
Easy Music Player : Playing Digital Music with Physical Objects

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Abstract

This paper explains and motivates the concept and design of *Easy Music Player*; a music player that facilitates playing digital music by associating its intangible files with tangible objects. The focus has been on ubiquity; extracting the digital music into everyday life, as well as on usability; creating a product that is easy to use even for non-technical users.

Keywords

Ubiquitous computing, intelligent home, digital music, music player, RFID products

Introduction

We are currently experiencing a new era of digital information. Digital music is one of the areas that have been most successful, allowing us to both buy and play music remotely using our personal computer. This digital music revolution contributes to a sustainable environment since it promotes dematerialization, preventing manufacturing and worldwide shipping of physical CD-albums.

However, in order to be a part of the digital music revolution today, knowledge of computers is required. Almost all the interactions with digital music today are carried out using the mouse and keyboard connected to the computer. Not only does this require basic knowledge of computers, it also requires the user to carry out all the interactions in front of the computer screen.

Using a tangible interface, the user will get an interface towards the digital music that resembles the way we usually play physical CD-albums. This will lead to a more comfortable and structured way of interacting with digital music albums.

Concept

The idea of associating physical objects to intangible music files is realized by developing a portable music player. The music player will work as a physical interface towards the digital music library stored on a stationary computer. All necessary interaction-based actions will be carried out on the portable device itself, including actions such as

creating playlists, changing volume, switching tracks etc.

The concept of removing the interaction from the stationary computer is an idea based on the way people listen to music nowadays. People listen to music not only in front of the computer, but everywhere in the room; and the way the user interacts with the music should follow that fact. Another interesting aspect is to explore the design of the physical objects that is used for playing the music. Nowadays, all CD-albums resemble each other, regardless of the content. We want to create physical objects with different shapes, looks and feelings depending on what kind of music that specific object represents. This is done by introducing moods and feelings instead of specific albums or songs. This is based on the idea that the genre of a song is more important than the specific song itself. If the user is feeling relaxed, a random playlist of calm songs is more interesting than a specific calm song.

Context of use

The context of the music player is an everyday environment. The digital music should be extracted from the computer and integrated in the vividly commonplace. When you are sitting in your living room, the proper way to listen to music is to interact with the table in front of you, not the computer in the corner.

Realization

Product design process

One of the key things in this project is the interaction between the user and the product. Since the concept implies that the interaction should be natural and non-technical, the interaction and the technology integration have been our main focuses when it comes to the product design.

Music player

The board is designed in a way which makes it look and feel non-technical. It is designed as a fairly flat box where the technology is hidden inside. This way, the board can easily be integrated into the everyday commonplace. For instance, the board can be integrated into a table, be placed on a wall as a shelf, etc.

The size of the board is designed to give the user enough space to play with the physical objects, create

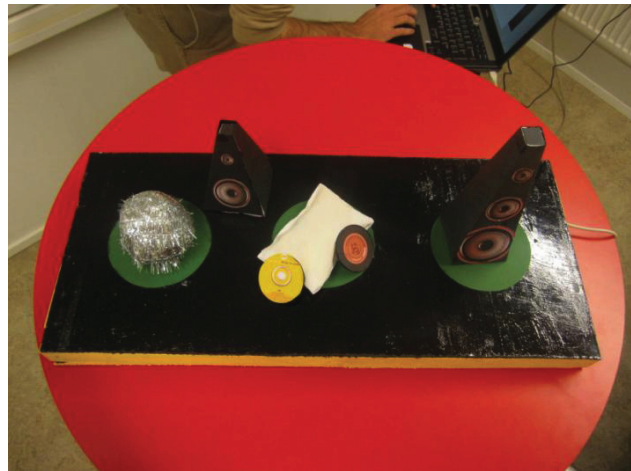


Figure 1: Product design showing the music player board and several tangible objects

playlists etc. It consists of three numbered hot spots where the user can place physical objects. The hot spots are numbered due to the fact that they have different priorities; number one is the first item in the playlist, number two the second item and so on.

Tangible objects

The tangible objects used to represent the normally intangible digital music can be divided into two different types. The first one is a small flat circle which can be associated with the common concept of a CD. One object represents one album, and a printed label on the circle tells the user which album it is. The other types of objects are moods. One mood does not represent a specific album or song; it represents a song categorized as the specific mood it represents. The user can for instance place the “pillow” object on the board and a song categorized as calm/soft is played. If the user on the other hand places the “disco ball” on the board, a disco song will be played.

The decision to include both the traditional type of objects, as well as the mood type was based on the idea to make the product more comprehensive, covering several aspects of how to play music.

Functionality

Since the product replaces the traditional computer interaction, it is vital that all important functionality can be carried out on the device itself. One of our key points is to explore and elaborate how users interact with the music player, and thus we have chosen to make all the interactions in a natural way, not using any buttons or other apparent digital solutions.

Instead, the music is controlled by the placement of the physical objects.

- ↪ Play: place the physical object on the board.
- ↪ Pause/Stop: remove the physical object from the board.
- ↪ Add/remove song to playlist: place another physical object on the board (beneath the first/second one), to remove a specific song: remove the physical object.
- ↪ Increase / Decrease volume: place the big speaker on the board to increase the volume / place the small speaker on the board to decrease the volume. The amount of time the speaker is placed on the board corresponds to how much the volume changes.
- ↪ Switch track: Remove the current playing object to switch to the next playlist. Another alternative is to use the Next and Previous objects which give you the possibility to switch track even inside a currently playing playlist.

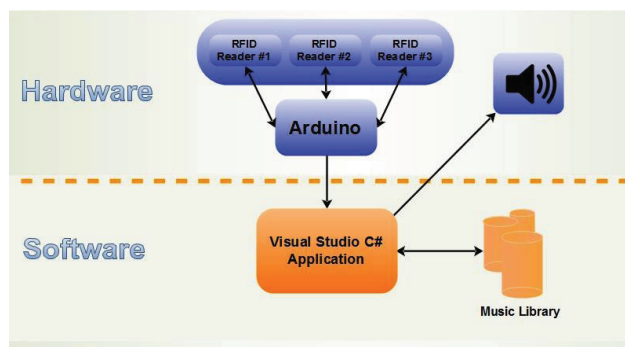


Figure 2: Hardware/software architecture

Technology

The technical part of the product is constructed using a architecture of several different hardware components communicating with software applications.

Hardware

An important part of the product design phase was to research what kind of technology would be most suitable for our product. We made an early decision to implement the wireless interaction between the physical objects and the Arduino by using RFID technology. RFID technology is wireless, cheap, operates on good distances, and the properties of RFID

tags (cheap, small, no battery) make them easy to integrate into physical objects. Alternatives to RFID technology could have been WiFi, Bluetooth, or any radio frequency based low distance communication standards. We have chosen to use an Arduino micro-controller as an interface between the device and the stationary computer (which is the computer running the Visual Studio C# application, see Figure 2), providing an easy way of communication between the RFID readers and the software applications.

One of the problems we faced was that when you connect three different serial out pins (SOut of RFID readers) to one single Arduino serial-in port, ordinarily you will get unreasonable values as tag IDs. The main reason was that, for example, when one reader wants to send its data the other readers also is sending something and the data would mix and one would get crashed values as read Tags. We managed to solve this problem by adding three 1N4148 diodes to separate the serial in/out lines.

Software

The software is developed using a combination of Arduino and Microsoft Visual Studio C#. An Arduino application has been developed, which reads the values from the RFID tags and sends them as serial data to the stationary computer. When the stationary computer receives the RFID value, the application interprets the value as a command and executes the appropriate action on the embedded music player.

We had two alternatives for handling music functionalities. One can read the serial port and do some process on it and send the appropriate command to Windows Operating system by calling windows APIs, or, one can embed a Media Player Component in the c# application and then do required functions there by calling the methods of the components. We came up with the latter one, since it's more sustainable and it will give us some hints toward moving to platform-independent solutions. However, we still take advantage of anipulating the current windows media player library. The C# program consists of two parts. One class called sCOMMS for handling serial port communication, and, one main form "frmMain.cs" which contains the embedded player and acts based on what is received from sCOMMS class. There is also a timer component in frmMain.cs with one second interval in order to handle

the presence/absence of TAGS. The embedded music player is based on Windows Media Player (WMP), giving us the possibility to control any WMP functionality directly from our C# application. Since we have three different RFID readers connected to one single Arduino, a slight modification of the readers' antennas had to be accomplished. We solved this problem by using software timers, controlling which antenna is currently the active one. The timers are operating on fractions of a second, which makes the reading smooth and user-friendly.

User test

The product was tried out on the Ubiquitous Computing Exhibition (Chalmers University of Technology, 2009). The exhibition attracted both people with extensive computer experience, as well as novice users. The focus of our observations was intuition; how easy the product was to understand and use without guidelines, as well as excitement and satisfaction; how the user valued the concept. In order to simulate the context, a living room environment was constructed and the music player placed on a sofa table.

Overall, the users were curious and excited to play digital music this way, understanding both the concept and most of the functionality intuitively. However, some users, both expert and novice, had problems understanding the playlist function without guidelines. Most comments regarded developing more apparent markings for the playlist function, since the function itself is hidden. A couple of users wanted to change volume in another way, not using the big and small speakers. The physical objects tempted the users to experiment and create playlists based on their moods, instead of other preferences. The possibility to play music categorized as moods and feelings, instead of specific songs, were very appreciated by the users.

Discussion

Future development of the product would include both technical and non-technical improvements. The technical improvements should lower the production costs as well as cover the possibility to make it completely portable. This can be done by trading the Arduino for an ASIC and include a Bluetooth chip and a battery to make it completely portable.

Improvement and development can also be accomplished when it comes to the RFID readers. Today, three readers have been implemented inside the product. By expanding the amount of readers (or more specifically: the amount of reading antennas) inside the products, the possibilities to create playlist and interact with the product become more natural. As it is designed today, a restriction of three commands at the same time is applied. Using several antennas instead of several RFID readers is preferred for creating a long-term solution when mass-producing the product; this because of the production costs. Using several antennas, the product development costs will be in line with actual market prices for these kinds of products.

The market for tangible interfaces and "body interaction" towards digital material is rising; and in a near future, companies will compete against each other to be the leading developer of such products. Tangible interfaces are a part of Mark Weiser's vision of Ubiquitous Computing; and in this paper, a presage of future tangible music players has been discussed and prototyped.

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Related Work

- ↪ Records of the future (ROTF) (M. Clare, J. O'Connor. <http://www.vimeo.com/3012500>, 2008)
- ↪ Tangible Music Player (M. Hjulström et al, http://web.student.chalmers.se/groups/idp091/docs/Tangible_Music_Player.pdf, Chalmers University of Technology, 2009)

This paper is the written part of a text + video submission to the SIDER '10 Conference. The full submission, including video file can be found on www.ingredientsingredients.com