**Implementation Results for Uncertainty in Object position**

**Summary:** Considering Velocity is 0.1(default), acceleration is 0.1(default). Here uncertainty is introduced in the X and Y coordinates of the object position by **Normal** distribution. If the object is grasped then it’s considered as success else failure.

**Case 1: Standard deviation =0.005**

**Sampled X**: [0.48104505, 0.49500613, 0.48290411, 0.48613197, 0.48766223, 0.48071802,

0.4867966, 0.48568909, 0.4925788, 0.48857789, 0.48800684, 0.49491971,

0.49021652, 0.48992253, 0.48866226, 0.49007996, 0.49169649, 0.48162079,

0.49471311, 0.48643898, 0.48699757, 0.4794064, 0.48695449, 0.48584121,

0.48853401, 0.48990025, 0.48912894, 0.48605018, 0.48776877, 0.47899036,

0.49935095, 0.48484099, 0.49212307, 0.48608106, 0.48561608, 0.49296978,

0.48520081, 0.48657169, 0.48789937, 0.48642898, 0.49229357, 0.48770107,

0.48960271, 0.49104514, 0.4931741, 0.48664178, 0.4788064, 0.49727768,

0.49401039, 0.48671501]

**Sampled Y:** [ 0.01350066, 0.00892971, 0.01529761, 0.01189608, 0.00951885, 0.01369649,

0.00920413, 0.00684811, 0.00629782, 0.01440446, 0.00538877, 0.01111595,

-0.00322494, -0.00102746, 0.00643475, 0.00439998, 0.00243189, 0.00473725,

0.01183447, 0.01258955, 0.0009119, 0.00384088, 0.00467828, 0.00756833,

0.01045308, 0.01324922, 0.00892898, 0.0096756, 0.0074446, 0.0114922,

0.00943294, 0.01111746, 0.00170099, 0.00406007, 0.01461333, 0.02636242,

0.01671961, 0.00968786, 0.00632463, 0.01006708, -0.0001044, 0.01469263,

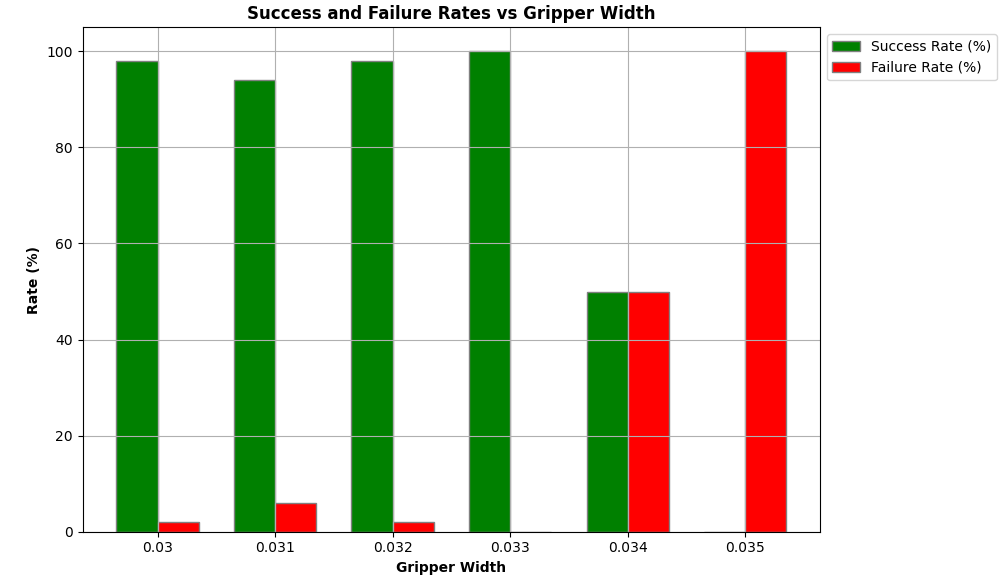
0.00328042, 0.00360712, 0.00404005, 0.00664857, 0.00685884, 0.01230925,

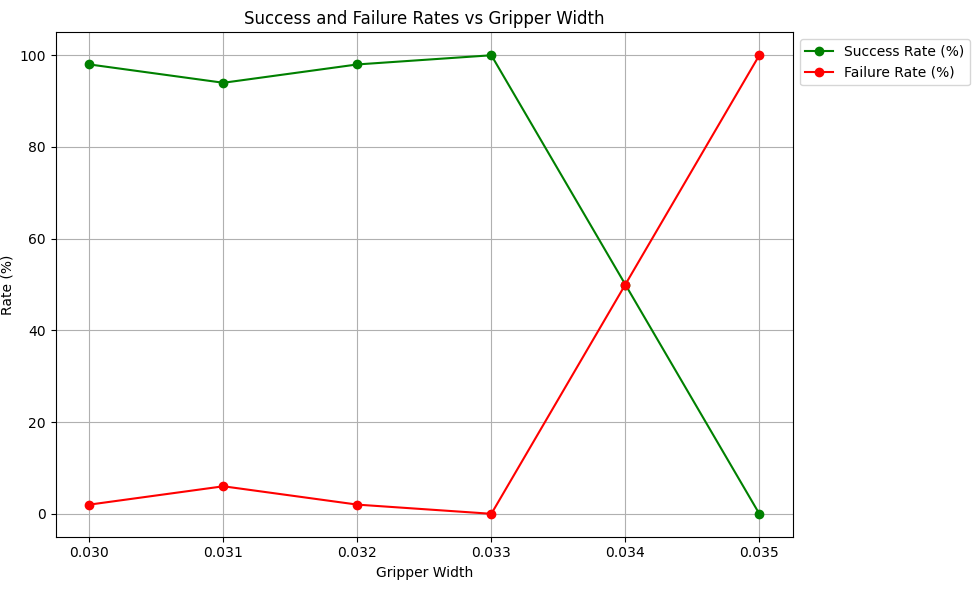
0.01252165, 0.00465789]

|  |  |  |  |
| --- | --- | --- | --- |
| **Experiment No:** | **Gripper Width** | **Success Rate (%)** | **Failure Rate (%)** |
| 1 | 0.03 | 98 | 2 |
| 2 | 0.031 | 94 | 6 |
| 3 | 0.032 | 98 | 2 |
| 4 | 0.033 | 100 | 0 |
| 5 | 0.034 | 50 | 50 |
| 6 | 0.035 | 0 | 100 |

**Graphical representation of this table is shown below:**

Note: I have shown both bar graph and line graph for same data.

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**Case 2: Standard deviation =0.01**

**Sampled X:** [0.50162274, 0.48951069, 0.50341215, 0.49615727, 0.48101159, 0.47225563,

0.501272, 0.48676327, 0.46111212, 0.47396221, 0.48636629, 0.49040326,

0.49434653, 0.48770368, 0.49803126, 0.48269194, 0.4861956, 0.47861138,

0.4871818, 0.47833452, 0.49097439, 0.49541848, 0.49616701, 0.49587376,

0.48589114, 0.48176583, 0.50880319, 0.50292152, 0.49137836, 0.48756908,

0.49160862, 0.49258558, 0.4923422, 0.5045687, 0.48087306, 0.50729335,

0.49387115, 0.48184728, 0.48098471, 0.48100386, 0.47912577, 0.48962986,

0.49796531, 0.49139124, 0.50437722, 0.47272433, 0.46046471, 0.50886724,

0.47090171, 0.48231243]

**Sampled Y**: [ 0.00583692, -0.00183908, 0.01022704, 0.01272923, 0.01383809 -0.00853211

-0.00863691, 0.00434802, 0.0148004, -0.0062895, -0.00249842, 0.01237284,

0.01789194, 0.00260495, 0.00278459, 0.01536117, -0.00491076, 0.00727189,

-0.01302764, -0.00467967, -0.0046506, 0.00556309, -0.00939853, 0.00011278,

0.01854924, 0.00540417, 0.00649814, 0.02043808, -0.00225368, -0.00759682,

0.00524199, 0.01498114, -0.00356128, -0.00178039, 0.01685438, 0.00172228,

-0.00232857, 0.0112997, 0.01051437, -0.00626076, 0.00211887, 0.01688476,

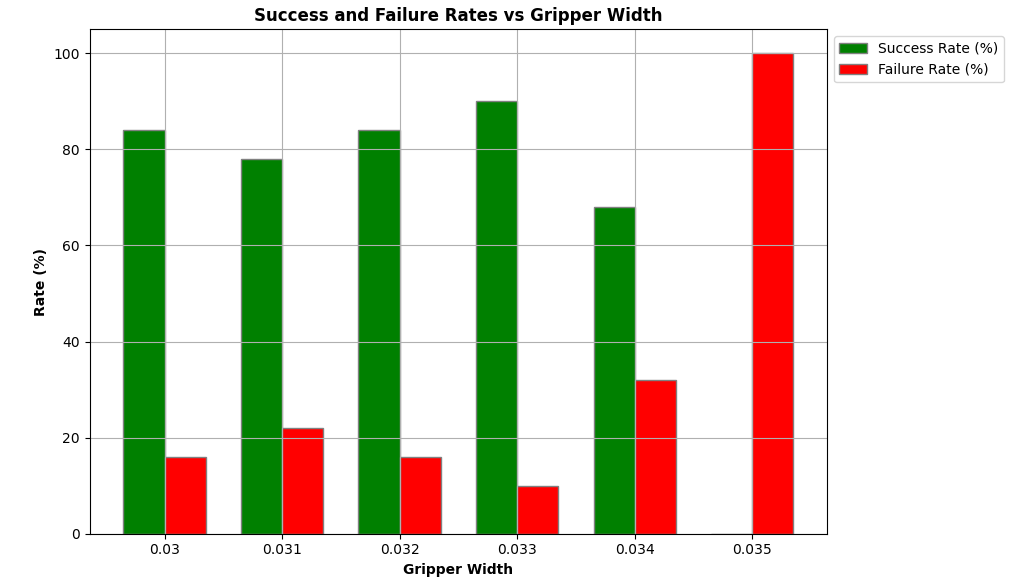
0.00964298, 0.00292617, 0.0043659, -0.00725703, 0.01913036, 0.01320721,

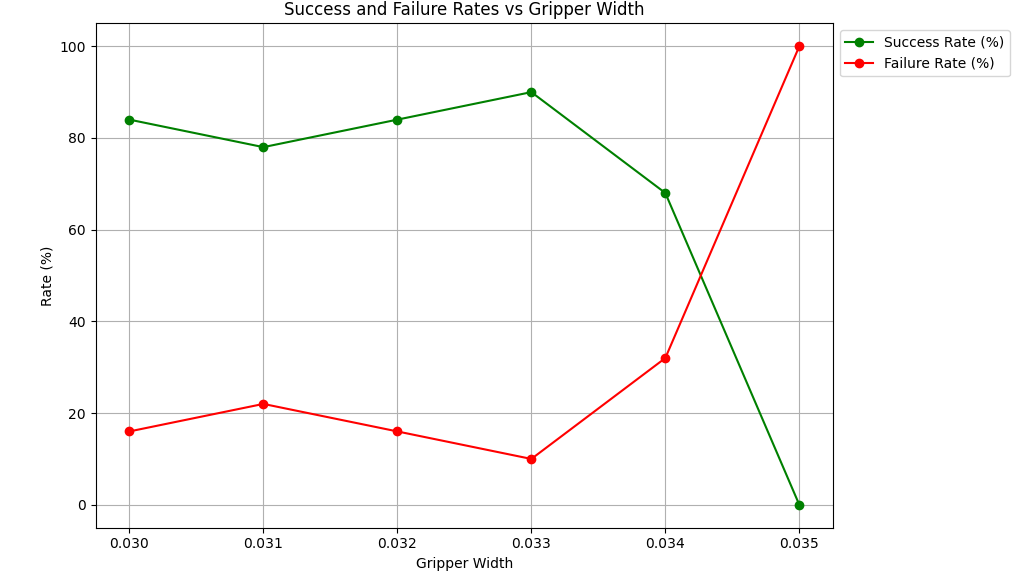
0.00547154, -0.00220461]

|  |  |  |  |
| --- | --- | --- | --- |
| **Experiment No:** | **Gripper Width** | **Success Rate (%)** | **Failure Rate (%)** |
| 7 | 0.03 | 84 | 16 |
| 8 | 0.031 | 78 | 22 |
| 9 | 0.032 | 84 | 16 |
| 10 | 0.033 | 90 | 10 |
| 11 | 0.034 | 68 | 32 |
| 12 | 0.035 | 0 | 100 |

**Graphical representation of this table is shown below:**

Note: I have shown both bar graph and line graph for same data.

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**Case 3: Standard deviation =0.015**

**Sampled position X :** [0.52817004 0.47781538 0.48347333 0.47644912 0.47229299 0.49215782

0.48108983 0.49451688 0.50952371 0.49467763 0.51931935 0.50406943

0.49365829 0.49154672 0.49319184 0.48044947 0.50444674 0.47691984

0.50546039 0.49994809 0.47802174 0.4848325 0.50472937 0.51108524

0.51438223 0.49737883 0.49826391 0.4869972 0.48975308 0.51026992

0.50486362 0.49438791 0.50473331 0.51478674 0.49482924 0.48635056

0.50991401 0.49723334 0.47070941 0.49569434 0.4955236 0.47879982

0.48015623 0.47116252 0.50248834 0.52423314 0.51931238 0.51656111

0.49286415 0.48616485]

**Sampled position Y :** [-0.00943561 -0.02403063 0.00894645 0.00433592 -0.00553837 0.00107396

0.00427964 -0.01813384 -0.01826828 0.00138178 0.01002217 -0.01870127

0.01286875 -0.00971145 -0.01140359 0.00098353 -0.00232736 -0.00583614

-0.00610171 -0.00162321 0.00885178 0.00818393 0.00982798 0.00796513

0.00892783 0.01155855 0.0058058 0.01999556 0.01775738 0.00606241

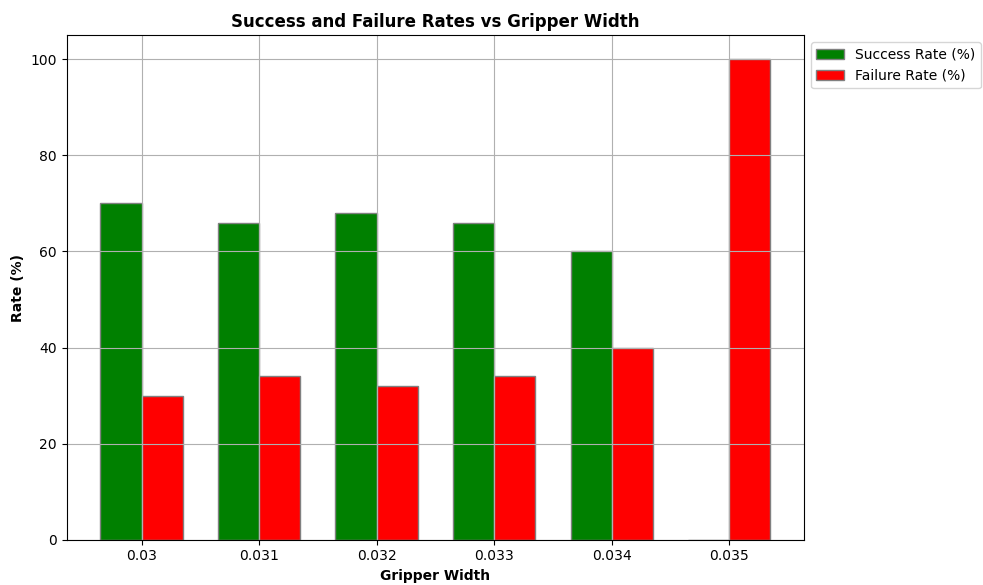
0.01453677 0.00698136 0.00927569 0.01693907 0.00515997 0.01059407

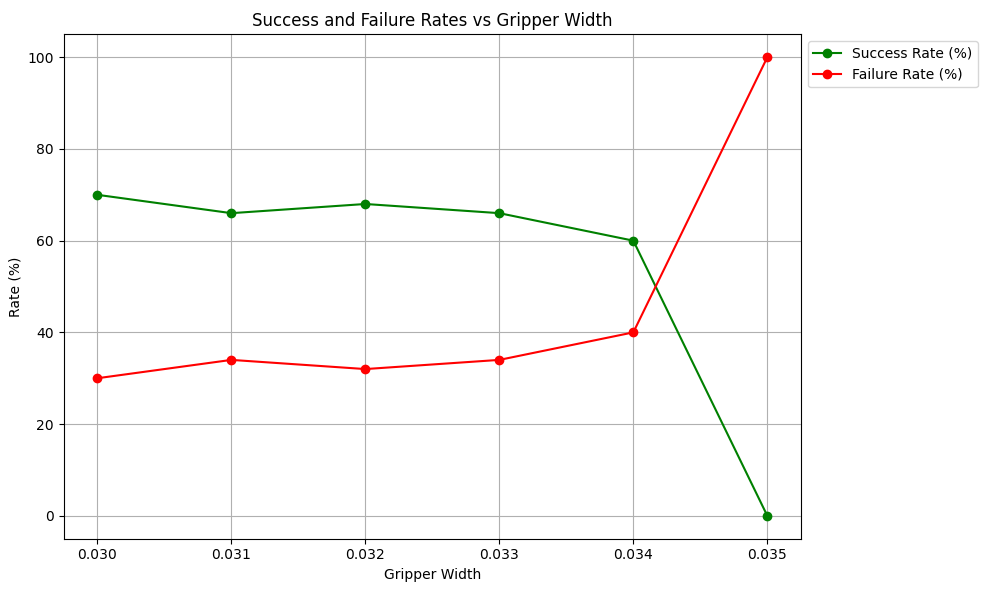
0.01457932 0.02728572 0.00247928 0.0099418 0.0112108 0.00118753

0.03796486 0.00330199 0.03771238 0.02097836 -0.03442989 0.02069857

0.0120679 -0.00014617]

|  |  |  |  |
| --- | --- | --- | --- |
| **Experiment No:** | **Gripper Width** | **Success Rate (%)** | **Failure Rate (%)** |
| 13 | 0.03 | 70 | 30 |
| 14 | 0.031 | 66 | 34 |
| 15 | 0.032 | 68 | 32 |
| 16 | 0.033 | 66 | 34 |
| 17 | 0.034 | 60 | 40 |
| 18 | 0.035 | 0 | 100 |

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**Case 4: Standard deviation =0.02**

**Sampled position X:** [0.49595519 0.49539206 0.48392382 0.50737977 0.47679858 0.45726685

0.47064831 0.50222171 0.48705423 0.47157001 0.46554328 0.46833145

0.51976731 0.49252534 0.47474103 0.49240316 0.48251021 0.48353603

0.49272743 0.48945895 0.4993079 0.52315294 0.45843905 0.49311931

0.48466342 0.47415746 0.50938196 0.51777378 0.51572448 0.47225704

0.49036271 0.4840957 0.47875408 0.49492706 0.47467887 0.46192672

0.51022041 0.44023917 0.46575549 0.4598838 0.49777198 0.46235493

0.47538211 0.48653783 0.46091943 0.53285508 0.50321611 0.47274003

0.51061581 0.46983421]

**Sampled position X:** [ 2.43223084e-02 4.44620745e-02 9.29145925e-03 1.97122990e-02

-3.86274063e-02 1.28020015e-02 2.82416773e-02 1.06298578e-02

1.81343996e-02 6.68036773e-03 1.87943506e-02 -1.62509629e-02

2.00391470e-02 -1.86082688e-02 -2.69842120e-02 3.50926798e-02

4.28721522e-03 -2.71098796e-02 3.33225654e-02 -8.57646753e-03

-1.43048979e-02 -2.37084094e-03 -1.25327594e-02 -7.78602404e-03

2.00410193e-02 4.19448413e-02 3.81693957e-03 9.79070576e-03

4.54507093e-02 2.37706165e-02 2.16710223e-02 2.24809193e-02

3.64643354e-02 -2.97929343e-03 2.78911145e-02 1.17545278e-02

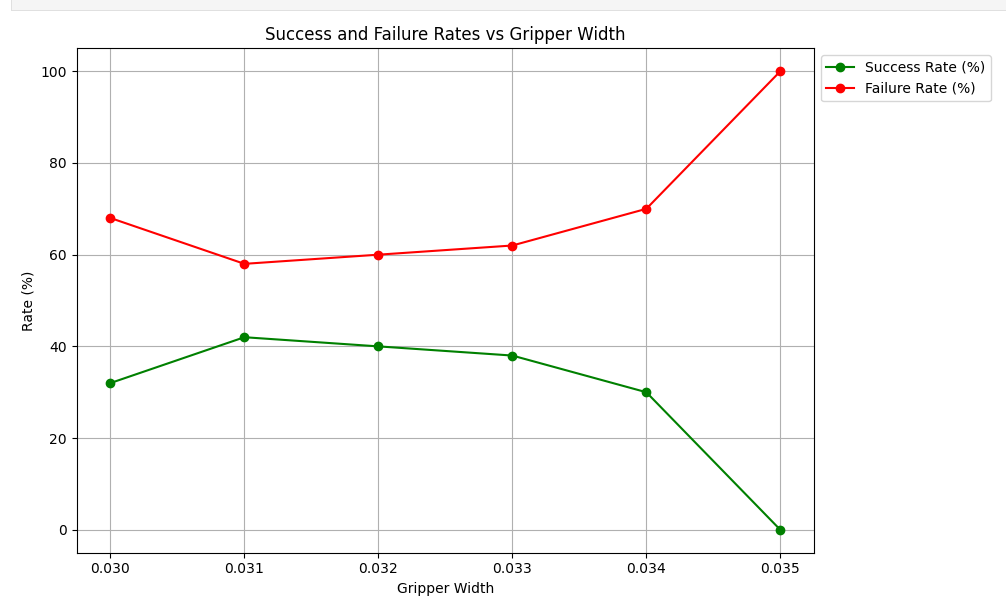
-9.48046440e-06 4.40884522e-02 -9.90316982e-03 1.10116038e-03

-3.23482610e-02 3.22922365e-02 1.26040358e-02 -8.57664368e-03

9.77686310e-04 1.35856087e-02 -6.27563093e-03 2.90043806e-02

1.48776529e-02 -3.75875632e-04]

|  |  |  |  |
| --- | --- | --- | --- |
| **Experiment No:** | **Gripper Width** | **Success Rate (%)** | **Failure Rate (%)** |
| 19 | 0.03 | 32 | 68 |
| 20 | 0.031 | 42 | 58 |
| 21 | 0.032 | 40 | 60 |
| 22 | 0.033 | 38 | 62 |
| 23 | 0.034 | 30 | 70 |
| 24 | 0.035 | 0 | 100 |

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**Summary:** Considering Velocity is 0.1(default), acceleration is 0.1(default). Here uncertainty is introduced in the X and Y coordinates of the object position by **Uniform** distribution. If the object is grasped then it’s considered as success else failure.

**Case 1: Scale =0.005**

**Sampled Position X:** [0.4935806 0.49002201 0.48766931 0.4938918 0.48646533 0.49207724

0.49005292 0.48846473 0.49132573 0.49484202 0.48912302 0.49380236

0.49552588 0.49258978 0.48955177 0.49061843 0.48634964 0.49365357

0.4893315 0.49123481 0.49268924 0.49140199 0.49180083 0.49475049

0.49293652 0.48993185 0.49071274 0.49544666 0.48802269 0.49523033

0.49511986 0.49259977 0.49437379 0.48909274 0.4897543 0.49118904

0.49119056 0.48821168 0.49066277 0.49554679 0.48787052 0.49059973

0.49365859 0.48618917 0.49340268 0.48807269 0.494415 0.49406533

0.48937076 0.49362769]

**Sampled Position Y:** [0.00849942 0.00857987 0.00807758 0.00751724 0.00789424 0.00795479

0.00880029 0.00813744 0.00906198 0.00730633 0.00899908 0.00812227

0.0076744 0.00914266 0.00768285 0.00781345 0.00771684 0.00861318

0.00868753 0.00816439 0.00825114 0.00920344 0.00885644 0.00909769

0.00898023 0.0078136 0.00830249 0.00765098 0.00769532 0.00787771

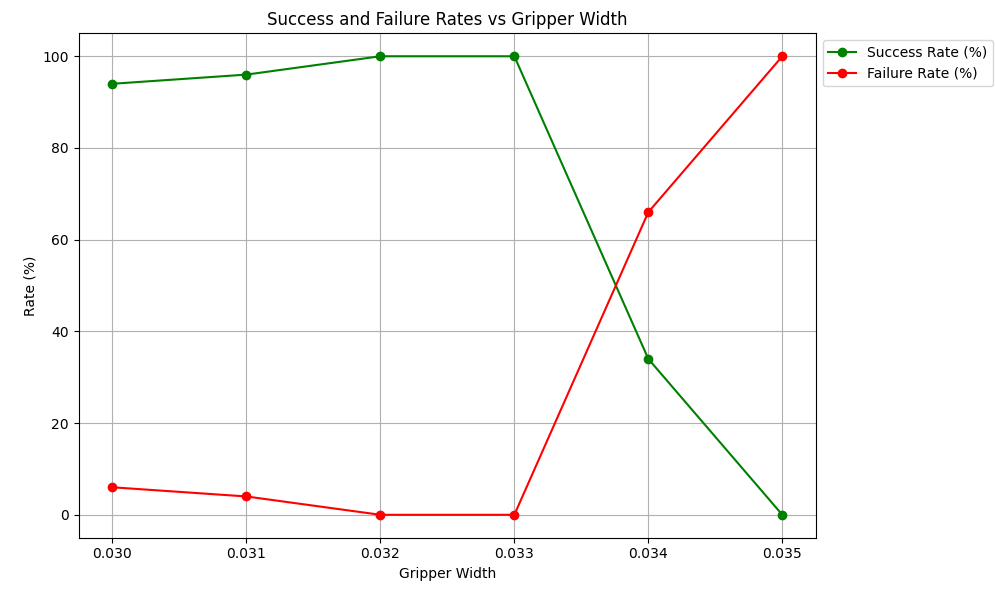
0.00917992 0.00850683 0.00755596 0.00757271 0.00771134 0.00864323

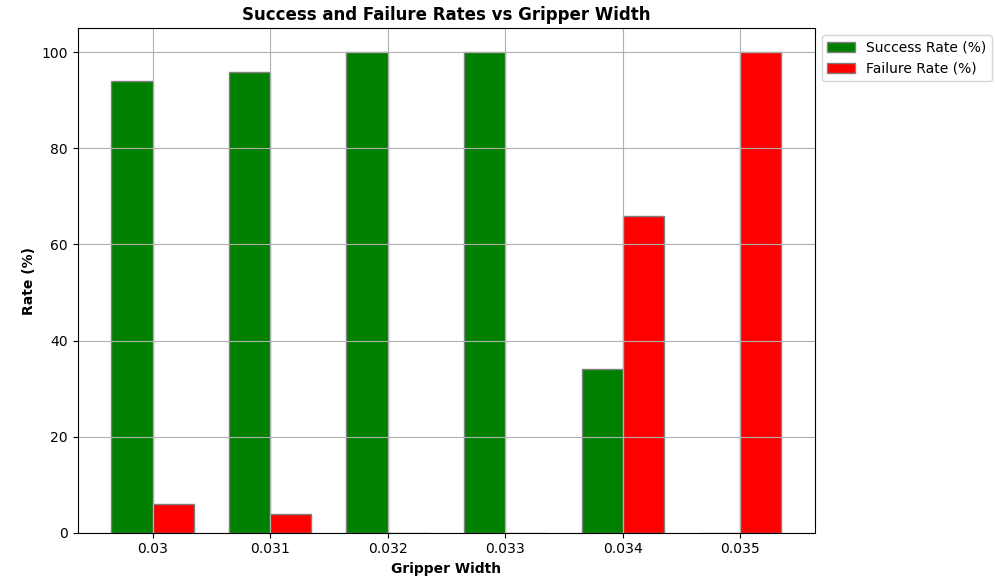
0.00906543 0.00806623 0.0089772 0.00787452 0.00820585 0.00901021

0.00741861 0.00830796 0.00800679 0.00817987 0.00739389 0.00801244

0.00906767 0.00765864]

|  |  |  |  |
| --- | --- | --- | --- |
| **Experiment No:** | **Gripper Width** | **Success Rate (%)** | **Failure Rate (%)** |
| 25 | 0.03 | 94 | 6 |
| 26 | 0.031 | 96 | 4 |
| 27 | 0.032 | 100 | 0 |
| 28 | 0.033 | 100 | 0 |
| 29 | 0.034 | 34 | 66 |
| 30 | 0.035 | 0 | 100 |

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**Case 2: Scale =0.01**

**Sampled position X:** [0.48986224 0.49849899 0.49778287 0.48310396 0.48068828 0.49456048

0.48937307 0.48399434 0.49187228 0.48131579 0.48919911 0.49474629

0.48715421 0.48735412 0.48411129 0.48731301 0.49293188 0.48430535

0.49549563 0.48640572 0.49226516 0.48802866 0.48474123 0.48997884

0.4820212 0.49842736 0.4890064 0.48327664 0.49841448 0.48389909

0.48390943 0.49219055 0.4959142 0.49832987 0.47924817 0.48366851

0.48431584 0.49344031 0.49185738 0.48715049 0.49455533 0.48847915

0.49799268 0.49167805 0.48618079 0.49783367 0.48494072 0.48907386

0.48088485 0.4977336 ]

**Sampled position Y:** [ 0.00591704 -0.00408768 -0.00502385 0.01091512 -0.00264546 -0.00371166

0.00853246 0.01098269 0.00593487 0.00638357 0.00891464 0.00316004

0.01102083 -0.0009722 0.00603625 0.00929173 0.00184509 -0.00399685

0.00850142 0.00390175 -0.00455973 -0.00021015 0.00501242 -0.00078634

-0.00488485 0.00936088 0.00652263 -0.00014801 0.01284807 0.01039371

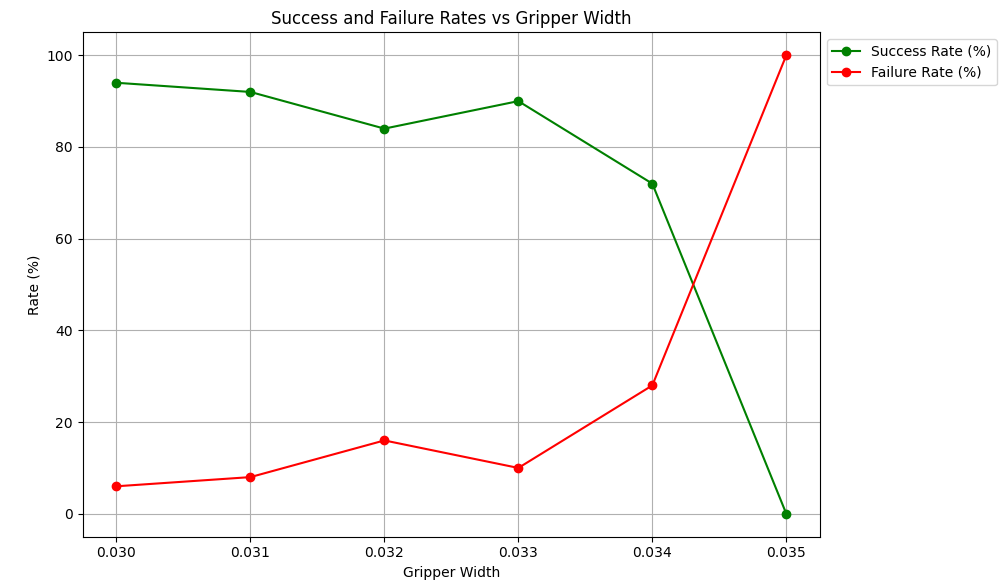
0.00421111 -0.00382274 0.00699854 0.00742337 0.00251283 -0.00249051

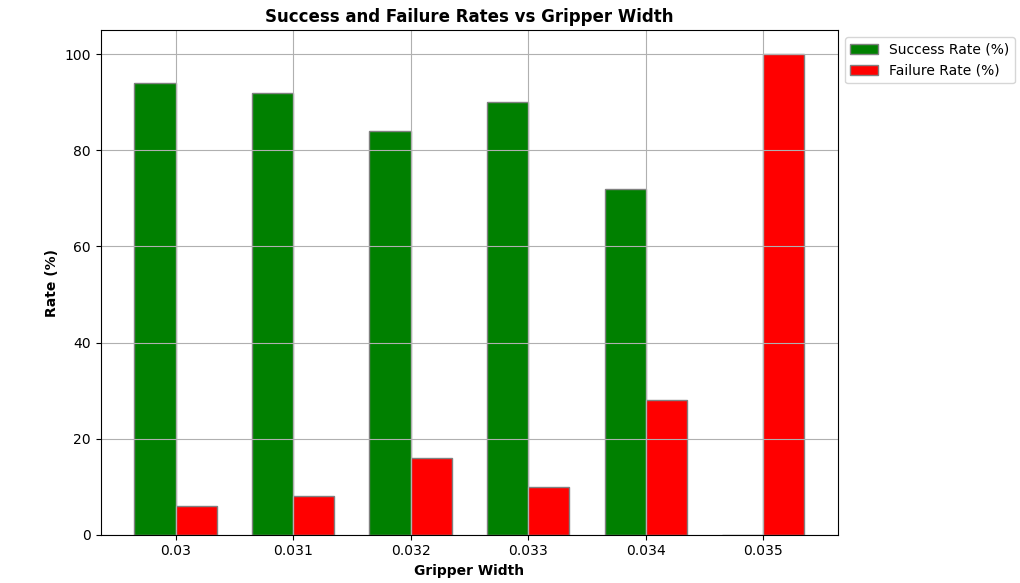
0.00198989 -0.00280405 -0.00356133 0.00018729 -0.00323177 -0.00545456

0.0113685 0.00210742 0.00934102 0.00206273 0.0034866 0.00364521

0.00863474 0.00360679]

|  |  |  |  |
| --- | --- | --- | --- |
| **Experiment No:** | **Gripper Width** | **Success Rate (%)** | **Failure Rate (%)** |
| 31 | 0.03 | 94 | 6 |
| 32 | 0.031 | 92 | 8 |
| 33 | 0.032 | 84 | 16 |
| 34 | 0.033 | 90 | 10 |
| 35 | 0.034 | 72 | 28 |
| 36 | 0.035 | 0 | 100 |



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**Case 3: Scale =0.015**

**Sampled position X:** [0.48939613 0.49077018 0.48973831 0.49283143 0.50161268 0.47634057

0.48942749 0.50087776 0.49621683 0.50180384 0.49610676 0.48885339

0.48609109 0.48579321 0.50444484 0.50027673 0.4868005 0.4915861

0.50397457 0.48470029 0.48272394 0.48698248 0.48014044 0.50311498

0.47530471 0.49124017 0.49404903 0.49303261 0.49345101 0.48988165

0.49553922 0.47567796 0.48140014 0.479682 0.47987438 0.48268084

0.49662951 0.49608315 0.5031264 0.48706709 0.48881139 0.48952831

0.50155226 0.49752681 0.48658458 0.49165245 0.47733061 0.48693354

0.4806583 0.4825417 ]

**Sampled position Y:** [ 0.01863245 -0.00527137 0.02146295 0.00232262 -0.00232966 0.01921742

0.01764583 0.01706353 0.00101758 0.00280894 -0.00454052 -0.00476592

0.02061263 0.01676417 0.0017193 0.01849194 0.0212133 0.00639641

0.01040398 0.01690422 0.01590506 -0.00068389 0.01953884 -0.00059241

0.00515226 0.02266521 0.01495946 -0.00526044 0.00805057 -0.00608711

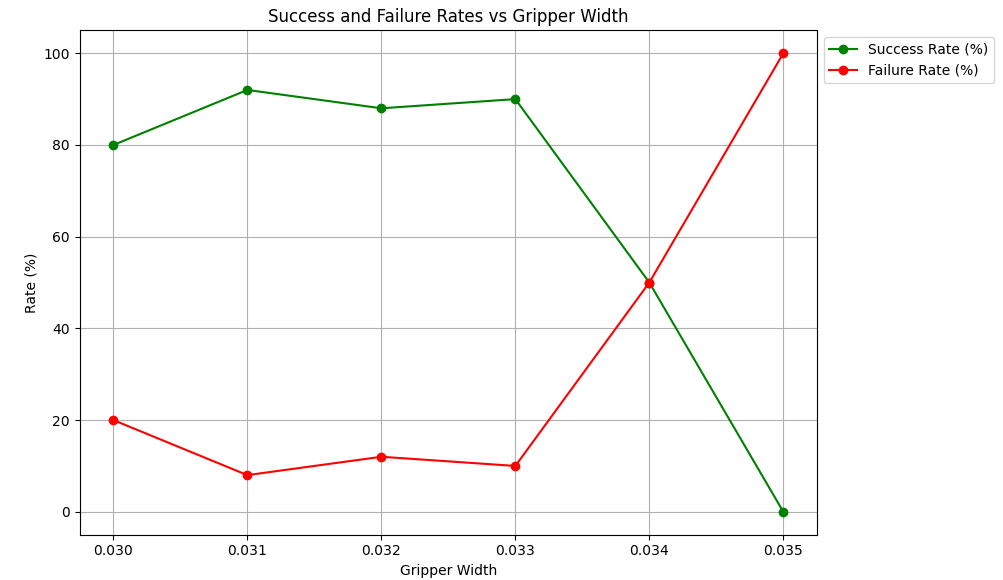
0.00530042 0.00028008 0.02045739 0.01814811 -0.00236258 0.00902515

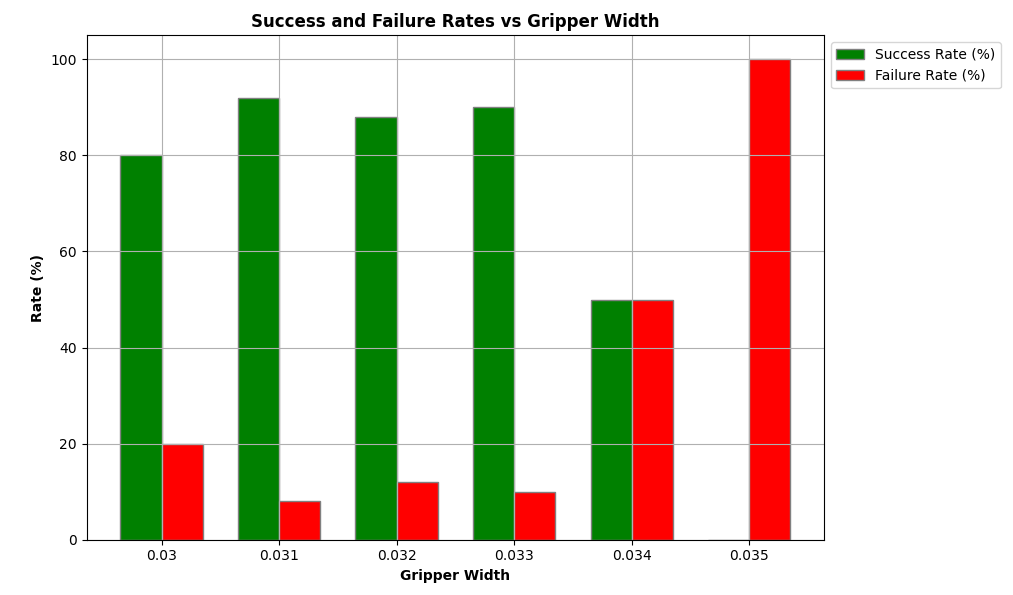
0.01926565 -0.00096212 0.0199311 0.00260788 0.01657832 -0.00303754

0.01655385 -0.00654511 0.00871424 0.01897553 0.00052 0.00344807

0.01593543 -0.00065189]

|  |  |  |  |
| --- | --- | --- | --- |
| **Experiment No:** | **Gripper Width** | **Success Rate (%)** | **Failure Rate (%)** |
| 37 | 0.03 | 80 | 20 |
| 38 | 0.031 | 92 | 8 |
| 39 | 0.032 | 88 | 12 |
| 40 | 0.033 | 90 | 10 |
| 41 | 0.034 | 50 | 50 |
| 42 | 0.035 | 0 | 100 |

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**Case 4: Scale =0.02**

**Sampled position X:** [0.48555117 0.47670729 0.50601379 0.48025193 0.49241815 0.51087208

0.48758345 0.47972214 0.49100881 0.50246381 0.49001166 0.510129

0.48088111 0.4817089 0.48177141 0.50998832 0.48058501 0.49660133

0.50473693 0.4993915 0.5105544 0.49098094 0.48511919 0.50822063

0.48842108 0.48255574 0.47922552 0.48463938 0.51512187 0.49656756

0.50391779 0.48678201 0.48533544 0.50141921 0.50103433 0.49805101

0.47996094 0.49691696 0.49168265 0.50303303 0.51450631 0.50803052

0.4838819 0.49102342 0.4895732 0.48106731 0.50603059 0.4924823

0.50504652 0.47665043]

**Sampled position Y:** [-0.01273905 0.00500519 0.00350171 0.01805933 0.0113926 -0.00864066

0.00787333 0.01708065 0.01691917 0.02366908 0.02147704 0.01862736

-0.00018133 0.00197057 0.01053857 0.02523747 0.0039918 0.00082397

0.01191046 0.00272241 0.00875555 0.01925381 0.00076027 0.00200981

-0.01189823 0.02496256 0.00411953 -0.00606639 0.01576231 0.02516817

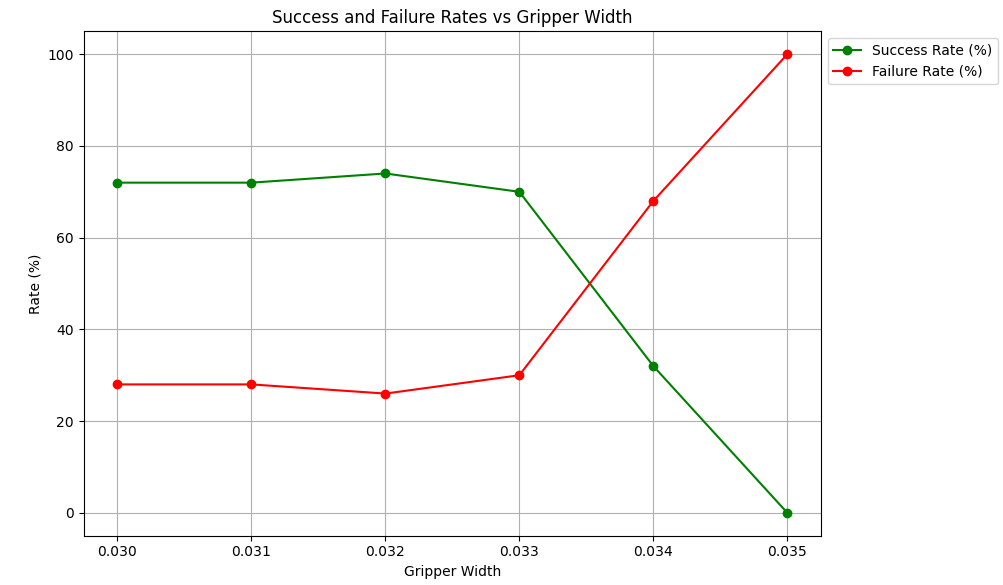
0.01197517 0.01728728 0.00288621 -0.00269427 -0.00100441 0.0115168

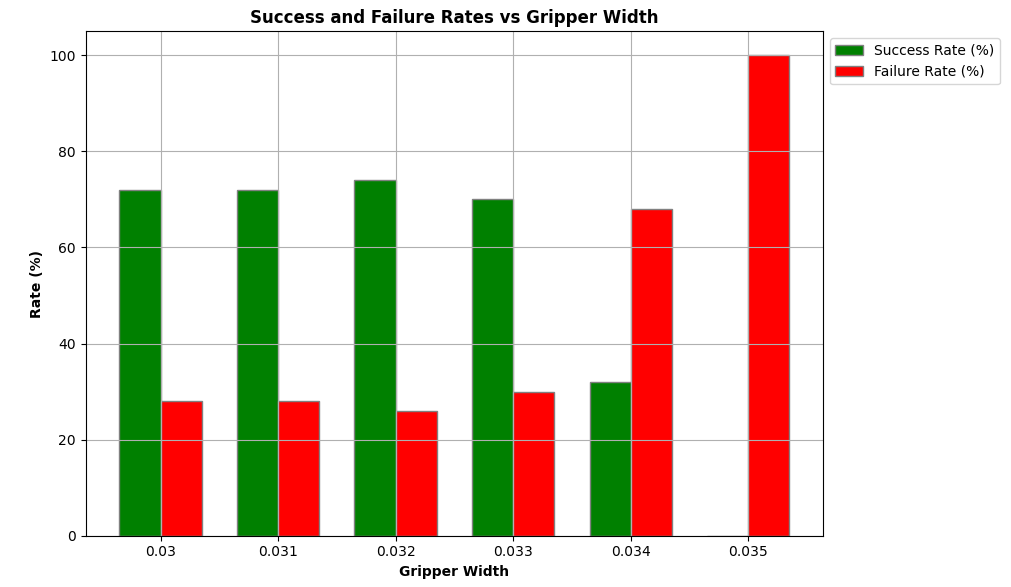
0.00822135 0.01535334 -0.00739405 0.01757615 -0.00643796 0.02534187

-0.01426708 0.00800934 0.0176593 -0.00022322 0.00118828 0.00154019

0.01565445 0.00514922]

|  |  |  |  |
| --- | --- | --- | --- |
| **Experiment No:** | **Gripper Width** | **Success Rate (%)** | **Failure Rate (%)** |
| 43 | 0.03 | 72 | 28 |
| 44 | 0.031 | 72 | 28 |
| 45 | 0.032 | 74 | 26 |
| 46 | 0.033 | 70 | 30 |
| 47 | 0.034 | 32 | 68 |
| 48 | 0.035 | 0 | 100 |

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