Part1 Arduino code

```
#include <Wire.h>
#include <VL53L0X.h>

VL53L0X sensor;

void setup()
{
  Serial.begin(9600);
  Wire.begin();

  sensor.setTimeout(500);
  if (!sensor.init())
  {
    Serial.println("Failed to detect and initialize sensor!");
    while (1) {}
  }

#if defined LONG_RANGE
  // lower the return signal rate limit (default is 0.25 MCPS)
  sensor.setSignalRateLimit(0.1);
  // increase laser pulse periods (defaults are 14 and 10 PCLKs)
  sensor.setVcselPulsePeriod(VL53L0X::VcselPeriodPreRange, 18);
  sensor.setVcselPulsePeriod(VL53L0X::VcselPeriodFinalRange, 14);
#endif

#if defined HIGH_SPEED
  // reduce timing budget to 20 ms (default is about 33 ms)
  sensor.setMeasurementTimingBudget(20000);
#elif defined HIGH_ACCURACY
  // increase timing budget to 200 ms
  sensor.setMeasurementTimingBudget(200000);
#endif
}

void loop()
{
  Serial.print(sensor.readRangeSingleMillimeters());
  Serial.print("mm");
  if (sensor.timeoutOccurred()) { Serial.print(" TIMEOUT"); }

  Serial.println();
}
```

Part2 Measured data and analysis

1. the Range of the Time of flight sensor:

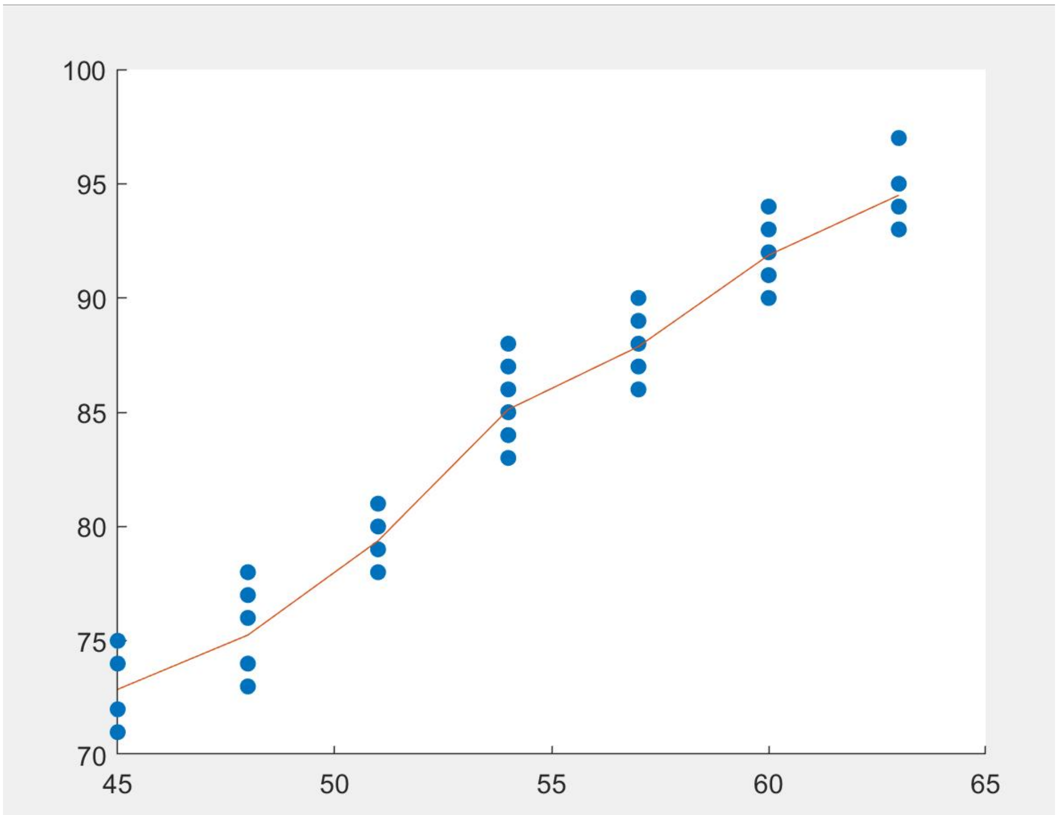
Data:

Actual value(mm)	0	5	10	15	1230
Measured value(mm)	32	35	35	42	1234
	31	36	39	44	8190
	31	37	34	41	8190
	30	38	36	41	8190
	32	34	35	40	8190
	34	36	33	41	8190
	30	35	35	41	1269
	33	36	33	42	1232

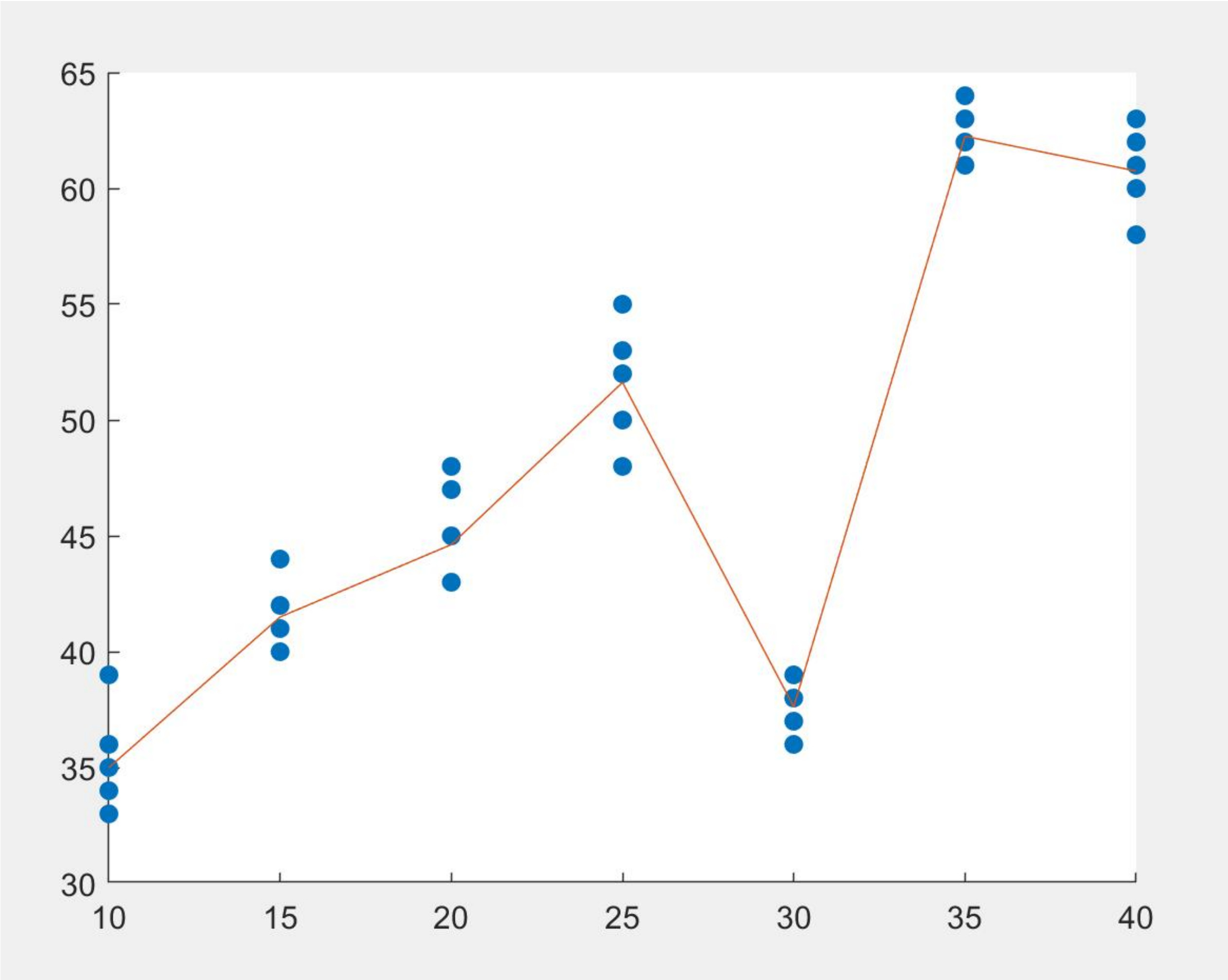
Analysis:From the data, it can be seen that when the actual value of X is 0~10mm, the measured data hardly changes, and when the actual value of X is 15mm, the measured data begins to change obviously, and after many measurements, it is found that the measured value of X is 20~30mm larger than the actual value. When the actual value of x is 1230mm, the measured data becomes unstable, and there is obvious distortion within the error range. So the Range of Time of flight sensor is 10mm~1230mm.

2. the Resolution of the Time of flight sensor:

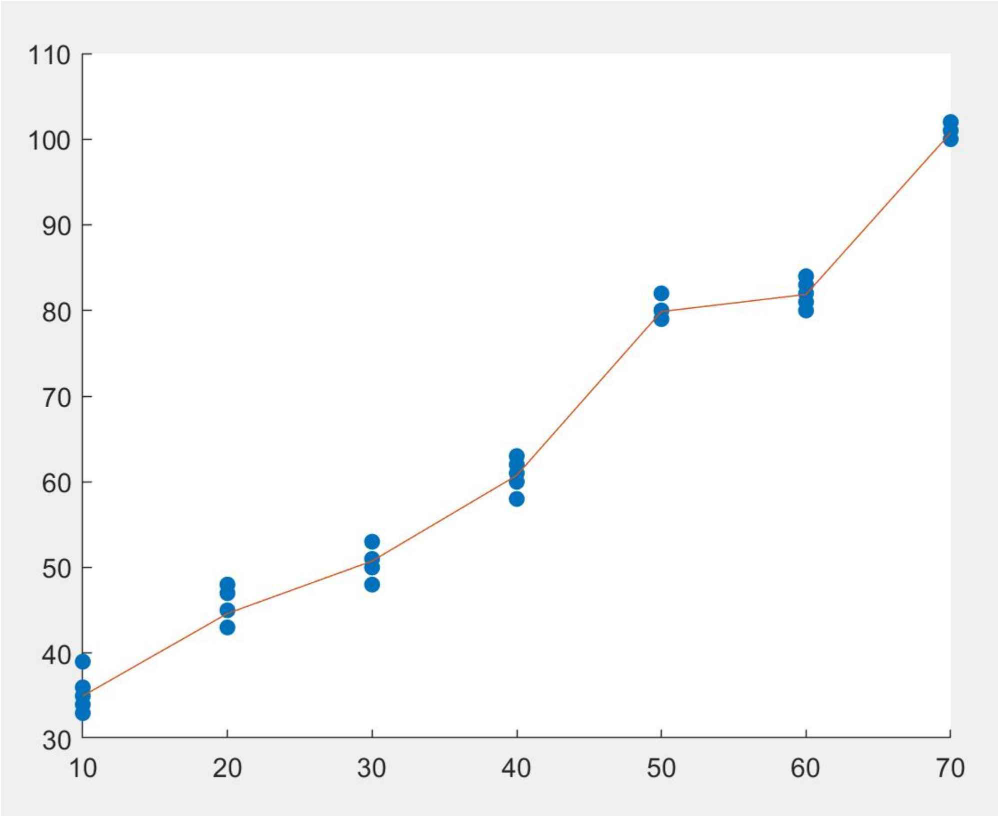
When Δx= 3mm:



When Δx= 5mm:



When Δx= 10mm:



Analysis:From the above three scatter charts, the line chart formed by connecting the midpoints corresponding to each abscissa shows that the slopes of the three line charts are all changing and nonlinear. Only when x=3mm, the trend of the line chart is roughly positively correlated with the change of x, so I think the Resolution is close to 3mm.

3. reduce the Static Error of the Time of flight sensor:

Data:

Actual value(mm)	45	48	51	54	57	60	63
Measured value(mm)	71	73	79	88	88	93	95
	72	76	81	87	89	90	95
	74	74	79	83	87	94	95
	75	74	79	83	87	92	97
	71	78	79	85	88	93	93
	74	74	78	85	86	91	93
	72	76	80	86	88	90	94
	74	77	80	84	90	92	94
Average measured value(mm)	72.875	75.25	79.375	85.125	87.875	91.875	94.5

Analysis : The average value is closer to every data measured in every group.

4. the Precision of the Time of flight sensor:

Actual value(mm)	45	48	51
Average measured value(mm)	72.875	75.25	79.375
Variance(s^2)	2.109375	2.6875	0.734375

Analysis : The smaller the variance,the closer it is to the average and the more stable it is.

Part3.Summarized final results and discussions

Compared with information from manufacture, the measuring range error of the sensor is very large, and the actual measuring range is 10 mm ~ 1230 mm. In the measuring range, the measuring error is that the measured value is always about 20mm~30mm larger than the real value, which does not completely conform to the Ranging accuracy in information of manufacture, and the resolution of different positions is also different.