

I. INTRODUCTION

Recent technological advancements have significantly changed the music industry. The growth of digital technology increasingly provides space and accessibility for music so that it can be heard easily at any given time [1]. One of the breakthroughs in the music industry that emerged along with technological advances is music streaming services. A music streaming service allows users to listen to legal music online or via streaming [2]. Based on a report from the International Federation of the Phonographic Industry (IFPI), around 73% of people worldwide listen to music via music streaming services [3]. This number clearly indicates that music streaming services have taken over the world's most used means of listening to music.

With over 615 million users, including 239 million subscription users, Spotify is one of the most commonly used audio streaming services available today. Spotify provides access to over 100 million songs, enabling users to enjoy a variety of genres and artists [4]. While music streaming services such as Spotify offer easy access and a large music catalog, users are still struggling to find music that suits their tastes among the available selections. This shows the potential of implementing a music recommendation system to assist users in finding music that users like more easily and efficiently.

Recommendation systems in music streaming services are essential to improve the music listening experience for users. Accurate music recommendation is an important factor in the business process of music streaming services [5]. Accurate recommendations can increase user satisfaction, revenue, and attract more users. Spotify and Apple Music continue to develop their service recommendation systems to improve a better user experience [6]. User experience is the result of interaction between users and products, services, or systems [7]. When users have positive interactions with the service, their loyalty to the application will rise [2]. Recommendation systems can be carried out on various sites such as e-commerce websites or playlist makers on video and music streaming services such as Spotify [8].

One of the most popular methods that can be utilized in a music streaming services recommendation system is deep learning algorithms. Deep learnings are used due to its capability of handling huge amounts of data in a relatively short amount of time. Deep learning techniques, especially neural networks have been widely used in recommendation systems such as Convolutional Neural Networks (CNN). Research related to CNN-based music recommendation systems has been done before. One of such is Zhang's research in 2022 which succeeded in providing more precise music recommendations according to user preferences. The research achieved a higher level of accuracy for user features in both single categories and diverse categories [9].

Besides CNN, there is another deep learning technique that also has great potential, which is Graph Neural Network (GNN). GNN is one of the deep learning architectures that can capture dependencies contained in graph data. In recent years, many GNN variations have emerged, including Graph Recurrent Networks, Graph Attention Networks (GAT), and Graph Convolutional Networks (GCN) have shown progress in deep learning algorithms [10].

GNNs are inherently designed to operate on graph-based data for the purpose of learning representations of nodes, edges, and the whole structure of the graph [11]. GNNs are capable of capturing detailed interactions and dependencies across nodes within a non-Euclidean space, in contrast to typical neural networks that operate on structured input like grids or sequences. By propagating and aggregating information across nodes through multiple layers, GNN enables each node to learn a representation based on both its features and the features of its connected neighbors [12]. This capability makes GNNs highly effective in scenarios where understanding the structural information and interactions between elements is crucial, such as social network analysis, molecular property prediction, and knowledge graphs.

GNN has an advantage in processing graph structure data due to its ability to utilize relationships in graphs consisting of vertices and edges by emphasizing connectivity and data topology [13]. In this case, it is necessary to use GNN in the music recommendation system. This is because GNN can improve user representation learning by exploring various correlations (multi-hop correlations), making it useful in enhancing the precision and efficiency of an application's recommendation process [14].

However, limited research currently focuses on the use of GNN in music recommendation systems. Therefore, this research will evaluate the use of GNN algorithms for music recommendation systems. Using the natural graph structure in music recommendation systems, GNN is expected to effectively capture collaborative signals and connect important connections between users and music items, thus providing more relevant recommendations.