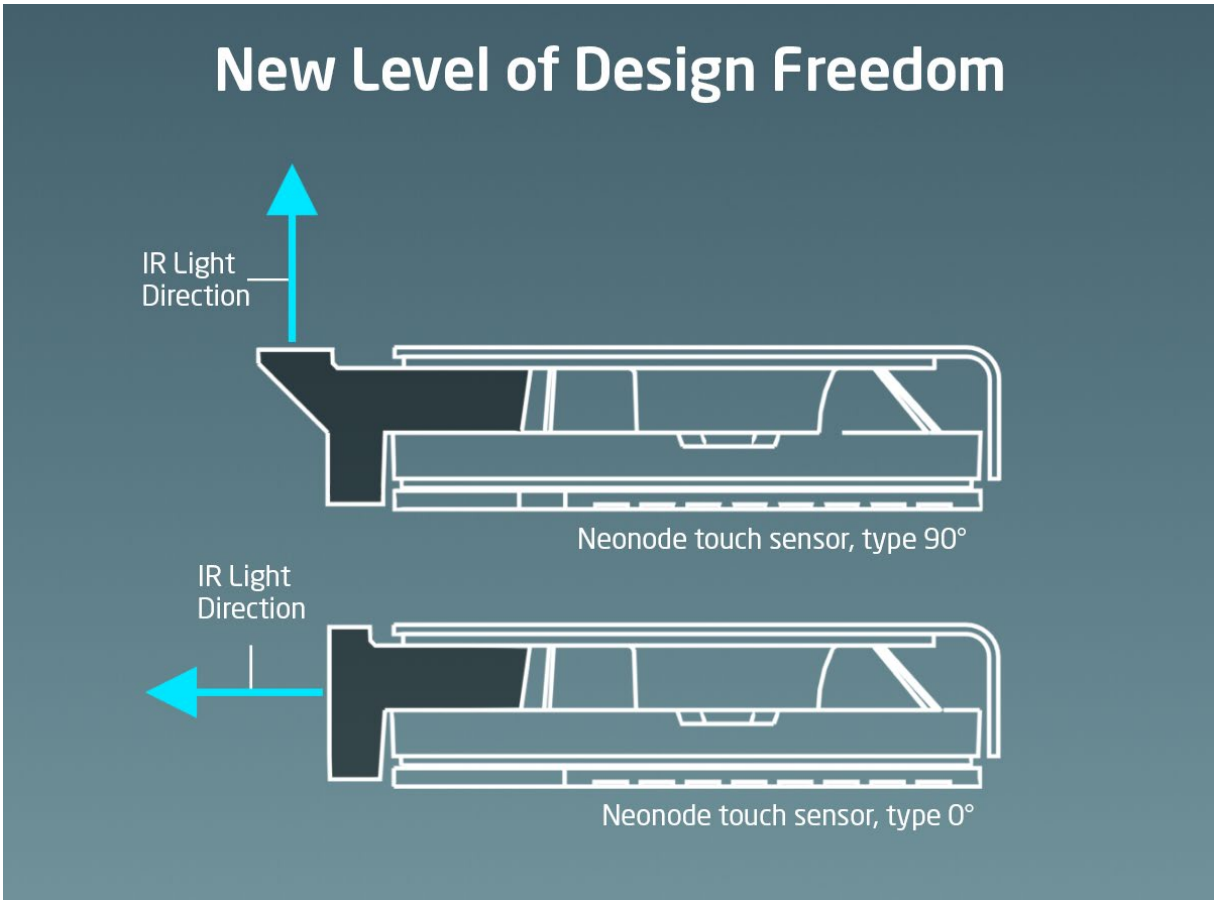
neonode®



Rapid Prototyping with Neonode® Touch Sensor Modules

Rapid product prototyping is a flexible process that uses knowledge gained by early interaction with a solution to improve or adapt the solution. Neonode Touch Sensor Modules are true plug-and-play sensor modules for adding touch to your solution, enabling rapid and iterative prototyping for hardware solutions.

Introduction

Rapid-application development (RAD), which began as an alternative software development approach [1], has since made inroads in hardware development as well [2]. In general, RAD approaches put less emphasis on planning and more emphasis on an adaptive process of developing prototypes. Prototypes have several advantages over traditional specifications, including reduced risk, improved user feedback early in the development process, and overall faster time to market for the final product.

Neonode has developed a product line of touch sensor modules enabling touch input on any surface and in-air, particularly designed for rapid prototyping and deployment. The touch sensor module is available in various lengths to support interaction areas from 3” to 16” diagonally, and mounting directions of both flat (0°) and flipped (90°).

Contrary to basic component offerings common in the market today, Neonode TouchSsensor Modules offer great design freedom that is easy to start with, easy to change during design - even after a design freeze, and easy to deploy.

Evaluation suite

Neonode offers an Arduino®-compatible prototyping board for fast prototyping with the Neonode Touch Sensor Modules. This small form-factor piece of hardware plugs directly into the connector side of the touch sensor module and supplies all necessary electrical connections.

After establishing mechanical and electrical connections with the touch sensor module, a developer can plug a standard micro-USB cable into the adapter board and start working on the functionality with the mature Arduino ecosystem.

To further reduce the initial friction for a developer to start working with the touch sensor module, Neonode provides a software library package, including a few different examples for inspiration.

Industrial design freedom

Neonode Touch Sensor Modules come in two different configurations in terms of cross-sectional shape. One with a 0° exit window, which is intended to be used flat in relation to the touch surface, and another with a 90° exit window, which is intended to be tucked on the side of the touch surface. These configurations give extra freedom when it comes to industrial design: the 0° type touch sensor module is ideal for flat and thin designs, and the 90° type is best when a design prioritizes touch area maximization over visible area. See examples 1 – 4 below.

Example 1

A 0° type touch sensor module mounted on the same plane as the touch surface. See Figure 1.

Example 2

A 0° type touch sensor module mounted below the level of the touch surface, exposing only the active part of the touch sensor module window. See Figure 2 and Figure 3.

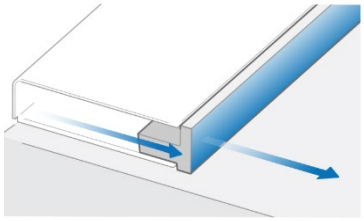


Figure 1. Mounting example 1.

Figure 2. Measurements / window for example 2.

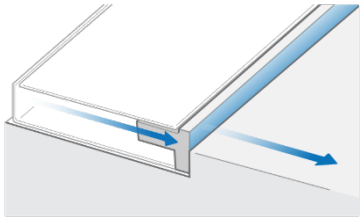


Figure 3. Mounting example 2.

Example 3

A 0° type touch sensor module mounted flush with the surface, creating a touch area above and vertical to the surface. See Figure 4.

Example 4

A 90° type touch sensor module mounted on the side of the touch surface, the touch sensor module exit window sits above the touch surface, like a periscope. See Figure 5 and Figure 6.

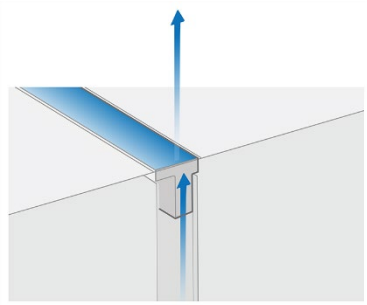


Figure 4. Mounting example 3.

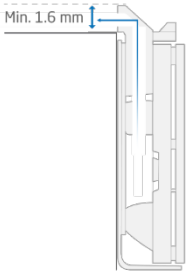


Figure 5. Measurements / window for example 4.

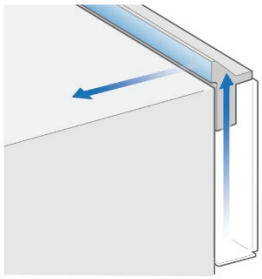


Figure 6. Mounting example 4.

Options for guiding and fastening

Double-sided adhesive tape

Double-sided tape works great as a fastener. The tape requires no extra features on the host system and makes the sensor module easy to apply on a flat surface inside the system.

Snaps

Another good and easy way to hold the touch sensor module in place is implemented by designing a few simple snap features on the host system. These must be designed to fit the specific host system.

Sandwiched

The touch sensor module is mounted by inserting the touch sensor module between the host system’s exterior cover and display. A structure (ribs, foam gasket or adhesive) is needed to ensure that the touch sensor module cannot move.

Electrical integration

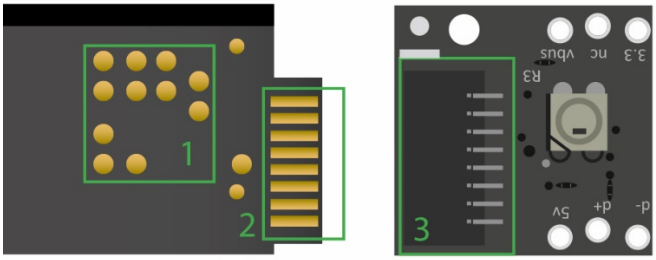


Figure 7. Testing pads (1), 8-pin gold-finger (2) and mating socket (3).

Using an FPC socket

The PCB gold finger (element 2 in Figure 7) which extends out of the touch sensor module is designed for mating with an ordinary FPC connector (element 3 in Figure 7) that accepts 0.3-0.35 mm FPC with 1.0 mm pitch.

The benefit of using a socket is that it's plug-and-play, and it can be connected and disconnected multiple times. There are some considerations when a socket is used, such as it may increase the space needed to facilitate the setup.

Using testing pads

The testing pads (element 1 in Figure 7) on the top of the touch sensor module PCB expose all the signals on the PCB gold finger. One way to get electrical connection with the test pads is by using pogo pins or a similar spring-loaded interface.

Please note that the touch sensor module comes with two types of communication buses, USB and I2C respectively. Very often only one type of bus is utilized in a particular application, so typically only five or six pins must be connected for an application.

Solder

The PCB gold finger (element 2 in Figure 7) can be used to directly solder onto other interfaces. One technique to solder onto a PCB is by utilizing pre-tinned PFC and automated hot-bar soldering.

Software integration

The Neonode Touch Sensor Module runs HID digitizer protocol through USB interface, and runs an ASN.1 protocol through I2C interface.

HID digitizer is a well-established protocol and many operating systems have good support for it [3]. Windows, Linux and MacOS (single touch) devices accept and correctly interpret the protocol with no extra development needed[1]. For example, when using USB interface with a Linux machine, the Linux OS recognizes the device as a touch input device and coordinates sent out from the touch sensor module are directly reflected by the mouse cursor on screen.

The ASN.1 protocol requires a counterparty on the receiving end to correctly decode and interpret messages from the sensor module. Neonode provides a software library (SDK) to ease the job on Windows or Linux hosts and a separate Arduino-compatible library for fast prototyping on microprocessors. Please visit support.neonode.com for detailed instructions on how to get the libraries working with host systems.

[1] On MacOS drivers are required to process messages that have more than a single touch point.

A few application examples

1. Add touch to a non-touch screen

In this example, the purpose of integrating the touch sensor module is to turn a non-touch screen into a touch screen. This integration can be done in an early design phase or as a retrofit. As a variation of the example above, one can add touch to a subarea of a screen, e.g., to provide a touch OSD menu on a monitor instead of buttons. See Figure 8.

Figure 8. Adding touch to a subarea of a screen to enable touch only within that subarea.

2. Add redundancy to existing controls

In some cases, a type of control has already been in service. However, the existing control may be limited, outdated, or broken, and in these scenarios a touch sensor module is a great alternative with the benefit of co-existing with the original control. And in some safety-critical or mission-critical cases, control panels benefit from having a redundant system to accept human input in order to reduce malfunction or misfunction. A touch sensor module can work together with mechanical keys to ensure every input is cross-checked by two input devices simultaneously. See Figure 9.

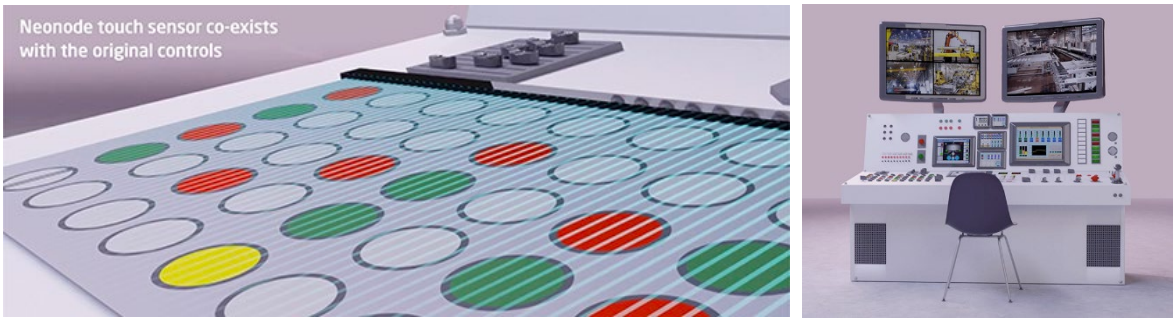


Figure 9. Replacing buttons by adding an interactive area with a sensor module to the surface of an industrial panel

3. Add other types of controls to a surface

The touch sensor module can be emulated to work as other types of input devices, such as a keyboard, mouse, sliders and buttons.

The touch sensor module can work with physical objects, tactile buttons, or objects with silk screen prints. It is a versatile and cost-efficient way to implement an input mechanism. See Figure 10.

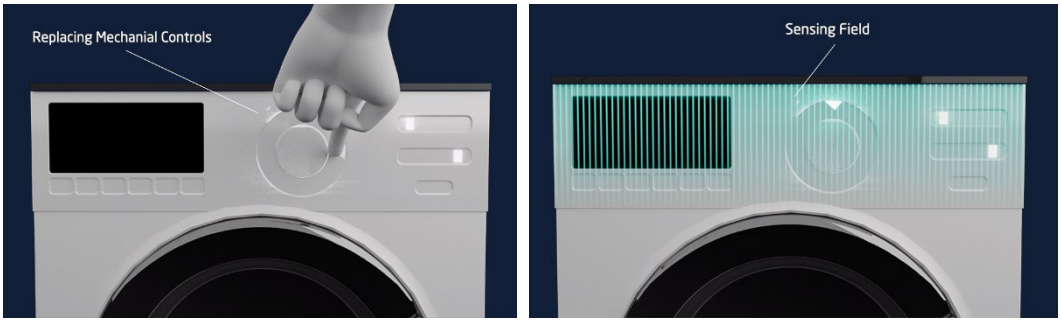


Figure 10. Adding an interactive area with a sensor module to mechanical controls.

4. Add gesture control to expand functionality

In this example the touch sensor module can be hidden on the surface of a device, such as a speaker, and it projects an invisible interactive area above the device. Users can then perform a set of in-air gestures to turn the volume up or down, swipe left and right to a switch track, and more. Users can also perform touch actions on the surface to activate additional functions. See Figure 11.

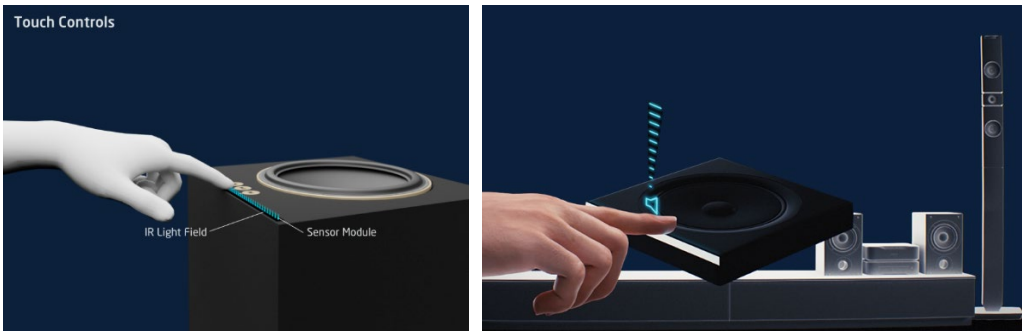


Figure 9. Interactive surface and space with a hidden touch sensor module on a speaker.

Ordering information

Buy the Neonode Touch Sensor Module at: http://www.digikey.com/en/supplier-centers/n/neonode
Get started with the touch sensor module at: https://support.neonode.com/docs/

References

1. Boehm, B.W. (1988) *A spiral model of software development and maintenance*. IEEE Comput. 21, 5, 61-72.
2. Collyer, S. and Warrren, C. M. J. (2009) *Project management approaches for dynamic environments*. International Journal of Project Management, 27 (4), 355-364.
3. USB-IF. https://www.usb.org/hid

About the Author

Xiatao Wang, Product manager

Xiatao Wang is a senior product manager at Neonode with more than 10 years of experience in sensor applications and embedded system design. He holds a master's degree in ICT system design and a bachelor's degree in industrial automation.

About Neonode

Neonode Inc. (NASDAQ:NEON) is a publicly traded company, headquartered in Stockholm, Sweden and established in 2001. The company provides advanced optical sensing solutions for touch, gesture control, and remote sensing. Building on experience acquired during years of advanced optical R&D and technology licensing, Neonode's technology is currently deployed in more than 73 million products and the company holds more than 120 patents worldwide. Neonode's customer base includes some of the world's best-known Fortune 500 companies in the consumer electronics, office equipment, medical, avionics, and automotive industries.

For further information please visit **products.neonode.com**