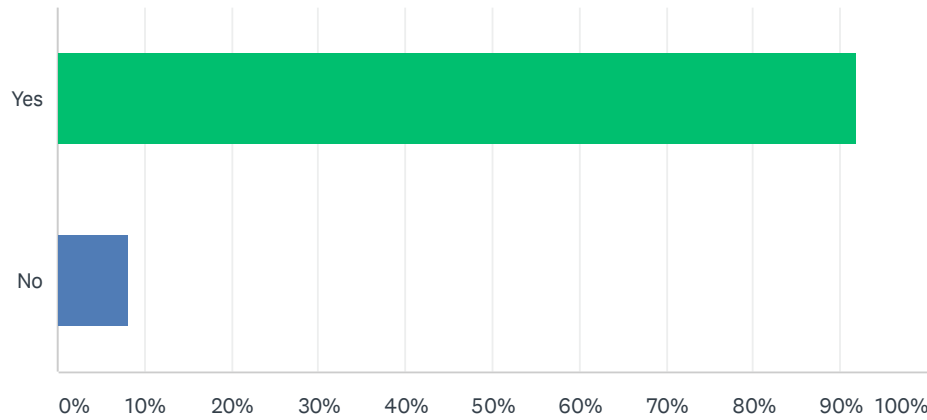


## Q1 Do you use simulation currently in your robotics development

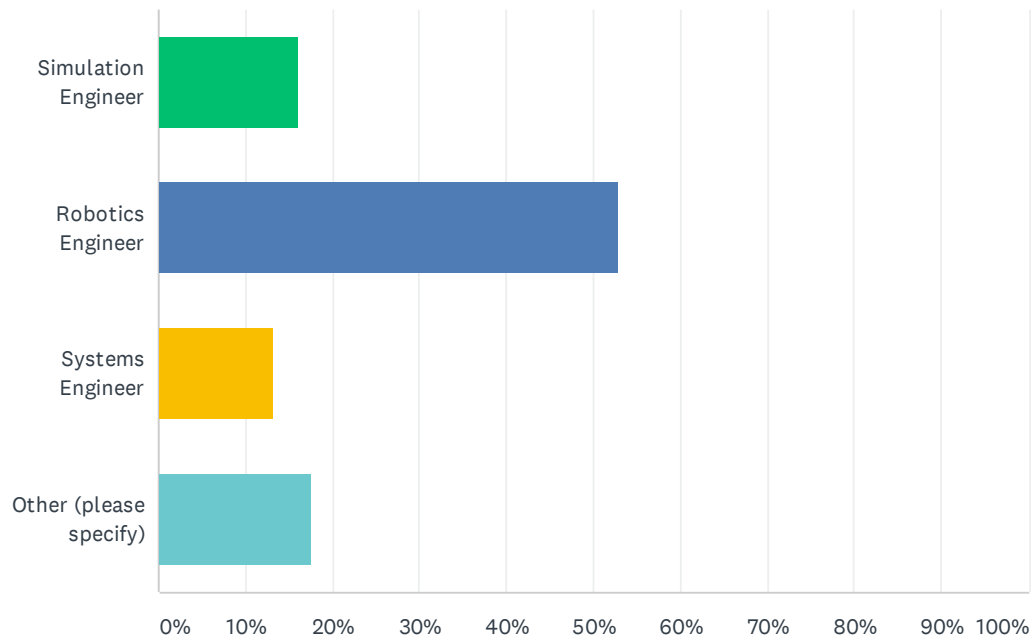
Answered: 85 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	91.76%	78
No	8.24%	7
TOTAL		85

## Q2 What is your role in the team?

Answered: 68   Skipped: 17

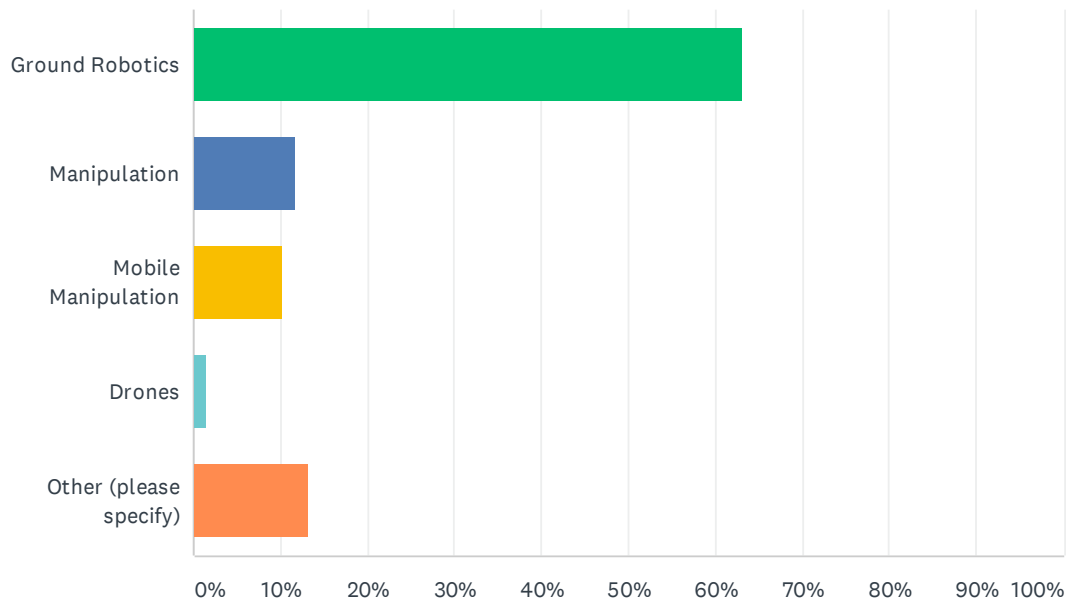


ANSWER CHOICES	RESPONSES	
Simulation Engineer	16.18%	11
Robotics Engineer	52.94%	36
Systems Engineer	13.24%	9
Other (please specify)	17.65%	12
TOTAL		68

#	OTHER (PLEASE SPECIFY)	DATE
1	founder	4/6/2020 4:10 AM
2	Support	3/25/2020 11:25 PM
3	Researcher and Project Leader	3/25/2020 5:47 AM
4	Software developer	3/24/2020 9:11 PM
5	Tech lead	3/24/2020 6:56 PM
6	product manager	3/24/2020 5:57 AM
7	Senior Researcher	3/24/2020 3:11 AM
8	Software Engineer	3/24/2020 2:54 AM
9	Engineering director	3/23/2020 10:46 PM
10	Lead Simulation	3/23/2020 10:42 AM
11	CEO	3/23/2020 10:41 AM
12	Software engineer	3/23/2020 10:02 AM

### Q3 What robotics application do you simulate?

Answered: 68 Skipped: 17

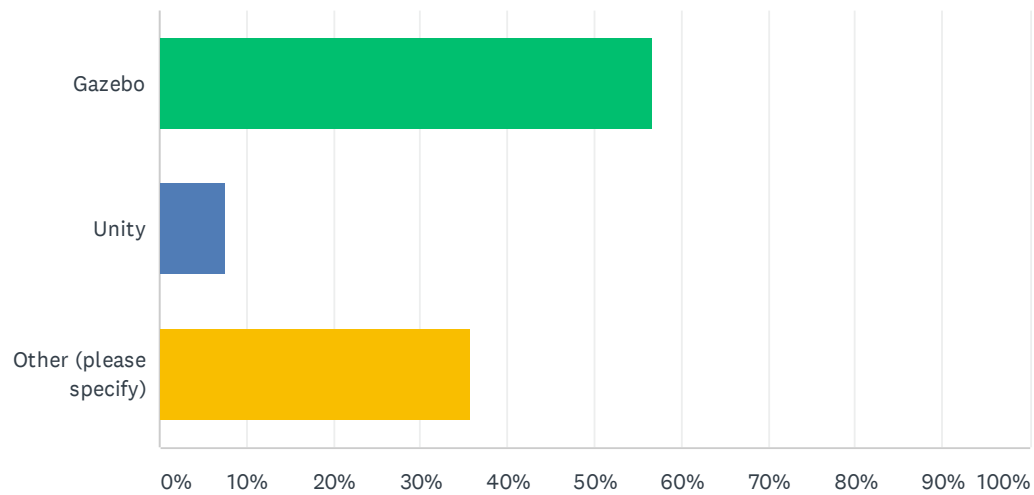


ANSWER CHOICES	RESPONSES	
Ground Robotics	63.24%	43
Manipulation	11.76%	8
Mobile Manipulation	10.29%	7
Drones	1.47%	1
Other (please specify)	13.24%	9
TOTAL		68

#	OTHER (PLEASE SPECIFY)	DATE
1	all above	3/24/2020 5:57 AM
2	autonomous mobile agricultural robot	3/24/2020 2:01 AM
3	Underwater	3/23/2020 3:10 PM
4	ASV, AUV	3/23/2020 2:36 PM
5	Multiple Ground Robotics	3/23/2020 2:08 PM
6	Underwater robotics	3/23/2020 11:35 AM
7	all of the above	3/23/2020 11:19 AM
8	Usv	3/23/2020 10:52 AM
9	UGV and Drones	3/23/2020 10:03 AM

## Q4 What simulator do you currently use or are planning to use in a future project?

Answered: 67 Skipped: 18

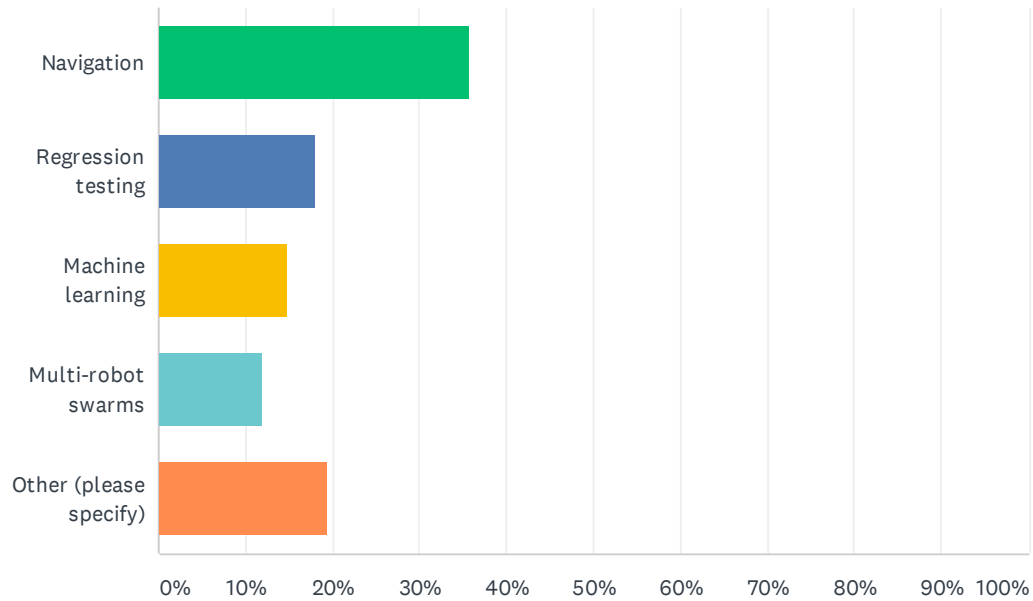


ANSWER CHOICES		RESPONSES	
Gazebo		56.72%	38
Unity		7.46%	5
Other (please specify)		35.82%	24
TOTAL			67

#	OTHER (PLEASE SPECIFY)	DATE
1	Webots	4/14/2020 6:29 AM
2	Webots	4/4/2020 9:49 AM
3	Gazebo, Carla, LGSim	3/26/2020 12:59 AM
4	Custom	3/25/2020 11:25 PM
5	Webots	3/25/2020 12:00 AM
6	webots	3/24/2020 4:50 PM
7	matlab and simulink	3/24/2020 5:57 AM
8	v-rep	3/24/2020 3:45 AM
9	Currently Unity, tried Gazebo but going to use Webots	3/24/2020 2:01 AM
10	Webots	3/24/2020 12:08 AM
11	LGSVL, Carla	3/23/2020 10:46 PM
12	Gepetto	3/23/2020 7:49 PM
13	Both Gazebo and Unity	3/23/2020 5:42 PM
14	Stage	3/23/2020 2:16 PM
15	Home grown 2d sim	3/23/2020 1:58 PM
16	Gazebo, Unity, U4E, Webots, other commercial simulators	3/23/2020 11:19 AM
17	By	3/23/2020 10:51 AM
18	Ignition Gazebo	3/23/2020 10:42 AM
19	Webots	3/23/2020 10:41 AM
20	Webots	3/23/2020 10:14 AM
21	Webots	3/23/2020 10:12 AM
22	Gazebo and Carla	3/23/2020 10:03 AM
23	Webots	3/23/2020 10:01 AM
24	Unreal Engine	3/4/2020 9:43 PM

## Q5 What role does simulation play in your application?

Answered: 67 Skipped: 18

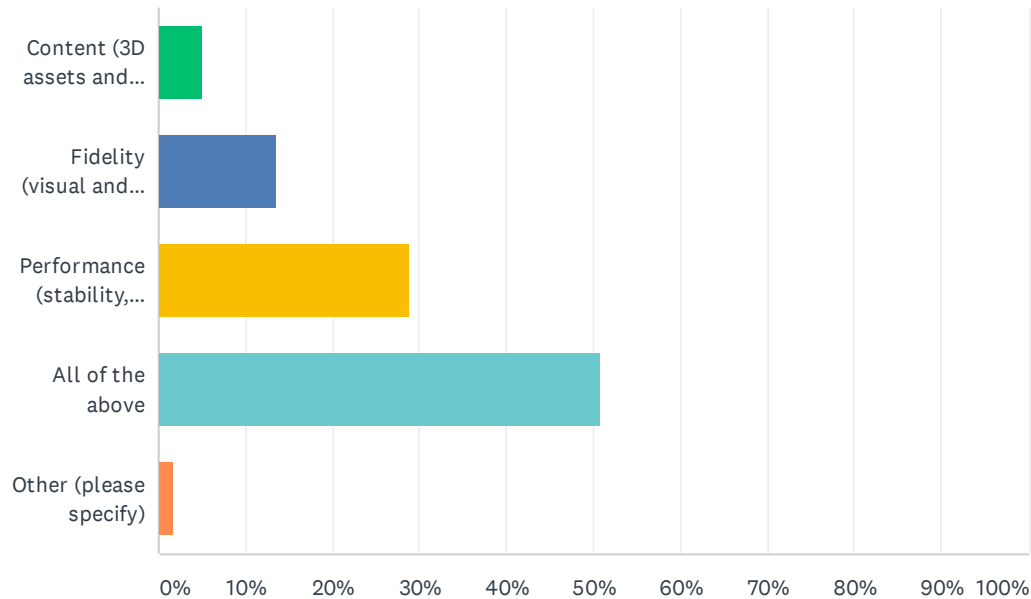


ANSWER CHOICES	RESPONSES	
Navigation	35.82%	24
Regression testing	17.91%	12
Machine learning	14.93%	10
Multi-robot swarms	11.94%	8
Other (please specify)	19.40%	13
TOTAL		67

#	OTHER (PLEASE SPECIFY)	DATE
1	placement.	4/6/2020 4:10 AM
2	Navigation, Delivery Service (contained interaction)	3/26/2020 12:59 AM
3	Issue reproduction	3/25/2020 11:25 PM
4	Navigation, Regression testing and Multi-robot swarms	3/24/2020 6:32 PM
5	Code verification pre deploying on robot	3/24/2020 4:50 PM
6	all above	3/24/2020 5:57 AM
7	Machine Learning, Task planning	3/24/2020 3:11 AM
8	Optimal Control	3/23/2020 7:49 PM
9	All of the above	3/23/2020 1:58 PM
10	replace the hardware (for purposes of regression testing, development of new sw, etc)	3/23/2020 11:19 AM
11	Validation	3/23/2020 11:02 AM
12	Testing, Prototyping, ML	3/23/2020 10:42 AM
13	It could be everything at once since I am a software engineer	3/23/2020 10:14 AM

## Q6 What features are important for your next simulation project?

Answered: 59   Skipped: 26



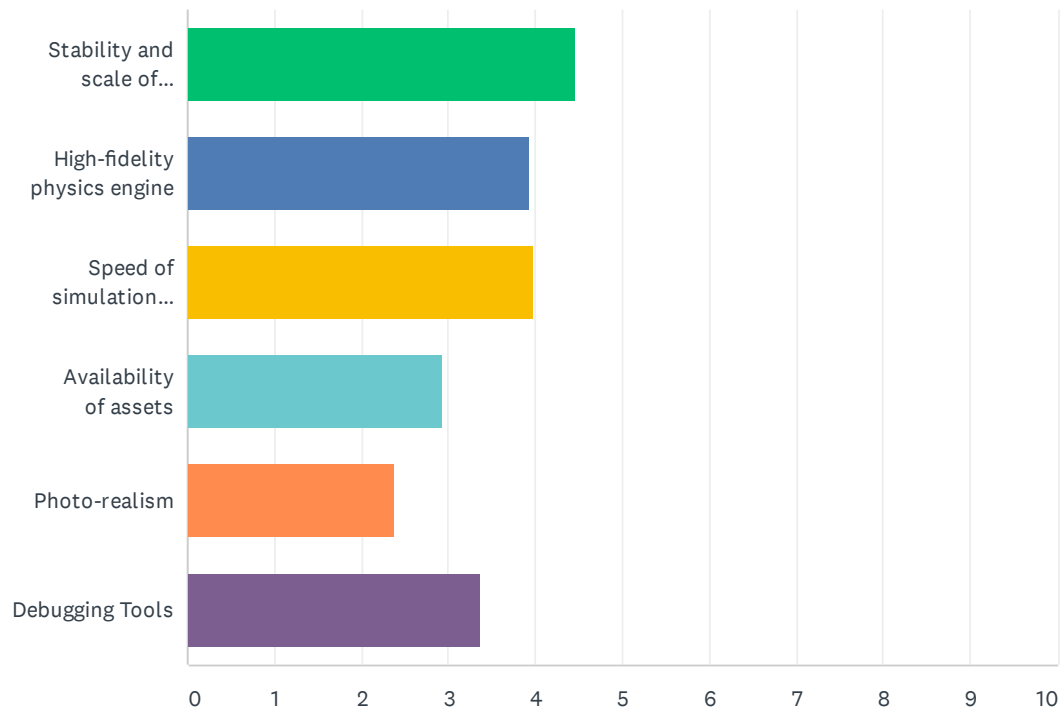
ANSWER CHOICES		RESPONSES	
Content (3D assets and worlds)		5.08%	3
Fidelity (visual and physics)		13.56%	8
Performance (stability, scale, and speed)		28.81%	17
All of the above		50.85%	30
Other (please specify)		1.69%	1
TOTAL			59

#	OTHER (PLEASE SPECIFY)	DATE
1	Utility	3/4/2020 9:50 PM



## Q7 What criteria do you consider in choosing a simulator? (Rank)

Answered: 56   Skipped: 29



	1	2	3	4	5	6	N/A	TOTAL	SCORE
Stability and scale of simulation	35.85% 19	16.98% 9	22.64% 12	9.43% 5	5.66% 3	7.55% 4	1.89% 1	53	4.46
High-fidelity physics engine	20.37% 11	25.93% 14	7.41% 4	27.78% 15	11.11% 6	7.41% 4	0.00% 0	54	3.94
Speed of simulation (Real-time factor)	16.36% 9	20.00% 11	30.91% 17	12.73% 7	12.73% 7	5.45% 3	1.82% 1	55	3.98
Availability of assets	7.41% 4	14.81% 8	5.56% 3	22.22% 12	27.78% 15	18.52% 10	3.70% 2	54	2.92
Photo-realism	13.21% 7	3.77% 2	3.77% 2	5.66% 3	30.19% 16	39.62% 21	3.77% 2	53	2.39
Debugging Tools	5.56% 3	16.67% 9	25.93% 14	20.37% 11	11.11% 6	14.81% 8	5.56% 3	54	3.37

**Q8 How satisfied are you with your current simulation on a scale of 1-10 and why?**

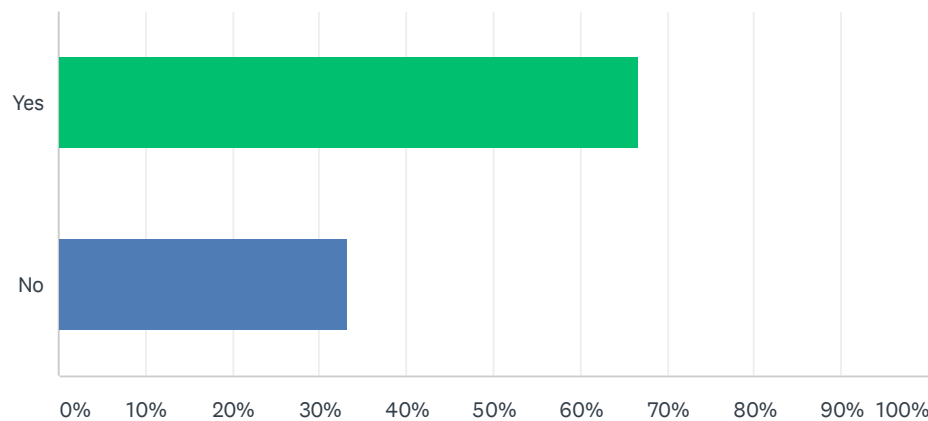
Answered: 49   Skipped: 36

#	RESPONSES	DATE
1	10	4/14/2020 6:31 AM
2	1	4/6/2020 4:10 AM
3	9	4/4/2020 9:50 AM
4	7. It crashes a lot.	4/3/2020 10:17 AM
5	ok	3/26/2020 1:00 PM
6	5. I have using Gazebo simulator for autonomous driving with mobile robot. It is useful to test and integrate our products, but it don't have powerful performance to simulate pysical robot model and reality sensor data.	3/26/2020 2:26 AM
7	5	3/25/2020 11:26 PM
8	We use Gazebo. We have run into issues where the simulation was not realistic / physics were not correct. It was difficult to find solutions. We saw that other groups were also using VREP, so we just started to look into other packages. We have not a clear list of criteria to select a simulation package.	3/25/2020 5:50 AM
9	7	3/25/2020 1:10 AM
10	10	3/25/2020 12:00 AM
11	6	3/24/2020 7:34 PM
12	5 Quite compilcated	3/24/2020 6:57 PM
13	5 Not able to simulate more than 20 robots at a real time factor of 1 (even 20 is at a cost of physics fidelity). Issues with physics stability when trying to tune robot to model real life behavior. Robot does not behave realistically given real physics parameters, extensive tuning of physics parameters, controllers etc is necessary to achieve this.	3/24/2020 6:40 PM
14	6, high learning curve but can get good video demos out of it	3/24/2020 4:52 PM
15	Quite good (8). It allows me to simulate most of the effects that I need. But it took a great deal of work to achieve that.	3/24/2020 7:43 AM
16	3: it's slow and unstable.	3/24/2020 7:07 AM
17	8 - generally meet our goals	3/24/2020 5:59 AM
18	7	3/24/2020 5:02 AM
19	5	3/24/2020 3:47 AM
20	5, contact detection is horrible	3/24/2020 3:18 AM
21	3. Contacts and manipulation are very unreliable.	3/24/2020 3:12 AM
22	5	3/24/2020 2:06 AM
23	2 (Unity) - C# and its tooling on linux is poor, performances on linux in the editor are not stable, license is expensive 5 (Gazebo) - Physics glitches on uneven terrain. Robot's suspension near impossible to tune. Lack of doc 8 (Webots) - Only caveat so far is performance when thousands of entities (like vine 3D model) are spawned	3/24/2020 2:06 AM
24	Assuming 1 is best and 10 worst: 4 Sometimes slow, debugging tedious, physics only okay.	3/24/2020 1:25 AM
25	8	3/24/2020 12:59 AM
26	10, the best found until now. Easy to learn and powerful.	3/24/2020 12:09 AM
27	Unsatisfied. It has poor performance. It needs a GPU to handle LiDAR simulation, and this is extremely expensive in the cloud.	3/23/2020 10:48 PM
28	5. Useful but it crashes a lot, no indication why.	3/23/2020 7:50 PM
29	5	3/23/2020 5:43 PM
30	6. Generation of realistic content is laborious.	3/23/2020 5:40 PM

31	7. Poor debugging tools, poor photo-realism, simulation crashes a lot and real-time factor decreases fast with some complexity.	3/23/2020 3:16 PM
32	5/10. Stage is a simple 2D simulator that runs very well on typical developer machines. It lets us test that the nodes we run are configured correctly and that nothing on the navigation side is obviously broken. We are not able to test in 3D or with much of our perception pipeline running properly.	3/23/2020 2:19 PM
33	8. All in all good but several minor instabilities and quirks.	3/23/2020 2:11 PM
34	1. We're still stuck on Kinetic and Gazebo 7, but there are some real fundamental problems with Gazebo. In addition to persistent stability issues, the documentation with respect to coordinate frames is completely bloody useless. It's also completely unable to simulate non-Cartesian coordinate frames, which become important when dealing with integrated navigation over O(km) length scales. Perhaps this is symptomatic, but the entire Spherical Coordinates back-end is broken. Among MANY other issues, it can't read a spherical coordinates origin to more than 6 digits-- that's several meters of error! So yeah, Gazebo's great for building roombas, but kinda use-impaired in the real world.	3/23/2020 11:38 AM
35	8. visual fidelity could be improved	3/23/2020 11:29 AM
36	6: lots of management of assets, packages, coordination, orchestration and integration. Especially integration is a task, as there is no functional parity between the various integrations available.	3/23/2020 11:24 AM
37	9	3/23/2020 10:54 AM
38	Under question 7 not all selections are maintained. For completeness: Stability and Scale: 6 High-fidelity physics: 6 (ideally configurable, s.t. speed and accuracy can be tuned to specific scenarios) Speed of simulation: 5 Assets: 4 (or at least a standard pipeline for assets) Photo-realism: 5 (Same as for physics, ideally configurable to scenario - not everything needs high fidelity rendering) Debugging tools: 6 Rating for current simulation: 6-7. Ideally a simulation environment would "work out of the box" instead of requiring heavy investments to get everything working.	3/23/2020 10:47 AM
39	9. Easy to use, good fidelity	3/23/2020 10:44 AM
40	9	3/23/2020 10:29 AM
41	6. Gazebo can be rather slow for multi-robot simulation or simulation with big environments. There is a lack of up-to-date documentation, which becomes especially confusing when a problem arises and different questions and answers point to different versions. Configuration is, therefore, also confusing since tuning of the model often involves incompatibilities between ROS parameters and Gazebo parameters, different software versions tied to specific distributions, checking the documentation of libraries (physical engine) of even the source code of Gazebo, plugins, etc.	3/23/2020 10:21 AM
42	10, because webots meets all the above criteria. I am not going to change	3/23/2020 10:16 AM
43	9	3/23/2020 10:13 AM
44	5 performace	3/23/2020 10:08 AM
45	8 Gazebo has great physics and rendering engine tents to be slow at times. Carla on the other hand has great graphics and physics but needs GPU, hence can't be used in in many laptops. Carla-ROS bridge needs much more features.	3/23/2020 10:06 AM
46	8	3/23/2020 10:04 AM
47	6- GAZEBO Many bugs for the projects from the scratch	3/23/2020 10:03 AM
48	meh	3/23/2020 10:02 AM
49	1	3/4/2020 9:50 PM

Q9 Would you like to learn more about new simulation offerings?

Answered: 57    Skipped: 28



ANSWER CHOICES		RESPONSES	
Yes		66.67%	38
No		33.33%	19
TOTAL			57

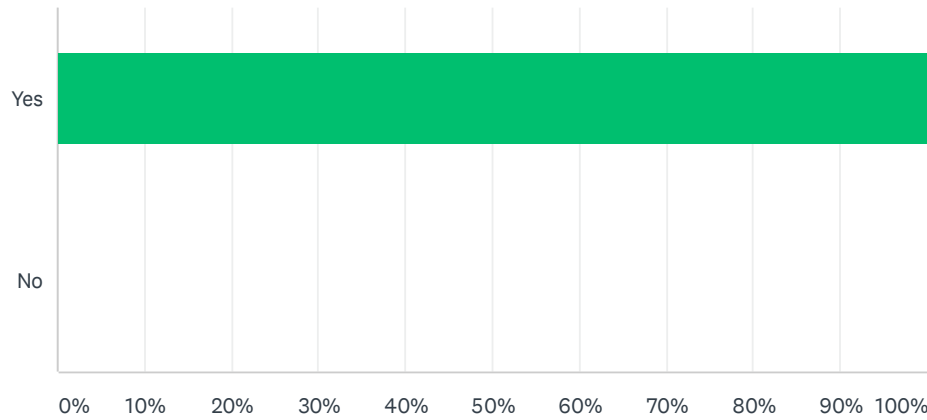
## Q10 What is preventing you from using simulation in your application?

Answered: 4   Skipped: 81

#	RESPONSES	DATE
1	long time to transfer software from simulation to a real robot	3/24/2020 12:33 AM
2	I'm just starting a new project, will be surveying simulation ecosystem	3/23/2020 1:26 PM
3	Time investment to create accurate models.	3/23/2020 12:50 PM
4	hw	3/4/2020 8:14 AM

## Q11 Would you like to learn more about new simulation offerings?

Answered: 4 Skipped: 81



ANSWER CHOICES		RESPONSES	
Yes		100.00%	4
No		0.00%	0
TOTAL			4