Terminal Application | Music Distribution | Motion Recognition Function

Technology Reports

FOMA 904i Application Functions

A music distribution function by a monthly-fixed subscription fee and a motion recognition function with i-appli were developed as new applications in the FOMA 904i series.

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1. Introduction

In order to realize new ways of using mobile terminals and operation sense, we have developed attractive functions for the FOMA 904i series users, such as the music distribution function by a monthly-fixed subscription fee and the motion recognition function with i-appli.

Our new music distribution function by a monthly-fixed subscription fee offers users a new music distribution option on mobile terminals by realizing Uta-hodai service that lets subscribers download as many songs as desired at a monthly-fixed subscription fee, in addition to the existing pay-per-song content system. Our motion recognition function with i-appli makes it possible to use the angle and movement of a mobile terminal itself as the input interface, and thereby realizes the Chokkan Game service where users can play games by using such intuitive operations as "tilting," "shaking," "holding one's hand," and "moving one's body."

2. Music Distribution Function by a Monthly-fixed Subscription Fee

2.1 Service Concept

Given the launch of music distribution services in recent years by a monthly-fixed subscription fee using PCs in Europe and the United States, an increasing number of users has been listening to downloaded music files imported into portable music players, especially in North America, the United Kingdom, and Germany. While music content can be imported into and listened to on portable music players and even mobile terminals in Japan, the major issue in expanding the user base was that it required the use of a PC.

The development of this new function made it possible to provide a service that only requires a mobile terminal to listen to songs at a monthly-fixed subscription fee, without PC connection.

2.2 Overview of Construction Technology

Existing mobile terminals handle music content and rights information in one batch. This means that rights information used for playing back songs cannot be dynamically changed. Updating only the rights information without a PC connection necessitates development of a server for music distribution, as well as modifying the method of managing music content on the mobile terminal.

Figure 1 shows the configuration of this function. This function is distinctive in that the rights information of music content is downloaded separately. The rights information consists of information for identifying the Contents Provider (CP), information for identifying songs, playback expiry date and grace period (playback period is extended to update the expiry date if the mobile terminal is out of range when executing a license check as explained later), and a list of songs that are prohibited from being played back as speci-

fied by the CP or other authority. Such information is managed on the mobile terminal with respect to each CP, so that it is possible to specify the playback expiry date, songs prohibited from being played back, and grace period with respect to each CP.

The music player installed in the FOMA 904i series has a license checking function to confirm whether the user is subscribed to the CP via a network, a function to count and manage the playback frequency of songs, a function to upload a playback frequency report to the CP, and a function to prohibit the playback of playback-prohibited songs as listed by the CP, in addition to conventional music player function.

The license checking function manages the music content by a monthly-fixed subscription fee with respect to each CP (download source), checks the user's subscription status and updates the rights information, with respect to each CP.

The playback frequency report uploading function enables the processing of copyright royalties on the CP side by counting the playback frequency of music content on the mobile terminal and notifying it to the CP. This function can also distribute a list of playback-prohibited songs to mobile terminals from the CP, so that even if songs that are no longer distributed due to copyright or other issues have already been distributed to the user, it can prohibit the playback of such songs. Providing CPs with a function to manage the copyright of songs in this manner makes it possible to provide a music distribution service by a monthly-fixed subscription fee.

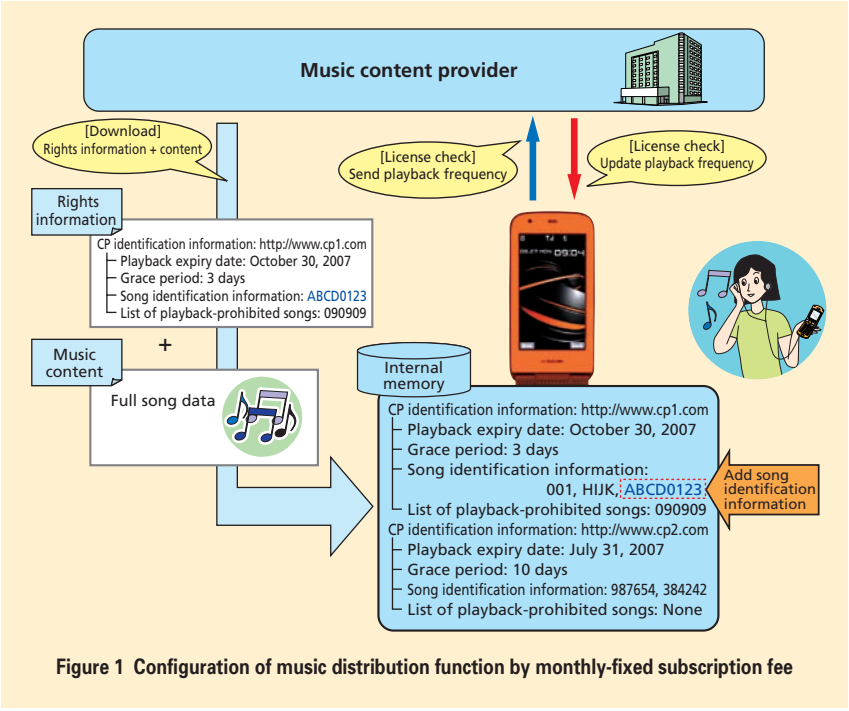

Figure 1 Configuration of music distribution function by monthly-fixed subscription fee

Figure 2 shows the flow from the activation point of the music player to the playback point of a song. Once activated, the player checks the music content database in the mobile terminal and executes the rights information of the music content downloaded from a CP by a monthly-fixed subscription fee. If any music content has passed the playback expiry date, a playback frequency report is sent to the CP from which the content was downloaded, while a batch license check is executed simultaneously. If non-subscriber information has been received from a CP after a license check is executed, such CP is excluded from the scope of a license check regarding the music content database in the mobile terminal. If non-subscriber information has been received from the CP when a license check is executed, the user can choose to either access the CP's subscription site or skip the song and play back other songs provided by CPs for which the license has not yet expired.

After a license check is executed, the music content of the CP for which rights information has been updated in the mobile terminal's database can be played back. If a license check cannot be executed when the mobile terminal is out of range, for example, the grace period is confirmed so that the song can be played back even if beyond the playback expiry date, provided that it is

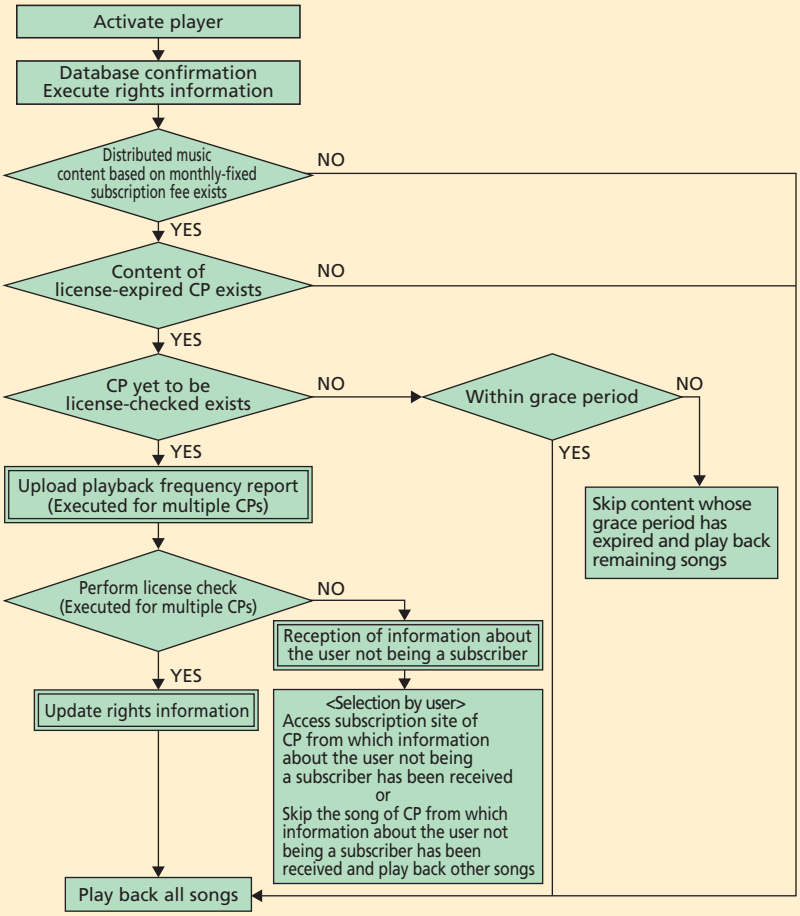

Figure 2 Flow from activation point of music player to play back point of song

within the grace period.

Music content using this function can be exported to SD memory by using the Secure Digital (SD)-Binding function[*1] as in the case of the conventional full song function. While such export involved the encrypting and storing of only music content in the case of conventional pay-per-song type music content, this function adds rights information consisting of a new unique value for identifying CPs for the music content, and encrypts and stores this data in the form of one file. This makes it possible to manage rights when playing back songs in SD memory by comparing the rights information with respect to each CP in the mobile terminal with the rights information in SD memory, and even if the mobile terminal model is replaced, the songs can be played back on the new mobile terminal.

2.3 Other Related Functions

Music content using this function can also be set as a ringtone or an alarm tone on a mobile terminal. When a playback order is issued to the music player upon receiving call on a mobile terminal or at the time set for an alarm, the music player refers to the rights information in the mobile terminal corresponding to the music content, and then either plays back the music content if playback authority can be confirmed, or plays back the default (factory-installed) tone of the mobile terminal if it cannot be confirmed. Since playback authority is also confirmed by the ringtone setting function at the time of playback, songs can be played back smoothly upon receiving call without a license check being executed.

3. Motion Recognition Function

3.1 Service Concept

Key entry is the main method of input on mobile terminals, but there is a lack of user-friendliness in having to press small keys arranged in the limited space on a mobile terminal, and perform diverse and complex key operations. For this reason, the FOMA 904i series enables users to operate software installed in the mobile terminal (such as i-appli and browser) more intuitively by adopting an input method whereby tilting, shaking and other such motions are recognized. This input method was adopted in i-appli for launching the Chokkan Game service.

In the FOMA 904i series, there are

*1 **SD-Binding function**: A technology to encrypt specific files of content, etc. for storage in SD memory. Using this technology to provide a content copyright management function desired by CPs alleviates the impact of limited mobile terminal memory and enables a smooth migration of content when users replace their mobile terminals with new models.

two methods of recognizing the motions of the mobile terminal: one using an acceleration sensor and the other using a camera. The acceleration sensor method offers superior recognition accuracy but requires the mobile terminal to be equipped with a new acceleration sensor to provide the motion recognition function. The camera method offers less recognition accuracy than when using an acceleration sensor, but can realize the motion recognition function by simply installing the necessary software, since most mobile terminals come equipped with a camera. The following explains the function to recognize the motion of a mobile terminal by using a camera (motion recognition function) and the use of this function from i-appli.

3.2 Motion Recognition

Figure 3 shows the module configuration that realizes the motion recognition function. The control unit receives images captured by the camera and passes the images to the motion recognition engine for processing motion recognition. Due to the characteristics of recognition processing by the motion recognition engine, images must be captured at intervals of at least 15 fps (frame per second) to ensure recognition accuracy. Accordingly, the FOMA 904i series is equipped with a module to enable the camera to capture images at 15 fps considering the processing performance of the mobile terminal.

There are two motion recognition modes. One mode calculates the distance that the captured image moved in the x and y directions (i.e., distance moved instantaneously and distance moved over a certain period of time). The other mode calculates the vibration amplitude of the captured image. Both modes calculate by comparing the characteristic values (values representing the characteristics of an image, which are calculated from the image) of two images captured serially as shown in **Figure 4**. The mode that calculates the distance moved also calculates the distance moved over a certain period of time by adding up the distances moved instantaneously. The FOMA 904i series can calculate movements and vibrations at about 66-ms intervals as it processes images at 15 fps.

3.3 Usage from i-appli

An Application Program Interface (API)[*2] for i-appli was newly developed to use the motion recognition function. The camera, control unit, and motion recognition engine are controlled through this API as shown in **Figure 5**. Switching between the two modes is

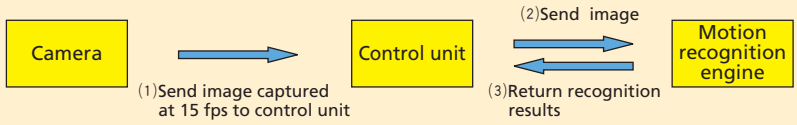

Figure 3 Module configuration

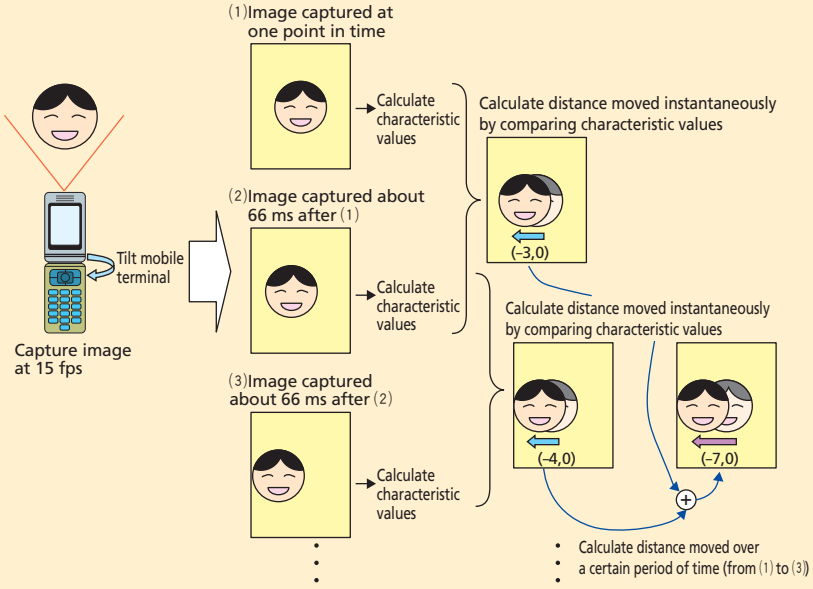

Figure 4 Calculation of distance moved by motion recognition engine

*2 **API**: An Interface allowing upper-level software to use functions provided by the OS, middleware, etc.

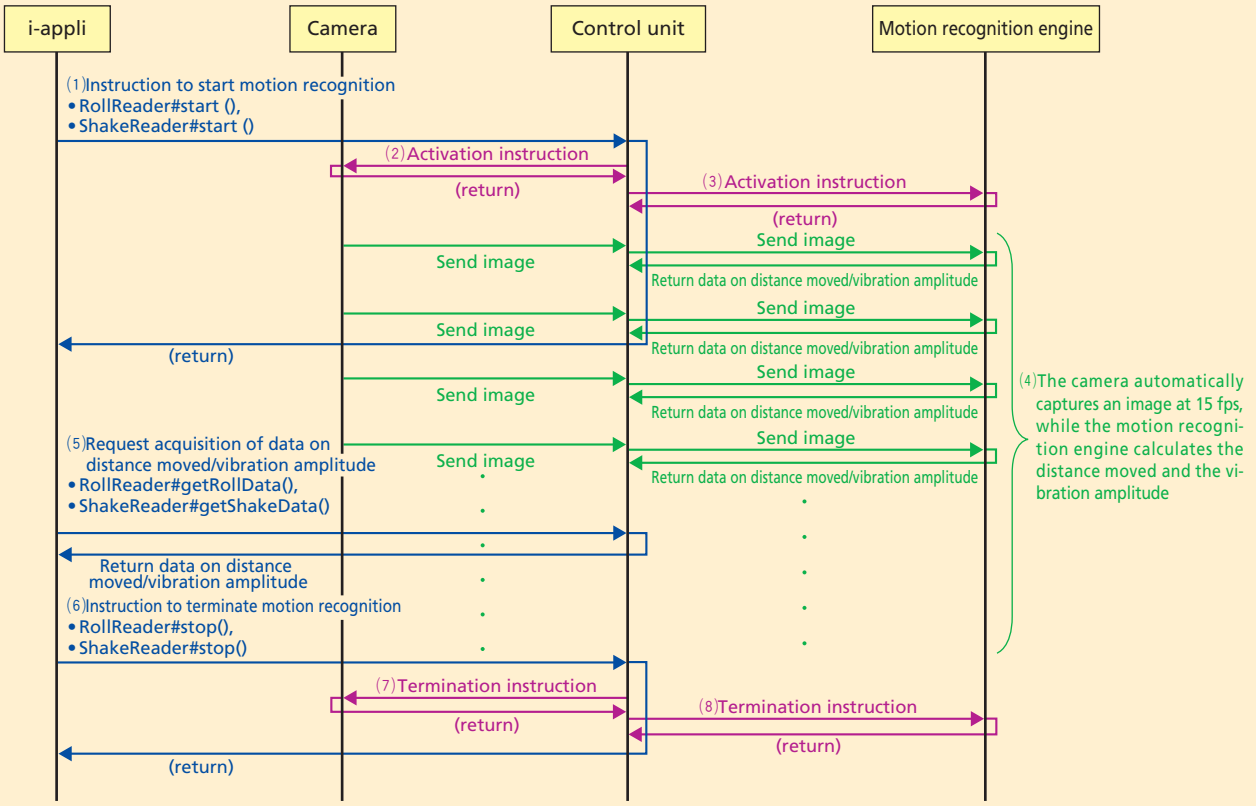

Figure 5 Control of motion recognition engine from i-appli

done by using different classes[*3] (RollMotion class and ShakeMotion class).

Activation of the motion recognition function is instructed by executing the start() method[*4] of either class from i-appli (Fig. 5 (1)). The control unit that receives this instruction activates the camera and the motion recognition engine (Fig. 5 (2), (3)). The camera then passes on images at intervals of 15 fps to the motion recognition engine via the control unit for calculating the distance moved and accumulative distance moved, or vibration amplitude (according to the activated mode), with the calculated data being returned to the control unit (Fig. 5 (4)).

The most up-to-date data on the distance moved and accumulative distance moved up to that point stored in the control unit are acquired by executing the getRollData() method in the RollMotion class, whereas the most up-to-date data on vibration amplitude is acquired by executing the getShakeData() method in the ShakeMotion class (Fig. 5 (5)). Motion recognition (Fig. 5 (4)) and the acquisition of values (Fig. 5 (5)) are processed asynchronously to ensure motion recognition processing at 15 fps.

The instruction to terminate the motion recognition function is given by executing the stop() method from i-appli (Fig. 5 (6)). The control unit that has received this instruction shuts down the camera and motion recognition engine (Fig. 5 (7), (8)).

3.4 Application Example

As an alternative to tilting and shaking the mobile terminal as an input method for i-appli, the user can also move around within the camera capturing range of the mobile terminal while keeping the mobile terminal still. This method makes the motion recognition function suitable for application to

*3 **Class**: Specified group of objects having similar states and behaviors in object-oriented programming.
*4 **Method**: Behavior of objects in object-oriented programming.

sports games and other activities where the mobile terminal is placed on a desk or other stable surface, with the user moving his/her body and arms while watching the screen.

4. Conclusion

This article described the music distribution function by a monthly-fixed subscription fee and the motion recognition function as main functions introduced in the FOMA 904i series. The introduction of these functions has made it possible to provide new services not possible on conventional mobile terminals.

We will continue developing mobile terminals that can offer attractive services and functions with the aim of further expanding the FOMA service in the future.