

“THE WAND” – A 3-DIMENSIONAL GENERAL-PURPOSE MOUSE

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Abstract

In this generation of such advanced computational devices which have evolved so much in the past decade mouse, the one device that we daily use hasn't changed much and is still stuck in 2-D axis even though its purpose has been upgraded for a 3-D environment. This is a huge limitation for many designers, developers and for the people who often travel for their work because for the designers and the developers (game developers) the environment that they use 3-D

In this paper, I want to introduce a 3-Dimensional mouse technology which can produce and use coordinates in all the 3-Dimensions X, Y & Z with the help of an Accelerometer, 2-Bluetooth module and 2-Micro Controllers

Keywords: 3-Dimensional mouse, Accelerometer, Bluetooth module, Micro Controller

1. INTRODUCTION

The people who use the computer for professional designing purposes such as Civil/Mechanical Engineers, fashion Designers, game developers and so on have always faced a problem with the current 2-D mouse and it has taken them a lot of time to get used to doing their work (i.e. designing in 3-D environment using this 2-D mouse) with the conventional mouse.

This new technology when implemented will not only ease their work and also help many casual users who use it for multimedia purposes. This will enhance the fun in gaming and will also help a lot of people.

The gesture control in this technology will also allow the users to switch between currently opened applications or open new applications or close the currently existing applications.

Hence this technology is much better than the current conventional mouse and not only beats it in every aspect but also has many additional features which reduce the human work required for a mundane task.

The 3-D mouse when used for general purposes it works on the X & Y axis unlike our current mouse's which work on the X & Z axis and with the help of the accelerometer which is used in this device when the user needs to work with a 3-D environment he can do it with ease since with the help of an accelerometer we will be able to read all three coordinates of X, Y & Z.

These coordinates are transmitted and calibrated with the help of Bluetooth modules and ATMEGA328 MC

2. WORKING

2.1 Components

1. Bluetooth Module

2. Atmega328
3. Accelerometer
4. USB male Pin

2.1.1 Bluetooth Module

HC-05 Bluetooth Module is an easy-to-use Bluetooth Serial Port Protocol module, designed for transparent wireless serial connection setup. ^[1] HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data. ^[1]



Fig.[a]: HC-05 modules

There are 2 HC-05 modules used for this device which are connected in the master-slave configuration. The HC-05 Module with the Master Config Is connected to an MC with the Accelerometer. The coordinates from the accelerometer are processed in the MC and transmitted to the HC-05 module

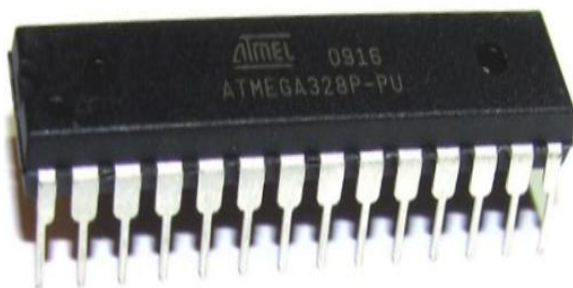
Table-1: HC-05 Pin configuration table

Pin	Description	Function
V _{cc}	+5v	Connect to +5v
GND	Ground	Connect to Ground
TXD	UART_TXD Bluetooth Serial Signal sending pin	Connect with MCU's (Microcontrollers and etc...) RXD pin
RXD	UART_RXD Bluetooth Serial Signal receiving pin	Connect with MCU's (Microcontrollers and etc...) TXD pin
KEY	Mode Switch Input	If the input is low or left unconnected, the module is in paring mode or communication mode. If the input is high then the module will enter AT mode

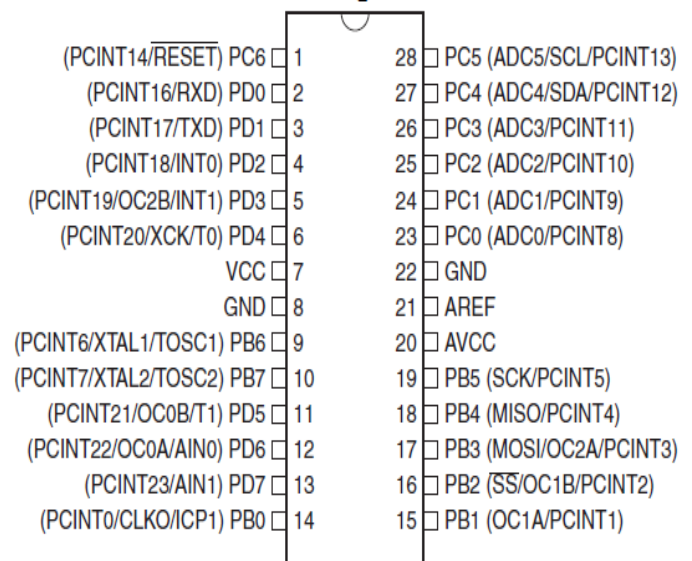
This Master Module sends this information to the Slave config module which is connected to the MC with USB male pin. The X, Y&Z coordinates received by the Slave module is transmitted to the MC

2.1.2 ATMEGA328

The Atmega328 is a high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device executes powerful instructions in a single clock cycle, balancing power consumption and processing speed.^[3]

**Fig.[b]:** ATMEGA328

Atmega328

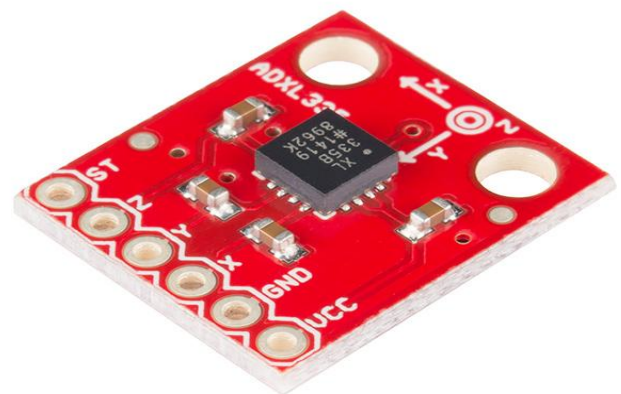
**Fig.[c]:** ATMEGA328 pin-out

The ATMEGA328 connected to the accelerometer calibrates the Accelerometer and also reads the input from various buttons and Compute their respective actions

The ATMEGA328 connected to the Slave Bluetooth module on reception of the coordinates transmits them

To the USB male pin which is in serial communication with the respective computer

2.1.3 Accelerometer (ADXL335):

**Fig.[d]:** ADXL335

The ADXL335 is an accelerometer which is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs.^[6] The product measures acceleration with a minimum full-scale range of ± 3 g.^[6] It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.^[6]

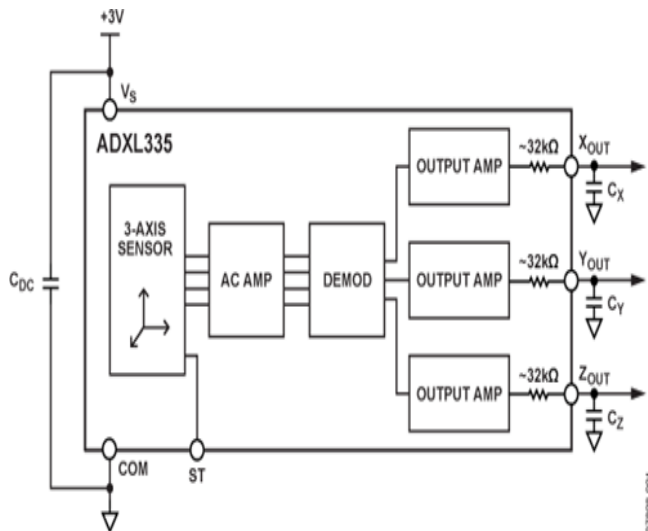


Fig.[e]: ADXL335 block diagram

The accelerometer or the gyroscope plays a key role in this device it consists of triple axis sensor which generates current on motion. This current is demodulated and differentiated into 3 output currents X_{out} , Y_{out} , Z_{out} . These output currents are received by the Microcontroller which are then calibrated into X, Y & Z axis coordinates and transmitted with the help of Bluetooth module.

2.1.4 USB Male Pin

The easiest way to connect computer peripherals is through a Universal Serial Bus.^[7] The USB is a plug-and-play interface between the PC and the peripherals.^[7]

The main advantage of USB is that the device can be plugged in or plugged out without the need of restarting the PC.^[7]



Fig.[f]: USB Male pin

The USB cable has 4 wires to connect the A-type connector

- Pin1 - +5V
- Pin2 - D-
- Pin3 - D+
- Pin4 - GND

This USB male pin is connected to the ATMEGA328(MC) which receives the calibrated coordinates from the Slave Bluetooth module

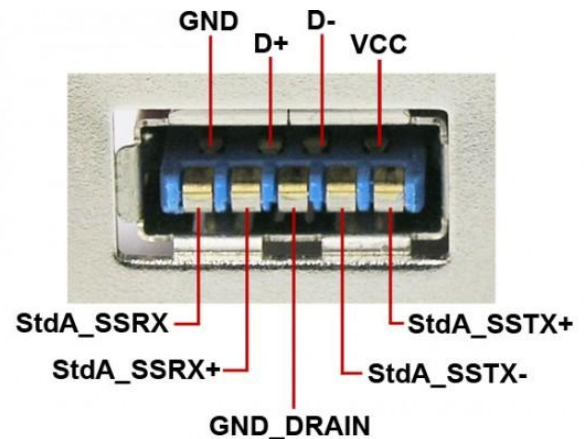


Fig.[g]: USB Male pin configuration

These coordinates are transmitted to the computer via serial communication by connecting the USB male pin to the serial communication port of the user's computers

2.2 Principle

2.2.1 Calibration and Transmission

The Device is two parts:

- 1) Handheld device
- 2) Serial communicator

2.2.1.1 Handheld Device

The handheld device consists of

- ATMEGA328
- ADXL335
- HC-05(MASTER CONFIG)

When this handheld device is moved the accelerometer transmits the X, Y and Z coordinates to the ATMEGA328(MC) which process these signals, calibrate them and transmit the coordinates with the help of Bluetooth module in the master configuration to the Bluetooth module in the slave configuration

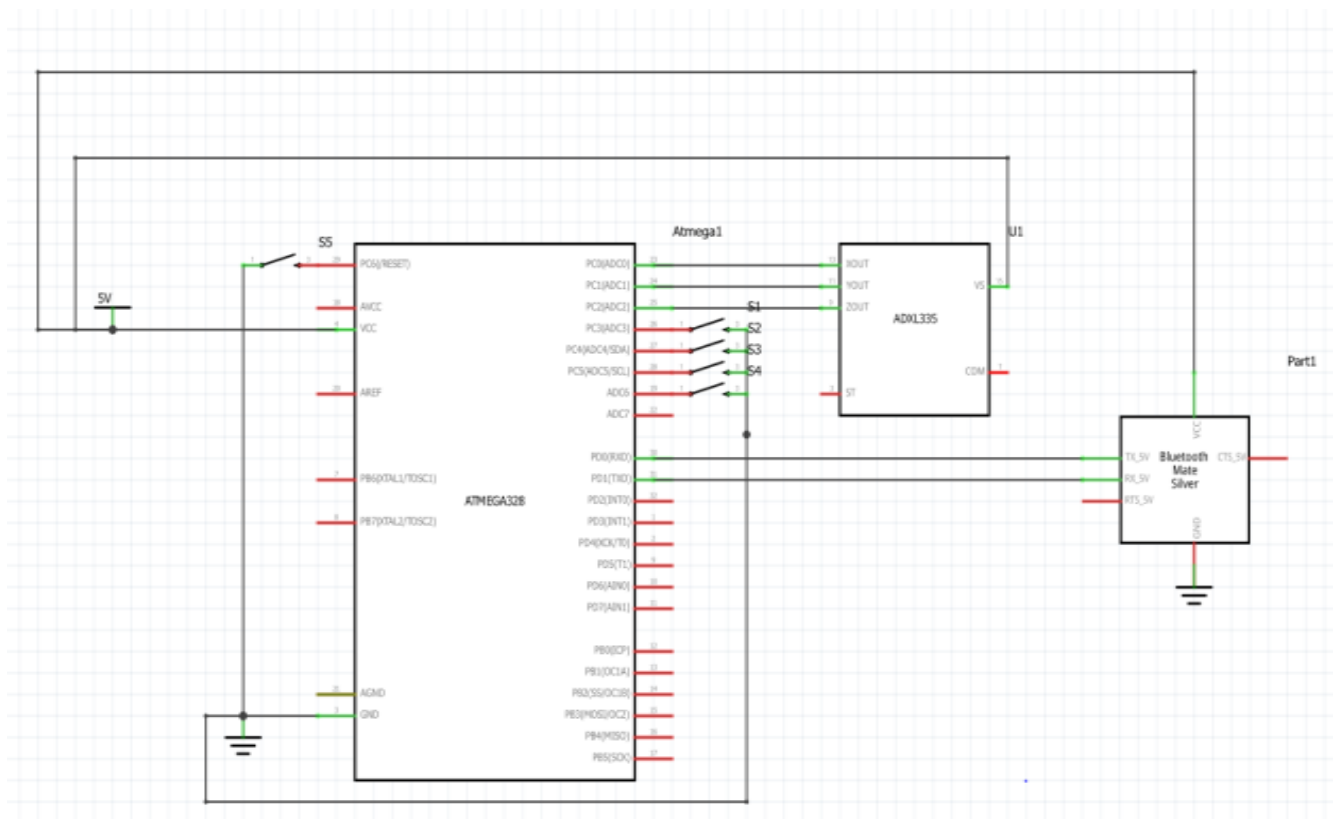


Fig.[h]: Circuit diagram of Handheld device

Once the Bluetooth module in slave configuration receives these coordinates it sends the information to the computer through serial communication port with the help of a USB male pin

This is a huge limitation for many designers, developers and for the people who often travel for their work because for the designers and the developers (game developers) the environment that they use 3-D

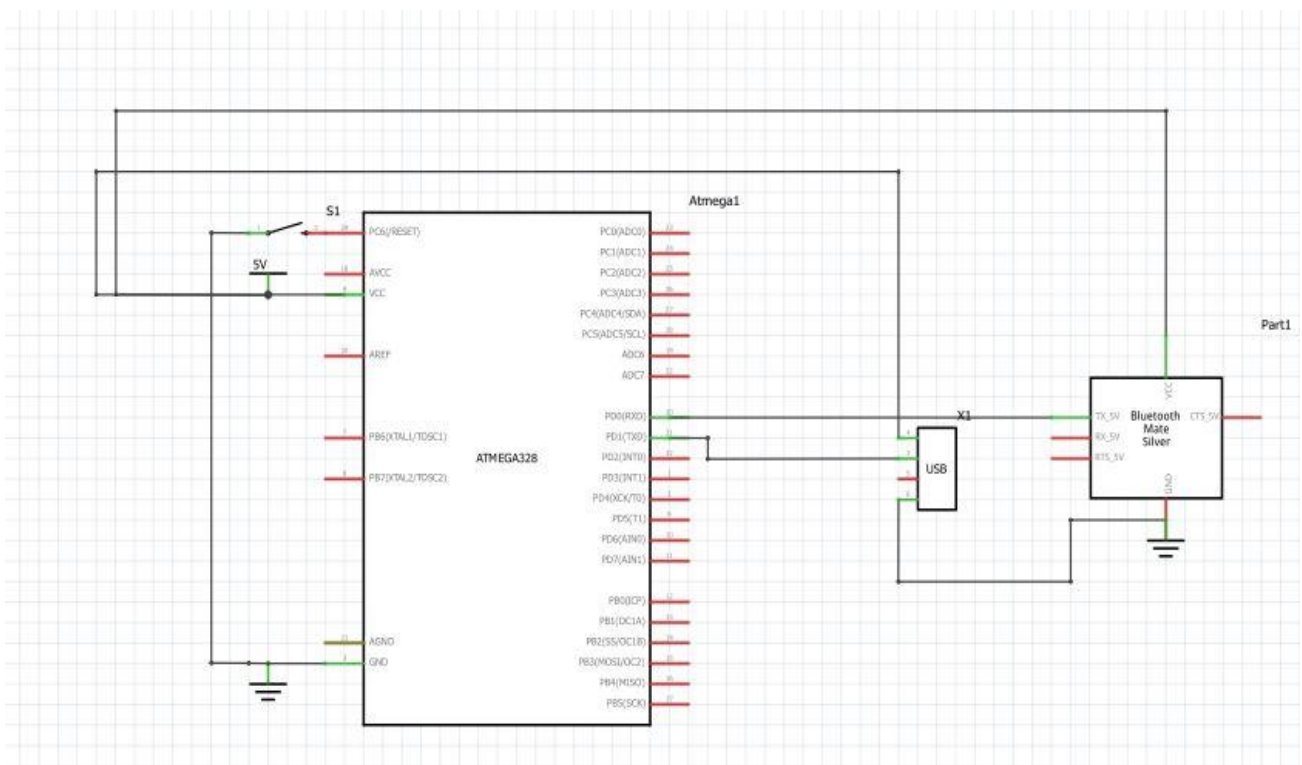


Fig.[i]: Circuit diagram of Serial communicator

With the use of a custom-made Driver software of developed with the help of Microsoft Visual Studio The mouse pointer receives the coordinates and each button's actions are defined and executed accordingly

2.2.2 Functionality

- 1) Mouse Move
- 2) Right Click
- 3) Left Click
- 4) Scroll
- 5) Gesture Control
- 6) Reset

2.2.2.1 Mouse Move

The Accelerometer ADXL335 which is in the handheld device generates 3 different currents on movement. Each of these currents are used to calibrate coordinates of X, Y and Z axis. These coordinates are sent to the computer through a

combination of wireless and wired serial communication and these coordinates are assigned to the mouse pointer with the mouse pointer or cursor with the help of the custom-made driver software

Unlike the traditional mouse the 3d mouse works on the X & Y axis hence the user will just have to hold the device in their hands and moving up, down, right and left according to the direction of movement required and the cursor will move along with their hands

2.2.2.2 Right Click

The Button1 i.e. the first button from the top end of ATMEGA328 has the right click function of the conventional mouse you can do all the operation that are available for the right click button of the conventional mouse

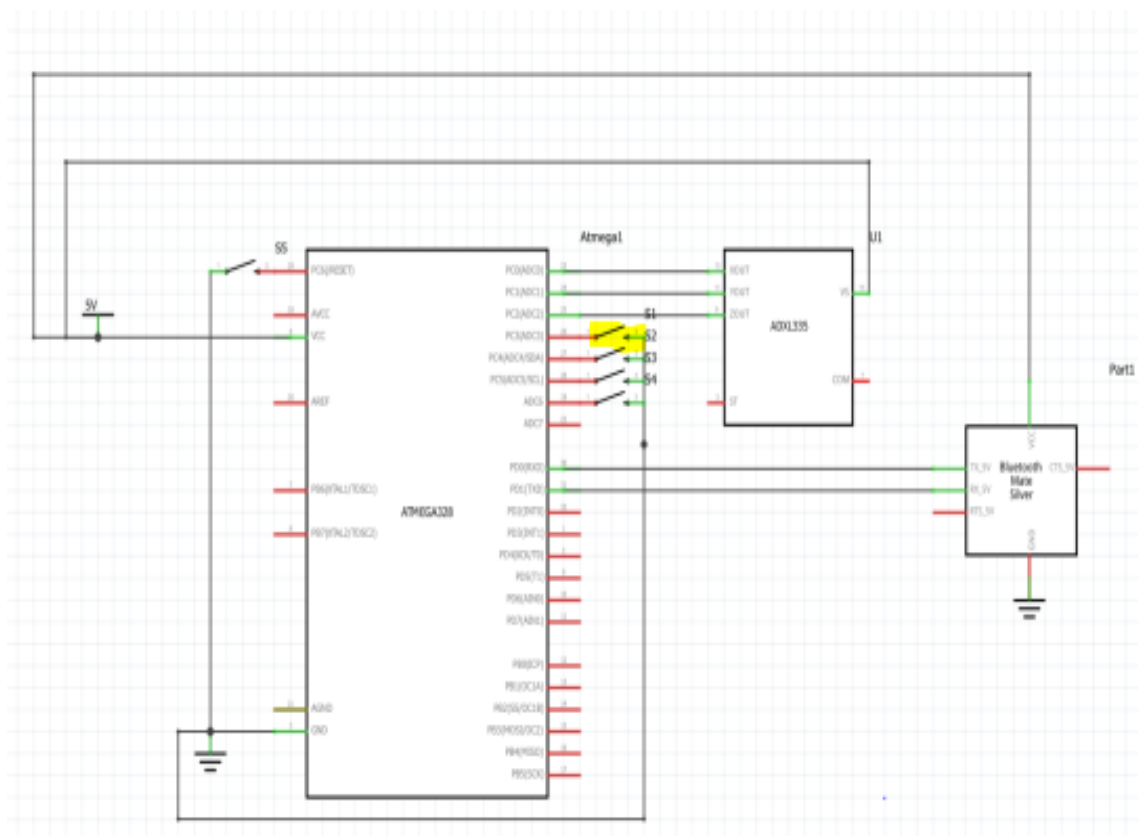


Fig.[j]: Circuit Diagram with Button1 highlighted

2.2.2.3 Left Click

The Button2 i.e. the second button from the top of ATMEGA328 has the exact same operations as the left click button of the common mouse which is currently in use

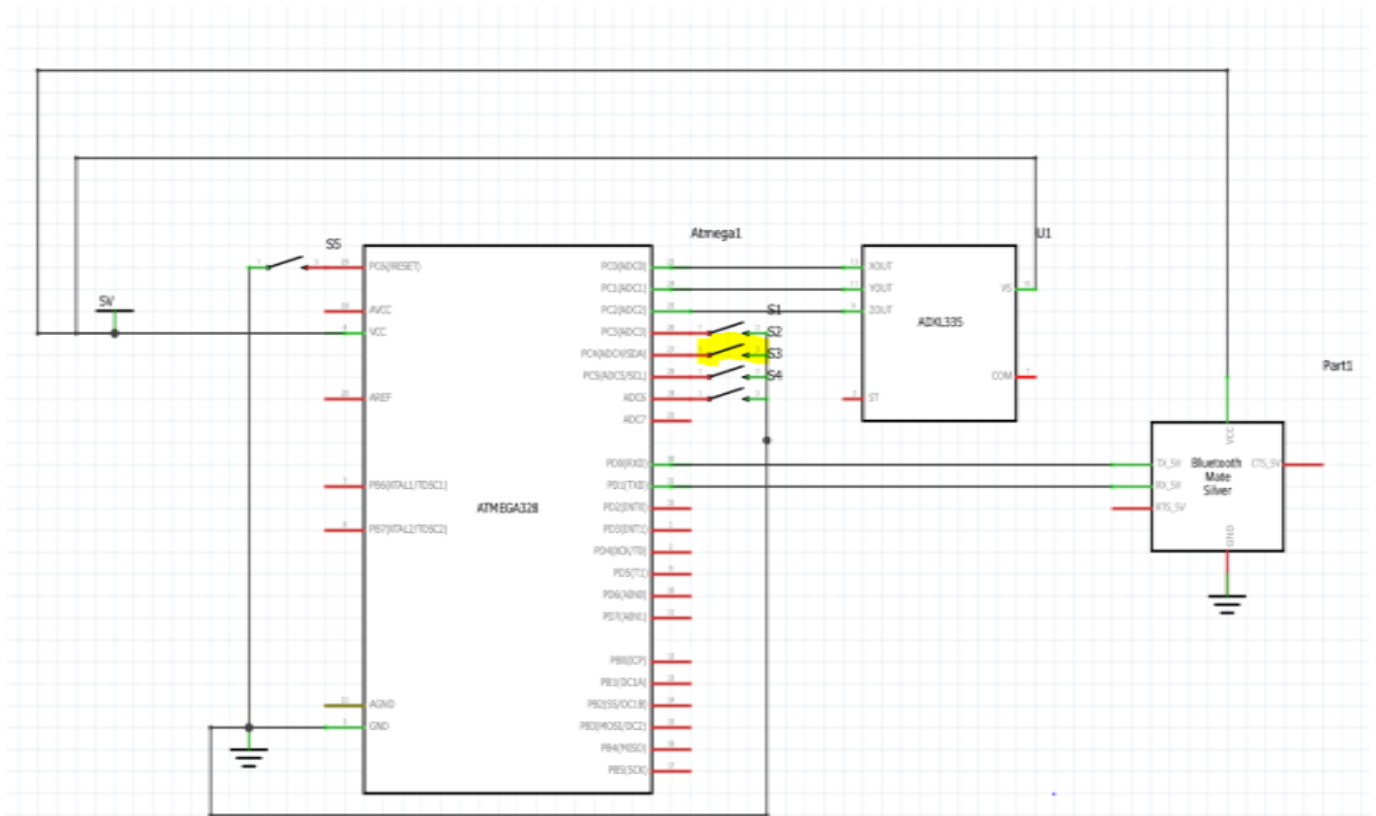


Fig.[k]: Circuit Diagram with Button2 highlighted

2.2.2.4 Scroll

Unlike the current mouse's which generally use a scroll wheel for scrolling action in this technology, the button4 is associated with scrolling. To do the scrolling action the user

has to press button4 i.e. the 4th button from the top of ATMEGA328 and just move his hand up or down depending on the direction they want to scroll

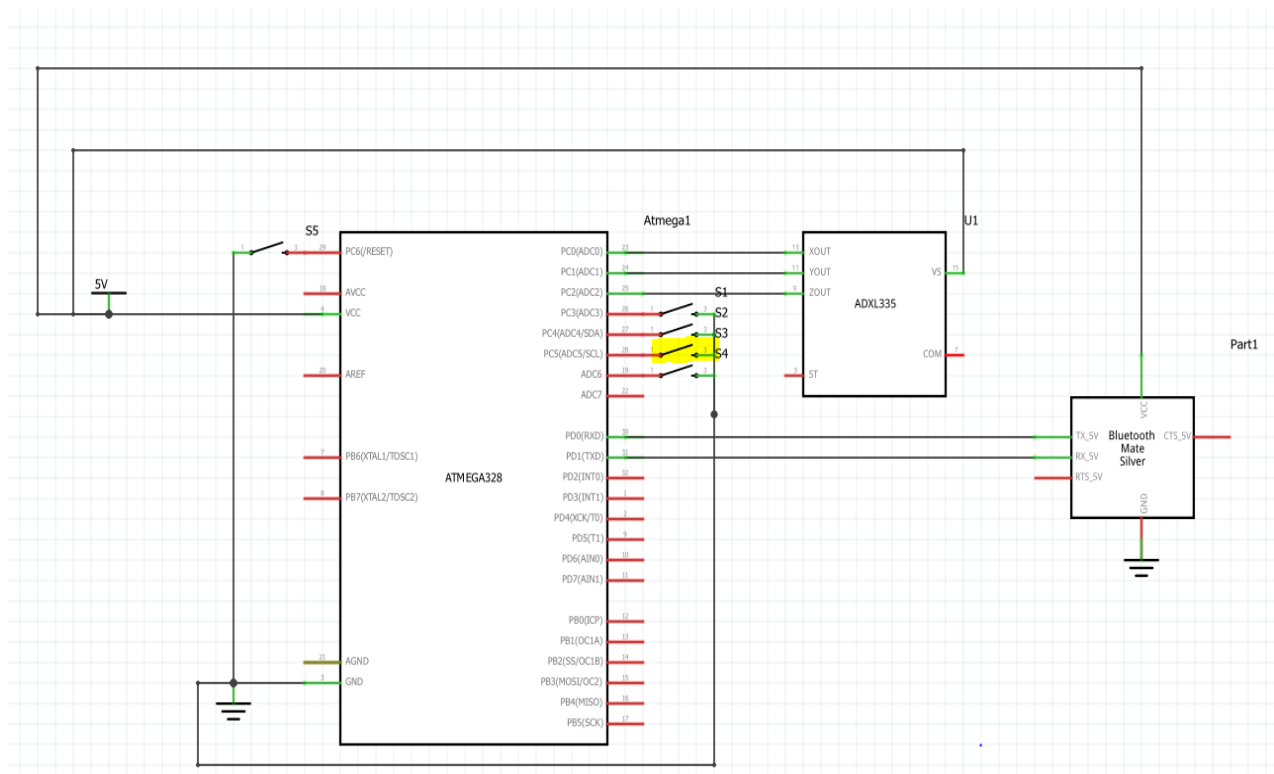


Fig.[l]: Circuit Diagram with Button3/Scroll button highlighted

2.2.2.5 Gesture Control

This is a new feature of this Device that is not found in a common mouse

This feature eases the required effort needed to be put in by the user to use the computer. This feature can be activated

by the pressing button5 or the 5th button from the top of MC. Once the user presses the button makes a gesture the respective application is opened or the currently open application is closed

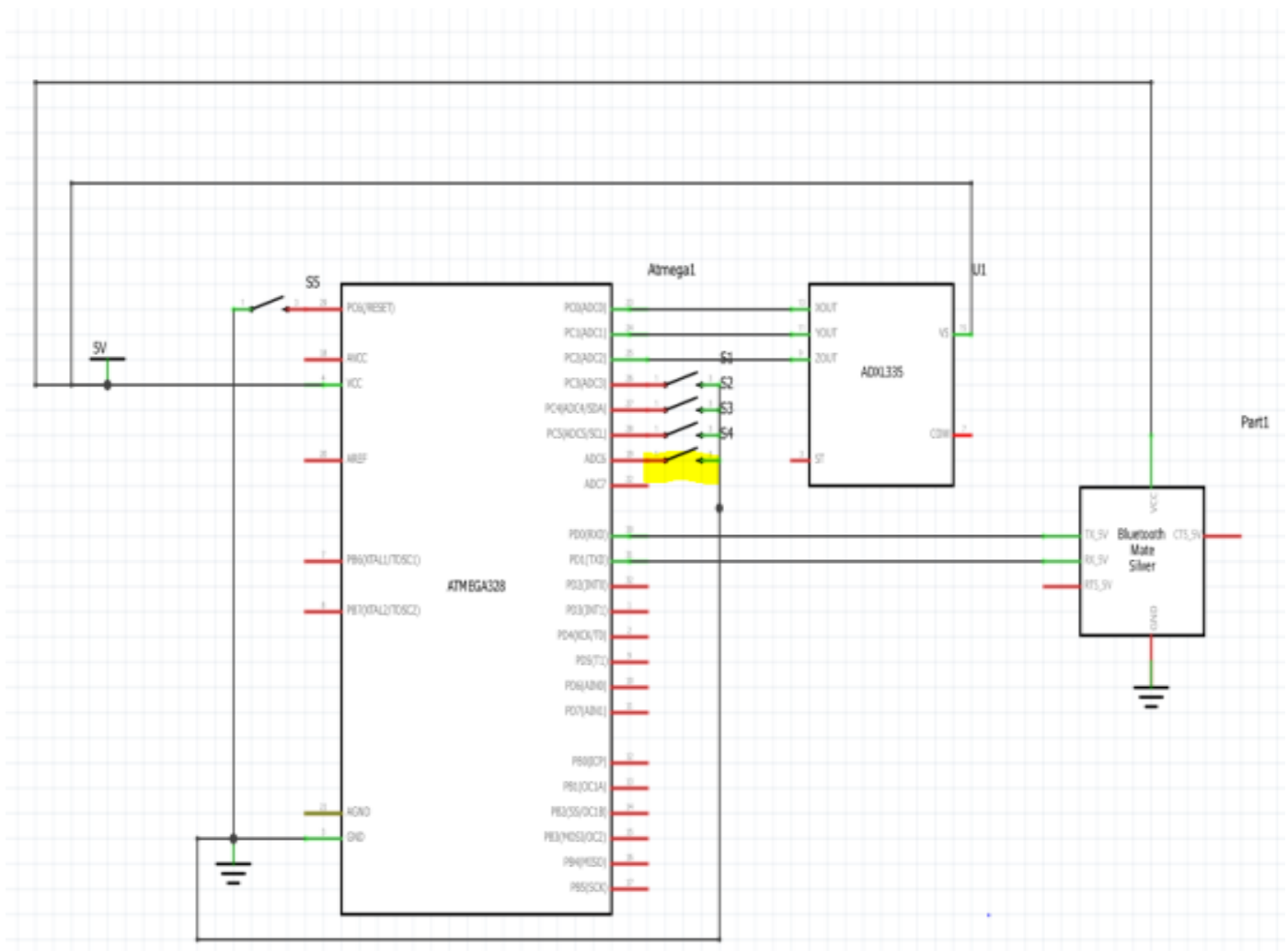


Fig.[m]: Circuit Diagram with Button4/Gesture control button highlighted

For example, if a user presses the button5 and makes the gesture as drawing the letter 'M' in mid-air it would open his emails and if he just holds the button at the top edge of an open application and drags it down it closes the application and the user can assign an application of his choice to each of the predetermined gestures

All these actions will be made possible with the help of accelerometer and the custom driver software developed for this Device

2.2.2.6 Reset

The reset button is available on both the MC's in case of any loss of connection between the Bluetooth module's or any error in the execution of operations

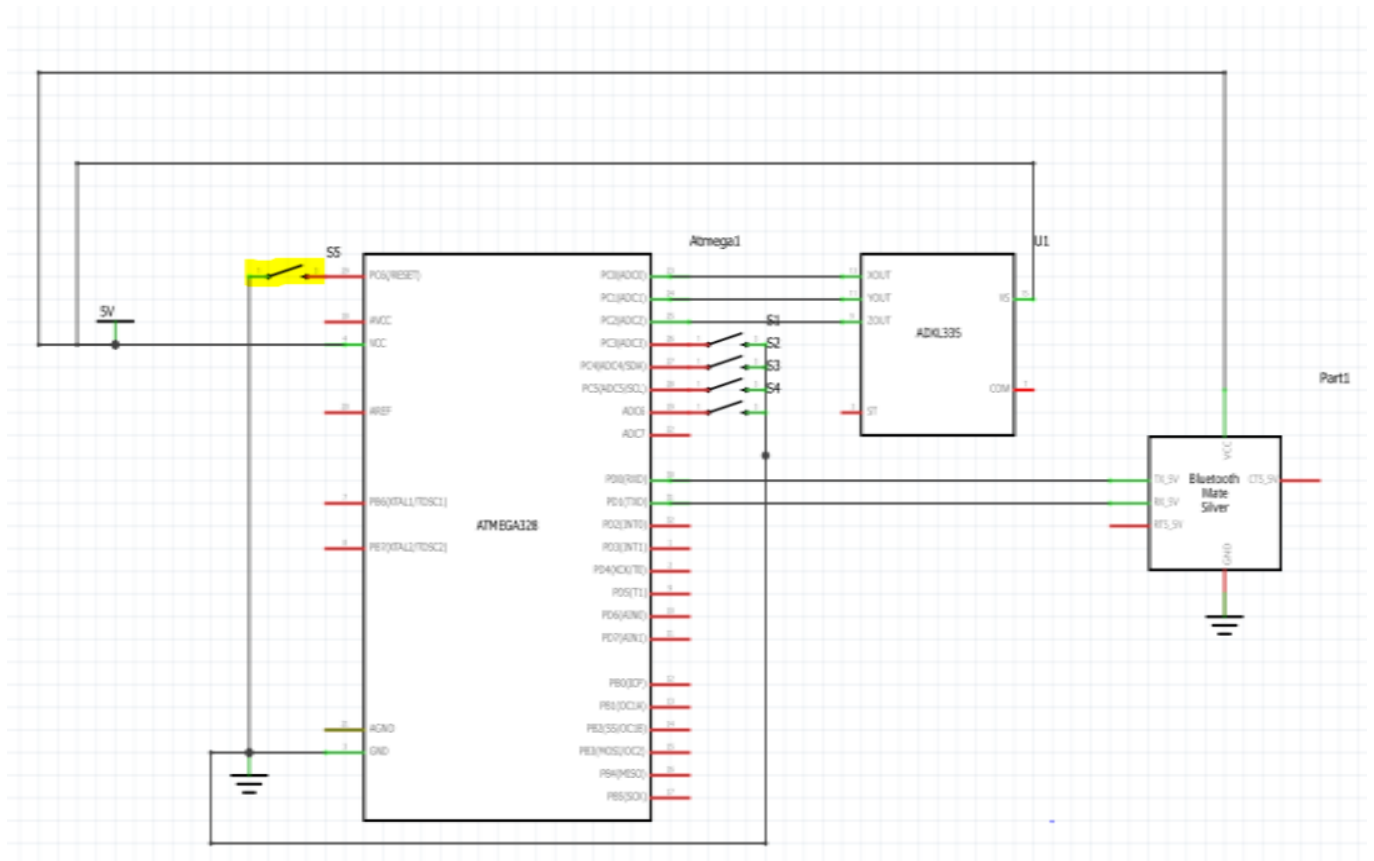


Fig.[n]: Circuit Diagram with Reset button highlighted

3. APPLICATIONS

- This device will ease the effort required by the user to put into use their computer
- This device will be a huge help to the All the users who work with 3D environments such as Engineers, Architects, Game developers, Animators and so on
- This device will be helpful all types of professional environments because of its 3-Dimensional flexibility and gesture control

4. CONCLUSION

There have been many advances made in the mouse which were custom made for a singular use and even then there have been many custom mouse's which had very complex working which was not easily followed by the user or they were really costly and a normal user could not afford them. This mouse is both easy to use, user-friendly and will be extremely cheap (11-12 USD approximate Estimation)

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BIOGRAPHIES



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