**Description**

The design solution we chose for the Wireless Hand Sensor was the use of an inertia measurement unit (IMU). The IMU incorporates gyroscope and accelerometer chips which sense rotational movement. Using an IMU, the hand sensor would have full rotational movement around the x, y, and z-axis. The IMU would control the mouse movements by being mounted on the top of a human hand. As the person rotates from left to right, the mouse pointer would move from left to right. As the person rotates up and down, the mouse pointer would move up and down. This correlation is simple to understand and is natural to human movement. The hand sensor will incorporate touch sensitive buttons, which would map to button clicks and other gestures that are changeable via a computer user interface. Each touch by the user will also generate a feedback via LED’s attached to the hand. The feedback system is present to provide a more intuitive feel.

**Customer Requirements**

Comfortable

The IMU is a small device so it will take up less space. This will make the device comfortable on the back of the hand. The IMU is also lightweight which fulfills the requirement of being less then one pound in this customer requirement.

Accurate

The IMU will make the entire system much more accurate which fulfills the customer requirement. The gyroscope and accelerometer are able to measure upwards of 2000 degrees/second. This will give accurate results for this purpose.

Visually Appealing

This design consideration will successfully pass this requirement as well. The IMU is small so an enclosure for it will be small as well. The less space it takes will appeal more to the customer as it will not stop interfere with their hand movements.

Easy to setup and Use

Because the IMU will take up less space, the battery circuit will be incorporated.

This will allow the customer to easily setup the device and recharge when necessary. The device will also calibrate quickly because the microcontroller will be free from intense mathematically computations from other designs.

Portable

The IMU will act as an add-on, which will attach to the hand sensor. It will not require any extra devices except for the microcontroller, which will be incorporated nonetheless.

Inexpensive

The portability fulfills a major customer requirement. The entire system will be inexpensive as well which is explained in the next section. The major component of complexity will be the IMU, which is inexpensive to produce.

Compact

The microcontroller will take up the majority of the space on this design because the IMU is small. Therefore, this requirement will be fulfilled as well.

Intuitive

The system will be much more intuitive with faster response time. The microcontroller with other systems will be bogged down with many calculations but with the IMU there will be less mathematical computations. This will allow the microcontroller to focus on feedback sensor and LED output to allow intuitiveness.

**Complexity of Design**

The major complexity of this design is the integration of the accelerometer and gyroscope, which creates the IMU. Without proper rotational movement, the project will fail because it will be unable to control the mouse. The gyroscope senses angular rotation and therefore a digital integration is required to achieve angular movement. Integration of angular rotation produces error when approximating the area under the data points. In traditional integration, it is assumed that the values are accurate but there is always an error factor that is disregarded because it is small. When digital integration is done in a microcontroller, the error exponential increases as time goes on. This error builds up and affects the entire system as a whole. To fix this issue an accelerometer is combined with the gyroscope so the data can be fused to produce reduce the error.

The total cost of this system is cheaper than other design considerations. The full IMU will cost roughly $20.00 to produce. This incorporates the cost of a gyroscope and an accelerometer. The other costs includes a microcontroller ($19), touch sensors ($48), glove ($20), wireless communication ($60). The total cost for this system is $167. With this investment, the system is easier to develop and will work accurately. All the customer requirements are fulfilled with this system compared to the other ones.