

# AIR MOUSE

## How to reduce WRMSDs related to the use of the computer mouse

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### 1. Introduction

Computers take pride of place in our lives. Using a computer in bad postures can result in WRMSDs (Work-Related MusculoSkeletal Disorders). These disorders can appear after using a computer for a great amount of time in a static position. In order to prevent these (recognized) troubles, we started thinking about an alternative to the computer mouse we are all used to.

Two solutions have been put to the test, in connection with a physiotherapist:

The first one uses an accelerometer and buttons, placed on a glove, the movements of the hand guide the mouse cursor.

The second one uses a touchpad and buttons, placed on a glove, the arms can then remain on the knees in their rest position.

### 2. Research Methods

Our final product should be small, so we decided to work on an Arduino nano microcontroller.

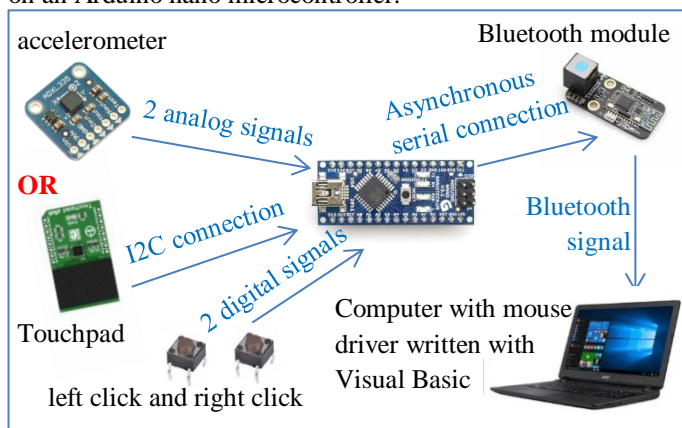


Image 1: components used

The first solution uses a 3-axis accelerometer. It can measure the static acceleration of gravity in tilt-sensing applications. 3 analog signals are delivered (X, Y and Z tracks).

Based on the position of the sensor on the glove, we will measure the signals of 2 channels and we will deduce the instruction of movement to be transmitted to the mouse cursor.

The second solution uses an intelligent touchpad. It is a capacitive touch input device driven by MTCH6102 controller. It communicates with the microcontroller through the I2C interface (SCL and SDA Pins)

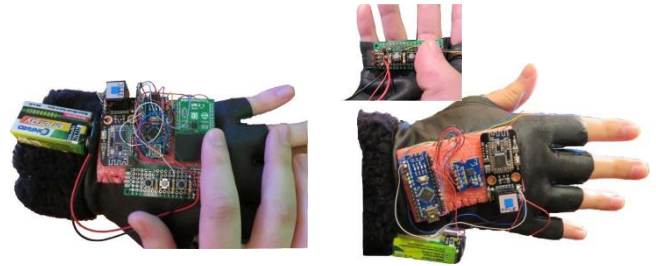
Although the touchpad detects the click, we found it more comfortable to add 2 buttons, for left and right clicks. These 2 buttons will deliver 2 digital signals to the microcontroller.

Depending on the sensed signals, the following movements will be transmitted to the mouse cursor: left, right, or double clicks, upward, downward, left or right movements (with 3 different speeds for each move). These instructions are sent to a Bluetooth module via a serial link (TX pin).

On the computer, a driver, written in Visual Basic, retrieves the instructions and pilots the mouse cursor.

### 3. Results

The models that we built for our tests :



Touchpad solution

Accelerometer solution

With the accelerometer, we used z-axis for the horizontal movement of the cursor and y-axis for the vertical movement, the following table is for the z-axis:

Gesture	H variable	Data sent to the PC
Hand tilted more than 40 degrees to the left	$H > 290$	20 (the mouse goes to the left, speed 3)
$25 < \text{tilt} < 40$ , left	$275 < H < 290$	16 (left, speed 2)
$10 < \text{tilt} < 25$ , left	$260 < H < 275$	12 (left, speed 1)
Vert. position $\pm 10^\circ$	$250 < H < 260$	0 (no move)
$10 < \text{tilt} < 25$ , right	$235 < H < 250$	13 (right, speed 1)
$25 < \text{tilt} < 40$ , right	$200 < H < 235$	17 (right, speed 2)
$40 < \text{tilt}$ , right	$H < 200$	21 (right, speed 3)

With the touchpad, we retrieve the information from register number 14, on the I2C bus:

Gesture	I2C data	Data sent to the computer
No gesture	0x 00	0 (no move)
Click and Hold	0x 11	50 (refocusing the mouse on the PC screen)
Down Swipe	0x 31	11 (down, speed 1)
Down Swipe & Hold	0x 32	19 (down, speed 2)
Right Swipe	0x 41	13 (right, speed 1)
Right Swipe & Hold	0x 42	21 (right, speed 2)
Up Swipe	0x 51	10 (up, speed 1)
Up Swipe & Hold	0x 52	18 (up, speed 2)
Left Swipe	0x 61	12 (left, speed 1)
Left Swipe & Hold	0x 62	20 (left, speed 2)

### 4. Conclusion

After demonstration in front of a physiotherapist, the option with the touchpad is the best alternative because it puts less strain on the wrist. This new mouse can be coupled to a conventional mouse, thus allowing to vary postures and therefore minimize the risk of WRMSDs.

### 5. References

- [1] MTCH6102 specifications (touchpad processor)
- [2] adxl335 specifications (accelerometer)
- [3] MakeBlock Bluetooth Module.