# Introduction

A wobble switch is an assistive switch that can be activated by moving a wand topper. Wobble switches are useful for users with poor gross motor control. These switches can be mounted easily and activated by pushing the wand in any direction. The switches can be operated with very little force. The switches can be activated with various parts of the body including: hands, head, chin, tongue through cheek.

Activating the wobble switch completes the circuit and activates the other end. When the 3.5 mm plug is inserted into an input, it activates the device it is plugged into. The switch can be plugged into different devices such as the Xbox Adaptive Controller to act as an extension of a button. This enables the user to activate a multitude of devices (or device buttons) without the use of fine motor control.

Commercial Options

Table 1 Commercially Available Wobble Switches

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Vendor** | **Cost** | **Link** |
| Ultimate Assistive Technology Switch | Enabling Devices | $80 USD Switch, $150 USD w/ mount | <https://enablingdevices.com/product/ultimate-switch/> |
| Wobble Switch | Prentrom | $195 | <https://store.prentrom.com/wobble-switch> |
| Wobble Switch | AbleNet | $100 USD | <https://www.ablenetinc.com/wobble-switch> |
| Wobble Switch | AMDi | $100 USD | <https://www.amdi.net/products/switches/wobble-switch/> |

# Switch Selection

The existing commercial switches appeared to be a modified commercial product, so this provided a starting point for the design. A similar looking industrial switch was found and tested and provided similar functionality.

## Mini Limit Switch

The switch selected for the base of the Wobble Switch is a ME-8169, which is available from a number of different manufacturers. This limit switch is typically used for CNC machines and there are a few different variants for the activation end. The end most suitable for a Wobble switch is the ‘Flexible Spring Arm’.

# Mounting

Mounting Considerations

-why ¼”-20 UNC?

The wobble switch has a ¼-20 UNC, 5/16" tee nut that attaches to a mount.

Mounting options

* Gooseneck
* Articulating arm

# Wand Topper

The bare wire of the limit switch has a pointy end and is not safe to be used on its own. Commercial wobble switches tend to have a ball or rounded cylinder that cover that activation portion.

A versatile feature of the wobble switch is its adaptable toppers. An anchored hex-grip base with extended threads allows for the customizability of different toppers. The T-Topper consists of five separate pieces: the socket, the top and bottom halves of the T, and two pins to hold the halves in the correct position when assembling. The socket was created to allow the female threads to be printed upwards (yielding more accurate 3D printed threads), while enabling the two T halves to be printed on the flat surface to avoid the use of support material. The same theory applies to the Ball-Topper, which only uses one pin. Printing the file vertically is the most logical orientation for the Hand-Topper, which is why the socket is combined into one file and printed as one piece.

Other attachment methods were ideated for attaching both the wand to the wire as well as between the base and the topper. Different methods were sketched, and some were prototyped such as dove tails and varying threads. Super glue was discovered to be the best option in connecting the base to the wire as the burr on the end on most units’ wire, along with inconsistent 3D printer tuning and accuracy, could not be proven to work consistently without high dexterity.

There is potential for future topper designs to be created. Depending on what is requested by an Occupational Therapist or user of the wobble switch, different toppers can be built to suit their needs, for either functionality, aesthetics, or personal interests. Figure 3 shows a variety of possible topper options.

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Figure : Wire Attachment Ideation

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Figure : Modular Interface Ideation

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Figure : Wobble Switch Topper Ideation

# Testing

A preliminary proof of concept was tested with several users in an adaptive gaming setup. The wobble switch was mounted to an articulated arm and positioned near the face to provide an additional input to the Xbox Adaptive Controller.

# Future Work