

WorkPartner

- A next generation interactive service robot for outdoor tasks.



The robot is called “WorkPartner”, because the idea is to make a highly adaptive robot, which can carry different tools and work interactively with a person by learning at the same time the details of the tasks. The platform has four legs equipped with wheels and a controllable body joint. Because of its four wheeled legs and articulated body it has very flexible and wide range of mobility. The actuation system is fully electrical and the power system a hybrid one with batteries and a combustion engine. The locomotion system allows motion with legs only, with legs and wheels powered at the same time or with wheels only. The purpose of the hybrid locomotion system is to simultaneously provide rough terrain capability and a wide speed range at the same time.

The mechanical parts are designed and manufactured by Rover Company Ltd, St Petersburg, Russia. They used to make all the Soviet Unions planetary rovers, so they have extensive experience with special platforms.

The computer system is distributed around a CAN-bus. Each leg has one controller (Leg Controller) based on Siemens 167 Micro-controller and PHYTEC 167-mini-MODULE. The middle joint controller is build using the same components. Other nodes, demanding more computing resources - like those taking care of motion and locomotion control, user interface or perception system devices - are based mainly on PC-104 card technology. Also, additional computer power can be used, via wireless local area network, WLAN. The main computer is a 586 PC-104 board and is running on a QNX operating system. The electronics include also servo controllers for the actuator motors and specially made amplifier cards for force sensors in the legs and the hip actuators.

The manipulator will also be connected to the CAN network. The main difference will be that the CAN-network is directly connected to each joint, to each motor controller. The motor controller is built from CAN-module and a DS processor. The DSP motor controller is capable of providing position, speed and force control. Only the head unit is a unit of its own, containing two degrees of freedom.

All the hardware is modular and easy to maintain. The leg control boards and the middle joint controller board are alike, likewise the physical leg controller box, including the micro controller board and the servo amplifiers, are alike. In a fault situation the computer control system can be by-passed and the machine can be driven manually with an external control box.

WorkPartner looks like a centaur, so instead of humanoid it may be called centaur.

For additional information (videos, pictures etc.):
<http://www.automation.hut.fi/IMSRI/workpartner/>

Features

Technical facts of body

2 bodies with active joint
4 electric wheeled legs
- l_wxh 1,4 x 1,2 x (0,5-1,2) m
Max clearance 0,7m
Max speed w. wheels: 7km/h
Weight with manipulator 230 kg
1 computer
5 micro controllers
CAN-bus
Sensors:
- 13 potentiometers
- 8 force sensors
- Inclinometers
- 3-dof gyro
- Accelerometers
- GPS

Manipulator facts

Two 3-degree of freedom arms
2-degree of freedom body
2-degree of freedom camera head
8 control boards
8 stepping motors
Handles objects up to 10 kg at 1-meter range

Sensors

- 8 potentiometers
- Camera
- Range sensor

Energy System:

Combustion engine

Honda 1 cylinder, 4-tact engine GC 160
Max power 3,3 kW (3600 rpm)
Dry weight 11,5 kg
Added 2-phase catalyser (Finn Katalyt Oy)
Added start motor

Generator

Bosch alternate current generator, build in
48V voltage regulator(real 56V)

Engine & Generator package

continuous max power 1 kW
weight 25 kg
coefficient 8-14 % (fuel calorific effect ->
electric power)
consumption 600g/h 1 kW max power
endurance 30 min 1 kW max power
-Volume of fuel tank 0,3 litre
-With 2 litre tank 3 h

Batteries

Sealed led battery 18 Ah
Weight 25 kg (4 pieces)

Computer system

