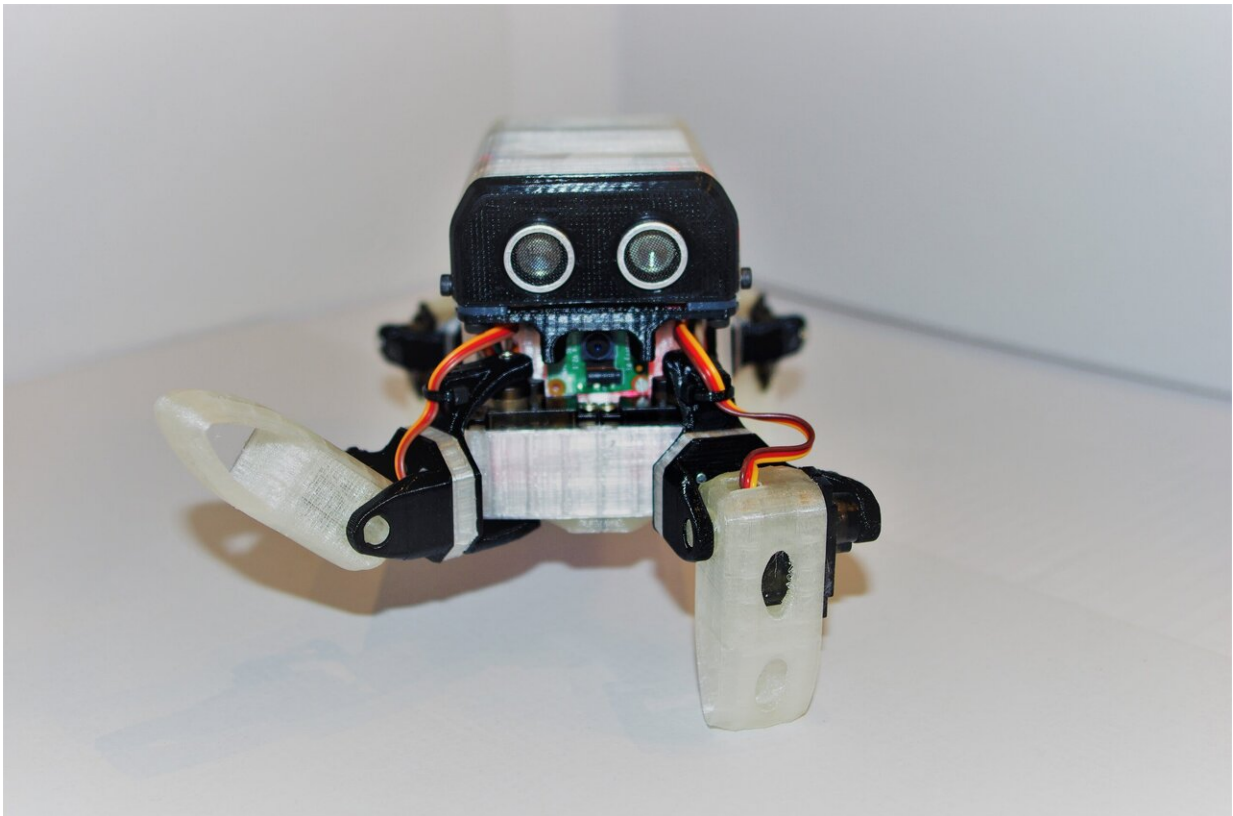


LoCoQuad: An arachnoid-inspired robot for research and education purposes

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LoCoQuad, the robot developed by the researchers. Credit: Bernal & Civera

Animal behaviors and the biological mechanisms underpinning them are among the greatest sources of inspiration for robotics studies. Over the past decade or so, countless research teams at universities and companies

worldwide have been trying to develop robots that recreate the behaviour or structure of specific animal species.

One of the latest attempts was made by two researchers at the University of Zaragoza, Manuel Bernal Lecina and Javier Civera, who recently developed a quadruped robot called LoCoQuad inspired by arachnoids. This robot, presented in [a paper pre-published on arXiv](#), could have a number of applications in robotics research and education.

"This research journey began with a summer project that became my bachelor's degree thesis," Bernal-Lecina told TechXplore. "The initial idea was to build a super low-cost robotics [platform](#) capable of basic ad-hoc movements, such as rotation, walking, and taking on specific poses. I started building basic prototypes and testing the advantages of each iteration, searching for the right typology and the best price-quality compromise for actuators, control units, and batteries."

After he had conducted extensive research into low-cost robots and produced a number of components using 3-D printing, Bernal-Lecina started collaborating with Javier Civera, his mentor at university, on the creation of a new robot. Their goal was to develop a low-cost robotic platform that could be used as a benchmark to train and evaluate reinforcement learning (RL) algorithms.

"Our study addressed the current need for robotic platforms that are capable of learning by doing, something complex for a cheap robot, but also something we see constantly in social networks, mobile technology and other digital environments," Bernal-Lecina said.

LoCoQuad, the arachnoid-inspired, four-legged robotic platform created by Bernal-Lecina and Civera, has remarkably low hardware costs (ranging between \$150 and \$165 USD), and could thus easily be fabricated on a large scale. While it may not be the most efficient

quadruped robot developed up to date, its low production cost, the fact that it is open-source, highly configurable and user friendly, make it a highly promising platform for both research and education.

"I always like to talk about LoCoQuad as a robotic platform capable of almost everything," Bernal-Lecina said. "But being realistic and a little bit more rational, LoCoQuad is a box with four legs, completely [open-source](#) and general-purpose, with the flexibility to implement a wide array of algorithms, ranging from behaviors relevant to basic education purposes to the advancement of state-of-the-art at the highest educational levels."

As part of their study, Bernal-Lecina and Civera demonstrated the effectiveness of LoCoQuad in a series of experiments. They found that the robot could complete a variety of basic tasks, suggesting that it is a great platform to test reinforcement learning and other machine-learning algorithms.

"The idea of bringing affordable robots into the market lays in the aptitudes that these robots may have," Bernal-Lecina said. "We do not need more stupid robots, we already have enough of them, and we know how to use them. We need clever and autonomous robots so we do not have to worry about them. I believe that robots should, in fact, take care of us."

Machine learning techniques, such as [reinforcement learning](#) models, are now playing a crucial role in the development of smart and efficient robots. LoCoQuad, the low-cost robotic platform devised by Bernal Lecina and Civera, can be used to test some of these techniques and identify ways in which they could be improved.

"LoCoQuad is just one more piece of the puzzle," Bernal Lecina explained. "It allows us to demonstrate that even clumsy, cheap and

simple robots can be taught (or learn by themselves) to fulfill basic and complex tasks. LoCoQuad brings a new alternative to verify that the next big milestone in the robotics field is possible."

Bernal Lecina and Civera have already started using LoCoQuad in other studies to compare algorithms and identify the most effective ones. LoCoQuad's design and the software necessary to implement it have been published online and [can be downloaded for free on GitHub](#). The researchers hope that other teams worldwide will download their software and start using LoCoQuad to test their own machine learning algorithms.

"We will continue working on updates for our fantastic little robot," Bernal Lecina said. "Our first objective is to improve the brain abilities to make the platform more interesting to other universities and research groups, so that they can start using LoCoQuad as a reference platform to test their algorithms and also to start teaching mobile robotics at lower academic levels with a [robot](#) for every student."

More information: LoCoQuad: a low-cost arachnoid quadruped robot for research and education. arXiv:2003.09025 [cs.RO].
arxiv.org/abs/2003.09025

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