

Finger Navigation in HID

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Human Machine interface (HMI) development has been and continues to be a key area of focus for many technology companies. New products with an innovative user interface have always been well received in any market space. For example, MP3 players were in the market for a long time before Apple introduced the cool “click-wheel” feature in the iPod, which became a huge hit in the market. They then expanded the innovation with the introduction of touchscreens in the i-Phone; now touchscreens are the standard for portable devices. In short, Innovative interfaces differentiate great products from good products.

Human Interface devices (HID) are the devices which translate the inputs from people to machine-understandable instructions and facilitate smooth interaction between them. Every HID device is comprised of three blocks. The first block is the analog front-end which interfaces with people and gathers their inputs. The central block is the logical transfer function block which translates the human inputs to machine-understandable instructions. The final block is the communications block which interfaces with the machine to communicate the received input.

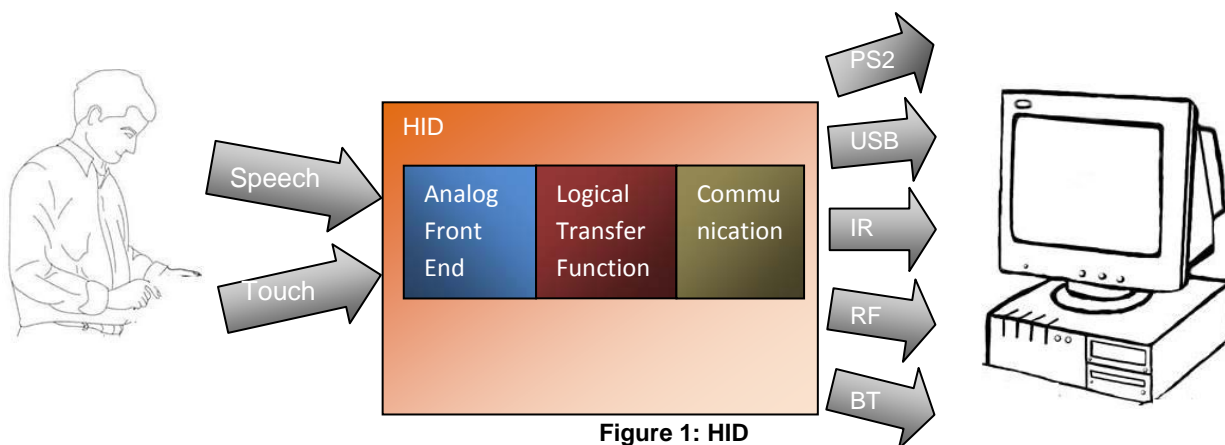


Figure 1: HID

Here are some of the important performance parameters that each of the user interface technologies compete upon:

- Ease of use
- Power Consumption
- Size
- Cost
- Ease of Design
- Ease of Manufacturing
- Accuracy
- Noise Immunity
- Long Life
- Speed
- Resolution
- Scalability

It is not possible to get all of the above parameters in a single technology. The application requirements specify which parameters can be traded off in favor of other parameters more important to the applications.

What is Finger Navigation?

Finger Navigation is one such User Interface gaining rapid momentum in mobile phones and other portable consumer products. We will see how Finger Navigation can be useful in HID applications.

Finger Navigation samples a fixed point and reports motion across it. The functionality is similar to a trackball or “red dot” pointer on laptop. The coherent light from a light source reflects off microscopic textural features in the area, resulting in different spatial frequencies that are a signature of surface and motion. The light source can be an LED or laser. Coherent laser light source is used widely versus an LED light source given an LED’s susceptibility to external vibrations and ambient light.



Figure 2: Finger Nav module

The Analog Front-End (AFE) is a key part in this technology. Usually the AFE is a detector which can receive the reflected laser light source. Apart from the regular analog to digital (ADC) conversion, some amount of signal processing will be required to make sure that noise sources are eliminated.

Once the signal is processed, the logical transfer function block takes care of the translation required as per the communication protocol chosen. Typically, this is done by a low-MIPS CPU.

The Communication can be either wired or wireless. USB is most commonly seen in the market in wired HID products because of standard HID Class driver support available across different OSes. There are a number of wireless options like IR, Bluetooth, and 2.4GHz RF. Every protocol has its own pros and cons and are not discussed in detail here.

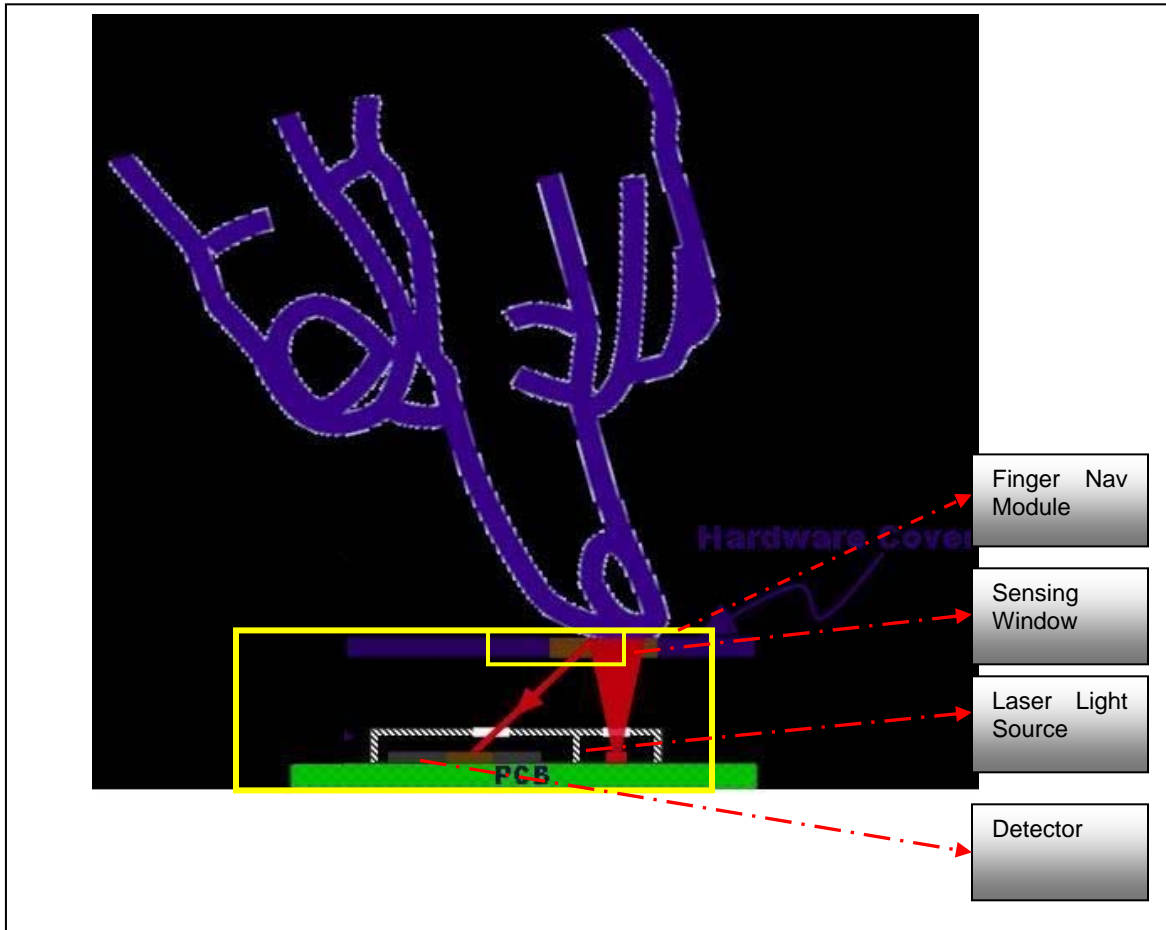


Figure 3: Finger Nav Module – Cross Sectional View

There are 3 parts in a Finger Navigation design.

- Optical
- Electrical
- Mechanical

The electrical design complexity can be reduced with a programmable intelligent SoC. The toughest part is the integration of the optical and mechanical parts of the design to make sure that light source is reflected into the detector efficiently. This definitely requires an expert who understand all three parts of the design to make a Finger Navigation Module work efficiently. In the next section, example applications are discussed where Finger Navigation can be better than the existing navigation technology used in a device.

Finger navigation in Wireless Air Mouse/Presenters/Remote Control:

Existing Architecture:

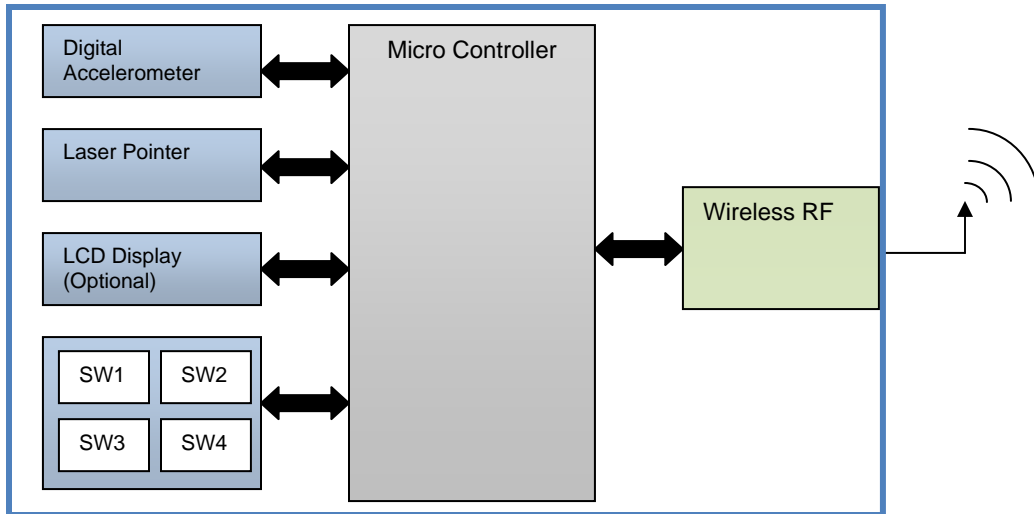


Figure 4: Wireless Air Mouse/Presenter – Existing Architecture

Modified Architecture with Finger Navigation:

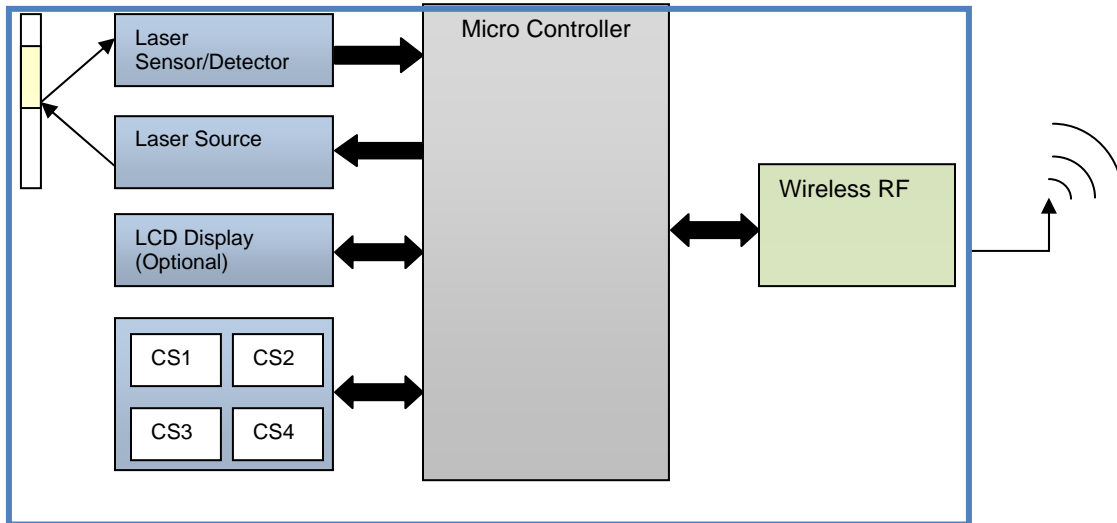


Figure 5: Wireless Air Mouse/Presenter – Modified Architecture

- The expensive digital accelerometer can be replaced by a multi-purpose Finger Navigation sensor
- The cursor can be used instead of a Laser Pointer to point over the presentation
- The mechanical buttons can be replaced with capacitive sensors for better durability/looks
- Finger Navigation can reduce the number of buttons required in a remote control. Instead of providing options on the remote, the GUI can be displayed in the target machine and Finger Navigation can be used to move around the options to select.

Cypress's OvationONS™ Laser Navigation Solutions are breakthrough technologies for precision motion-sensing applications. Built around Cypress's patented OptiCheck™ laser technology, these devices offer a variety of performance advantages, such

as high accuracy tracking at high speed, broad surface coverage, and low power. The product delivers fast, precise, responsive tracking, without the trade-offs that characterize traditional navigation systems. OvationONS™ devices are strategically designed to simplify assembly, reduce manufacturing costs, and improve yield. Cypress based Finger Navigation solution reduces the cost/size considerably and increases the performance by a huge factor.

Note: A receiver is required for a 2.4GHz Wireless RF communication in the PC side. That block diagram is not discussed in this article.

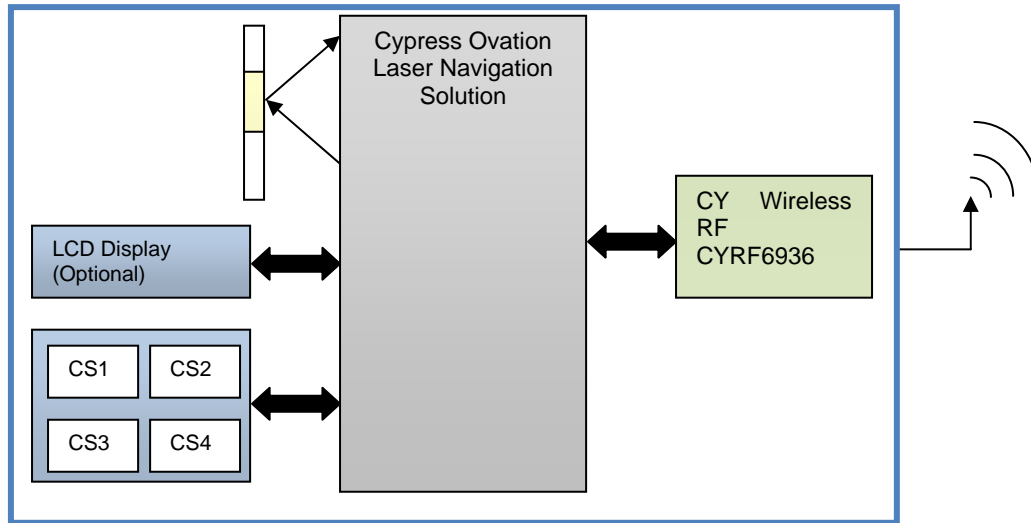


Figure 6: Cypress based Wireless Air Mouse/Presenter

Finger Navigation in Integrated Wireless Keyboard/Mouse:

In most cases, a wireless keyboard and mouse go together. However, finding space for them separately has been really tough. Integrating both sets of functionality has also been difficult because of the mouse form factor and operating surface constraints. Finger Nav Technology with high resolution & high accuracy in a small form factor simplifies integration. In addition, the performance requirements demanded by gaming HIDs are very high, and Finger Navigation can address them without any trade-offs compared to traditional HIDs.

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