1.Old Computers

MITS Altair 8800

Input-front panel switches

Output- front panel LEDs

Minimum RAM- 256 bytes

Maximum RAM- 64K

CPU- Intel 8080, 2.0MHz

MOS KIM-1

Input- on-board hexadecimal keypad

Output- 6 digital LED display

Minimum RAM- 4 K

Maximum RAM- 1024 bytes

CPU- MOS 6502, 1MHz

Apple 1

Input- Cassette Board

Output- toggle switches and indicator lights red LEDs

Minimum RAM- 4 KB

Maximum RAM- 8KB or 48 KB

CPU- 1 MHz 6502

IBM Personal Computer (PC) 5150

Input- IBM Model F 83-key keyboard with five-pin connector

Output- IBM 5151 monochrome display

IBM 5153 color display
Composite-input television

Minimum RAM- 16KB

Maximum RAM- 64 KB (expandable to 256 KB)

CPU- Intel 8088, 4.77MHz

Apple Macintosh

Input- Two DB9 serial ports
Printer port
External floppy port

Output- 9-inch monochrome screen 512x342 pixels

Minimum RAM- 128K

Maximum RAM- 512 K

CPU- Motorola 68000 (8MHz)

2.Base Conversion

Decimal -	$(1)_{10}$,	$(10)_{10}$,	$(42)_{10}$,	$(255)_{16}$
Binary -	$(1)_2$,	$(1010)_2$,	$(101010)_{10}$,	$(11111111)_2$
Hexadecimal -	$(1)_{16}$,	$(A)_{16}$,	$(2A)_{16}$	$(FF)_{16}$
Octal -	$(1)_8$,	$(12)_8$	$(52)_8$,	$(377)_8$

Decimal to binary =

128 64 32 16 8 4 2 1

1 = 1

1→

1 0 1 0 = 10

10→

1 0 1 0 1 0 = 42

42→

255→ 1 1 1 1 1 1 1 1 = 255

Decimal to Hexadecimal -

$16 \underline{|\,1\,}$ 1, 0 $\quad (1)_{10} \rightarrow (1)_{16}$

$16 \underline{|\,10\,}$ A, 0 $\quad (16)_{10} \rightarrow (A)_{16}$

$16 \underline{|\,42\,}$ A, $16 \underline{|\,32\,}$ 2, 0 $\quad (42)_{10} \rightarrow (2A)_{16}$

$16 \underline{|\,255\,}$ F, $16 \underline{|\,240\,}$ F, 0 $\quad (258)_{10} \rightarrow (FF)_{16}$

Decimal to Octal

$8 \underline{| 1 \quad} 1$
$\quad 0$

$(1)_{10} \to (1)_8$

$8 \underline{| 10 \quad} 2$
$8 \underline{| 8 \quad} 1$
$\quad 0$

$(10)_{10} \to (12)_8$

$8 \underline{| 42 \quad} 2$
$8 \underline{| 5 \quad} 5$
$\quad 0$

$(42)_{10} \to (52)_8$

$8 \underline{| 255 \quad} 7$
$8 \underline{| 248 \quad} 7$
$\quad 31 \quad 3$

$8 \underline{| 255 \quad} 7$
$8 \underline{| 31 \quad} 7$
$8 \underline{| 3 \quad} 3$
$\quad 0$

$(255)_{10} \to (377)_8$

Hexadecimal to Decimal

$(F)_{16} = (15)_{10}$

F
$\hookrightarrow 15 \times 16^0$

$(DF)_{16} = (223)_{10}$

$\hookrightarrow 15 \times 16^0$
$\hookrightarrow 13 \times 16^1$

$(DF)_{16} = (13 \times 16) + (15 \times 1)$
$= 208 + 15$
$= (223)_{10}$

$(81)_{16} = (129)_{10}$

$= (10000001)_2$

128	64	32	16	8	4	2	1
1	0	0	0	0	0	0	1

1 0 0

$(04)_{16} = (4)_{10}$

$= (00000100)_2$

$(F)_{16} = (1111)_2 = (17)_8$

$$\begin{array}{cc} 001 & \boxed{111} \\ \downarrow & \downarrow \\ 1 & 7 \end{array}$$

$(DF)_{16} = (11011111)_2$

$$= \begin{array}{ccc} 011 & 011 & 111 \\ \downarrow & \downarrow & \downarrow \\ 3 & 3 & 7 \end{array}$$

$= (337)_8$

$(81)_{16} = (10000001)_2$

$$= \begin{array}{ccc} 010 & 000 & 001 \\ \downarrow & \downarrow & \downarrow \\ 2 & 0 & 1 \end{array}$$

$= (201)_8$

$(04)_{16} = (100)_2$

$\downarrow$

$(4)_8$

Binary to Decimal to hexadecimal

10010011

$= (1\times2^7)+(0\times2^6)+(0\times2^5)+(1\times2^4)+(0\times2^3)+(0\times2^2)+(1\times2^1)$
$+ (1\times2^0)$

$= 128+16+2+1$

$= (147)_{10}$

$$\begin{array}{r|l l} 16 & 147 & 3 \\ 16 & 9 & 9 \\ & 0 & \end{array}$$

$(147)_{10} = (93)_{16}$

$(111\ 111)_2$

$= (1\times2^5)+(1\times2^4)+(1\times2^3)+(1\times2^2)+(1\times2^1)+(1\times2^0)$

$= 32+16+8+4+2+1$

$= (63)_{10}$

$$\begin{array}{r|l l} 16 & 63 & F \\ 16 & 3 & 3 \\ & 0 & \end{array}$$

$(63)_{10} = (3F)_{16}$

$(81)_{16} = (129)_{10}$

1×16^0

8×16^1

$(81)_{16} = (8 \times 16^1) + (1 \times 16^0)$

$= 128 + 1$

$= (129)_{10}$

$(04)_{16} = (4)_{10}$

$(04)_{16} = (0 \times 16^1) + (4 \times 16^0)$

$= (4)_{10}$

Hexadecimal to binary → binary to octal

8 4 2 1

1 1 1 1

$(F)_{16}$ $(15)_{10}$ $F = (1111)_2$

$DF = (11011111)_2$

DF

D → 1101

F → 1111

Binary to Octal

10010011

$$\underset{\downarrow \atop 2}{010} \quad \underset{\downarrow \atop 2}{010} \quad \underset{\downarrow \atop 3}{011}$$

$$(10010011)_2 = (223)_8$$

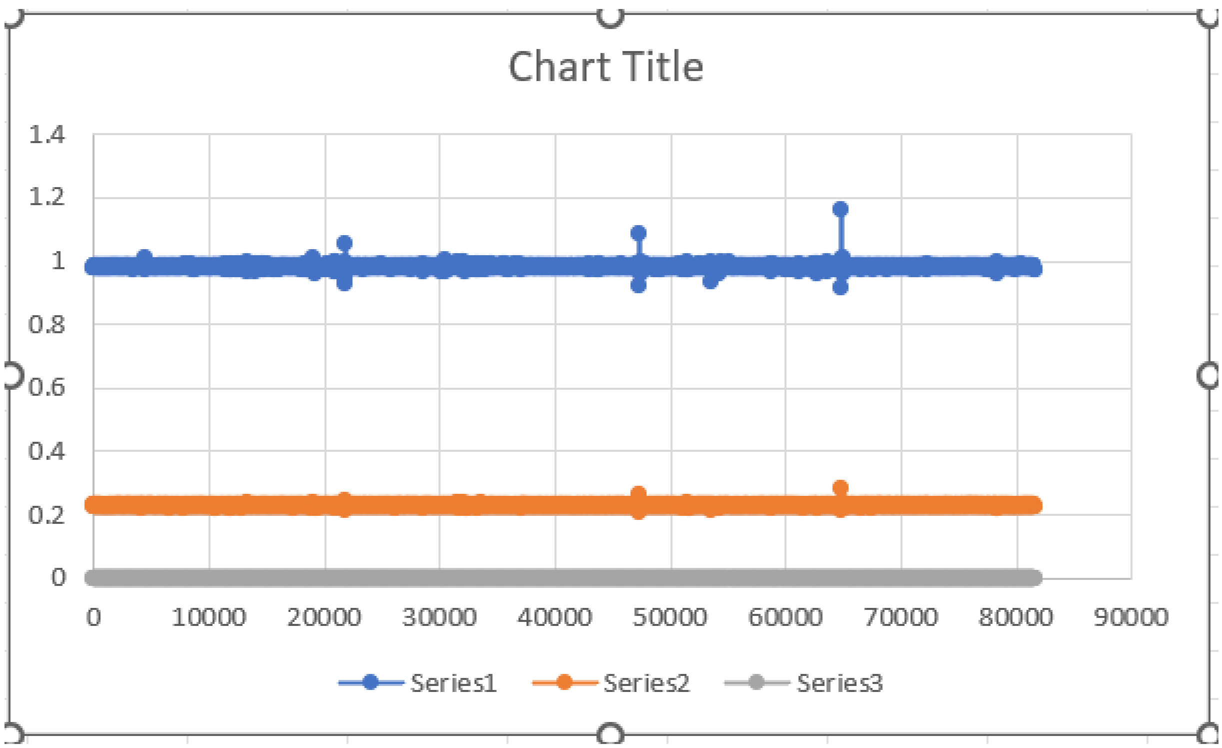
$$\underset{\downarrow \atop 7}{\underline{111}} \quad \underset{\downarrow \atop 7}{\underline{111}} \qquad (111111)_2 = (77)_8$$

3. Exploration

I think each column data here presents the initial movement of joystick’s buttons. As I recorded this graph during using joystick's button up,down,right and left. The graphical representation helps us to understand the situation much better. By measuring the changes of joystick's each of the buttons' movement we can represent the data on the microsoft excel sheets.

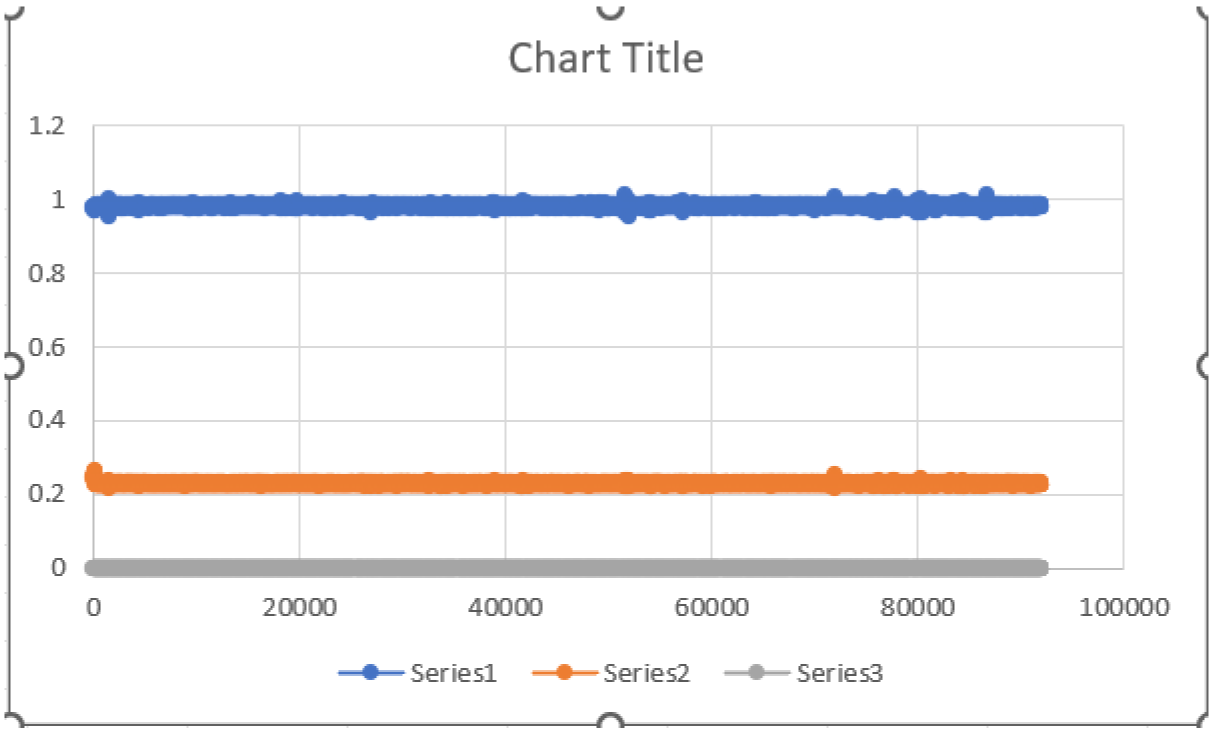
The flags are the source for datapath and helps us to understand the pad movement. The joystick's input handling depends on these flag changes. It changes when an axis changes into itself. When a joystick is moved , a message is relayed to the device always. Afterwards, it triggers a corresponding movement.

Since I recorded all the data in the excel sheets it is measured in inches and pixels. There are columns, rows, and the graduation of horizontal and vertical sheet rulers. These are the items which is used while recording joystick's movement. Moreover, the graph chart shows that it has divided the whole situation into 3 parts. All 3 series illustrate the movement of the buttons.



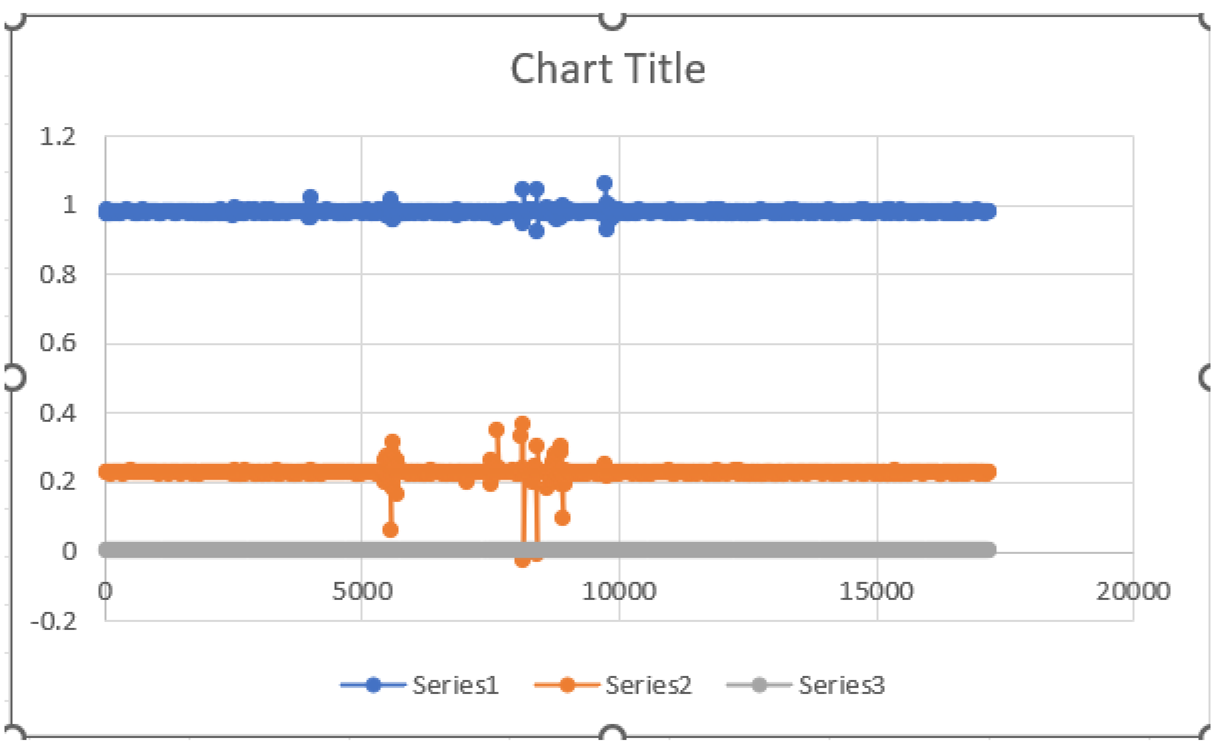
Flat-1

In flat-1 the graph's both series is close enough to a flatline, as the joystick's button pad had not been moved too much. It illustrates the upward and downward movement of that moment.



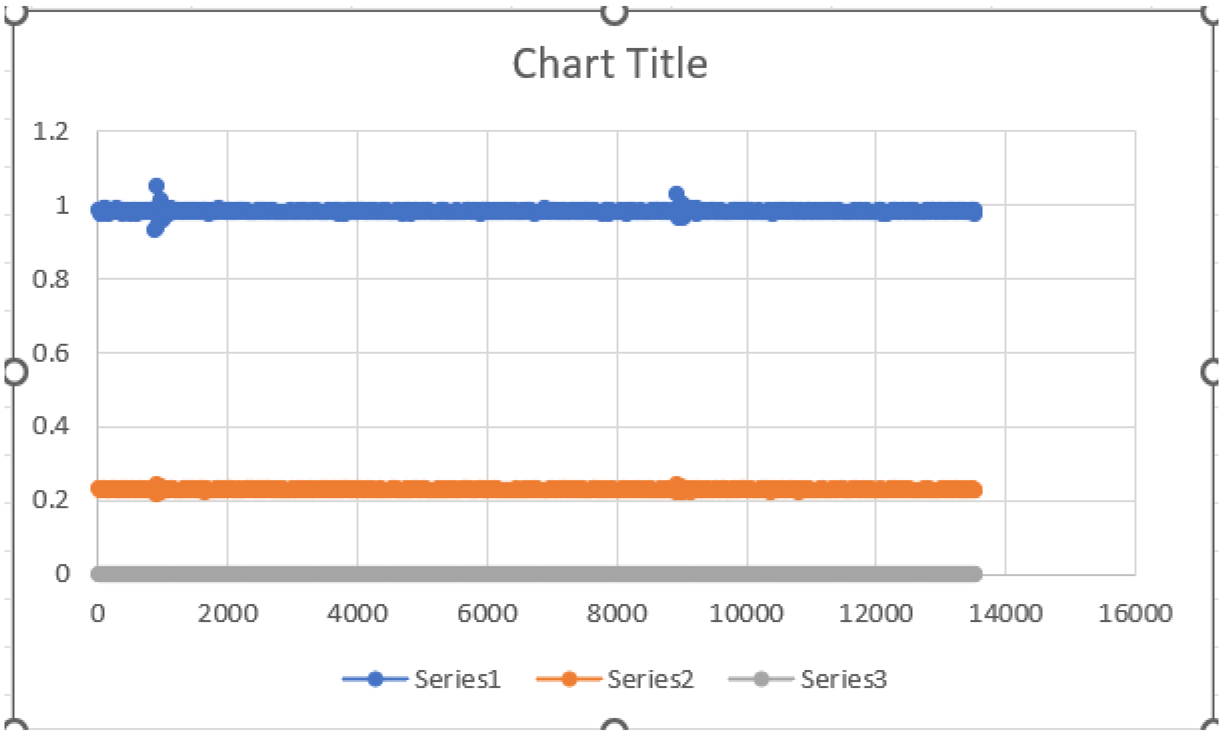
Flat-2

This graph shows us also similar flat lines like flat-1. The points are more stable and in a flatline than the other one. Here the joysticks's right and lift side movement is mentioned.



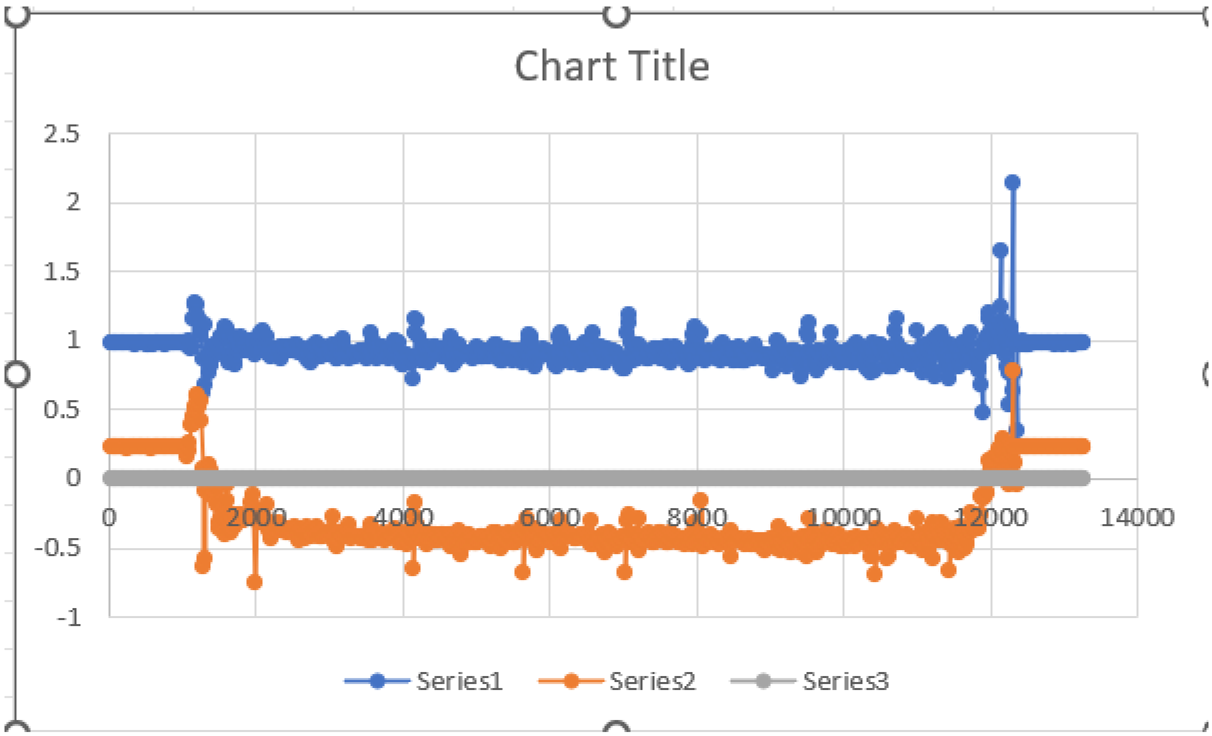
Front-1

From this graph we can see the pad movements of joystick's. Each point shows the changes of movement for that particular time-being. Moreover, an important topic to be noted that the orange one (series-2) fluctuated more than series-1.



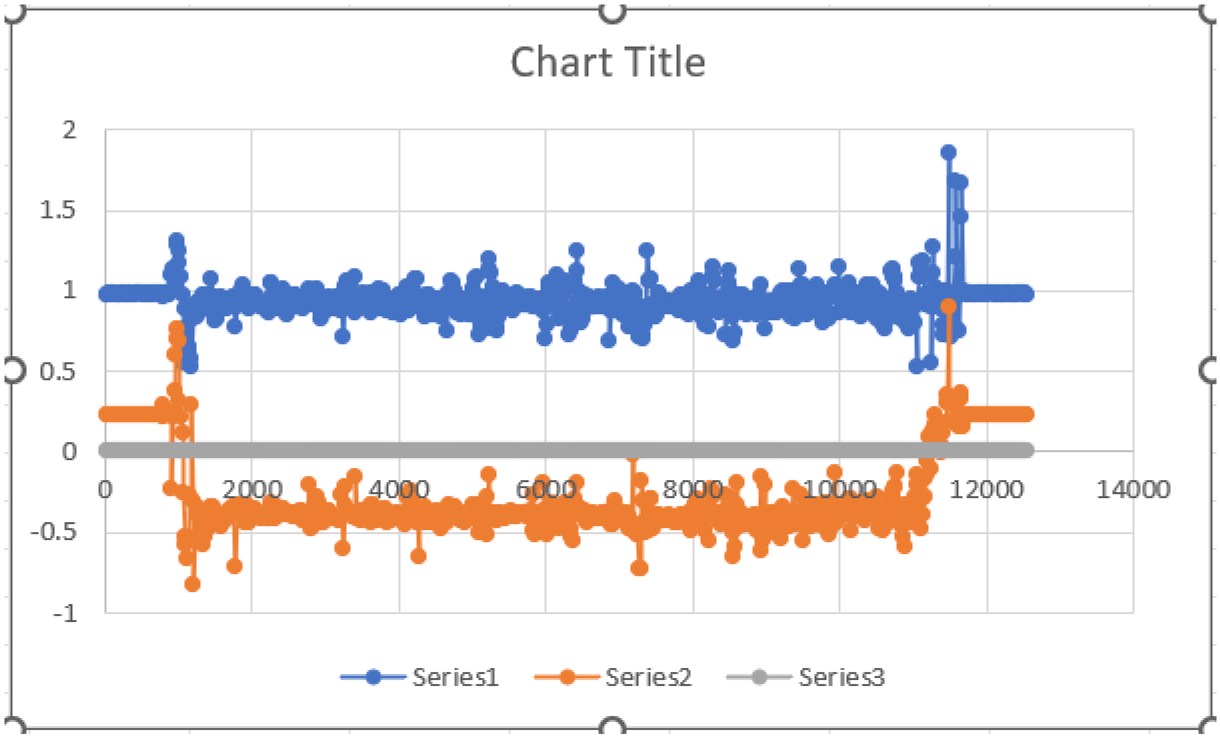
Front-2

In this section the chart title represents that both series-1 and series-2 almost nearer to flatline. But there are some points which helps us to know that there was a little bit of movement on that time. Series-1 fluctuate a little bit more than the orange one.



Custom-1

Whie recording custom-1 both right and left joysticks's were moved randomly. This is why the blue (series-1) and the orange (series-2) fluctuated a lot. Moreover the flatline for series 3 is because of the buttons were in the center position. When those button pads were in the center the series was close enough to 0. And for the other movement it stayed between +1 to -1.



Custom-2

From the custom-2 graph we can describe about the changes of each button's random movements. The grey flatline which is nearer to 0 stays stable when the button pad is in the center position. Besides, series-1 and series-2 show up the flactuation. The most noticiable factor here rather than other graphs here is the series-1crossed 1.5 at some points. On the other hand series-2 also crosses 0 and reach the positive side. This is the most fluctuated graph among all of these.

4.Joystick Calibration

1. The vertical and horizontal joystick equations are partially similar. They are not completely similar among themselves. There are little bit of changes among themselves.

2. At the center point all the graphs showed flatline on 0. While we take the button pad to center it is supposed to be 0 as it is not moving or committing any work.

3. When the joystick's button pad remains on the center, the graph always show a 0 flatline. When we stable the center point the button is at rest. It is not doing any command or work or moving horizontally or vertically that is why the it shows a 0 everytime.

4. If the internal mechanism of button changes and replaced with those points the outcome might be different.