Sphero Dance! Project Proposal

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Abstract

Our individualism is strongly correlated with our ways of self-expression, notably in regards to the arts. With the advancement of human-robot interaction, humans are presented with a new challenge of demonstrating uniqueness and intelligence in robots. A common way of researching this is by pairing robots with music and dance. This paper explains our proposed Sphero project, an interface that allows a user to interact with three individual Spheros simultaneously using a smartphone or a tablet. The Spheros will follow the music or the user in synchronized movements similar to a dance. As we introduce our project, we will examine the current state-of-the-art applications of the Sphero and review their design with our proposed idea. An exploration of our proposed project as well as our motive for creating the application will also be discussed. Finally, we will conclude with a low-fidelity prototype of our interface and possible questions we hope to answer in our final report.

Keywords

Sphero; robotic ball; robotic intelligence; perception; music; human-robot interaction

1. Introduction

The Sphero 2.0 is an app-enabled robotic ball designed by Orbotix that can be controlled by a smartphone or a tablet via Bluetooth [6]. It is capable of displaying LED lights and moving in any direction as well as on water and other terrain types.

As of current, there are already several applications and games developed for the Sphero in the Google Play, iOS, and Windows stores. Most of them involve controlling the Sphero with a smartphone or tablet through tapping the screen, drawing paths, or tilting the device. These applications usually allow for the user to control one Sphero per device and while they do allow directional and chromatic control, they provide little to no error checking. Also, either the application can control a single Sphero at runtime or they can support multiple Spheros, but not both in the same application.

Through these applications, we realized how restricted studies involving Spheros can be when humans are able to control only one on a single device. The scale of projects will continue to be limited until we are able to control multiple robots with a single device at run time.

As with our project, we hope to synchronize three Spheros with one device. However, if the robot was only following the directions of the user, it does not convey autonomous behaviour. Furthermore, if the

robots all acted in the same manner, there is no perception of individuality and intelligence. This is important to consider, given that one day, humans aim to develop robots intelligent enough to be integrated into society.

How can we design a robot so that it is perceived to be intelligent? Can we show a robot to be distinct from another? Could a robot still be unique when following the instructions of a human?

Similar questions were asked in another study dealing with how the design of a robot influences its animacy and perceived intelligence [1]. In that study, the robots used were designed resembling an animal or a human. For our proposed project, we would like to see if we can answer these questions not with the use of facial features and sounds but with colours and movement.

The following section will review the current technology developed for Spheros and the way humans are able to interact with the robotic ball through Bluetooth devices. This paper will also discuss our proposed project and how we plan to create a Sphero application that allows users to interact with three Spheros and answer the questions we proposed above by incorporating music and dance.

2. Current State-of-the-Art

Due to its popularity, there are many Sphero applications in the iOS, Google Play, and the Windows App Store. Since our project is based on mobile platforms, we will only be looking at the applications from the Apple Store and Google Play Store. The control and manipulation of the Sphero can be done in various ways such as a controller, built-in accelerometers in mobile devices, touch gestures, programmed macros, and built-in cameras.

2.1 Sphero Multi-Drive

Sphero Multi-Drive is an app develop by Orbotix that allows users to control their Sphero in three different ways: joy-stick, tilt (using the mobile device built-in accelerometer), and "old-school remote control" [7]. The Multi-Drive App allows the user to directly control/manipulate the Sphero's movement and its colour. Recently, the application introduced the Multi-Ball mode where users can support multiple Spheros. Unfortunately, it is still experimental and not guaranteed to work on all devices.

2.2 Sphero MacroLab

MacroLab is another application developed by Orbotix for both iOS and Android devices. MacroLab allows the user to program sequences/macros for their Sphero. The application is meant to introduce users to basic programming concepts so that they can program basic commands and sequences on their own [5]. The application does not allow the user to directly control the Sphero in run-time. Unlike the Multi-Drive application, this supports multiple Spheros.

2.3 RollWithMe for Sphero

RollWithMe for Sphero is an application developed by

Figure 1: The Sphero follows the user holding the device in RollWithMe for Sphero.

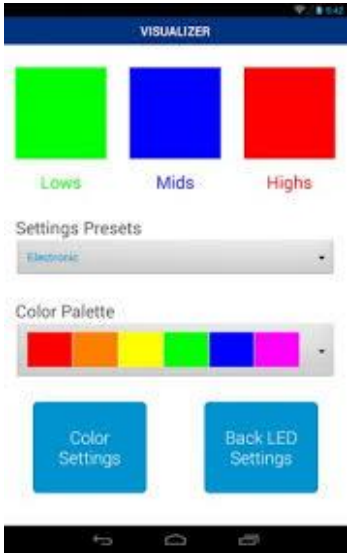

Figure 2: Sphero Music customization categories offered to the user.

Lingering Socket Apps. Contrasting with the other Sphero apps, RollWithMe for Sphero allows the user to control the Sphero by attaching a virtual leash from a mobile device to the Sphero as depicted in Figure 1. To function properly, the application needs access to accelerometer and gyroscope sensors.

2.4 Sphero Music

Sphero Music is an application developed by TheMDP LLC. The application allows the Sphero to perform a pre-choreographed dance matching the genre of the music being played. The user can change the LED lights, LED patterns, and the different dance settings [8] programmed into the application. Like the Sphero Macrolab, Sphero Music has pre-programmed functions so the user has limited personalization privileges.

3. Sphero Dance!

Our project will be an application that supports three Spheros connected to a single Bluetooth device. Similar to Sphero Music and RollWithMe for Sphero, we hope to create an application where a group of Spheros will dance and perform in a synchronized manner when music is played in the background. The user controlling the Spheros will be able to move and have the Spheros follow much like a featured dancer leading a group.

In order to answer the questions we proposed in the introduction of this paper, there will be two experiments conducted using our application.

To experiment whether a robot can be designed to seem intelligent, our application will require the Spheros to react to music. To achieve this, Sphero Dance! will take place mostly in a physical environment with some use of the mobile device. To indicate that they are ready, the Spheros will move randomly and blink random colours. Once music begins to play, the Sphero will begin to move in synchronized movements with one another. As the song continues, the Spheros will try and coordinate their movements to match the beat of the song playing. Once the music is stopped, the Spheros will conclude their dance.

In this first scenario, we predict that users will perceive the Spheros to be intelligent and that they are immediately interested once they see the Spheros come alive when they are ready. Since the random movements and colours only occur before a song starts to play, we expect the randomness will be interpreted as intelligence. The short amount of time this randomness is displayed is advantageous since prolonged randomness could be viewed as a malfunction or predictable behaviour [2].

The second experiment has the user enter the interface and lead the Spheros through Bluetooth connection. The Spheros will attempt to follow the user's movements and dance with the user. The Spheros will still have a degree of randomness where the colours they blink might be different or their movement patterns are slightly out of sync. This attempts to gather feedback for whether robots can be distinct from one another and whether they can still be unique when following input from a human. The interface for the second experiment can be seen in Figures 3, 4, and 5 on the following page.

For the second scenario, we expect that users and viewers will find the Spheros not only intelligent but

Figure 3: Sphero Dance! experiment two interface where the user leads the Sphero.

Figure 4: Sphero Dance! with the Spheros following the user's movement and moves to a new location.

Figure 5: Sphero Dance! Spheros randomly colour change.

unique. Certain patterns and movement patterns will distinguish the Spheros from each other and the humans involved will be able to perceive that. Therefore, not only will the Spheros seem intelligent based on their ability to follow the user's movements but individualistic because their uniquely randomized colours and paths will add more depth and personality to each Sphero without relying on human or animal characteristics.

As seen in the current state-of-the-art, most of the interactions between the user and the Sphero is done through controllers, touch gestures, or through the use of the accelerometer of the mobile device. The use of the mobile device will be very limited since its purpose is to provide a means of communication between the user and the Spheros. The user will not be controlling the Spheros through the mobile device screen but rather through the physical movements that the user makes.

4. Conclusion

In this paper, we proposed creating an application, Sphero Dance! that allows a group of three Spheros to move in a synchronized pattern when it detects music playing. The application will also allow the user to lead a group of Spheros to perform a dance like sequence. We feel like this will allow a more immersive interaction between the user and the Spheros. The main goal of our project is to research the abstract idea of perceived intelligence and individualism in robotics. Can a faceless, voices robot be recognized as intelligent? Can random colours and movement paths distinguish robots from one another? Could a robot still be seen as an individual when following the instructions of a human? We hope to receive feedback that could get us closer to answering these questions with our project.

References

[1] Bartneck, Christoph, Takayuki Kanda, Omar Mubin, and Abdullah Al Mahmud. "Does the design of a robot influence its animacy and perceived intelligence?." *International Journal of Social Robotics* 1, no. 2 (2009): 195-204

[2] Bartneck, Christoph, Dana Kulić, Elizabeth Croft, and Susana Zoghbi. "Measurement instruments for the anthropomorphism, animacy, likeability, perceived intelligence, and perceived safety of robots." *International journal of social robotics* 1, no. 1 (2009): 71-81.

[3] Lingering Socket Apps Sphero RollWithMe on the Google Play Store. https://play.google.com/store/apps/details?id=org.goseumdochi.android.leash&hl=e

[4] Orbotix Sphero Drive on the Google Play Store. https://play.google.com/store/apps/details?id=orbotixdrive

[5] Orbotix Sphero MacroLab on the Google Play Store. https://play.google.com/store/apps/details?id=com.orbotix.macrolab&hl=en

[6] Sphero 2.0. "Sphero | Connected Toy for iOS, Android, and Windows. Sphero.com. https://store.sphero.com/ (accessed November 4, 2016).

[7] Sphero Interactive Entertainment Sphero Multi-Drive on the Google Play Store. https://play.google.com/store/apps/details?id=orbotix.drive&hl=en

[8] TheMDP LLC Sphero Music on the Google Play Store. https://play.google.com/store/apps/details?id=com.blogspot.michaeldephillips.spherodance&hl=en