Simulation and Analysis of Federated Learning for Mobile Edge Computing

Project-III (IT208PPC31) report submitted to

Guru Ghasidas Vishwavidyalaya

in partial fulfilment for the award of the degree of

Bachelor of Technology

in

Information Technology

by

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April,2025

April 3 ,2025

DEPARTMENT OF INFORMATION TECHNOLOGY

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CERTIFICATE

This is to certify that the project report entitled "**Simulation and Analysis of Federated Learning for Mobile Edge Computing**" submitted by **Soma, Dhana Lakshmi** (Roll No. 21036154, 20107061) to Guru Ghasidas Vishwavidyalaya towards partial fulfilment of requirements for the award of degree of Bachelor of Technology in Information Technology is a record of bonafide work carried out by them under my supervision and guidance during April,2025.

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Abstract

Name of the student: **Soma, Dhana Lakshmi**

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Degree for which submitted: **Bachelor of Technology**

Department: **Department of Information Technology**

Thesis title: **Simulation and Analysis of Federated Learning for Mobile Edge Computing**

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Month and year of thesis submission: **April 3 ,2025**

Mobile Edge Computing (MEC) has emerged as a critical paradigm for enhancing computational efficiency and reducing latency in modern distributed systems. This project explores the integration of Federated Learning (FL) into MEC environments, aiming to optimize edge-based model training while minimizing power consumption and communication overhead. Using EdgeAISim, a simulation framework for edge computing, we implement and analyze a Federated Learning framework where edge servers collaboratively train a global model without sharing raw data, ensuring privacy preservation and efficient resource utilization.

The simulation evaluates key performance metrics such as power consumption, communication cost, model accuracy, and convergence speed across multiple federated learning rounds. We introduce constraints on energy usage and bandwidth to reflect real-world MEC limitations and study their impact on the learning process. Furthermore, our approach incorporates Age of Information (AoI) constraints to

ensure timely and optimal task execution. The results demonstrate the feasibility of FL in MEC, showcasing improvements in energy efficiency and model convergence compared to traditional centralized learning approaches.

This work provides insights into the practical deployment of FL-based MEC systems, contributing to the advancement of intelligent edge computing for applications in smart cities, IoT, and UAV-assisted networks.