**Report of Tests on Different Heights and Distances**

1. Basics of the Test

Below is the form of the number of tests on combinations of different heights and distances. The sampling points of distances are four points that are evenly distributed from the closest measuring range to the farthest. Heights are set accurately, from the module to the ground. For each test, we select 100 points and write scatter plots and histograms.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Height Distance | Close | Medium-Close | Medium-Far | Far |
| 10cm | (1) | (2) | (3) | (4) |
| 60cm | (5) | (6) | (7) | (8) |
| 110cm | (9) | (10) | (11) | (12) |
| 160cm | (13) | (14) | (15) | (16) |

2. Plots and Basic Statistics

(1) (10 cm above the ground, close in distance)

图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 1611

Min: 1452

Mean: 1519.9

Range: 159

Standard Deviation: 30.9577

Variance: 958.3802

(2) (10 cm above the ground, Medium-Close in distance)

图形用户界面

描述已自动生成

Statistics (in mm):

Max: 6904

Min: 6815

Mean: 6858.7

Range: 89

Standard Deviation: 19.4200

Variance: 377.1358

(3) (10 cm above the ground, Medium-Far in distance)

图形用户界面, 图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 11900

Min: 11815

Mean: 11859

Range: 85

Standard Deviation: 16.9038

Variance: 285.7390

(4) (10 cm above the ground, far in distance)

图形用户界面

描述已自动生成

Statistics (in mm):

Max: 17993

Min: 17656

Mean: 17821

Range: 337

Standard Deviation: 46.7444

Variance: 2185

(5) (60 cm above the ground, close in distance)

图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 1503

Min: 1391

Mean: 1442.7

Range: 112

Standard Deviation: 23.1093

Variance: 534.0415

(6) (60 cm above the ground, medium-close in distance)

图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 6810

Min: 6730

Mean: 6767.4

Range: 80

Standard Deviation: 17.9039

Variance: 320.5506

(7) (60 cm above the ground, medium-far in distance)

图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 11885

Min: 11665

Mean: 11729

Range: 220

Standard Deviation: 33.8354

Variance: 1144.8

(8) (60 cm above the ground, far in distance)

图形用户界面

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Statistics (in mm):

Max: 18082

Min: 17482

Mean: 17650

Range: 600

Standard Deviation: 80.9988

Variance: 6560.8

(9) (110 cm above the ground, close in distance)

图形用户界面

描述已自动生成

Statistics (in mm):

Max: 1593

Min: 1466

Mean: 1536.7

Range: 127

Standard Deviation: 29.5017

Variance: 870.3479

(10) (110 cm above the ground, medium-close in distance)

图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 6866

Min: 6782

Mean: 6820.4

Range: 84

Standard Deviation: 15.0962

Variance: 227.8945

(11) (110 cm above the ground, medium-far in distance)

图形用户界面, 图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 11956

Min: 11839

Mean: 11869

Range: 117

Standard Deviation: 19.0478

Variance: 362.8178

(12) (110 cm above the ground, far in distance)

图形用户界面, 图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 17637

Min: 17426

Mean: 17565

Range: 211

Standard Deviation: 29.8037

Variance: 888.2605

(13) (160 cm above the ground, close in distance)

图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 1527

Min: 1443

Mean: 1484.1

Range: 84

Standard Deviation: 19.5872

Variance: 383.6585

(14) (160 cm above the ground, medium-close in distance)

图形用户界面, 图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 6815

Min: 6726

Mean: 6770.0

Range: 89

Standard Deviation: 16.6745

Variance: 278.0388

(15) (160 cm above the ground, medium-far in distance)

图形用户界面, 图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 11890

Min: 11825

Mean: 11854

Range: 65

Standard Deviation: 15.9517

Variance: 254.4570

(16) (160 cm above the ground, far in distance)

图形用户界面, 图表, 散点图

描述已自动生成

Statistics (in mm):

Max: 16905

Min: 16788

Mean: 16842

Range: 117

Standard Deviation: 24.5733

Variance: 603.8460

1. Histogram

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描述已自动生成

1. Conclusion

For the distance, the modules still work fine in the close range (about 1m), but when the distance goes too far, the accuracy may not be so good. In the middle range, the modules perform best.

For the height of placement, placing the module too low may have a bad influence on the accuracy, but not so severe.

Furthermore, if we apply a filtering algorithm to get rid of some extreme data, the results will be easier to see.