

# Distance Sensor (sharp 0A41sk f 54)

\*\*\*\*\* I have used Python Programming to compute all the mathematical parameters and graphical representation as well.

## **ACCURACY MEASUREMENT:-**

**Absolute error** in a measurement  $a_1$  is given by  $\Delta a_1 = |a_m - a_1|$ , In general we say that the absolute error in the  $a_n = \Delta a_n = |a_m - a_n|$

**Mean Absolute Error:** If  $\Delta a_1, \Delta a_2, \Delta a_3 \dots a_n$  are the absolute errors in  $a_1, a_2, a_3, \dots a_n$ , then ,

**Mean Absolute Error** =  $[|\Delta a_1| + |\Delta a_2| + |\Delta a_3| + \dots + |a_n| ]/n$

**Relative error** = (Mean absolute error)/  $a_m$

**Here**  $a_m$  is measurements at 5, 10, 20, 30, 40, 50 cm.

$a_1, a_2, a_3 \dots a_n$ : Data obtained by distance sensor measurement at 5, 10, 20, 30, 40, 50 cm respectively

## **# 5 cm**

AVERAGE= 7.296567944857139

MEDIAN= 7.302109756

VARIANCE= 0.0002172346841282525

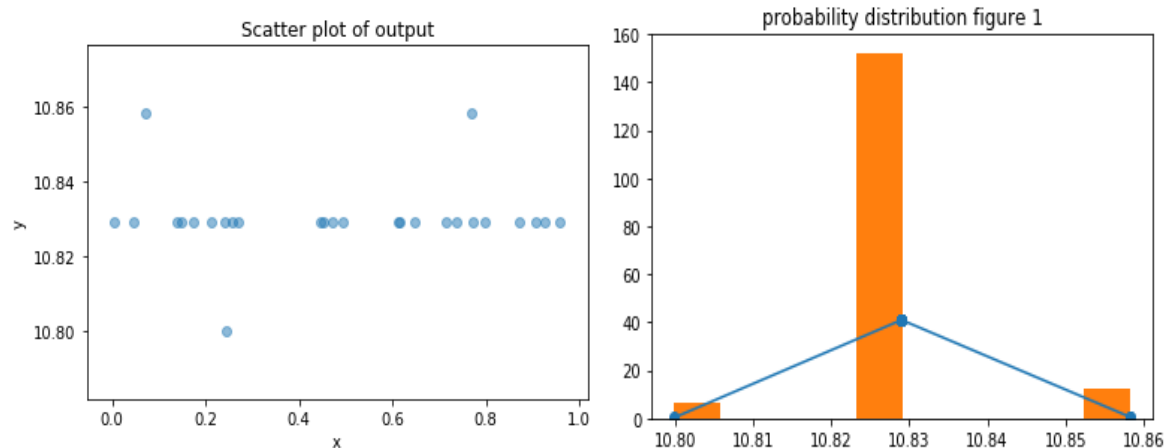
STANDARD DAVIATION= 0.01473888340846254

ABSOLUTE ERROR =

[2.302109756, 2.302109756, 2.302109756, 2.302109756, 2.231804306, 2.302109756, 2.2738380620000003, 2.302109756, 2.302109756, 2.302109756, 2.302109756, 2.302109756, 2.302109756, 2.302109756, 2.302109756, 2.2879488189999995, 2.2879488189999995, 2.302109756, 2.302109756, 2.302109756, 2.302109756, 2.302109756, 2.302109756, 2.2738380620000003, 2.302109756, 2.302109756, 2.302109756, 2.302109756]

MEAN ABSOLUTE ERROR = 2.2965679448571428

RELATIVE ERROR = 0.45931358897142854



# 20 cm

**AVERAGE= 20.138303544814818**

**MEDIAN= 20.14426065**

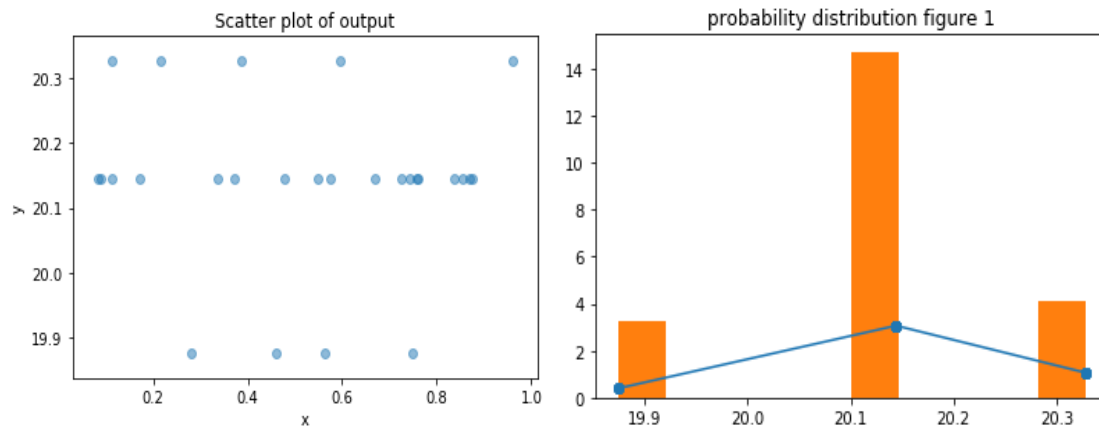
**VARIANCE= 0.016927356962182644****STANDARD DEVIATION= 0.13010517653876283**

**ABSOLUTE ERROR =**

[0.14426064999999966, 0.14426064999999966, 0.14426064999999966, 0.14426064999999966,  
0.14426064999999966, 0.14426064999999966, 0.14426064999999966, 0.14426064999999966,  
0.14426064999999966, 0.14426064999999966, 0.14426064999999966, 0.14426064999999966,  
0.14426064999999966, 0.14426064999999966, 0.14426064999999966, 0.14426064999999966,  
0.14426064999999966, 0.14426064999999966, 0.32752440999999877, 0.32752440999999877,  
0.32752440999999877, 0.32752440999999877, 0.32752440999999877, 0.12502951000000095,  
0.12502951000000095, 0.12502951000000095, 0.12502951000000095]

**MEAN ABSOLUTE ERROR = 0.1753493255555524**

**RELATIVE ERROR = 0.008767466277777762**



**# 30 cm**

**AVERAGE= 24.49886260444444**

**MEDIAN= 24.49350865**

**VARIANCE= 0.01451524594029667****STANDARD DAVIATION= 0.12047923447755082**

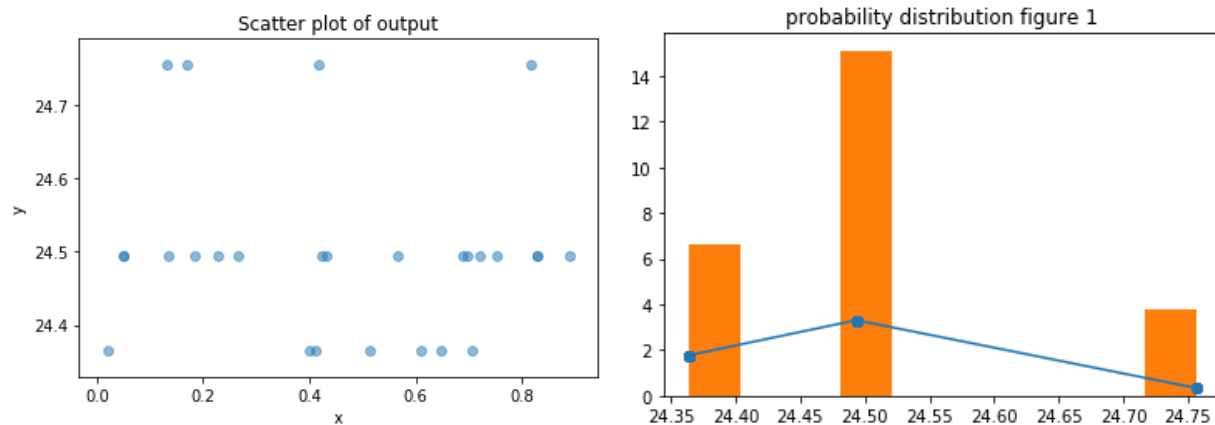
**ABSOLUTE ERROR =**

[5.635829879999999, 5.5064913500000001, 5.5064913500000001, 5.5064913500000001,  
5.5064913500000001, 5.5064913500000001, 5.5064913500000001, 5.5064913500000001,

5.506491350000001, 5.506491350000001, 5.506491350000001, 5.506491350000001,  
 5.506491350000001, 5.506491350000001, 5.506491350000001, 5.635829879999999,  
 5.635829879999999, 5.635829879999999, 5.635829879999999, 5.635829879999999,  
 5.635829879999999, 5.244009729999998, 5.244009729999998, 5.244009729999998,  
 5.506491350000001, 5.506491350000001, 5.244009729999998]

MEAN ABSOLUTE ERROR = 5.501137395555558

RELATIVE ERROR = 0.1833712465185186



# 40 cm

AVERAGE= 34.84960364259258

MEDIAN= 34.73913647

VARIANCE= 0.028896095199262305

STANDARD DAVIATION= 0.16998851490398492

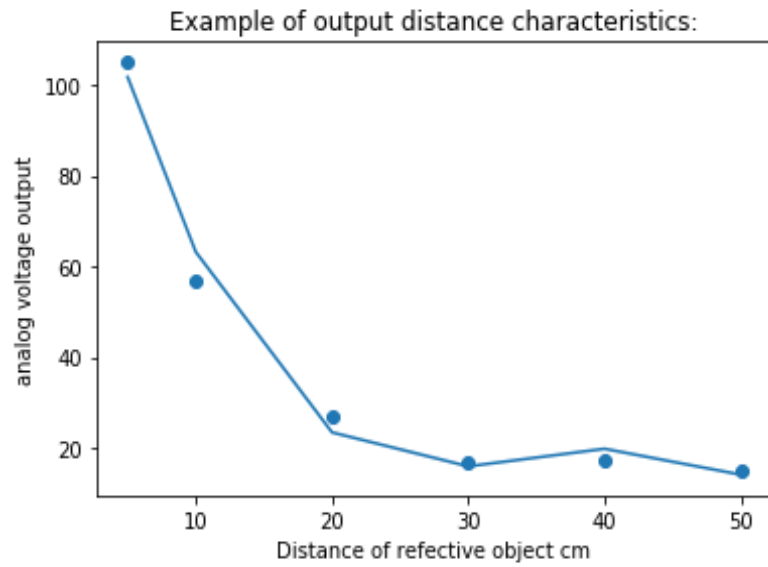
ABSOLUTE ERROR = [5.260863530000002, 5.260863530000002, 5.260863530000002,  
 5.260863530000002, 5.260863530000002, 5.260863530000002, 5.260863530000002,  
 5.260863530000002, 5.260863530000002, 5.260863530000002, 5.260863530000002,  
 5.260863530000002, 5.260863530000002, 5.260863530000002, 4.762124669999999,  
 4.762124669999999, 5.013120530000002, 5.013120530000002, 5.013120530000002,  
 5.013120530000002, 5.013120530000002, 5.013120530000002, 5.013120530000002,  
 5.013120530000002, 5.013120530000002, 5.260863530000002, 5.505414590000001]

MEAN ABSOLUTE ERROR = 5.150396357407409

RELATIVE ERROR = 0.12875990893518524



**Example of output distance characteristics:**



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