

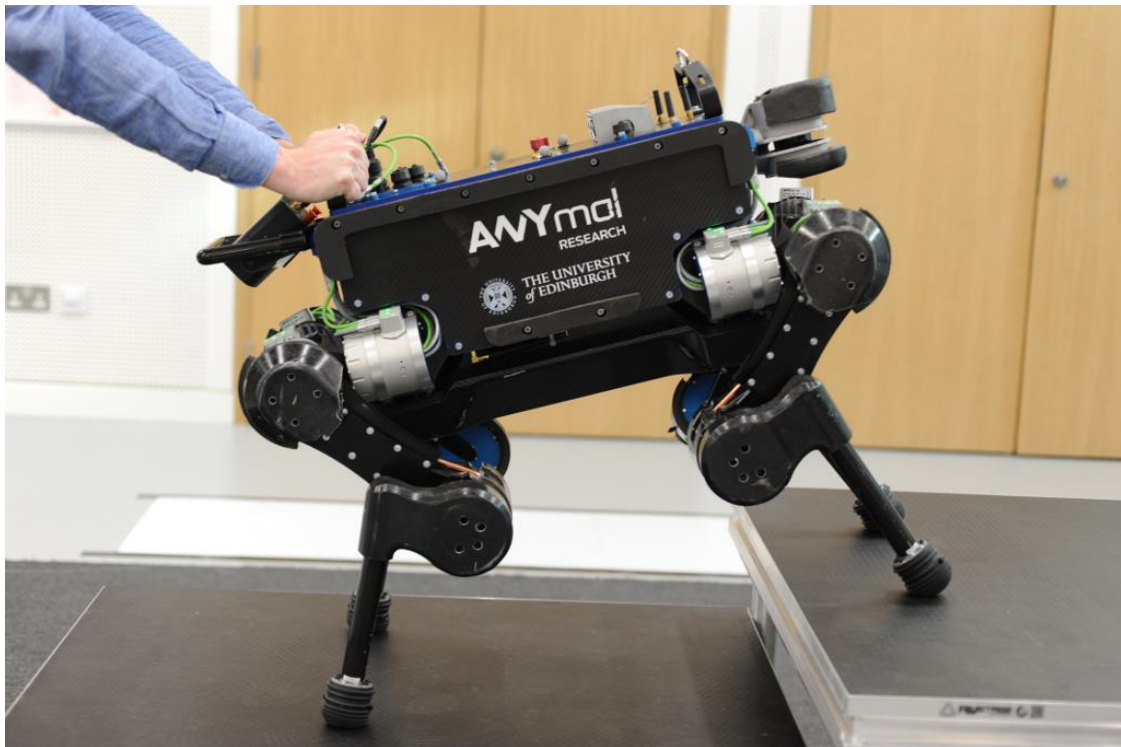


Anymal Quadruped Risk Assessment Form

School Assessment No:	INFRA50
Title of Activity:	Operating Anymal Quadruped Platform
Location(s) of Work:	Field Robotics Lab; Bayes Centre G.7

Brief Description of Work:

Experimental work using the Anymal Quadruped Platform



Hazard Identification:

Hazard(s)	Present Risk Evaluation L/M/H	Control Measures (i.e., alternative work methods / mechanical aids / engineering controls, etc.)	Risk Evaluation after control L/M/H
Impact between robot and people or objects in its path (e.g., being struck by the body of the quadruped in motion)	M	<p>Only authorised and trained operators may work with the equipment.</p> <p>The emergency STOP remote (HRI Remote) must be always in hands of the operator with the ability of pressing the STOP button easily.</p> <p>The operators should be familiar with the safe code of working practice for working with the robot.</p> <p>No person should enter the robot's working envelope when the robot is in operation unless authorised and trained operator is present attending control of the quadruped and the emergency STOP remote.</p> <p>A minimum of two authorised and trained operators are required for the operation of the quadruped.</p>	L
Crushing and trapping (e.g., part of the body being trapped between the quadruped and a fixed object)	M	<p>Those working in close proximity to the robot should be aware of areas of possible injury.</p> <p>All trained operators and users should be familiar with the emergency stop behaviour as well as the loss of communication behaviour.</p> <p>Those working with the robot should avoid putting any body parts underneath or in between the legs of the robot due to the</p>	L

		<p>emergency stop behaviour of the robot.</p> <p>When available and supervised by an extra experienced, authorized, and trained operator, operation of the robot should be carried out supported by a crane suitable for the 35 kg mass of the Anymal platform. The crane should be attached with suitable ropes/cabling onto the support eyelets on the top of the robot frame.</p> <p>Any damage or wear to the support eyelet, rope/cabling or the crane should be reported to the Admin Office/Local Safety Adviser or another member of senior staff, then suitably labelled and taken out of use until the repair has been effected.</p>	
Burn Risk	M	<p>Users should not touch the cooling fans, heat sinks/pipes, or the actuators during or after operation.</p> <p>Batteries should not be overdriven or charged/discharged quickly. The batteries should only be charged with an approved charger and in a safe manner.</p>	L
Ejection of parts from the robot due to malfunction, overloading, or crashing into the environment.	M	<p>The emergency STOP remote must be always within easy reach of the operator.</p> <p>No person should enter the robot's working space when the robot is in operation unless authorised and trained operator is present attending control of the quadruped and the emergency STOP remote.</p> <p>Inspection of the legs for damage before running should be</p>	M

		performed by the user. Any damage should be reported, and the robot not used until fixed.	
Electric Shock	L	<p>The equipment must be regularly tested for electrical safety.</p> <p>Any changes/adjustments to the equipment can be made only when it is powered off.</p> <p>Electrical cables, plugs should be regularly inspected by the user for damage.</p> <p>Any defective equipment should be reported immediately to the Admin Office/Local Safety Adviser or another member of senior staff, then suitably labelled and taken out of use until the repair has been effected.</p>	L
Slipping/Tripping Hazard	L	<p>Working areas should be kept clear of obstructions.</p> <p>Any spillages should be cleaned up immediately.</p> <p>Any hazards such as trailing cables, defects to floor coverings, faulty lighting etc. should be reported immediately to the Admin Office/Local Safety Advisor or another senior member of staff.</p>	L
Fire	L	Lab users must be acquainted with the Fire Routine and Procedure for the area.	L
Fire caused by the lithium-ion battery pack	L	<p>Users should be familiar with the fire routine for the robot that is summarised as:</p> <ul style="list-style-type: none"> Letting the fire department fight fires. 	L

		<ul style="list-style-type: none"> • Use only Class D fire extinguishers, (copper powder for combating lithium fire). • Do not use any water or any other type of fire extinguisher, as lithium fires react violently with water and combustible substances. <p>The robot on charge should not be left unattended at any point. The approved charger should be turned off and disconnected from the robot.</p>	
Lifting related injuries	L	<p>Users should use the provided crane to lift the robot in the majority of cases when the robot is attached.</p> <p>Normal lifting for moving the robot off crane should be carried out by two people using correct lifting techniques. The robot itself weighs 35kg.</p> <p>Under extreme cases the robot can be lifted by a single user, however, this is only in extreme cases of possible injuries due to the robot falling on a person. Use proper lifting technique and keep straight back to avoid injury.</p>	L

Engineering Controls:

Guarding	X	Extraction (LEV)		Interlocks		Enclosure	
Guarding by separation of unauthorized people from the robot's working environment.							

Personal Protective Equipment (PPE): Identify all necessary PPE.

Eye / Face		Hand /Arm		Feet / Legs		Respiratory	
Body (clothing)		Hearing		Other (Specify)			
Specify the grade(s) of PPE to be worn:							
Specify when during the activity the item(s) of PPE must be worn:							

Non-disposable items of PPE must be inspected regularly, and records retained for inspection

Persons at Risk:

Academic staff	X	Technical staff	X	P'Grad students	X	U'Grad students	X
Maintenance staff	X	Office staff		Cleaning staff		Emergency personnel	
Contractors		Visitors	X	Others			

Authorisation and training are required prior to the use of the Anymal Quadruped platform.

Assessment carried out by:

Name:	Vladimir Ivan	Date:	25/08/2021
Signature:		Review Date:	25/08/2022



Safe system of work – Form SSW

Working with the Anymal Quadruped robot – INFRA 50

INFRA 12 must be read, understood, and signed off along with this SSW, before use of the robot inside the robotics labs.

INFRA 02 must be read, understood, and signed off along with this SSW, before use of the robot outside of the robotics labs.

The Anymal is designed to allow close human-robot interaction, however it should only be used in this manner by authorised experienced users.

Inexperienced and unauthorised users should only enter the working envelope under the direction of an experienced authorised user who is present at the time.

No unauthorised use is allowed.

Before use, the area should be checked and cleared of unnecessary items. Cables should be neatly routed, and the emergency stop button available for use.

If any injury occurs, the unit should be stopped, disabled and medical assistance sought.

Once finished. Shut down unit and any associated equipment. Ensure computer is logged out, to prevent unauthorised use.

The emergency phone number is 2222

The nearest First Aid box is in the floor kitchen

Informatics First Aider list can be found on the web at;

<http://www.inf.ed.ac.uk/safety/first-aiders.html>

