



AN ACTIVE TANGIBLE DEVICE FOR MULTITOUCH-DISPLAY INTERACTION

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ABSTRACT

We introduce an interactive tangible device (TID) for touchscreen interaction. Our approach complements a passive TID design by active micro-controller-driven features focusing on user-experience aspects. This TID provides battery-powered wireless operation, autonomous position sensing capabilities, visual and tactile feedback, multiple touch and momentary click button inputs as well as Unity3D software integration.

THE INTERFACING BODY

The rotor-shaped device enclosure holds the inner electrical components and forms the graspable front-end interface to the user. That enclosure is made up of rings which are connected via universal snap-in joints. This design allows to rapidly exchange or add/remove single components.

The bottom features a conductive touch-pattern that allows it to be recognized by capacitive touchscreens.

The user can emit input events by moving the whole enclosure or clicking / touching one of the five top level roof elements.

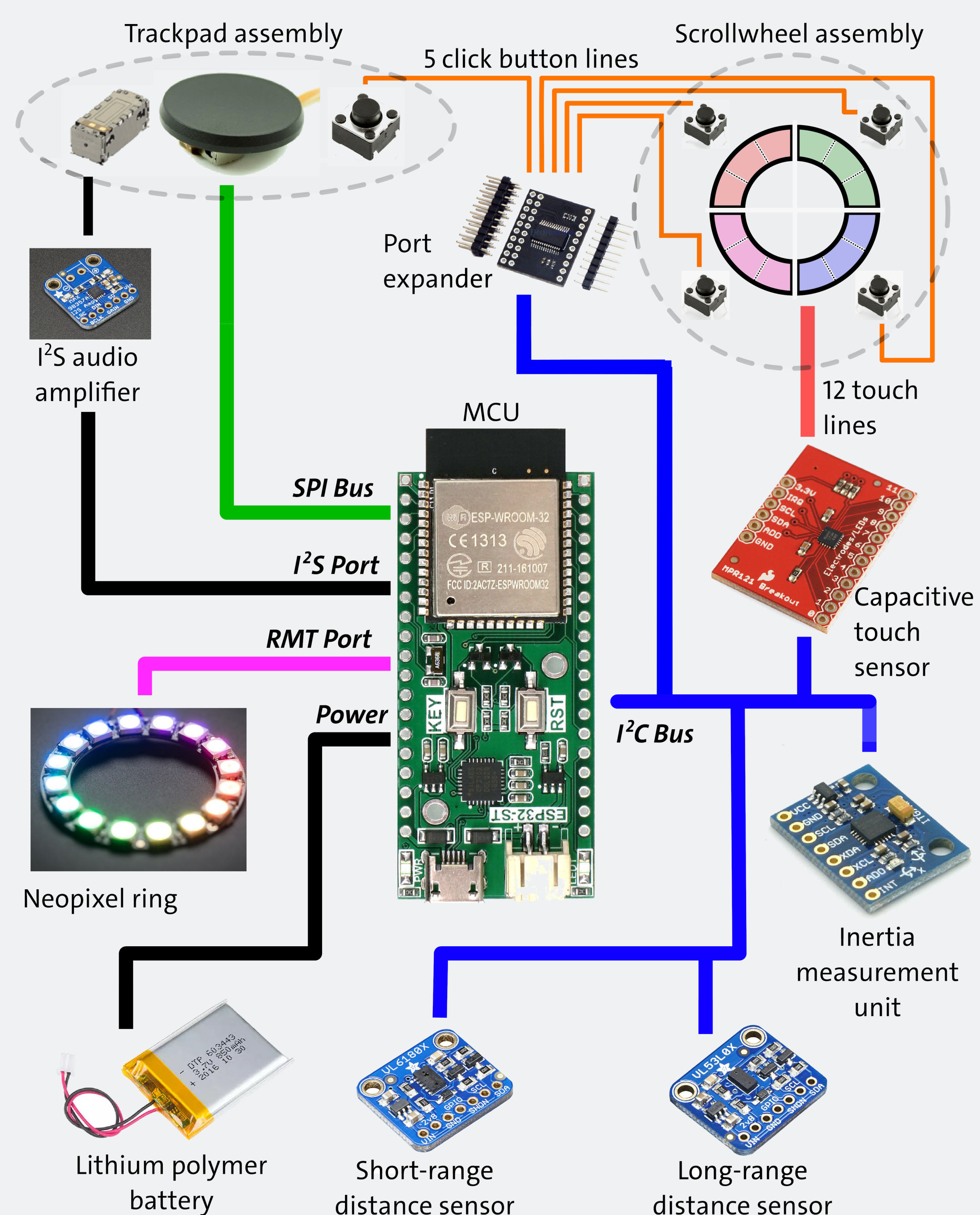
The circular top disc is a high resolution touchpad which acts both as a momentary click button and a fine grain touch input panel, the surrounding four circular button slices act as one capacitive touch and one click buttons each.. Relative position sensing is performed internally by two combined laser time-of-flight distance sensors and one 6-degrees-of-freedom inertia measurement unit.

Feedback from this device to the user can be provided via visuals provided by a custom programmable 24-segment RGB LED ring mounted inside the translucent enclosure or vibrations emitted by a haptic actuator mounted to the body of the the circular trackpad.

The wireless connectivity allows for a fine grain programmable relationships between input and output events, simple static actions can be handled by the TID's firmware directly, more complex interactions can be shifted towards the host system.



THE INNER WORKINGS



HARDWARE COMPONENTS

ALPS Haptic Reactor analogue LRA, Steam/Circque 40mm capacitive SPI trackpad, Semtech SX1509B 16-bit I2C port expander, NXP MPR-121 12-channel I2C touch controller, TDK MPU-6050 6-dof I2C IMU, STM VL6180X ToF short range sensor, STM VL53L0X ToF long range sensor, 1000mAh LiPo battery, WS2812B 24x NeoPixel Ring, Maxim MAX98357A I2S audio amplifier, Espressif ESP32 microcontroller

RESOURCES

The details of this complex design, schematics, firmware, connection diagrams, BOMs are available via <https://github.com/CBR1911/ActiveTID>

