EX ROBOTICS

Be Kind to Your Robot

RUGGED, RELIABLE, ROBOTS
For *Extreme* Environments

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1 Introduction

A robot can feel like your pet. We even have a customer that names each of their robots after a "minion". Like pets, robots misbehave. Or do they? Our robots spend most of their time in autonomous mode when they're rather predictable and boring. Maybe it's the owners that need to be more thoughtful.

Treat this short article as a training guide for robot owners. It's based on some of the issues we've seen over the last 7 years and suggests how owners might improve their attitude, driving style, and the robot's environment.

2 Attitude

Robots aren't sentient creatures with a will of their own, they're machines. So, let's drop the pet analogy and think of your robot as a car. What is it: a Ferrari or your favourite performance car from Grand Theft Auto?

Surely no-one would think of their robot as a Ferrari. So, why do so many robot drivers perform doughnuts when they first get their hands on a robot controller? Also, whilst robots seem achingly slow when standing next to them, they seem surprisingly fast when seen through the low perspective of their drive camera. Fortunately, the Ferrari phase doesn't last long and seldom damages the robot.

Perhaps younger robot drivers should be forgiven for thinking of Grand Theft Auto. After all, they're peering into a laptop screen and driving the robot with an X-Box controller. Unfortunately, this can be more serious than the Ferrari approach. Robots don't have "reset" buttons. If you drive over the edge of a cliff, there's no coming back.

Let's take a step back. Robots need to perform in challenging industrial environments and to survive anything that the weather throws at them. Maybe a Toyota Land Cruiser is a better analogy. We pride our ExR-2s for their ruggedness and reliability. With a little basic maintenance they'll survive for years. Hopefully, they'll become a "classic" of the future just like the Toyota.

2.1 Driving Style

Sometimes, humans need to drive robots when programming missions, investigating unusual events, or during tests and demonstrations. If they'd thought of their robots as cars we might have seen less issues.

One of our favourite customers wanted to drain a robot's batteries quickly. So they rapidly alternated between full speed forwards and full speed backwards until a gearbox broke. The Toyota's gearbox wouldn't have lasted as long as the robot's. Fortunately it's easy to set the maximum acceleration on an electric motor and this has never happened again.

We permitted one of our partners to demonstrate a robot to a customer. They were located several thousand kilometres away from the robot so there was a lag of about half a second between operating the controller and the robot reacting. The driver disregarded "safe stopping distances", released the throttle too late, and the robot drove over the edge of a ramp. The result can be seen in the picture. Again we were fortunate. When our team arrived the next morning, they rocked the robot onto its tracks and it worked (there were some dents in the bodywork that the "local repair shop" knocked out).

If you drive your car up a high curb you slow down. So why do some customers drive their robot up (or down) ledges at full speed? Our older gearboxes couldn't handle this. Our newer, stronger gearboxes are more robust, but please don't test them out. We're guilty too. We realised that the robot's autonomy software drove up 10cm ledges at full speed. Result, a dizzy robot that's lost its sense of direction.

Why do robot drivers sometimes abandon them at the end of a shift so that their batteries are fully depleted the next day? Please park your robot safely on its dock before you leave.

3 Working Environment

A little thoughtfulness can improve robot behaviour and increase life expectancy. Here are some examples.

Think carefully about where you put the docking station. If there are prevailing dry winds, try to put the dock on the leeward side of a structure to protect the robot's windows from dust build-up. Solar gain can be reduced by putting the dock in a shady location or even rigging a tarpaulin. On one notorious occasion, a customer placed a robot's docking station under a vent in sub-zero temperatures. The steam from the vent encased the robot in an "iceberg" (see picture). The robot was pushed into a warm location, the dock relocated, and robot missions resumed with no maintenance.

It's a really bad idea to put the dock in a location with poor wireless communications. The robot may not be able to upload its data at the end of the mission and you can't start an autonomous mission if you can't communicate with the robot.

Think about where the robot is going to turn. Try to turn on smooth surfaces where tracks won't snag on edges. Don't try to turn in potholes. Also, try to avoid driving on loose surfaces like gravel. It's often possible to avoid loose surfaces by positioning the robot further away and using its zoom camera. If you can't avoid the loose surface, don't turn or climb ledges so that the robot's tracks don't "dig" holes. If a robot can't avoid turning, why not put down a smooth steel plate.

Sometimes robots must share roads with other vehicles. If they "carve up" the robot it can play havoc with its collision avoidance software. Educate the other road users and tell them robots always have "right of way".

4 Recommendation

Life is improving for ExR-2 robots. Our Field Engineers are teaching customers how to "be kind to your robot". They spend time with a customer's robot team at their deployment location – think driving lessons. Also, we're seeing a trend towards "mission as a service". ExRobotics or one of its partners programmes and supervises robot missions. A chauffeur service if you will, freeing the customer to focus on the information and insights generated by the robot.