## **Pulurobotics: Open Source Robotics**



Fosdem 2018 - 4th February 2018, Brussels, Belgium, Europe, EarthAntti Alhonen – The NerdMiika Oja – the other guy

## **Pulurobotics Community Launch**

- Software fully GPL v2, in GitHub
- Hardware licensing still unclear, but schematics, drawings, etc. available
- The 3D Sensor under development
- Call for participation



# Ultra-low-cost autonomous platform: project spawned from a real need

- No real alternative available
  - Horrendous price from 20K up to over 60K
  - No ability to stand rough terrain
  - Complex as hell
- Remote controlled "toys" (see right) were prototyped, no good
- Need autonomy



## 2017: design principles defined

- Simplicity & robustness
- Easy manufacturing
- Cheap electronic components no special "robot parts"
- Must be:
  - Autonomous perform tasks
  - Able to map autonomously no teaching, any environment
- Platform thinking: autonomous platform is the smallest component
- PLATFORM = PRODUCT
- INTEGRATION = SIMPLIFICATION
- INTEGRATION = COST REDUCTION



Photo of actual product

## Found the definition of autonomous robot

- A fully autonomous robot can
  - Gain information about the environment
  - Learn about changing surroundings
  - Work for an extended period without human intervention
  - Move itself throughout its operating environment without human assistance
  - Avoid situations that are harmful to people, property, or itself (unless those are part of its design specifications)





# We don't use ROS





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... but will support it. Need help for that.

## **ROSsian HW**



## **ROSsian HW**



## PULU vs. ROSsian HW



\$150



# SLAM – simultaneous localization and mapping

- Chicken-egg problem
- Analytically hard
- Not too difficult in practice, given full control over HW+SW
- More effort should go here
- Our SLAM now is a very simple prototype, yet usable



#### SLAM, how Pulu M does it



#### From yesterday: J building



Pulu Robotics established Company established in July 2017 after we decided to do open source

No.A

Decided to go to the first possible international venue

Visited Robot World 2017 in September

RESPECT

Found out we had done something unique



## Navigating future



- Basic hardware is ready
- The Groundbreaking 3D Sensor is almost there
- Manufacturing small batches, different models
- Open Sourcing
- Application development
  - Platform is very good, suitable for most needs
  - Extremely affordable
  - Needs more hands to make YOUR applications









## Software architecture

- 99% in C, approx. 35000 lines of code
- 15000 of which is firmware
- No "frameworks" or "middlewares" of any kind
- Very few dependencies:
  - libpng
  - rsync, ssh
  - opencv in near future
  - libwebsockets for web UI prototype
  - SFML for standalone client prototype

### Software structure



## Back to PULU vs. ROSsian HW



\$150



## Back to PULU vs. ROSsian HW



\$150





## 3D Time of Flight explained

- Distance measurement, like 2D LIDAR, but:
- From 2D plane to 3D point cloud!
- From 500 to 500000 samples/second
- Replacing all other sensors with 3D TOF
- Unique challenges mostly solved!
- LIVE DEMO (or a demo effect)



Software distance min 0 avg 2652.2 max 7495 Point 1: val 2646.6 nvalid=8192 avg9 2790.3 avg49 2902.8 spatnoise49 404.0

## We Want YOU!

- Let's make open source robotics affordable again!
- Participate!
- Get a 999€ (+ VAT) Pulu S developer special by ordering now – deliveries in June



## Thank You!



(Pulu is Finnish and means pidgeon)