

## Extensions - Omnidirectional Vision Turret

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The Omnidirectional Vision Turret (OVT) was developed at the Laboratory of Intelligent Systems (LIS) at EPFL. The purpose of this extension is to provide basic omnidirectional vision capabilities to the epuck, without the expense of complex processing hardware. Using a simple microcontroller, the turret is capable of advanced vision tasks such as distinguishing colour blobs in any direction, finding other robots in its vicinity, and basic navigation.

**Vision System** Omnidirectional vision is achieved using a standard perspective camera (the same VGA camera used on the e-Puck) looking up on a custom-designed hyperbolic mirror. The mirror was designed to provide a full 360 degree view around the robot, and can see up to 5 degrees above the horizon. An added advantage of the OVT is that it is not a top turret! All the signals from the e-Puck are passed on to a top PCB using card-edge connectors, which allows other turrets to be stacked on top of the OVT. **Hardware** The CMOS camera is connected to a First-In-First-Out (FIFO) frame buffer (Averlogic AL440B-24-PBF), which is then connected to a microcontroller (dsPIC33FJ256GP506 from Microchip). The frame buffer allows de-coupling between the camera and the microcontroller, which means that the microcontroller is no longer a slave to the camera, and can read an image at whatever pace is required from the frame buffer. **Firmware** Several algorithms have been implemented, including basic drivers for reading an image from the camera, as well as image processing algorithms. There are two ways of reading the image:

- An entire image can be read in low resolution and stored in the memory of the dsPIC. An image of up to approximately 80x80pixels can be read this way.
- The image can be read line by line, and then processed before the next line is read. This allows for the full resolution of the camera to be used (480x480 pixels), but slows down the reading time of the image. Some image processing steps also require the entire image in dsPIC's memory to work.

Some basic image processing algorithms have also been implemented on the dsPIC

- Image unwrapping (of both low-res images resident in memory, and high-res images being read line-by-line)
- Colour thresholding (only on images stored in memory)
- Edge detection (only on images stored in memory)

The firmware for the OVT will be posted on the download page once the bugs have been ironed out.

Detailed schematics and PCB gerber files for the Omnidirectional Vision Turret can be found on the [Download Page](#) . This extension was designed at the Laboratory of Intelligent Systems (LIS) at EPFL.