

# TUM robots 'Kinect' to sandwiches and popcorn

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(PhysOrg.com) -- A robotics team from the Technical University of Munich are now able to show an audience how their cuisine robots James and Rosie have graduated from a previously famous repertoire of sausages and pancakes to making salami and cheese sandwiches and stovetop popcorn. The robots do so with an impressive measure of dexterity and precision in turning on a stove and the other tasks.

The robots, James and Rosie, can respond to orders like "make me a

sandwich" with the use of visual-detection systems from an Xbox Kinect. They also use [perception](#) algorithms to assess surroundings, and to make inferences about what they see, in order to execute their tasks.

The make-me-a-sandwich goal of a toasted-bread salami and cheese sandwich with sandwich spread, for example, consists of complex actions. The team's goal is developing robots that don't need instructions for each and every step.

The video shows James and Rosie performing their tasks with precision. Moving around the pots, pouring popcorn neatly into a bowl, placing bread slices in the toaster, forking up items for the sandwich, all indicate the TUM team is making progress in developing "autonomous" robots that can perform everyday activities.

James and Rosie are part of the school's CRAM project. CRAM stands for Cognitive Robot Abstract Machine. CRAM is a set of software tools to design and deploy robots that use cognition to manipulate items.

The robots are kitted out with reasoning mechanisms all along the way that make them capable of decisions, rather than decisions that are pre-programmed. According to the Munich team, these robots can be more flexible and more reliable than robots using control programs without cognitive strengths.

According to TUM, CRAM "grounds symbolic expressions in the knowledge representation into the perception and actuation routines, and into the essential data structures of the control programs." The CRAM kernel consists of the CPL plan language and the KnowRob knowledge processing system. Both are coupled to perception and actuation components.

The project notes also say that CRAM is designed to be highly modular;

plug-ins can provide further cognitive capabilities.

James and Rosie belong to a family of four [robot](#) platforms in the lab: There are TUM-James (PR2), TUM Rosie, iCub and Bender. The PR2 is a standard research platform for mobile manipulation by Willow Garage. The PR2 Beta has a mobile base, two arms for manipulation, a sensor suite, and sixteen CPU cores for computation. Each PR2 Beta comes with the open source ROS robotics framework. TUM Rosie was built around the KUKA-omnidirectional base and KUKA-lightweight LWR-4 arms. Meantime, one might see further corners turned by robotics researchers at TUM. Their research will continue to explore how robots can perform everyday tasks such as setting tables, emptying dishwashers, and preparing meals.

**More information:** [ias.cs.tum.edu/research/pr2beta](http://ias.cs.tum.edu/research/pr2beta)

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