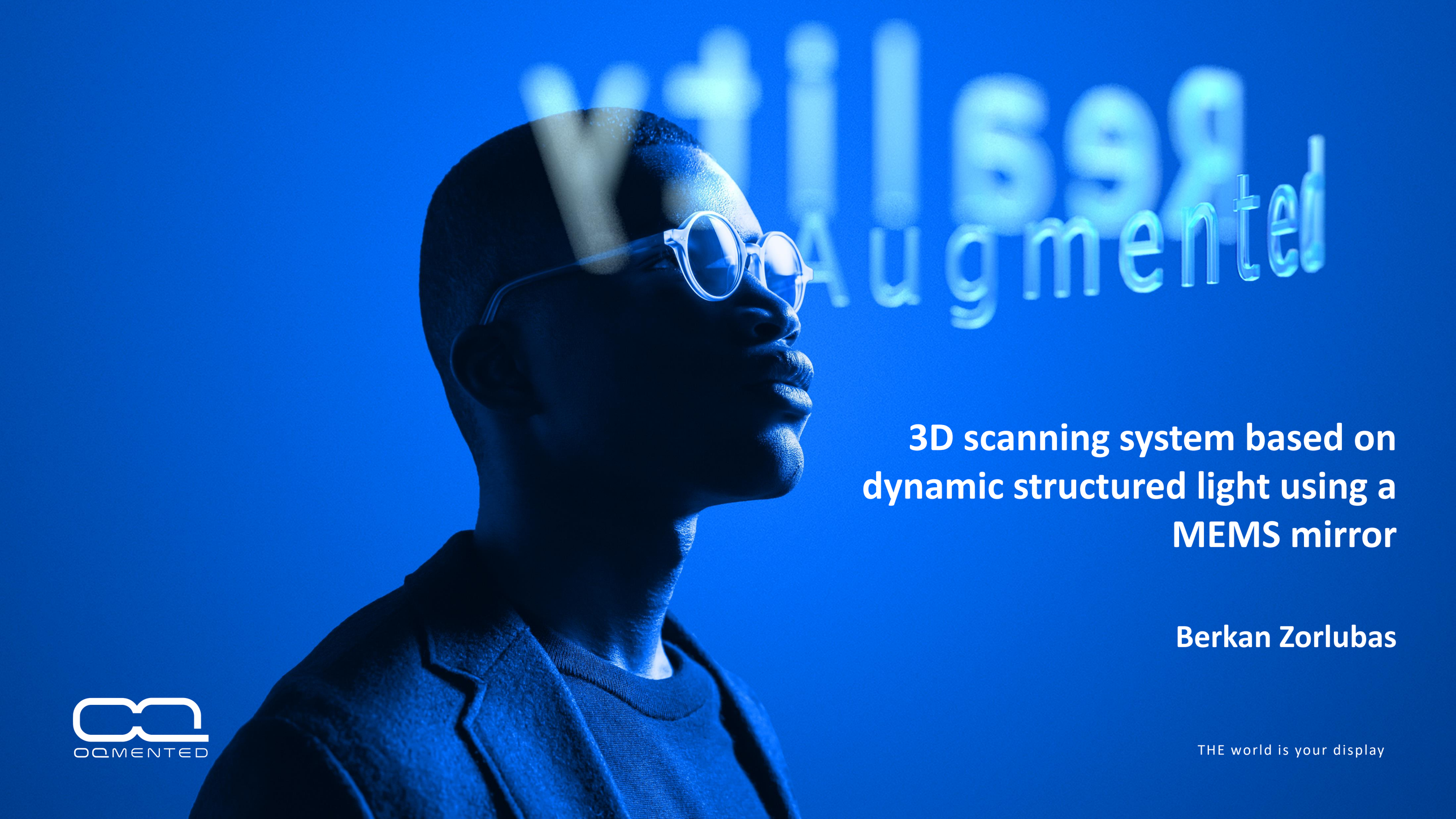


3D scanning system based on dynamic structured light using a MEMS mirror

Berkan Zorlubas

OQMENTED

THE world is your display

OQmented

Company

Products & Technology

OQmented is a deep tech company developing and selling ultra-compact LBS display and 3D sensing solutions. The systems are customized for application in Augmented Reality, 3D cameras, large advertising panels with several projectors or automotive head-up displays.

100+ patents & patent applications

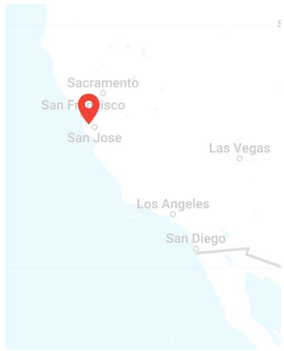
Founders & Team

Thomas von Wantoch (left) & Dr. Ulrich Hofmann (right) are major drivers in the development of MEMS mirror technology for more than 20 years.

Team

- 71 Technology & Engineering
- 8 Business Development & Marketing
- 14 Operations

Offices



Germany:
Headquarters: Itzehoe
Offices: Kiel, Jena

USA:
Office: Palo Alto

Investors

SHARP · vsquared ventures · SALVIA · BALTIC BUSINESS ANGELS SCHLESWIG-HOLSTEIN e.V. · MBG SCHLESWIG-HOLSTEIN · Deep Tech-A · LENNERTZ & Co · IT-FARM CORPORATION · Leblon Capital

History

2023 Series A1 $20m

2022 Accumulated seed investment $ 14.5m
Office in Silicon Valley/ USA
Optics R&D site in Jena

2021 Strategic partnerships with Dispelix and ST Microelectronics

2020 Winner of 3 month Silicon Valley Program
GERMAN ACCELERATOR
Management buyout Fraunhofer

2019 Exclusive IP license agreement
Winner of 3 month Silicon Valley Program
PLUG AND PLAY

2018 Founded OQmented as Fraunhofer Spin-Off

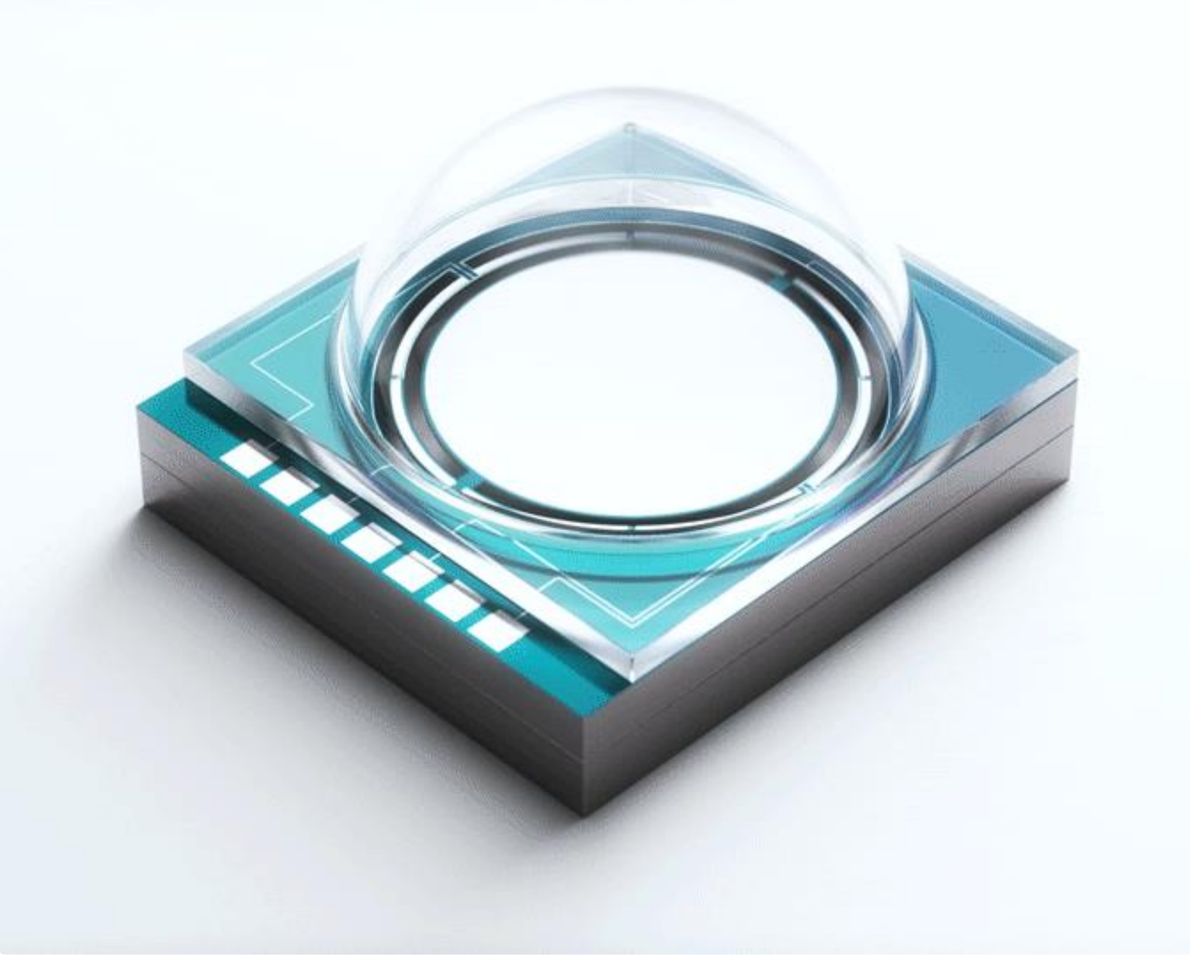
1995 Start of MEMS Mirror Developments at Fraunhofer ISIT

Content

- **Insights into the MEMS scanner**
- Introduction to 3D sensing
- Lissajous scanning based structured light
- Results & Discussion
- Conclusion

MEMS Technology

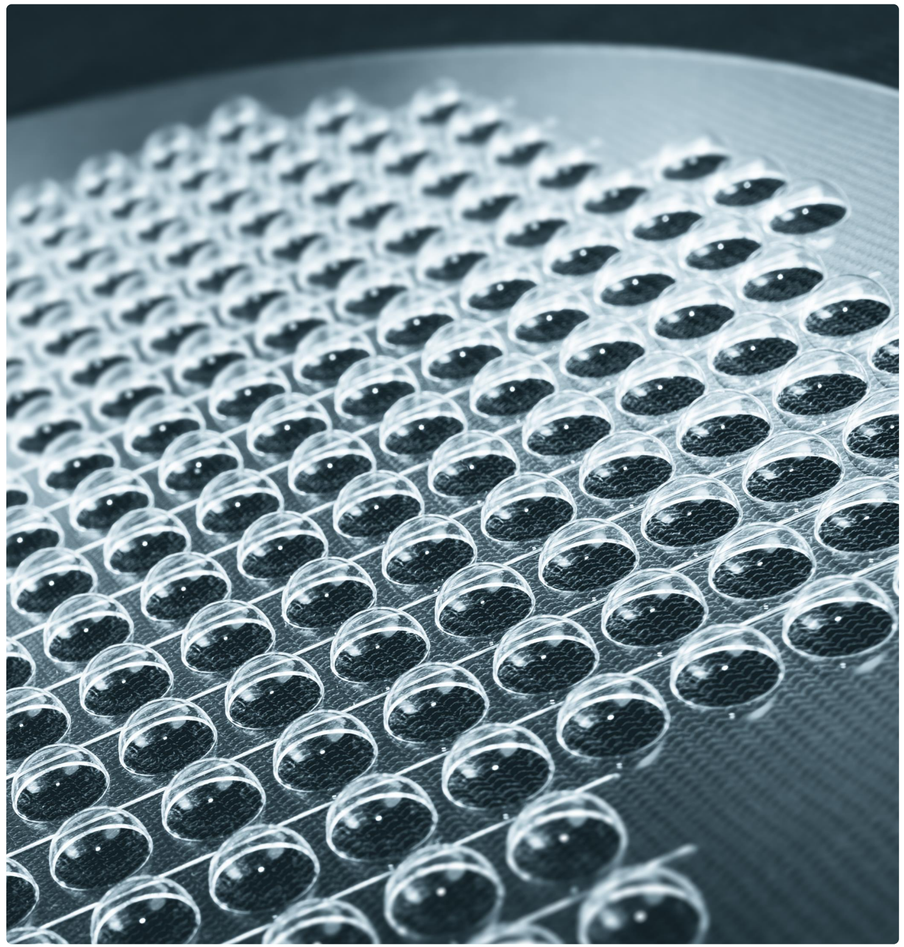
Bi-Resonant MEMS



- Hermetic sealing for maximized lifetime
- Resonant operation for energy efficiency on two axis
- Glass dome for high diagonal FOV angles up to 100°
- Gimble-less design for space efficiency

MEMS Technology

For Volume Production



- Scalable Wafer Technology
- Simultaneous encapsulation at wafer level in high precision
- Full manufacturing process based on 8’’ wafer
- R&D pilot production up to 1 Mio. units at ISIT
- Ramp up and high volume with foundries

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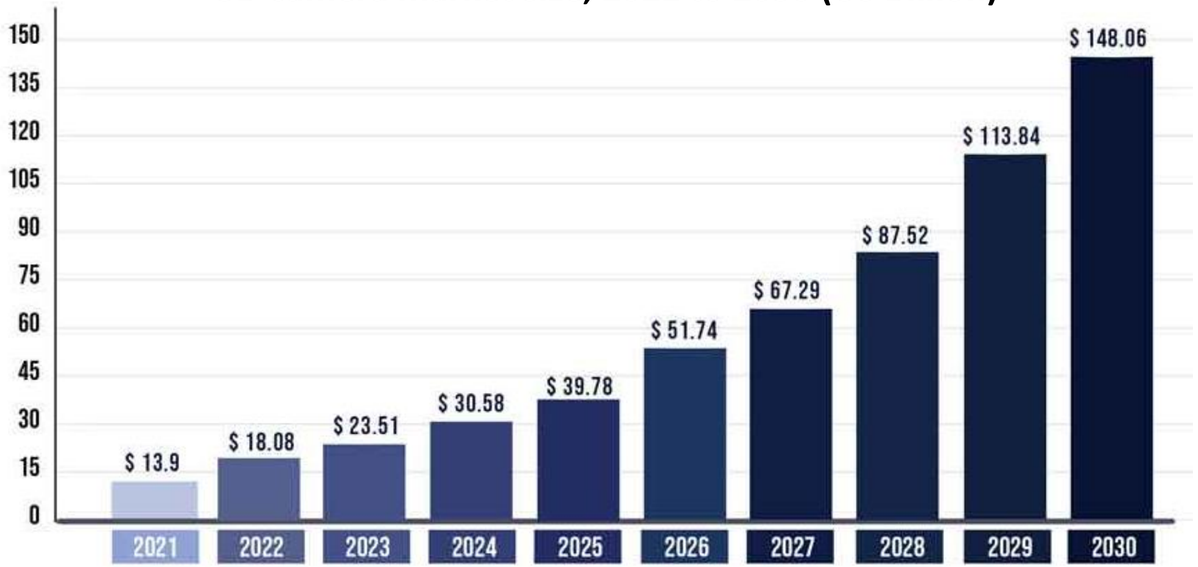
Introduction

3D Camera Market Review

3D camera market size, 2021 to 2030 (US Billion)



Source: https://www.precedenceresearch.com/3d-camera-market

- Widespread adoption across various markets (smartphones, healthcare, automotive, robotics…)
- New emerging markets: AR&MR&VR devices (spatial web computing, seamless object interaction, touchless control)
- Requirements the existing solutions need to fulfill get wider

Introduction

Challenge & Solution

- **Challenge in the market** is that existing solutions cannot fulfill entire requirements all at once:

  Structured light → high resolution but low range

  ToF and iToF → higher range but lower spatial resolution

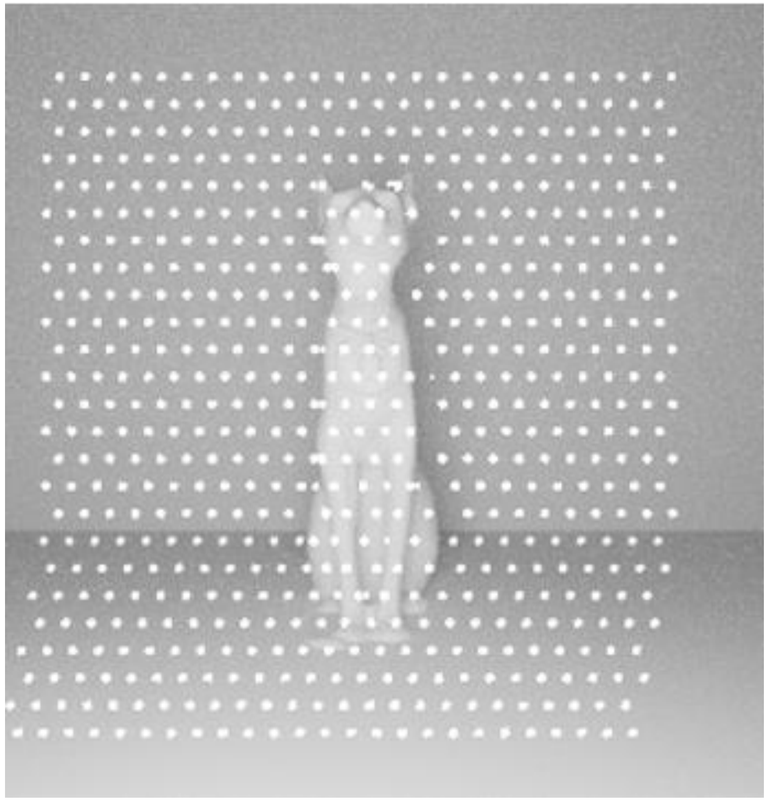
  Stereovision → low performance on low light conditions and homogeneous scenes & user privacy

- **Proposed solution** is a 3D scanning system based on dynamic structured light using a MEMS mirror.

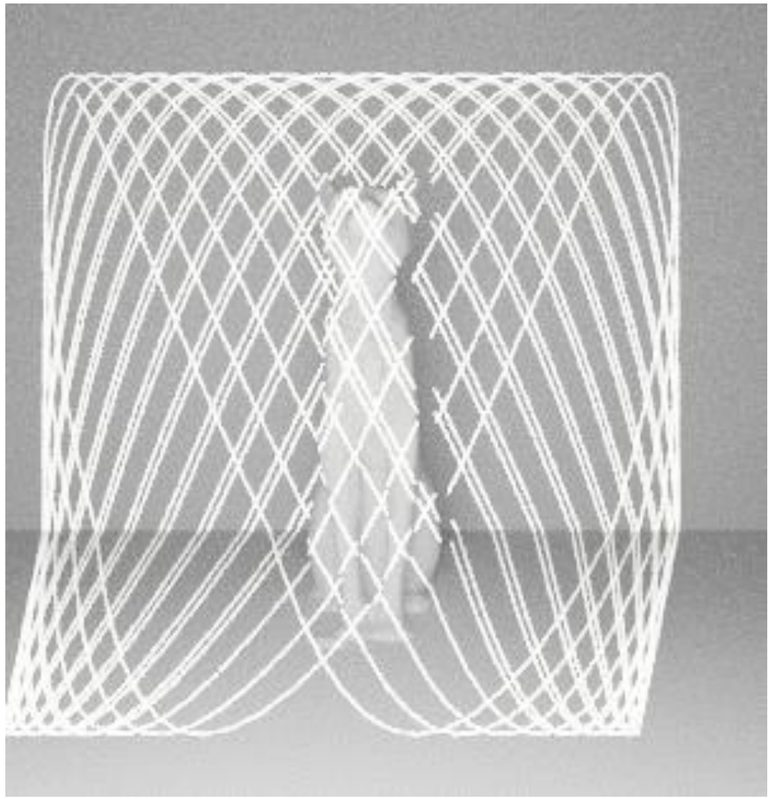
Introduction

Challenge & Solution

static structured light pattern



dynamic structured light pattern



LBS – Laser Beam Scanning

3D perception

Principle

- Structured light-based 3D sensing through Lissajous pattern

Advantages

- Fast full area depth reconstruction
- Interlaced frame rates at a high kHz rate
- Allows much smoother motion rendering
- Greatly reduces artifacts in 3D perception of fast-moving objects
- Increases line density
- Minimization of motion blur

Content

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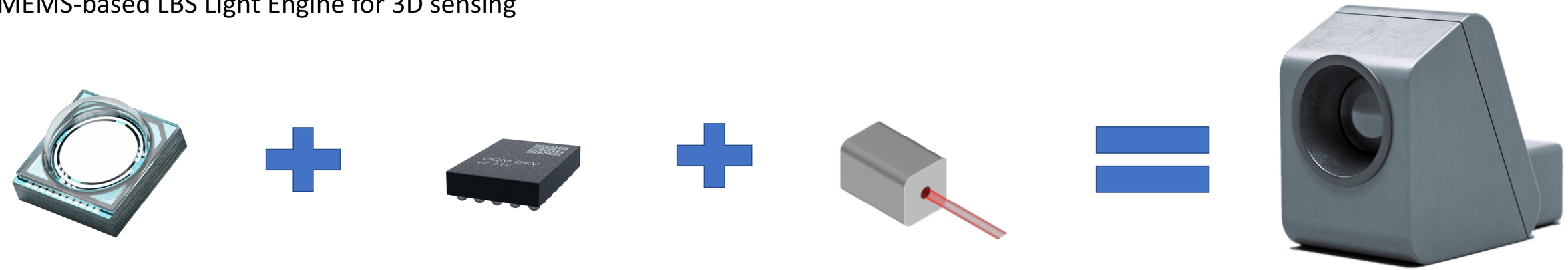
Product

MEMS-based LBS Light Engine for 3D sensing



Laser Beam Scanning – 3D sensing

- Light weight and low BOM
- High FoV scanning (up to 130° diagonal)

Content

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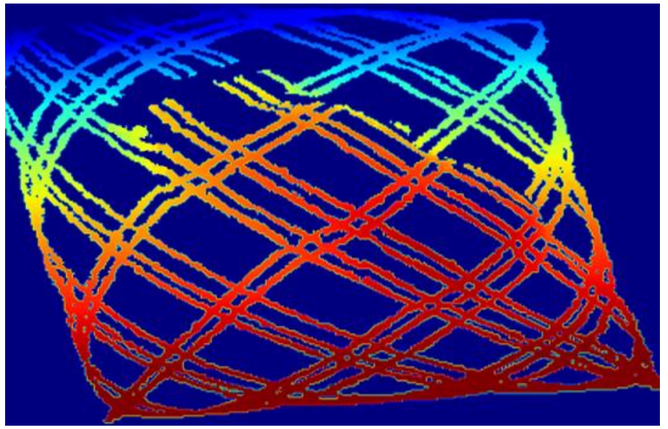
- Conclusion

Results & Discussion

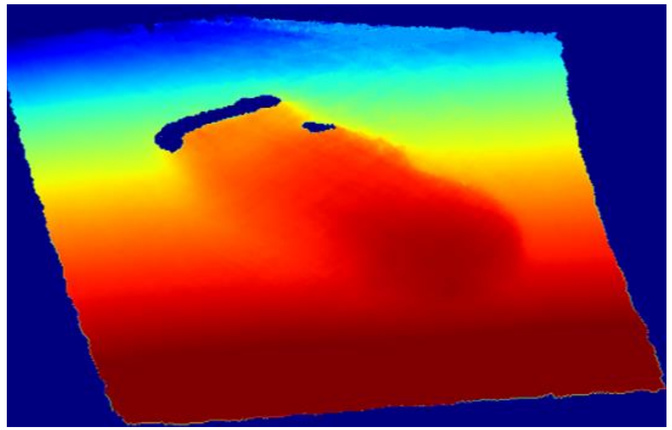
Depth density & quality

- RC car at 1.2 meters distance
- Sparse (single-shot) and dense (multi-shot) results are given
- Object scanned with >60k points in multi-shot acquisition

Scanned scene



Single-shot depthmap (8ms exposure)



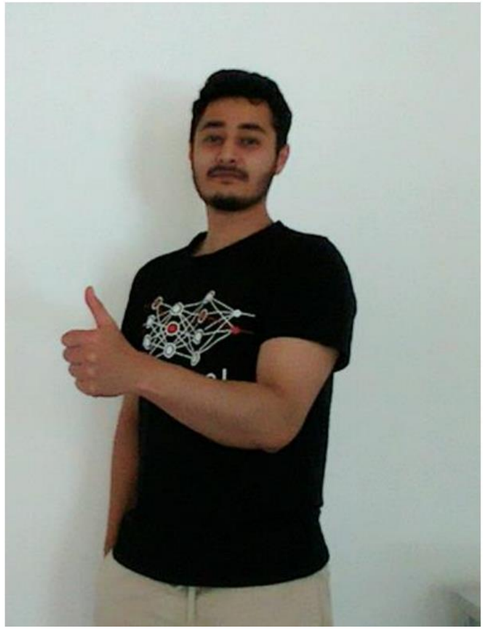
Multi-shot depthmap (40ms exposure)

Point cloud generated by multi-shot results

Results & Discussion

Depth density & quality

- A person with thumbs-up gesture at 2.5 meters, wall in the background at 3 meters
- Object scanned with >85k points in multi-shot acquisition



Scanned scene

Multi-shot depthmap

Point cloud generated by multi-shot results

Results & Discussion

Key advantages and possible use-cases

Dynamic adaptation of spatial resolution and frame rate

- Spatial resolution of a scan defined by the receiver, not by illuminator
- **Latency:** 30 fps for 720p and >60fps for 480p is achievable on the latest mobile chipsets.
- Operation modes: (same hardware, different use cases)
    I. low latency & low accuracy mode → gesture scanning, presence detection, sparse spatial computing
    II. high latency & high accuracy mode → detailed mesh generation, dense spatial computing

Low & short BOM:

- No laser modulation, no diffractive optics or illuminator arrays
- Standard low-cost camera
- All components are mass-producible and easy-to-assemble

Potential target platforms:

- AR & MR wearables → hand gesture detection, environment scanning, in-door SLAM
- Standalone system → object detection, presence detection, industrial applications

Content

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- **Conclusion**

Conclusion

- ✓ We presented an LBS-based 3D structured light scanner:
  - Active illuminator: bi-resonant MEMS mirror, together with a continuous-wave infrared laser
  - Receiver: standard CMOS imaging sensor
- ✓ Key advantages of Lissajous scanning for 3D sensing has been discussed.
- ✓ Features of OQmented's MEMS technology have been introduced.

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