Ontology-Based ID3 Tag Management System

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***Abstract*— Since music service providers offer different ID3 tags, it is difficult for users to maintain a consistent multimedia environment. To overcome this difficulty, we propose a system that uses an open API, a social network service, and ontology. The system collects ID3 tag information using the open API and maintains the consistency of the MP3 metadata through the ontology. In an implementation, we achieved a 93.5% success rate when we automatically entered ID3 tags into MP3 files and an 84.7% success rate when we inserted the information into ID3 tag frames.**

***Keywords*— MP3, Ontology, ID3, Music, Open API, SNS, Twitter**

I. INTRODUCTION

The online music market in the multimedia has developed rapidly because MP3 files can provide a high-quality sound. The streaming and downloading of MP3s is now common [1]. As the use of MP3 files has increased, it has become necessary to include the metadata of relevant audio data in these files. In smartphones and other multimedia players the music management has changed from a folder-based method to one based on metadata. As a result, ID3 tags have become important for classifying and managing files in portable multimedia players. However, since music service providers offer different methods for entering ID3 tag information into MP3 files, maintaining consistent metadata has become a challenge.

Recently, SNSs are becoming a treasure trove of resources in diverse fields. In particular, Twitter users share singer names and song titles by including hash tags such as #nowplaying in their posts [2]. Moreover, they can acquire diverse music data via these tags.

In this paper, we propose a system that obtains music metadata using an open API [3] and an SNS and uses ontology to insert ID3 tags into MP3 files consistently. In our system, we use a formal ontological representation for the ID3 tag information, and this allows the sharing of information among many different users. Our system uses ontological characteristics such as openness, sharing, and standardization [4, 5]. We can increase information conformity by allowing many users to share well-arranged ID3 tag information. We have also enhanced the response speed of our system by collecting metadata for the latest music via the SNS. Our system has the following characteristics:

- Even if the ID3 tag has inaccurate or insufficient information, we can enter consistent information into the ID3 tag of the MP3 file.
- By gathering ID3 tag information from Twitter in real time, we can reduce the need for expensive manual data collection.

II. RELATED WORK

The MO (music ontology) is an ontology designed to represent various music-related information including composition, the performance process, recording, and sales [6]. The MO is based on the timeline ontology [7] and the event ontology [8]. These ontologies represent diverse musical information such as the conductors, performers, musical instruments, composers, and arrangers. The advantage of the MO is that it can express detailed musical information such as the entire production process and related details. In the event-centered research [9], the ontology was based on events that show changes over time such as the composition, performance, production, and reproduction of music. However, only experts can use these ontologies.

III. ONTOLOGY-BASED ID3 TAG MANAGEMENT SYSTEM

TABLE I. ATTRIBUTE MAPPING BETWEEN ID3 TAG AND ONTOLOGY

Attribute	ID3 Tag Frame	Ontology	Open API
Title	TIT2	SongName (SN)	○
No. of Track	TRCK	TrackNumber (TN)	○
Artist	TPE1	Artist (AT)	○
Album	TALB	AlbumName (AN)	○
Published Year	TYER	ReleaseYear (RY)	○
Images	APIC	AttachedPicture (AP)	○
No. of Disk	TPOS	DiscNumber (DN)	○
Genre	Genre	Genre (GR)	○
Album Artist	AlbumArtist	AlbumArtist (AA)	
Composer	TCOM	Composer (CP)	
Lyricist	TEXT	Lyricist (LR)	

A. System Workflow

The workflow is divided into the client part and the server part. When the client requests ID3 tag information for an MP3 file, the server collects the necessary information. When the client makes a request, the workflow in part ② of Figure 1 will be carried out. When there are no client requests, the server constructs ID3 tags for frequently played music by continuously collecting *#nowplaying* information from Twitter

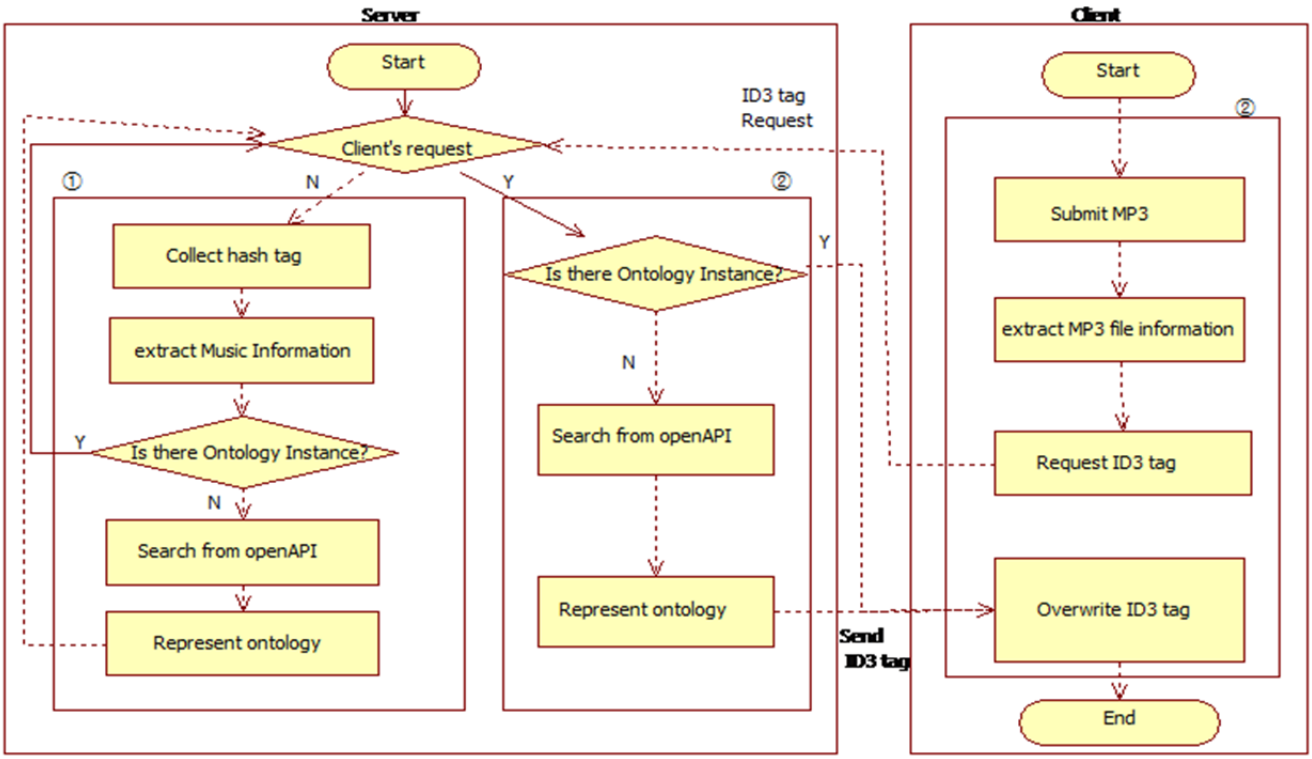

Figure 1. Workflow of ID3-tag management system

via the workflow of part ① of Figure 1. The workflow of part ① allows a fast response to user requests.

B. *Ontology Design for ID3 Tag*

We constructed a hierarchical structure of the ontology for the tag frames that we most frequently use. This ontology is mapped with the information retrieved from the open API as shown in Table 3. Via this hierarchical structure, the ID3-tag management system maintains consistency and the appropriate tag information are inserted into the MP3 file.

We can obtain the widely used tag frames shown in Table 1 via the open API. These frames are stored as the formal representation of the ontology. When there is a request for ID3 tag information for an MP3 file owned by the user, the workflow of the server is shown by ② in Figure 1. And when there are no requests from the client, the system collects music information provided by users of the SNS. It also collects ID3 tags so that it can respond quickly to user requests. The workflow for this procedure is shown by ① in Figure 1.

C. *System Implementation*

We now show how to automatically manage the ID3 information of an MP3 file. The ID3-tag management system shown in Figure 2 inserts an ID3 tag when there is no tag information in the MP3 file. To measure the performance of

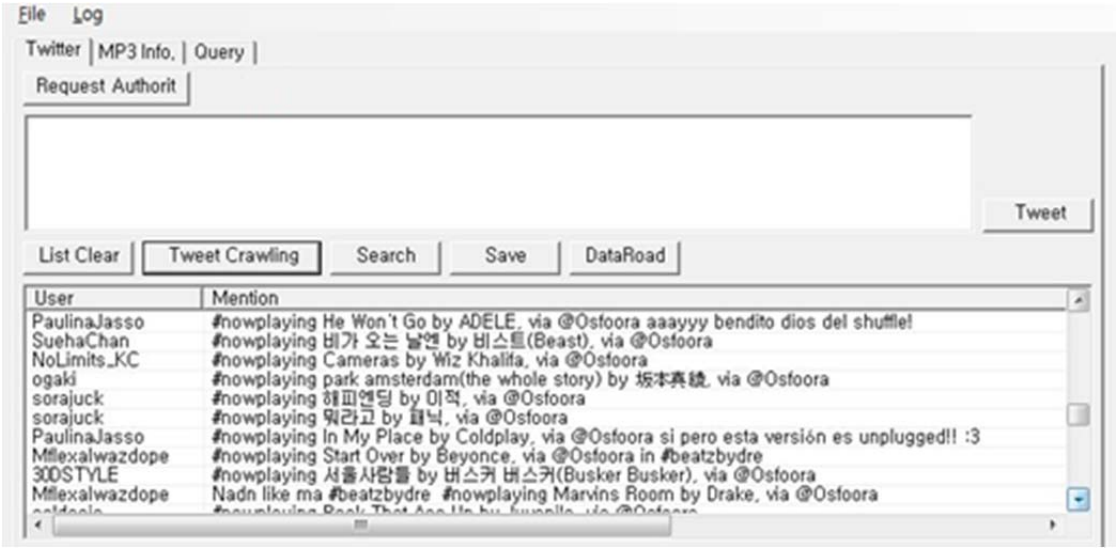

Figure 2. ID3-tag management system

our system, we carried out experiments on 300 MP3 files without tag information. First, we searched for metadata from an open API, with a 93.5% success rate. Then, we searched for metadata using hash tags from Twitter, with an 84.7% success rate (see Figure 7). We failed to insert the ID3 tag correctly only when there were misspelled or omitted words or the MP3 file name was entered incorrectly. Therefore, our approach is successful.

D. Performance Evaluations

To measure the performance of our system, we carried out experiments on 300 MP3 files without tag information. First, we searched for metadata from an open API, with a 93.5% success rate (see Figure 3). Then, we searched for metadata using hash tags from Twitter, with an 84.7% success rate (see Figure 3). We failed to insert the ID3 tag correctly only when there were misspelled or omitted words or the MP3 file name was entered incorrectly. Therefore, our approach is successful.

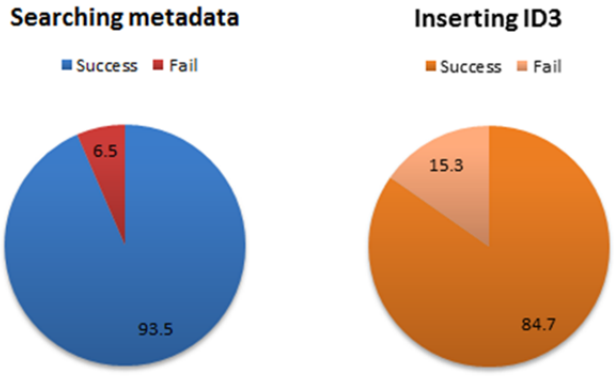

Figure 3. Results of searching metadata and inserting ID3 tags

IV. CONCLUSION

The ID3 tag information in portable multimedia players and smartphones is important for classifying files. Therefore, consistent tags in MP3 files are essential for managing music files efficiently. However, service providers offer different ID3 tags. In this paper, we proposed an ID3-tag management system that provides consistency. We used an ID3 tag ontology to maintain the consistency of the tag information. We also enhanced the flexibility by entering retrieval result of open API as instance of ID3 tag ontology. Moreover, we enhanced the efficiency of the information retrieval by using hash tags from Twitter. Our system allows users to easily enter consistent ID3 tag information into MP3 files. Since it can extend the ontology using information from Twitter, it allows the sharing of various music resources.

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