1 Digital 3D Lidar- Oster robotics Nicholous

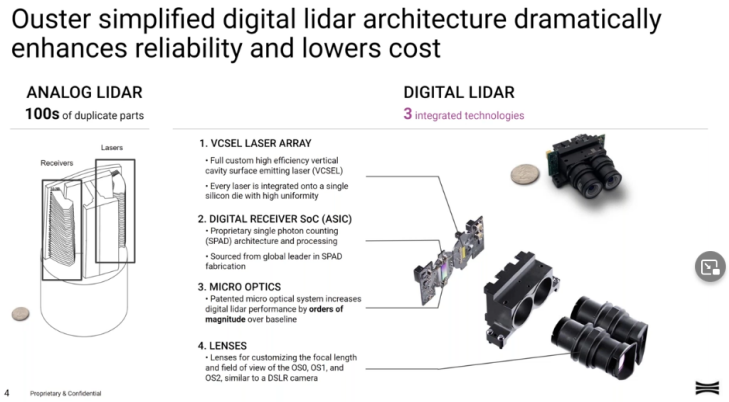
1.1 what they do

- Industrial
- smart infrastructure
- robotics
- Automative

Figuur 1:

1.2 Why digital lidar

- same as digital camera replaced analog cameras



Figuur 2:

- 3 integerated technologies
  - 1. VSCEL laser array(Vertical cavity surface emitting laser)

- Every laser is in single die

1.3 Their product

Figuur 3:

1.4 Past warehouse automation

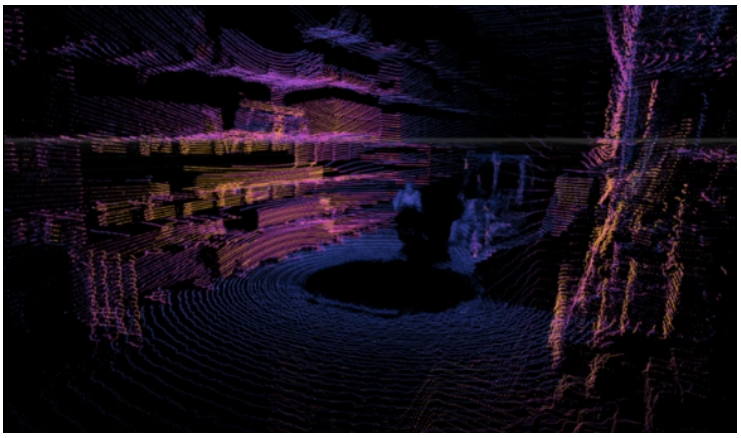
- Multi sensor suite
  - Each task has its own sensor
  - 2d lidar and 3dTOf
  - Expensive and limiting technology,several points of failure
- Digital sensor can replace all senor to a single one
  - reduce cost
  - improve localisation
  - high resolution(People can be seen clearly)
  - high field of view

1.5 Improved localisation

- ULtrawide view
- maintain accurate postion in desolate area
- reduce lost robot downtime

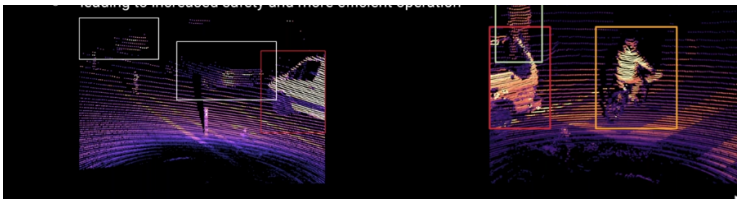
1.6 Advanced perception

- Using high resolution provides robust perception
- Range,Signal,Near IR,calibirated reflectivity
- Next generation perception algorithms



Figuur 4:

- Balyo warehouse,vecna robotics,has utilsed this sensors
- Can be used for object classification (partially)



Figuur 5:

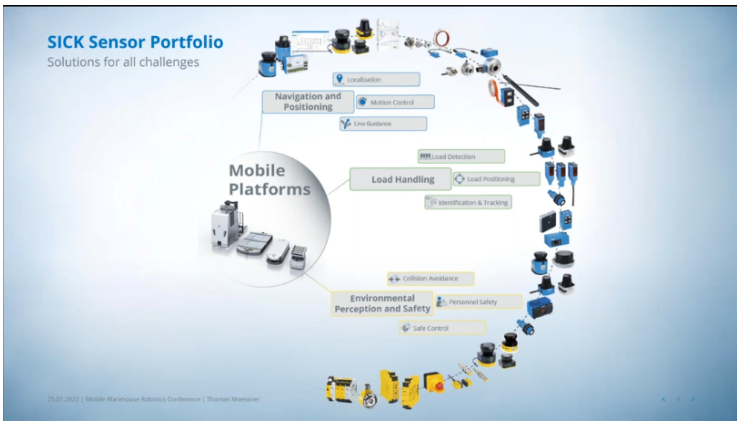
1.7 Final Notes

- ITS - fixed infrastructure for trafic management and accident detection same used inside warehouse for collision avoidance
- Will lidar be the next camera? - yes(accd to ouster)
- ros package is provide
- supplies to india(Indian listeners are here ;))
- ethernet communication

2 Thomas - sick sensors sensor fusion for navigation and perception

2.1 About

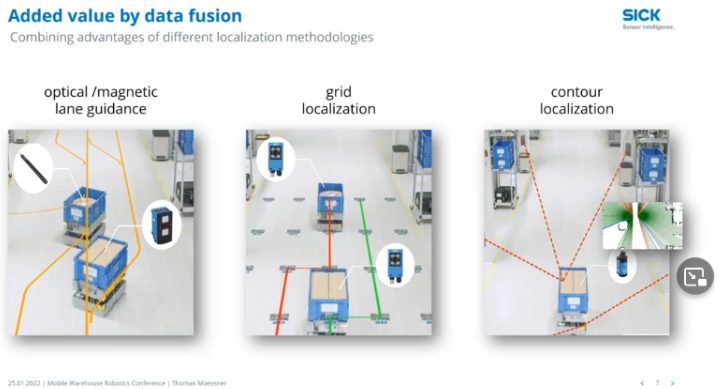
- Industrial lidars and sensors
- over the globe
- Creating sensor inteligence



Figuur 6:

2.2 Evolution of localisation

- long history of lidar sensor



Figuur 7:

- fuse all three to get better performance
- contour -classic lidar localisation

2.3 Vitual line localisation

https://www.youtube.com/watch?v=5IH-_PrQ7Io
Use virtual lines for guiding the robots to move in path

2.4 3d trolly position

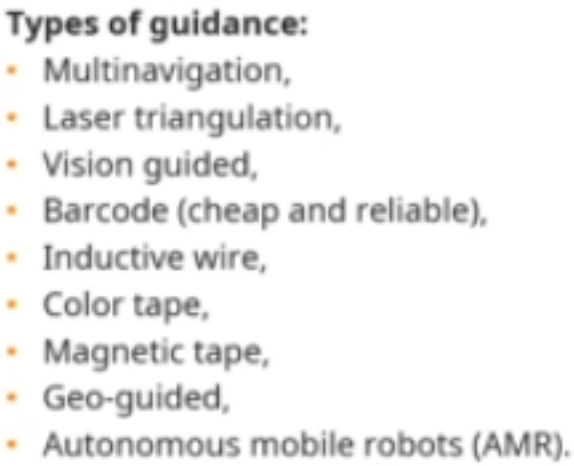
- Typical load handiling postion
- fusing 3d lidar and 2d lidar
- capture with 3d lidar
- when trolley goes out of view for 3d lidar and 2d lidar can be used capture its postion

3 Encoders for AGV - Nech Recelj RLS

3.1 About

- found in 1989
- rotary and linear encoders
- europe based country
- mission is to develop motion sensing components

3.2 Types of guidance



Figuur 8:

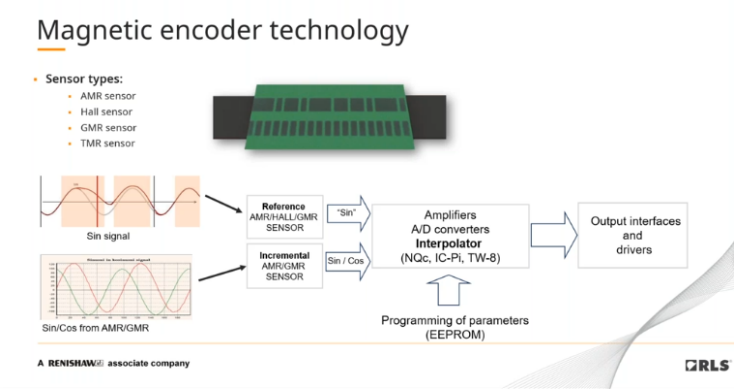
AGV - uses fixed infrastructure
AMR - uses software to move freely in task space

3.3 Types of steering in AGV

- Diff drive
- steer drive
- quad drive

3.4 encoders

- **wheels** - incremental
- **steering** - absolute
- analog is best for certification



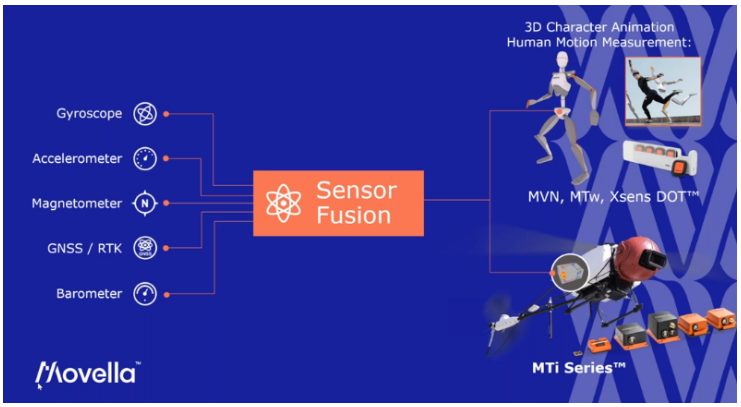
Figuur 9:

- protocols
  - SSI
  - BiSS C
  - CanOpen

4 Multi sensor fusion hub

4.1 About

- found in 2009
- fullstack hardware software and cloud analytics
- 33+ patents for motion sensing



Figuur 10:

4.2 Multi sensor fusion hub

- challenges
  - challenging structure
  - lighting conditions
  - Displacement of static objects
  - dynamic object controlled and uncontrolled
- sensor solutions
  - Vision
  - Lidar
  - RFID
  - wifi
  - encoder
  - Bumpers

4.3 IMUs

- Acceleromenter
- Gyro
- Magneto

- Application
  - Heading control
  - Fall over protection
  - Load estimation

4.3.1 Why IMUs

- precise dead reckoning
- better prediction
- reject outliers
- reacts to system failure

5 Our vision for adopting Edge AI in Autonomous Machines - eddie and terresa Nvidia

- Grace arm based cpu
- **Omniverse** - virtual world of photorealistic factory

5.1 Robotics platform

5.1.1 challenges

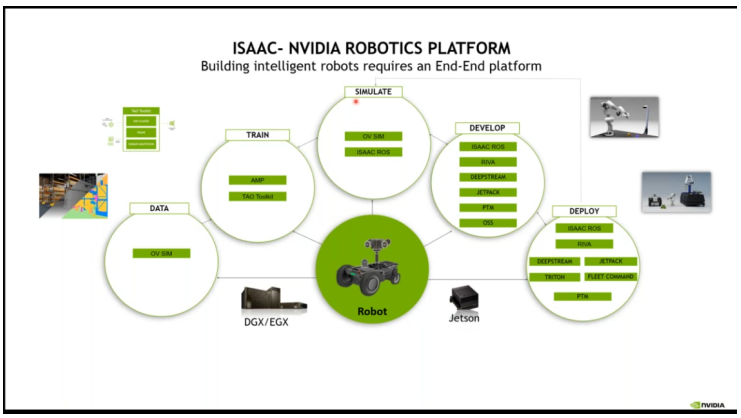
- Expensive and time consuming
- sunstructured environment
- complex system with precise components

5.1.2 Everything will become smarter

- anything built will have digital twin
- anything that moves will be autonomous
- anything autonomous will be simulated(mainly for taking datas)

5.2 Isaac - nvidia robotics

not a single sdk, combination of many things



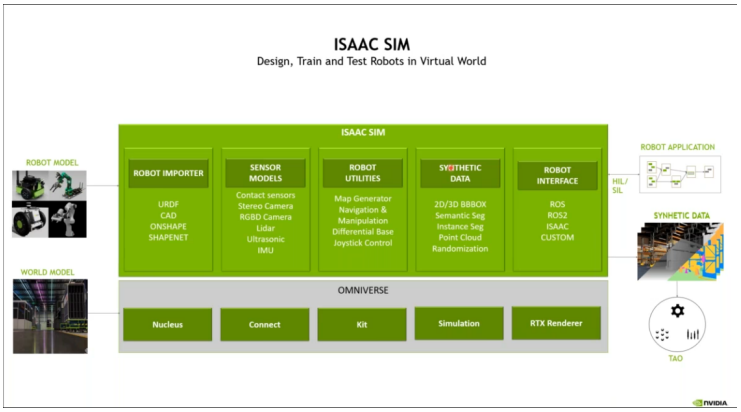
Figuur 11:

5.2.1 Development phases

- Data
- Train
- simulate
- develop

- deploy

5.2.2 Isaac



Figuur 12:

- Synthetics sensors
- navigation simulation
- roboust dataset
- hardware accelerated for ROS

6 Future of ros

Rolling ridely - daily update of ros
humble hawksbil - best for indutrial application 5 years of support
OpenRMF - framework for integerating multirobots and environments