TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

PURWANCHAL CAMPUS

A MINOR PROJECT PROPOSAL ON A DECENTRALIZED SOCIAL MEDIA FOR SCIENTIFIC COMMUNICATION

BY

Rijan Karki(PUR078BCT067)

Saurav Khanal(PUR078BCT080)

Spandan Guragain(PUR078BCT086)

Sudesh Subedi(PUR078BCT088)

DEPARTMENT OF ELECTRONICS AND COMPUTER ENGINEERING

PURWANCHAL CAMPUS

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Rijan Karki PUR078BCT067
Saurav Khanal PUR078BCT080
Spandan Guragain PUR078BCT086
Sudesh Subedi PUR078BCT088

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

API : Application Programming Interface

UI : User Interface

W3C : World Wide Web Consortium

CHAPTER 1

INTRODUCTION

1.1 Background

Scientific communication plays a vital role in advancing research and knowledge sharing across academic communities. Traditional social media platforms while effective for general communication often lacks specialized features necessary for scientific discource. The emergence of decentralized technologies particularly the ActivityPub [1] Protocol and the Fediverse presents an oppurtunity to create a more switable platform for academic communication.

1.2 Gap Identification

Current platforms for scientific communication face several limitations:

- Limited accessibility of scientific communication to the broader population beyond niche communities.
- Insufficient support for mathematical expressions and scientific notations.
- Lack of integration with academic citation systems.
- Reliance on a third party for the protection and moderation of user data.

1.3 Motivation

To create a social media platform that empowers researchers and academics to communicate their scientific work effectively. By bridging the gap between specialized communities and the general public, the platform aims to promote the understanding and appreciation of cutting-edge research across a wider audience. Along with the ability to run individual servers by individual people/institutions without losing the ability to communicate between each other.

1.4 Objectives

- Develop a federated social media platform using the ActivityPub protocol with support for mathematical and scientific typesetting.
- Streamline the server setup process to enable technically literate individuals to host their own servers with minimal effort.

CHAPTER 2

RELATED THEORY

2.1 Decentralization

Decentralization refers to the distribution of authority, control, and decision-making away from a central authority. In the context of digital platforms, decentralization allows users to maintain control over their data and interactions, fostering a more democratic and resilient online environment. This approach contrasts with traditional centralized systems, where a single entity governs all operations and data management.

2.2 Federation

Federation is a model that enables different systems or organizations to interoperate while maintaining their independence. In social media, a federated approach allows users from different platforms to communicate and share content seamlessly, creating a more interconnected online community. This is achieved through protocols that facilitate data exchange and interaction across diverse platforms.

2.3 Scientific Typesetting

Scientific typesetting involves the formatting of mathematical and scientific content for clarity and precision. It is essential for effectively communicating complex ideas in academic and research contexts. Proper typesetting ensures that equations, symbols, and notations are presented in a way that is easily understandable and visually appealing. The prime example of a Scientific Typesetting is LaTeX but there are alternatives like AsciiMath and Typst.

2.4 ActivityPub Protocol

ActivityPub is a decentralized social networking protocol standardized by the World Wide Web Consortium (W3C) [1]. It provides a client-to-server API for creating, updating, and deleting content, as well as a server-to-server API for delivering notifica-

tions and content between different servers. The federation model offers several key advantages over centralized systems, such as resilience (no single point of failure as the network operates across multiple independent servers), data sovereignty (each instance maintains control over its users' data and policies), interoperability (users can communicate across instances using standardized protocols), and scalability (the network can grow organically as new instances join the federation). The protocol is built on several key concepts:

- **Actors** which represent users, groups, or applications that can send and receive activities.
- **Activities** which describe actions that actors take.
- **Objects** which represent the content being acted upon.

CHAPTER 3

LITERATURE REVIEW

3.1 Related Works

The Fediverse connects various decentralized social networks, allowing users to interact across different platforms. This section reviews some of the prominent projects within the Fediverse.

- **Mastodon**[2]

  Mastodon is a decentralized social network that operates on open-source software. It allows users to create their own servers (instances) and interact with users on other instances. Mastodon emphasizes user privacy and control over content, providing features like content warnings and robust moderation tools.

- **Pixelfed**[3]

  Pixelfed is a federated image-sharing platform similar to Instagram. It focuses on user privacy and data ownership, allowing users to share photos and interact with others without centralized control. Pixelfed supports ActivityPub, enabling interaction with other Fediverse platforms.

- **PeerTube**[4]

  PeerTube is a decentralized video hosting platform that uses peer-to-peer technology to distribute video content. It aims to provide an alternative to centralized video platforms like YouTube, giving users control over their content and reducing reliance on centralized servers. PeerTube instances can federate with each other, allowing for a distributed network of video content.

- **Lemmy**[5]

  Lemmy is a federated link aggregation and discussion platform similar to Reddit. It allows users to create and join communities, share links, and engage in discussions. Lemmy instances can federate with each other, enabling a decentralized network of communities.

3.2 Decentralization and Federation

Decentralization and federation are key concepts in the Fediverse. Decentralization refers to the distribution of data and control across multiple servers, reducing reliance on a single central authority. Federation allows different servers to communicate and interact with each other, creating a network of interconnected platforms.

3.2.1 Benefits of Decentralization

Decentralization offers several benefits, including:

- **Privacy and Control**: Users have greater control over their data and privacy settings, as there is no central authority collecting and monetizing user data.
- **Resilience**: Decentralized networks are more resilient to censorship and outages, as there is no single point of failure.
- **Community Governance**: Users can create and govern their own instances, fostering diverse and self-sustaining communities.

3.2.2 Challenges of Decentralization

Despite its benefits, decentralization also presents challenges:

- **Interoperability**: Ensuring seamless interaction between different platforms and instances can be complex.
- **Moderation**: Decentralized networks require robust moderation tools to manage content and prevent abuse.
- **Scalability**: Decentralized systems must be designed to handle large numbers of users and high volumes of data.

3.3 Protocols and Technologies

The Fediverse relies on various protocols and technologies to enable decentralization and federation. Some of the key protocols include:

- **ActivityPub**[1]

  ActivityPub is a decentralized social networking protocol used by many Fediverse platforms. It enables users to follow, share, and interact with content across different instances.

- **WebFinger**[6]

  WebFinger is a protocol for discovering information about people and resources on the internet. It is used in the Fediverse to locate user profiles and instances.

3.4 Conclusion

The Fediverse represents a growing movement towards decentralized and federated social networks. By leveraging protocols like ActivityPub, platforms within the Fediverse offer users greater control over their data, enhanced privacy, and resilient communities. However, challenges such as interoperability, moderation, and scalability must be addressed to ensure the continued growth and success of decentralized social networks.

CHAPTER 4

METHODOLOGY

The proposed system for a decentralized social media platform includes the following blocks:

4.1 Requirement Analysis

Identify user needs, including secure data sharing, privacy controls, and support for decentralized communication. Analyze existing federated platforms such as Mastodon to integrate best practices. Define key features like user profiles, posts, and federation.

4.2 System Design

Create an architectural blueprint for a federated platform using the ActivityPub protocol. Define data flow for secure communication between servers. Design a user-friendly interface (UI) through wireframes and mockups.

4.3 Development

Implement the system in two main parts:

- **Backend Development:** Build APIs for features like user authentication, content creation, and federation. Ensure secure communication using data encryption.
- **Frontend Development:** Develop a responsive interface integrating with backend APIs.

4.4 Integration with Decentralized Protocols

Use ActivityPub to enable federated interaction between instances.

4.5 Testing

Conduct unit tests for individual components such as authentication and post sharing. Perform integration tests to validate interactions between backend, frontend, and federation protocols. Stress test the platform to assess scalability.

4.6 Deployment

Deploy the platform by hosting federated instances. Provide tools for users to create new instances or join existing ones.

4.7 Performance Evaluation

Regularly monitor the platform's performance, focusing on scalability, security, and user satisfaction. Iterate based on feedback and improvements in decentralized protocols.

CHAPTER 5

EXPECTED RESULTS

The implementation of a social media platform for the people of science is anticipated to yield the following outcomes. These expected results are aligned with the project objectives and will contribute to the establishment of a space for scientific communicators in the wider network of the Fediverse:

1. **Foster Scientific Community:**
    - With the ability to use scientific typesetting, users will be able to express their thoughts better than in regular plain text.
    - Connecting the scientific instance with the Fediverse will help more people become aware of the presence of the scientific community. The more people post, the more others will know.
2. **Increased User Control:**
    - Users will have full ownership of their data if they decide to host the platform themselves.
    - Users will have increased privacy since the data will not be under a big tech corporation but rather individually controlled servers.
3. **Better Engagement:**
    - Users will be connected to the wider network of the Fediverse, eliminating the need for wide adoption to enable user interaction.
    - With how the Fediverse works, users can choose to interact with the people they want to be around (e.g., only within the scientific community) or with the wider general audience.

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APPENDIX A

APPENDIX B