# Mobile platform for seismic measurements

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European Union European Regional Development Fund



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### **Robotics**

- Is very fast developed area of science and industry
- Industrial robots manipulators
- Mobile robots autonomous vehicle
- Flying robots UAV (Unmanned Aerial Vehicle), Drone
- Personal robots vacuum cleaner, medicines assistance

- Idea:
- Mobile robot can make automatic measurements of signal, e.g. seismic signal









# Mobile platform

- Many possibility to moving robotics platform
- Legs, wheels, caterpillar
- Wheels can be 2WD or 4WD (wheel drive)
- Many types of wheels
- Selected 4WD with mecanum (Swedish) wheels

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• Omnidirectional movement allowable







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## **Basic equipment**

- Linear motors for platform moving
- Motors equipped with encoders
- Drivers of motors with I2C
- Accumulators 12 V and 5V
- Camera for video streaming
- Raspberry Pi for robot logic









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# **Operating system**

- The main computational unit Raspberry Pi 4
- Raspberry Pi OS based on Debian as the operational system (formerly Rasbian)
- For robotic purpose the ROS is installed
- ROS is Robot Operating System
- ROS is standard in robotics at now









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**III** ROS

## **Teleoperation**

- Moving can be done by operator supervision
- Communication over Ethernet type network
- Web page with video view and user interface for robot steering
- Communication by ROS messages and services



Seismobo Status State: stop Angle Direction: right Angle Degrees: 18.43 Angle Degrees: 0°





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## Self alone moving

- First step mapping of working area by moving over it
- Yielded map can be used for navigation
- Example map corridor in building





# Navigation

- Navigation = localization + path planning
- Controlled by publishing goal position in map coordinates
- Nominal positioning accuracy 0.1 m
- Driving speed 0.25 m/s



# Navigation test

 The robot has to sequentially achieve given positions.



### **Navigation test - demo**



# Robot task put a seismic sensor on the ground and collect data

Ideas of putting sensor:

- robotic arm

very flexible solution but complex control algorithm

- some kind of forklift forks good idea but hard to practical realization

- crane

seems meet requirements and reasonably simple to construct and test





# Crane protype

- Stepper motor for rising and lowering the sensor
- Stepper motor allows to more control the movement and speed of its rotation
- The crane integration with platform with using service property of ROS system
- The service provides two actions:
- lowering and rising of sensor
- The design allow that the crane could be calibrated (the amount of rope unwinding and rewinding) and tested independently



#### Demo













### **Futher plans**

- Algorithms for data acquisition
- On board data processing
- Robot health status reporting
- Emergency return to base station
- Automatic battery charging in some docking station
- ETC.









#### Conclusions

- Functional, mobile platfrom has been build from scratch.
- The platform is functional and able to do automatic task - move to some point and do measurements

#### Thank You for Your attention.







