



## Low-Cost 3D Controller with Intuitive Handling

### Technology Description



The 3D market develops rapidly. Our invention contributes to this progress by providing a system for computing accurate six degrees of freedom (6DOF) of an input device. 3D-position and 3D-orientation are computed in real time at a high frequency. All computations are executed with minimalistic processing power and can be handled by an 8-Bit microcontroller. This provides versatile 2D and 3D applications. Objects can be intuitively moved and rotated in 3D space, just as if the user holds the item in their hand. The intuitive handling, the high precision and the real-time processing promise an extremely realistic experience.

### Technology Description

**Up to now:** Existing 6DOF input devices compute the position and orientation at high material and processing costs. Multiple sensors provide accurate pose estimates, but presume high data rates and sophisticated analysis.

**Now:** Our low-cost 6DOF input device system is handy and easy to use. A single sensor is used and data is analyzed at lowest processing costs.

### Applications

- ❑ **Robotics:** Remote manipulation; programming of manipulators (Teach-In or CAD based)
- ❑ **Software tools:** Input device for CAD programs; manipulation of 2D and 3D objects
- ❑ **Medical engineering:** Sterile navigation controlling device for image organization
- ❑ **TV:** Remote controller for 3D television sets; organization of images
- ❑ **Video games:** Controller for sports games, flight simulators

### Advantages

- ❑ **6DOF:** Instantaneous, precise and reliable six degrees of freedom tracking
- ❑ **Intuitive:** Moving and rotating the device, exactly as if it is held in a hand
- ❑ **Handy:** Wireless and handheld input device
- ❑ **Low-cost:** Components of the system are available at very low prices.
- ❑ **Resource-saving:** Single sensor solution, no data link required, minimalistic processing costs
- ❑ **Versatile:** Works with PC, TV, embedded systems

### Proof of Concept/IP Status

Prototype. For more information, please turn over.  
DE 10 2011 075 253.6, PCT/EP2012/057446,

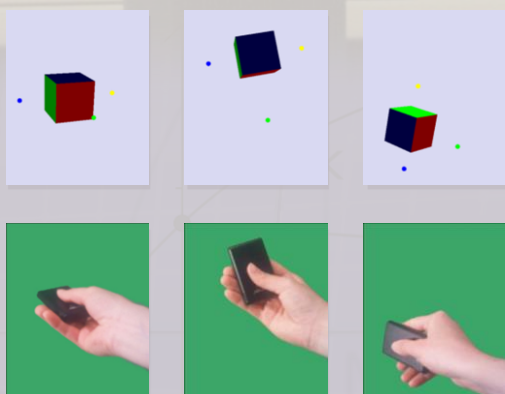
### Requested Cooperation

License agreement, joint further development, adaptation to specific needs

# Low-Cost 3D-Controller with Intuitive Handling

```
: 8 mm  
: 17 mm  
: -307 mm  
  
roll: -1  
pitch: 40  
yaw: -37
```

## Easy and Intuitive Handling



- As the user moves our handheld device, the controlled object directly mimics the movement without perceivable latency
- The user gets the feeling of holding the object in his own hand

## Complete Showcase Prototype

- The exemplary setup shown here consists of a camera, an ATmega 644 microcontroller and a handheld input device with a pattern of four infrared (IR) lights.
- The camera is distributed by the manufacturer with the capability to track up to four IR spots and to provide their pixel positions.
- The microcontroller calculates the 6DOF pose of the input device at approximately 65Hz and sends the result to a PC via USB.
- Besides the absolute values, here displayed on the left side of the screen, the visualization shows the detected markers and a cube, moving and rotating in 3D space according to the movement and rotation of the input device performed by the user.

## Technical Details

- The precision and range of the system depends on the resolution of the camera sensor, and the size of the pattern. Positions close to the camera are more precisely captured than positions farther away. With a pattern of size 5x1x0.5(cm), used in the picture above, it is possible to get a 0.1cm resolution at a 50cm distance to the camera. At a distance of 500 cm, a resolution of 0.5 cm can be achieved.
- Although our method of determining the pose performs great on a microcontroller, it can be used — without limitation — on any system with processing unit.

## Usage Scenarios

- Robotics: Teach-In of manipulators can be done in all degrees of freedom intuitively, even with manipulators which do not support Teach-In by their mechanics. To program an industrial robot manipulator, the camera is either fixed or mounted on the end effector. Given the 6DOF pose by our device, the manipulator can actively follow the instructions.
- Virtual manipulation: The device can be utilized in CAD software for intuitive modeling of 3D objects.