Blind Crown - Vibration motors for haptic devices and proximity sensors

+ alternative with sound instead of vibration

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1. Vibration motors

Introduction

The term “haptic” comes from the Greek word “haptikos,” which pertains to our sense of touch. Nowadays, the most common haptics use case is in smartphones—your phone vibrating whenever you get a call or text message—but it is also used in gaming, virtual reality, automotive, accessibility, and medical applications.

What is a vibration (haptic) motor?

To create haptic effects, a crucial technology is required: the vibration (haptic) motor. A vibration motor is a device that provides tactile feedback through the use of vibrations.

Types of vibration motors:

1. **Eccentric Rotating Mass (ERM):**

The ERM is a rotary electric motor with an off-center part. As the ERM rotates, the off-center part moves, creating the "noise" and vibration sensation.

For many years, ERMs have been the most popular type of haptic motor due to their low cost, simplicity, and effectiveness. However, their vibrations are imprecise and can be slow to start and stop, limiting the range of sensations they can produce.

2. <u>Linear Resonant Actuator (LRA):</u>

LRAs are commonly found in handheld devices and smartphones. LRA motors consist of a magnet attached to a spring, surrounded by an electromagnetic coil and housed in a housing. The coil is used to drive the motor by moving the mass back and forth in the housing, creating the vibrations we feel.

LRAs offer faster response times and more efficient power usage than ERMs, making them a popular choice for devices that require fast haptic feedback. However, they are more expensive than ERMs and the spring is susceptible to wear.

<u>Utilised in the initial project idea</u>

We chose the coin-type vibration motors (Linear Resonant Actuator or LRA) due to their compact dimensions, low energy consumption and ease of integration into portable devices such as the BlindCrown in the completed vision. They provide clear vibrations, ideal for tactile feedback in assistive devices. The flat shape and the possibility of simple mounting make them suitable for an efficient and discreet design.

(**IMPORTANT!** To use coin vibration motors it is essential to have a transistor in their circuit, otherwise the arduino will not be able to provide enough power to use them.)

Utilised in the presented project:

Passive Buzzer to produce sound instead of vibrations

A passive buzzer is a device that generates sound when an electrical signal is applied to it. It is called passive because it does not have an internal oscillator to generate sound on its own. Instead, it relies on an external signal from a microcontroller like Arduino to produce sound. The passive buzzer module is a small electronic component that contains a passive buzzer and some additional circuitry that makes it easier to use with Arduino.

2. Proximity sensors

Introduction

A proximity sensor is a non-contact sensor that detects the presence of an object (often called a target) when it enters the sensor field. Depending on the type of proximity sensor, sound, light, infrared (IR) radiation, or electromagnetic fields may be used by the sensor to detect a target. Proximity sensors are used in phones, recycling plants, autonomous cars, anti-aircraft systems and assembly lines.

Types:

- inductive
- capacitive
- with ultrasounds
- optic (infrared)

Utilised in the project

We chose to use the **HC-SR04** ultrasonic sensor because of its accuracy in distance measurement and low cost. This sensor works by emitting a high-frequency (ultrasonic) sound pulse, and the time it takes for the signal to return to the sensor is measured to calculate the distance to an object. It is ideal for applications such as obstacle detection, being able to measure distances from 2 cm to 4 m. Due to its ability to detect objects without physical contact, the HC-SR04 is perfect for projects that require proximity feedback, such as assistive devices for the blind.

Conclusion

In conclusion, using proximity sensors such as the HC-SR04 together with vibration motors allows the development of effective tactile feedback devices. This combination provides a good solution for detecting obstacles and providing a signal to the user within the BlindCrown prototype. (Due to technical issues (not being in possesion of transistors) we used sound based alerts using a buzzer for the presented project)

References

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