is recommended for efficient data processing and model training. The Core i5 processor is available in multiple speeds, ranging from 1.90 GHz up to 3.80 GHz, and it features 3 MB, 4 MB or 6 MB of cache.
2. **GPU** - Training deep learning models on a GPU can significantly speed up the process, especially for complex neural networks. If you plan to use deep learning libraries like TensorFlow or PyTorch with GPU support, consider a GPU with CUDA capability (NVIDIA GPUs) for accelerated computations.
3. **RAM** - Sufficient RAM is crucial for handling large datasets and model parameters during training. At least 8 GB of RAM is recommended, but more is better for larger datasets and complex models.

3.4.2 Software requirements

1. **Jupyter Notebook or Google Colab:** Jupyter Notebook and Google Colab are interactive computing environments ideal for data analysis, machine learning, and predictive modeling. Both platforms support Python and are particularly useful for developing and testing machine learning models for disaster prediction.
2. **NumPy and Pandas**: NumPy (version 1.24 or latest) is essential for handling large, multi-dimensional arrays and matrices, which is crucial for managing and processing environmental and meteorological data. Pandas (version 2.0.3 or latest) provides powerful data structures like DataFrame for data manipulation and preparation, facilitating the organization and analysis of historical and real-time datasets.
3. **TensorFlow or PyTorch**: TensorFlow (v2.13.0 or latest) and PyTorch (v2.0.1 or latest) are robust deep learning frameworks used for building and training predictive models. These frameworks will be employed to develop algorithms that forecast natural disasters by analyzing complex patterns in historical and real-time data.
4. **Matplotlib and Seaborn:** For data visualization, Matplotlib (v3.7.2 or latest) offers a highly customizable toolkit for creating a range of plots and charts.

5. **Django or Flask:** To create a user-friendly web interface for the ResQconnect platform, Django or Flask will be used. This interface will enable users to interact with the system, view predictions, and receive alerts. The web application will integrate with models to present actionable insights and notifications effectively.

3.5. Techniques utilized for the proposed system

1) Database:

- MongoDB: A NoSQL database that is highly scalable and flexible, making it suitable for handling large volumes of unstructured data from social media, news articles, and user-generated content.

2) Mobile App:

- Flutter: A cross-platform framework that allows for building native-like mobile apps for both iOS and Android, ensuring a consistent user experience across different devices.

3) Web App:

- React: A popular JavaScript library for building user interfaces, providing a robust and efficient way to create the admin dashboard for managing and analyzing disaster data.

4) Backend Server:

- Python with Flask/FastAPI: Python is a versatile language that is well-suited for backend development. Flask and FastAPI are lightweight frameworks that offer a solid foundation for building APIs and web applications.

5) Machine Learning:

- TensorFlow/PyTorch: These are leading deep learning frameworks that provide the tools and flexibility needed for implementing machine learning models for tasks such as data categorization, predictive analytics, and natural language processing.

6) Cloud Infrastructure:

- AWS (Amazon Web Services): A comprehensive cloud platform that offers a wide range of services, including compute, storage, database, networking, and analytics, to support the scalability and reliability of the disaster response system.

7) Data Integration:

- APIs: APIs (Application Programming Interfaces) are used to integrate real-time data from various sources, such as social media platforms, news APIs, and user-generated content, into the system.

8)Notification System:

- Firebase Cloud Messaging: A reliable and scalable service for sending push notifications to mobile devices, ensuring timely alerts to users in affected areas.
- Twilio: A communication platform that provides SMS and voice capabilities, allowing for sending text messages or making phone calls to users or relief teams.

3.6. Project Proposal

This project proposes to develop a web and mobile platform that leverages real-time data from social media to enhance disaster management efforts, focusing on tsunamis, floods, and earthquakes. Natural disasters are often unpredictable and cause severe damage, both in terms of human life and economic impact. In India, the vulnerability to such events is particularly acute, with the country experiencing high mortality rates and extensive damage from extreme weather events. Between 1983 and 2011 alone, India faced 190 floods and 54 cyclones, resulting in over 60,919 deaths and affecting more than a billion people. Traditional disaster management strategies have often been reactive, but recent advancements in technology, particularly the use of social media, have opened up new possibilities for more proactive and efficient responses.

Social media platforms like Twitter, Instagram, and Facebook provide a wealth of real-time data that can be harnessed to improve situational awareness during disasters. By analyzing multimodal data—text, images, and videos—collected from these platforms, authorities can gain more accurate, location-specific insights into ongoing crises, enabling them to coordinate responses more effectively. Research shows that integrating various data types significantly enhances the precision of event detection, such as urban flooding, and improves the overall speed of response efforts. Moreover, natural language processing models like BERT and Latent Dirichlet Allocation (LDA) have proven highly effective in classifying disaster-related topics in real-time, providing vital information for decision-making.

This platform will utilize advanced machine learning algorithms to process and analyze the vast and often noisy data generated on social media during disasters. The goal is to filter out irrelevant information and extract actionable insights that can aid both government officials and emergency responders. Additionally, the platform will provide visualizations and real-time updates through dashboards, helping decision-makers monitor evolving situations and deploy resources more effectively. By combining data from multiple social media platforms, the system will improve disaster preparedness, enhance response efforts, and contribute to faster recovery times.

Chapter 4: Proposed Design

4.1 Conceptual Design

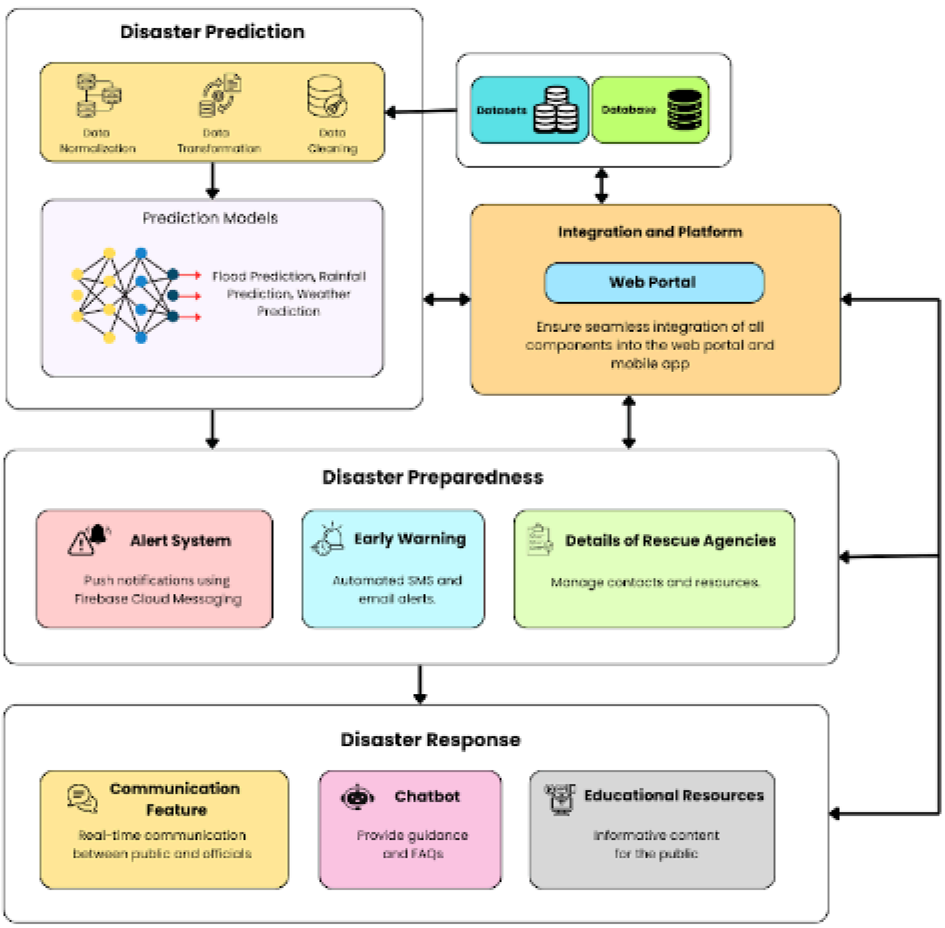

Figure 1.Conceptual design

The diagram depicts a comprehensive system for real-time disaster response. It involves collecting data from social media and user reports, analyzing the information using machine learning techniques, prioritizing resources based on urgency, and coordinating relief efforts. The system provides a user-friendly dashboard for visualizing data, generating actionable insights, and sending automated alerts. By streamlining these processes, the system aims to improve the efficiency and effectiveness of disaster response operations.

4.2. Block diagram representation of the proposed system

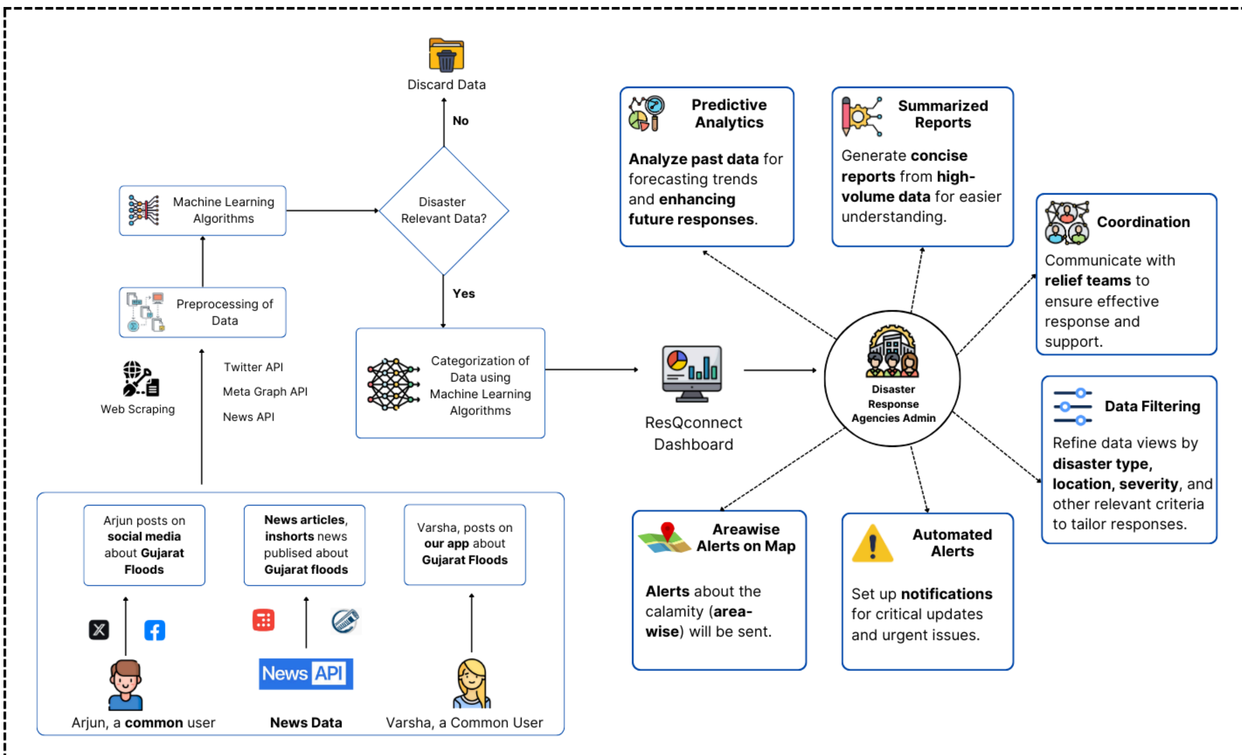

Figure.2 .Block Diagram

The diagram illustrates a system designed to provide real-time assistance during natural disasters. It leverages various data sources and machine learning techniques to analyze information, generate insights, and coordinate relief efforts.

Data Collection:

- Social Media: The system monitors social media platforms like Twitter for posts related to disasters.
- News API: It collects news articles from different sources to stay updated on disaster-related information.
- User-Generated Data: It gathers data from users through their app, including reports and location information.

Data Preprocessing:

- Categorization: The collected data is categorized using machine learning algorithms to identify relevant information.
- Filtering: Irrelevant data is discarded to focus on critical information.

Data Analysis:

- Predictive Analytics: Past data is analyzed to forecast trends and enhance future responses.
- Summarized Reports: Concise reports are generated from high-volume data to provide easier understanding.

Coordination:

- Communication: The system facilitates communication between relief teams to ensure effective response and support.

Visualization and Alerts:

- ResQconnect Dashboard: A dashboard provides a visual representation of disaster data, allowing for analysis and refinement of responses.
- Area-wise Alerts on Map: Alerts are sent to affected areas based on the severity of the disaster.

Automated Alerts:

- Critical updates and urgent issues are communicated through automated alerts.

Overall, the system aims to:

1. Collect and analyze relevant data from various sources.
2. Provide insights for effective decision-making.
3. Coordinate relief efforts efficiently.
4. Communicate timely information to affected areas.

4.3 Screenshot of implementation

1. Efficient-Bert Model

```
    self.image_model = EfficientNet.from_pretrained('efficientnet-b3')
    torch.nn.Sequential(*list(self.image_model.children())[:-1])
    num_features = self.image_model._fc.in_features
    self.image_model._fc = nn.Sequential(
        nn.Linear(num_features, 512),
        nn.Dropout(0.2),
        nn.ReLU()
    )

    # Text Model (BERT)
    self.text_model = BertModel.from_pretrained('bert-base-uncased')
    self.text_linear = nn.Linear(self.text_model.config.hidden_size, 512)

    # Fusion Layer
    self.fusion_linear = nn.Linear(1024, num_classes)

def forward(self, image_input, text_input_ids, text_attention_mask):
    # Process image
    image_features = self.image_model(image_input)

    # Process text
    text_outputs = self.text_model(text_input_ids, attention_mask=text_attention_mask)
    pooled_text_output = text_outputs.pooler_output
    text_features = self.text_linear(pooled_text_output)

    # Concatenate image and text features
    multimodal_features = torch.cat((image_features, text_features), dim=1)

    # Fusion Layer
    combined_logits = self.fusion_linear(multimodal_features)

    return combined_logits
```

Figure3.Implementation code for Efficient-Bert Model

2. Resnet-Bert Model

```
class MultimodalClassifier(nn.Module):
    def __init__(self):
        super(MultimodalClassifier, self).__init__()

        # Image Model (ResNet-50)
        self.image_model = models.resnet50(pretrained=True)

        num_image_features = self.image_model.fc.in_features
        self.image_model.fc = nn.Sequential(
            nn.Linear(num_image_features, 512),
            nn.ReLU(),
            nn.Dropout(dropout_rate)
        )

        # Text Model (BERT)
        self.text_model = BertModel.from_pretrained('bert-base-uncased')
        self.text_linear = nn.Linear(self.text_model.config.hidden_size, 512)

        # Fusion Layer
        self.fusion_linear = nn.Linear(1024, num_classes)

        for param in self.fusion_linear.parameters():
            param.requires_grad = False

    def forward(self, image_input, text_input_ids, text_attention_mask):
        # Process image
        image_features = self.image_model(image_input)

        # Process text
        text_outputs = self.text_model(text_input_ids, attention_mask=text_attention_mask)
        pooled_text_output = text_outputs.pooler_output
        text_features = self.text_linear(pooled_text_output)

        # Concatenate image and text features
        multimodal_features = torch.cat((image_features, text_features), dim=1)

        # Fusion Layer
        combined_logits = self.fusion_linear(multimodal_features)

        return combined_logits
```

Figure 4.Implementation code for Resnet- Bert

Filename	Tweet	Label	Image
ad_2017-11-25_10-36-26.txt	⭐ We are really getting into the Christmas spirit...	non_damage	ad_2017-11-25_10-36-26.JPG
building_2017-10-30_17-26-34.txt	IJOY uv board has a competitive price and very...	non_damage	building_2017-10-30_17-26-34.JPG
floodwater_2017-09-04_04-46-10.txt	Arriving in Kalkundi island destroyed in #bangladesh...	flood	floodwater_2017-09-04_04-46-10.JPG
accrafloods_2015-06-06_16-59-56.txt	Hi my lovelies, check out my firsthand experience of...	flood	accrafloods_2015-06-06_16-59-56.JPG
buildingfire_2016-10-02_03-07-17.txt	The Hamilton fire service during an exercise at...	fires	buildingfire_2016-10-02_03-07-17.JPG

Figure 5. Dataset description of tweets for text

The dataset consists of columns for the filename, tweet (text data), label (classification of the event), and image (associated visual data). The label column indicates whether the post refers to flood, fire, or non-damage events. This multimodal dataset is essential for training models that can handle both textual and visual data to predict disaster-related events.

```python
from selenium import webdriver
from bs4 import BeautifulSoup

# Initialize Selenium WebDriver
driver = webdriver.Chrome(executable_path='/path/to/chromedriver')
driver.get('https://twitter.com/search?q=%23disaster')

# Scroll and load tweets
for i in range(10):
    driver.execute_script("window.scrollTo(0, document.body.scrollHeight);")
    soup = BeautifulSoup(driver.page_source, 'html.parser')
    tweets = soup.find_all('div', {'data-testid': 'tweet'})
    for tweet in tweets:
        # Extract tweet content, metadata, etc.
        print(tweet.text)

```

Figure 6. Code for Webscraping

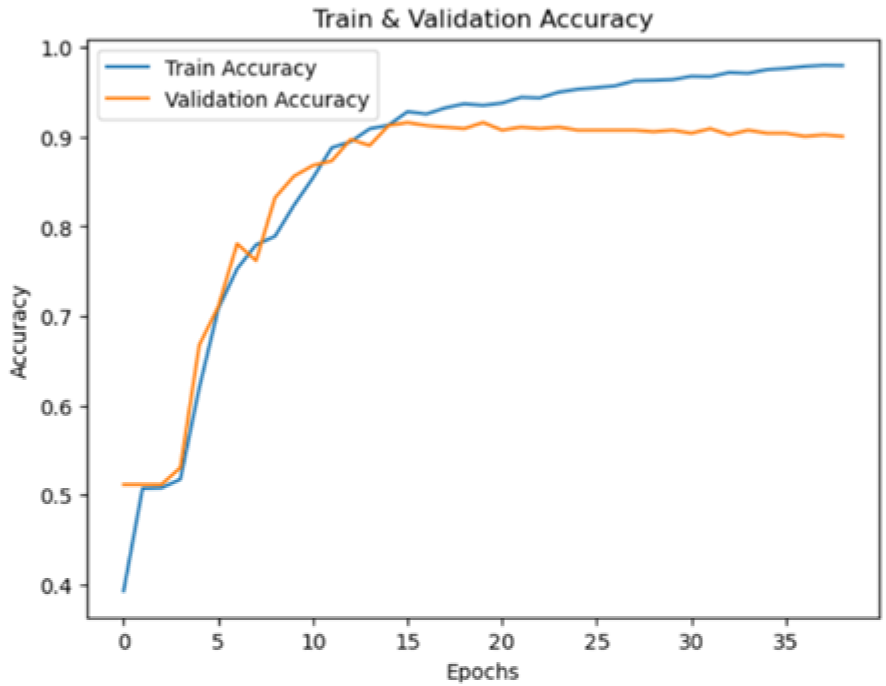

Figure 7.Train & Validation Accuracy Over Epochs

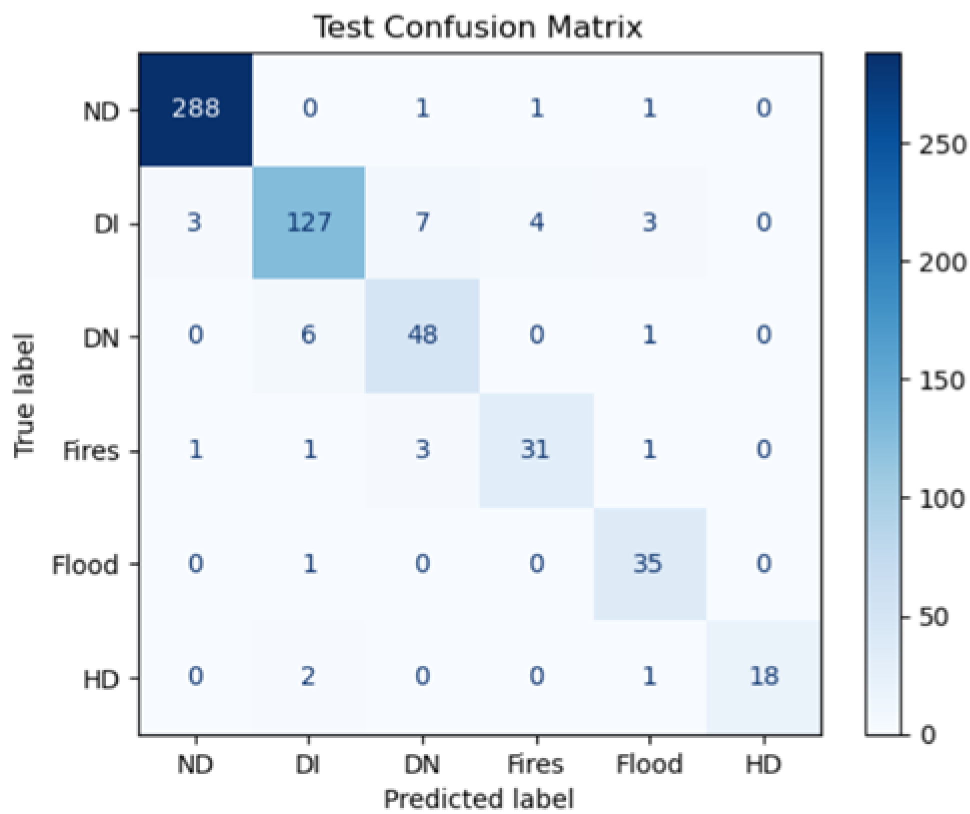

Figure 8.Confusion Matrix

Chapter 6 : Plan of action for the next semester

6.1 Work done till date

1. **Data Collection**: Successfully gathered real-time disaster-related data from social media platforms such as Twitter and Instagram using various APIs. This data includes text posts, images, and videos related to natural disasters like tsunamis, floods, and earthquakes, which form the core of our analysis.
2. **Admin-Side Web Application**: Developed an admin-side web application using React to facilitate the management and visualization of the collected data. This web interface allows administrators to view, filter, and analyze incoming disaster data in real-time, providing an intuitive dashboard for monitoring disaster activity.
3. **Multimodal Analysis for Severity and Verification**: Worked on integrating multimodal data, including text, images, and videos, to conduct more comprehensive disaster severity analysis. This involved creating models capable of assessing the severity of disasters based on visual and textual cues. In addition, we implemented verification mechanisms to filter out misinformation or irrelevant posts, ensuring that only credible and accurate data is used for decision-making.
4. **Machine Learning Models**: Implemented machine learning techniques to analyze and classify the severity of disasters based on the collected social media data. These models enhance the system's ability to prioritize severe incidents and provide accurate real-time insights for disaster response teams.

6.2. Work for next semester

1. **User-Side Application Development**: We plan to develop a user-side mobile application using Flutter, which will allow users in disaster-prone regions to receive real-time updates and notifications about ongoing or imminent natural disasters, such as tsunamis, floods, and earthquakes.
2. **Location-Based Notifications:** The application will feature location-based services to ensure that notifications are sent specifically to people in affected areas. This will involve integrating geolocation services and mapping APIs to accurately target users in disaster zones.
3. **User Alerts and Safety Features:** The app will provide users with critical information, such as the severity of the disaster, evacuation routes, and emergency services available nearby. We aim to implement push notification features for immediate disaster alerts, ensuring people in the region are informed promptly.

Chapter 7: Conclusions

In conclusion, the development of a web and mobile platform that leverages real-time social media data for disaster management holds immense potential to transform the way authorities respond to natural disasters such as tsunamis, floods, and earthquakes. By integrating advanced machine learning techniques to analyze multimodal data, the platform can provide more accurate, location-specific insights that enhance situational awareness and support rapid, informed decision-making. While the project faces constraints related to data quality, privacy concerns, real-time processing, and scalability, these challenges can be mitigated with thoughtful design and implementation of robust algorithms, ethical data handling practices, and scalable infrastructure. Ultimately, this platform aims to strengthen disaster preparedness, improve response coordination, and reduce the impact of disasters on affected populations, contributing to a more resilient and responsive disaster management framework.

Chapter 8: References

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Appendix

a. List of Figures

Research Paper Link -

BE Research Paper

Screenshots of last review marks

19

Industry/Inhouse: ✓ **Project Evaluation Sheet 2024-25** **Class: D17 A**

Title of Project(Group no): ResQconnect: AI ~~Driven~~ Disaster Management System (Group.No :- 19)

Group Members: Arya Banavali (D17A-1), Sai Thikekar (D17A-64), Yash Chhapreo (D17A-7), Aradhya Ingle (D17A-24)

	Engineering Concepts & Knowledge (5)	Interpretation of Problem & Analysis (5)	Design / Prototype (5)	Interpretation of Data & Dataset (3)	Modern Tool Usage (5)	Societal Benefit, Safety Consideration (2)	Environ ment Friendly (2)	Ethics (2)	Team work (2)	Presentati on Skills (3)	Applied Engg &Mgmt principles (3)	Life - long learning (3)	Profess ional Skills (5)	Innov ative Appr oach (5)	Total Marks (50)
Review of Project Stage 1	04	04	04	03	05	02	02	02	02	02	03	03	04	05	45

Comments:

Dr. Dashrath Mane.
Name & Signature Reviewer1

	Engineering Concepts & Knowledge (5)	Interpretation of Problem & Analysis (5)	Design / Prototype (5)	Interpretation of Data & Dataset (3)	Modern Tool Usage (5)	Societal Benefit, Safety Consideration (2)	Environ ment Friendly (2)	Ethics (2)	Team work (2)	Presentati on Skills (3)	Applied Engg &Mgmt principles (3)	Life - long learning (3)	Profess ional Skills (5)	Innov ative Appr oach (5)	Total Marks (50)
Review of Project Stage 1	4	4	5	3	5	2	2	2	3	3	3	3	5	5	47

Comments: Good work

Date: 26th September, 2024

Dr. Rohini Temkar
Name & Signature Reviewer2

Industry/Inhouse: **Project Evaluation Sheet 2024-25** **Class: D17A**

19

Title of Project (Group no): ResQconnect: AI-Driven Disaster Management System (Group 19)

Group Members: Arya Banavali (D17A) Sai Thikekar (D17A), Yash Chaproo (D17A), Aradhya Ingle (D17A)
(1) Saikekar (64) (7) (24).

	Engineering Concepts & Knowledge (5)	Interpretation of Problem & Analysis (5)	Design / Prototype (5)	Interpretation of Data & Dataset (3)	Modern Tool Usage (5)	Societal Benefit, Safety Consideration (2)	Environ ment Friendly (2)	Ethics (2)	Team work (2)	Presentati on Skills (3)	Applied Engg &Mgmt principles (3)	Life - long learning (3)	Profess ional Skills (5)	Innov ative Appr oach (5)	Total Marks (50)
Review of Project Stage 1	04	04	04	03	04	02	02	02	02	02	03	03	05	05	45

Comments: Data collection sources to be specified clearly.

Dr. Dashrath Mane (Reviewer1)

	Engineering Concepts & Knowledge (5)	Interpretation of Problem & Analysis (5)	Design / Prototype (5)	Interpretation of Data & Dataset (3)	Modern Tool Usage (5)	Societal Benefit, Safety Consideration (2)	Environ ment Friendly (2)	Ethics (2)	Team work (2)	Presentati on Skills (3)	Applied Engg &Mgmt principles (3)	Life - long learning (3)	Profess ional Skills (5)	Innov ative Appr oach (5)	Total Marks (50)
Review of Project Stage 1															

Comments: