Tema: Embedded System Simulator for robotics aplications

Students of the Polytechnic School of the University of São Paulo developed a simulator that allows embedded software tests without electronic components and firmware modification.
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In robotics, one of the main challenges for software developers is testing. A robotic system integrates mechanical, electrical, and computational components, making it difficult to identify the source of errors: "Is it software, hardware, or mechanics?" This reliance on physical components for testing and validating embedded software can lead to delays, increased costs, and added complexity during development, which brings the urge of having a way to test it independently.

Therefore, aiming to make it easier to create and develop firmware for embedded systems and also increase the reliability in embedded system, the students Antonio Lago Araújo Seixas and Vanderson da Silva dos Santos developed a simulation platform for embedded systems, enabling binary code to run seamlessly in both simulated and real environments without modification. This approach reduces costs and errors during embedded system development.

The project could be summarized as two huge challenges: the hardware emulation and the emulation integration with the chosen environment simulation. Hardware emulation was performed using QEMU (Quick Emulator), an open-source tool capable of virtualizing an entire computer system. It was used to emulate the Bluepill development board microcontroller. Meanwhile, the emulation integration was performed using Robot Operating System (ROS) with a TCP/IP socket to connect the ROS provider inside of the QEMU with a ROS provider outside it. For simulation, they chose to use Gazebo, a platform for simulating robots and complex environments.

At the project's conclusion, the students developed one of the first integrations between ROS and QEMU in the software and firmware engineering field. They also created the first open-source Arduino library for the P2OS communication protocol, widely used in Pioneer robots, enabling easier integration between Pioneer robots and the Arduino platform in the future.
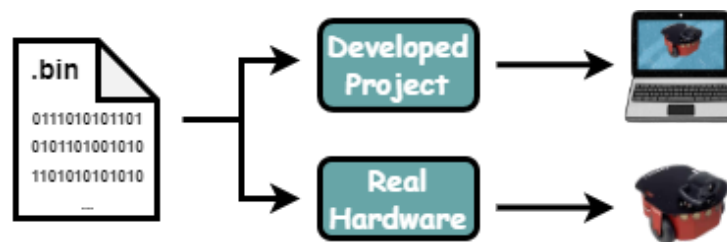
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