

ניסוי במיניבוס אוטונומי בישראל



IMAGRY

Mapless Autonomous Driving

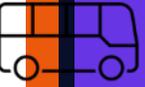


Dr. Ilan Shaviv



## Background

- Sheba Bus – Initiative by Sheba Medical Center, supported in part by the Israel Innovation Authority.  
Approved: Oct. 2022
- Public transportation bid – קול קורא by the Israel Innovation Authority + Ministry of Transportation.  
Approved: Dec. 2022



# Market Need

- Global demand for autonomous shuttles and buses
- Lack of drivers
- Regulatory support in order to increase and improve public transportation in fast growing urban environment
- Airports, Medical Centers, Municipalities, Resorts, Universities, Parks
- Promoting clean energy (all buses are electric and, in the future, also fuel cell)

In Europe, 7% of bus and coach driver positions were unfilled in 2021, and bus and coach companies estimate that shortages will further increase in 2022 to reach 8% of unfilled bus and coach positions.

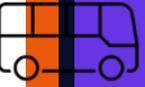


**RJ**

**Intelligence**  
Briefing

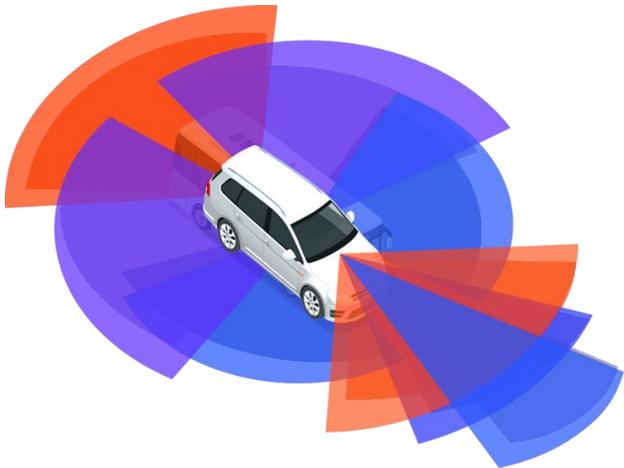
**Driver Shortage**  
**Global Report 2022: Summary**

Understanding the impact of driver shortages in the industry



# A PLATFORM THAT SEES THE REAL WORLD, LEARNS & PLANS IN REAL-TIME

Autonomous driving for a private vehicle on a public road – Replace the driver



## MiniMap

### CONSTANT SITUATIONAL AWARENESS

#### VISION

360° Perception

#### VISION-ONLY BASED PERCEPTION

Image interpretation and construction of tractable environment perception

Real-time image interpretation system that runs perception modules using camera images to produce a tractable model of the environment.

## SpaceNet

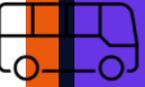
### HUMAN-LIKE COGNITIVE PERFORMANCE

#### LEARNING BY IMITATION

#### MOTION PLANNING

Making real-time data driven decisions

A neural network-based driving decision-making system that utilizes advanced AI and deep neural networks.



# MAPLESS, HARDWARE-AGNOSTIC, LOCATION INDEPENDENT



Deep Neural  
Networks



HD-Mapless



Self-sufficient



Location  
Independent



Hardware  
Agnostic

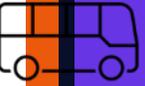


Self-driving  
Ready



Fits many  
self-driving  
applications

Imagry's solution enables lower-cost, mass-scale, commercial deployment of autonomous vehicles, globally.



# WHY WE CHOSE OTOKAR: A CLEAR COMPETITIVE ADVANTAGE



EasyMile



Navya

## 1

- 6X Navya EVO shuttle range
- 2X EasyMile EZ10 range
- Comparable range to Karsan

## 3

- Unparalleled Efficiency**
- 1.5 hours per charge (200Km)
  - 50% of the time required by the closest competitor

## 2

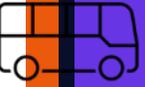
- Greatest passenger capacity (32)
- Six folding chairs
- Wheelchair docking stations and electric ramp

## 4

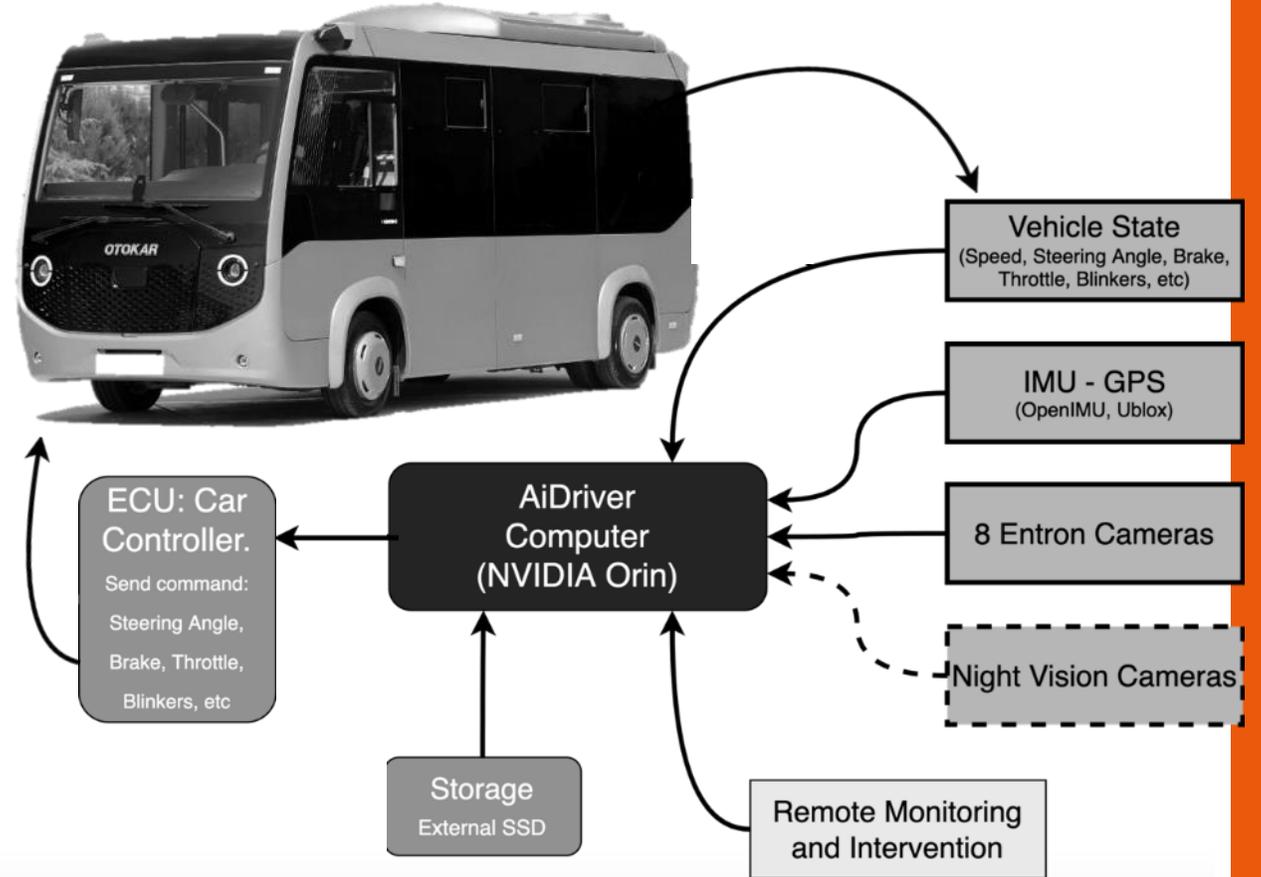
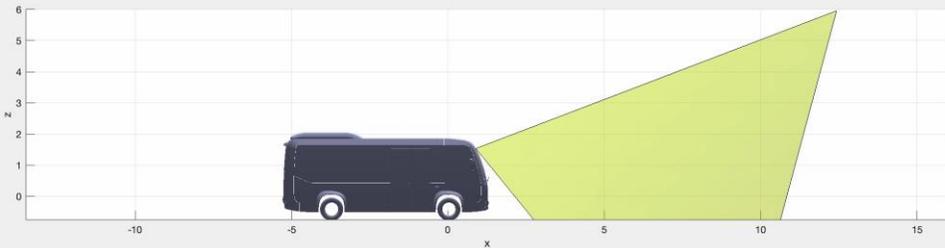
- 6.6 meters in length
- Larger shuttle, greater passenger space, spacious, comfortable

## 5

- Otokar - Industry Leader**
- 50+ export countries, 300 + POS
  - 3,500 buses produced in 2022
  - 3,580 employees

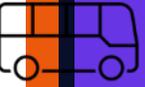


# VEHICLE CONFIGURATION FOR AUTONOMOUS DRIVING



Otokar





# THE FIRST AUTONOMOUS BUS IN ISRAEL

- Autonomous Driving technology is provided by Imagry
- Service in Sheba Medical Center and Nahariya is operated by Nateev Express
- Imagry equips the buses with computing, cameras, controller...
- Autonomous shuttle bus in Sheba on the road in June 2023
- Autonomous bus on public roads in Nahariya by Jan 2024
- Selling the platform in other markets by late 2023, for 2024 deliveries
- Full system integration – software, firmware, integration, installation, control...



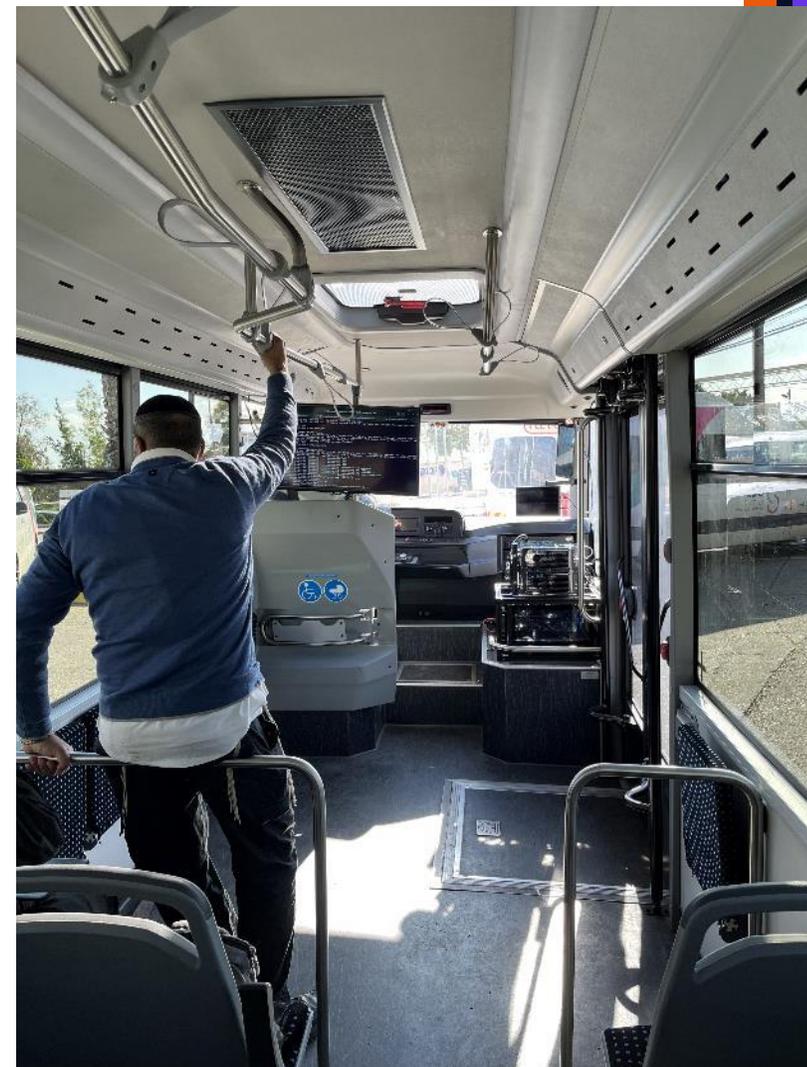




# Sheba Shuttle Bus



# Sheba Shuttle Bus



# The Road to an Autonomous Bus

1. Import request from MOT
2. Safety check by authorized lab
3. Vehicle MOT license – manual driving
4. Manual driving for data collection on site
5. NCAP testing by MOT-authorized lab
6. Request vehicle license for autonomous safety driving without passengers – MOT committee
7. **Drive for 6 months in an operational zone** ← we are here
8. Request vehicle license for autonomous driving with passengers – MOT committee
9. Drive additional 6 months
10. Pass cyber qualification
11. Request vehicle license for autonomous driving with passengers without safety driver – MOT committee
12. Drive bus autonomously

# NCAP Testing at Various Speeds

## Car-to-Car following

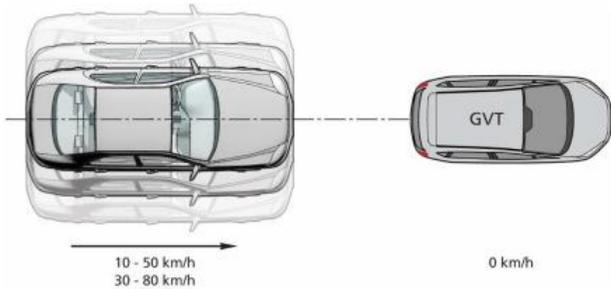


Figure 8-1: CCRs scenario

## Car-to-Car braking

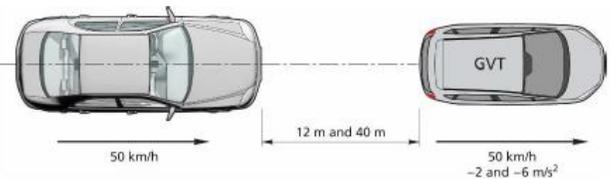
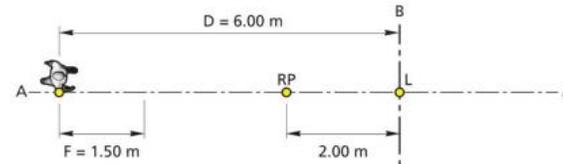


Figure 8-3: CCRb scenario

## Car-to-Pedestrian - Adult



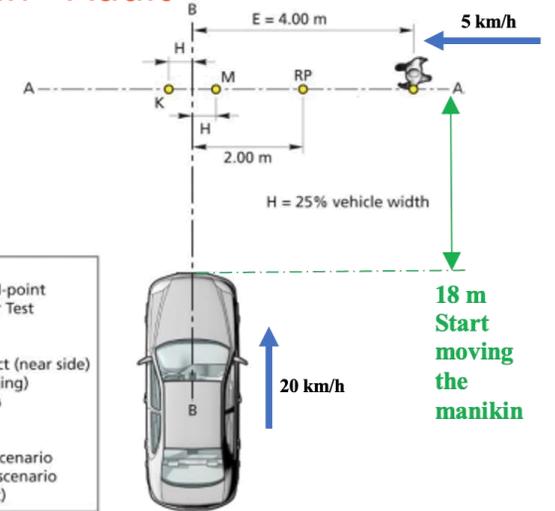
**Axes**  
 AA – Trajectory of pedestrian dummy H-point  
 BB – Axis of centerline of Vehicle under Test

**Distances**  
 D – Dummy H-point, start position to 50%-impact  
 F – Dummy acceleration distance (running)

**Points**  
 L – Impact position for 50% scenarios  
 RP – Reference Point (dummy hip-point)

Figure 7-1: CPFA-50 scenario, Adult running from Farside

## Car-to-Pedestrian - Adult



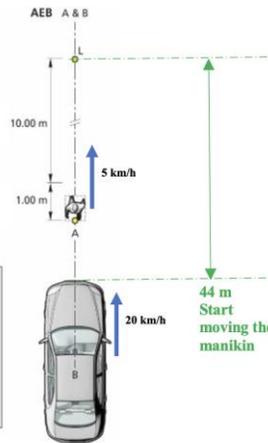
**Axes**  
 AA – Trajectory of pedestrian dummy H-point  
 BB – Axis of centerline of Vehicle under Test

**Distances**  
 E – Dummy H-point, start to 50%-impact (near side)  
 G – Dummy acceleration distance (walking)  
 H – Impact point offset for 25% or 75%

**Points**  
 K – Impact position for 75% near-side scenario  
 M – Impact position for 25% near-side scenario  
 RP – Reference Point (dummy hip-point)

Figure 7-2: CPNA-25 & CPNA-75 scenarios, Walking Adult from Nearside

## Car-to-Pedestrian Longitudinal - Adult



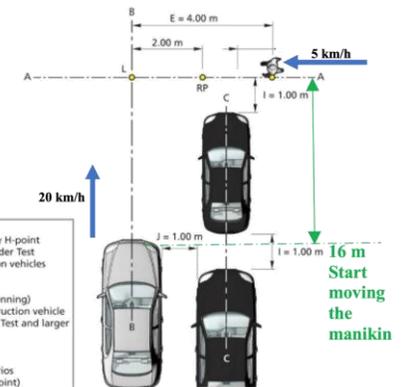
**Axes**  
 AA – Trajectory of centerline of pedestrian dummy  
 BB – Axis of centerline of Vehicle under Test

**Distances**  
 G – Dummy acceleration distance  
 S – Dummy steady state distance  
 H – Impact point offset for 25%

**Points**  
 L – Impact position for 50% longitudinal scenarios  
 M – Impact position for 25% longitudinal scenarios

Figure 7-4: CPLA scenario, Longitudinal walking Adult

## Car-to-Pedestrian - Child



**Axes**  
 AA – Trajectory of pedestrian dummy H-point  
 BB – Axis of centerline of Vehicle under Test  
 CC – Axis of centerlines of obstruction vehicles

**Distances**  
 G – Dummy acceleration distance (running)  
 I – Dummy H-point to front of obstruction vehicle  
 J – Distance between Vehicle under Test and larger obstruction vehicle

**Points**  
 L – Impact position for 50% scenarios  
 RP – Reference Point (dummy hip-point)

Figure 7-3: CPNC-50 scenario, Running Child from Nearside from Obstruction (Annex A)

# NCAP Testing – Bus vs. Child



# Summary

- The shuttle bus experiment has started
- We have a long way to go
  - Educating the public (passengers)
  - Managing Passengers: on/off boarding, assist
  - Accessibility (e.g., electric ramp)
  - Control room capabilities
  - Cyber testing (UN-R155 and similar)





Questions?