# Autonomous Delivery Network for the Middle Mile

## Testimony before the Senate Transportation Committee - Kansas Legislature

February 1, 2022

# Gatik's Senior Leadership Team

Technical experts & business leaders from leading tech, automotive & logistics companies

**Gautam Narang**
Co-founder / CEO
Carnegie Mellon University (Robotics)
Research @ Honda, NREC, CNRS, Boeing

**Arjun Narang**
Co-founder / CTO
Purdue University (AI & Robotics)
Research @ Carnegie Mellon,
Waseda U, Carnegie Robotics

**Apeksha Kumavat**
Co-founder / Chief Engineer
Purdue University (ML)
Perception Lead @
Ford's Self-Driving Systems

## Engineering and Systems

**Engin Burak Anil**
VP of Software Engineering

Former Lead at Toyota Research Institute

**Kartik Tiwari**
Head of Systems

Former co-founder / CTO
Starsky Robotics

**Brian McLean**
Head of Hardware Eng.

Former Director at Clearpath

**Shaurya Agarwal**
Head of Product

Former Director of Product at Motional

## Business and Operations

**Sam Saad**
VP of Strategic Initiatives

Former Director @ MaRS, United Nations, OCI

**Sam Dundee**
VP of Finance

Former VP Finance & Strategy at Romeo Power, ex-Deloitte

**Brad Gillette**
Head of Operations

Former VP Becker Logistics, Director Ryder Systems

**Richard Steiner**
Head of Policy & Regulations

Former Sr. Mgr at Ontario Health, UofT

Google · Uber ATG · Cruise · Ford · University of Waterloo · Ryder · NREC · Honda · Clearpath · D. · Carnegie Mellon University The Robotics Institute · Waymo · BMW · MIT · University of Toronto · Starsky Robotics · Carnegie Robotics · Romeo Power · United Nations

# Gatik and Walmart Partner to Optimize the Supply Chain

# Gatik is Helping Walmart Automate its Middle Mile Operations

## Gatik's solution makes the supply chains more elastic and resilient


### Reliability & Scalability

- Protect against driver shortages
- Scalable & dedicated capacity
- Enable a constant flow of goods

### Operational Efficiencies

- Lower Costs
- Increase Asset Utilization
- Eliminate inefficiencies

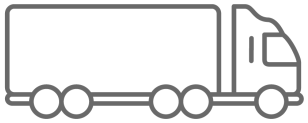
### Improves Safety

- 100% Safety Record
- Improve Sensing & Spatial Awareness
- Maintain Control & Prevent Infractions


# Company Background - Gatik's Solution for Middle Mile Logistics

The autonomous truck leader for B2B short-haul routes - focusing exclusively on fixed, repeatable routes

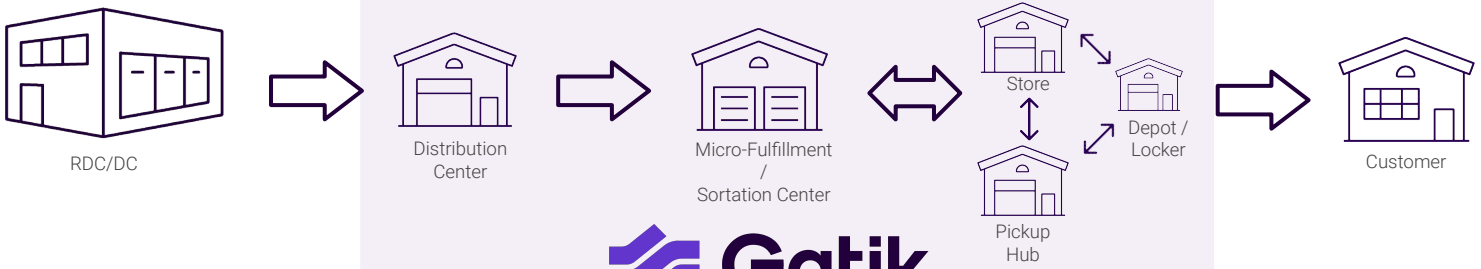
| Long Haul | Middle Mile | Last Mile |
|---|---|---|



- B2B long haul (highway, interstate)
- Large Class 8 trucks
- Dynamic and high-speed routes


- **B2B short-haul routes (for urban, semi-urban environment)**
- **Class 3-6 autonomous straight trucks, < 26,000lbs**
- **Fixed repeatable routes**

- B2C last mile and ride-sharing
- Vans, cars, bikes, sidewalk robots
- Slower moving, smaller capacity



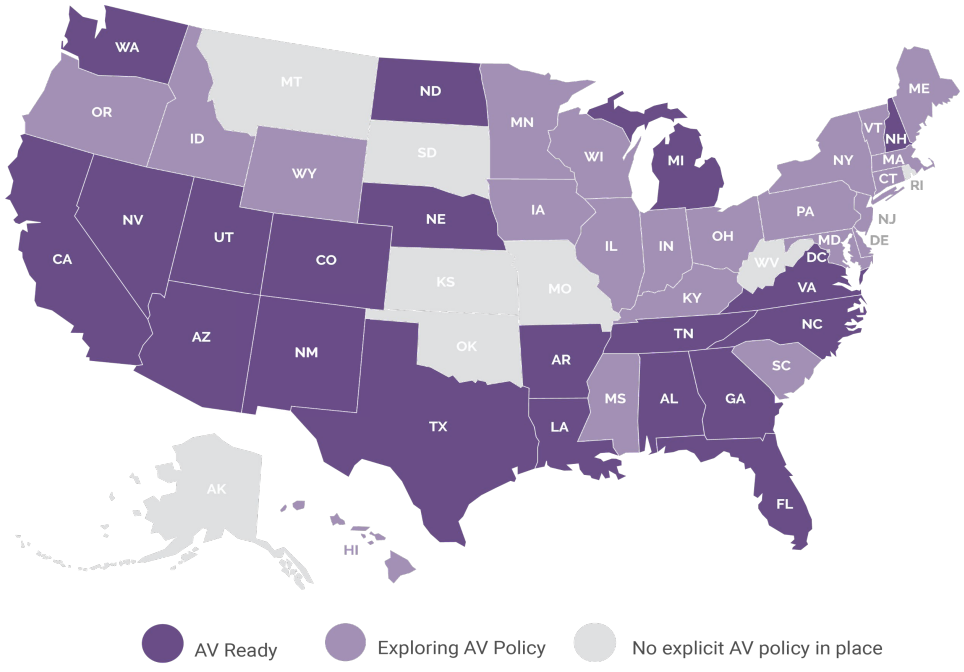

Gatik

Autonomous Vehicles for B2B Short-Haul Logistics

# Developing the Ideal Regulatory Environment

# 44 States Have Autonomous Vehicle Policies

Establishing a regulatory environment conducive to the safe roll-out of autonomous vehicles




*Sources: State legislatures and DOTs*

- **21 states are ready for Gatik's AVs** indicating that fully driverless and paid movement of freight are permitted
- **23 additional states currently have progressive AV policies** (e.g. testing, structured programs)

## Close working relationship with states in which Gatik is deployed:

- **Arkansas:** Gatik and Walmart received regulatory approval to operate fully driverless
- **Texas:** Gatik obtained regulatory approval to operate autonomously (2 x deployment sites - San Antonio and DFW)
- **California:** Gatik obtained regulatory approval to test autonomously
- **Louisiana:** Gatik and Walmart obtained regulatory approval to operate autonomously
- **Gatik has established transparent, accountable data sharing and reporting processes**

# Key Elements of an Ideal Regulatory Environment

**Fully Autonomous Operations Permitted**

Ensures the full advantages of autonomous technology and operations can be realized

**Paid Movement of Freight Permitted**

Allowing movement of goods for a fee offers significant economic and employment benefits


**Reporting Mechanisms in Place to Share Data**

Facilitating exchange of information enhances key learnings at the state level

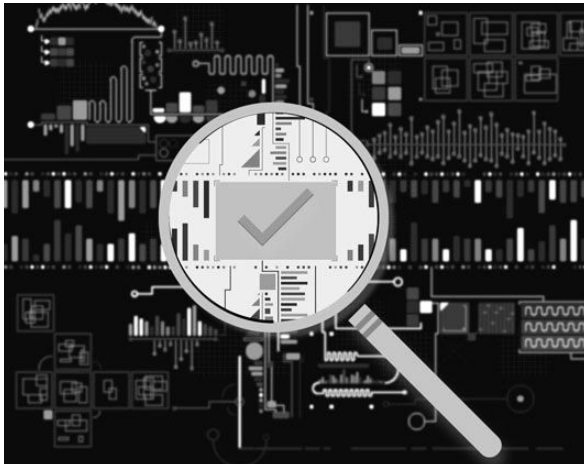
**Structured Approvals**

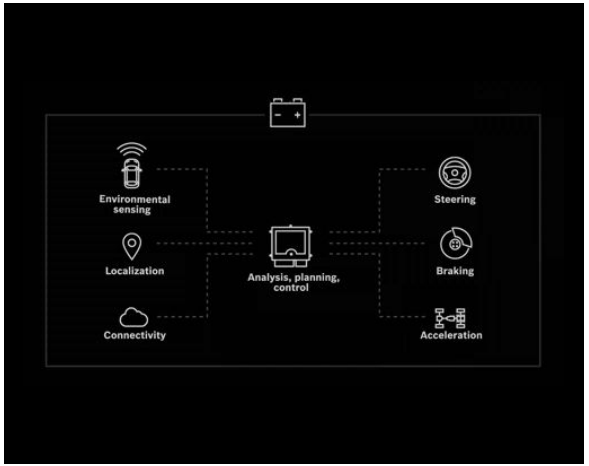
Ensures opportunity to provide comprehensive information on systems safety prior to deployment

# The Middle Mile and Gatik's "Structured Autonomy" Approach

# The Three Pillars of Gatik's Technological Approach

Our purpose-built technology for the middle mile is proven in the field




**Exponentially Less Data Needed**

Due to Overfitting Modular Stack for Known Routes

**Deterministic Learning-First**

Using Hyper-Optimized Hybrid Stack with Rich Priors

**Redundancies at All Levels**

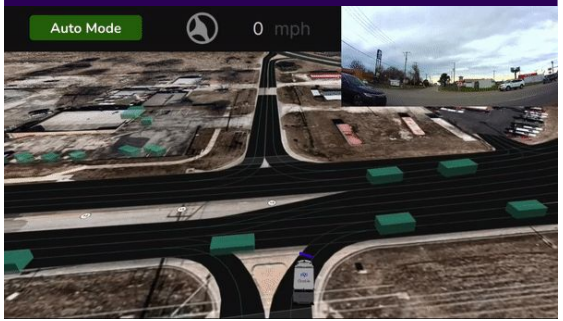
Strategic OEM Partnership for L4 Platforms

**With every delivery, our autonomous vehicles are contributing to a safer and more responsible logistics community**

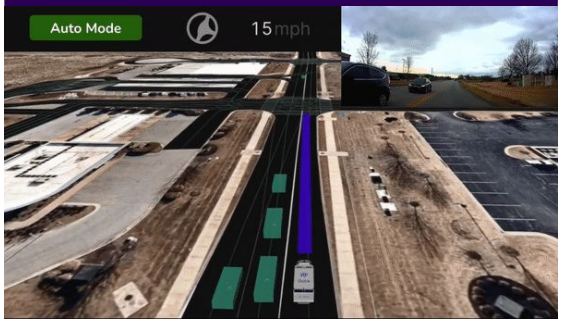
# Our System Safely Navigates Complex Edge Cases

Safely navigates urban and suburban areas, as well as highways — year-round, day & night

## Unprotected Right Turn Navigation




## Unprotected Left Turn Navigation

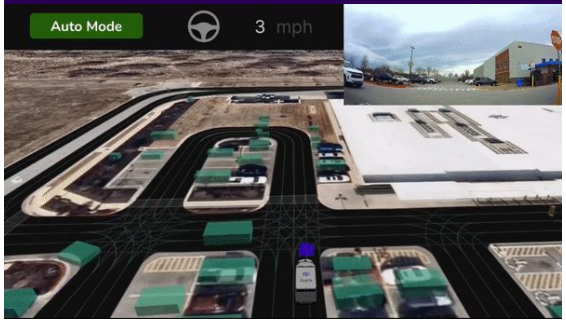



## Unprotected Traffic Light Left Turn


## Construction Zone Navigation

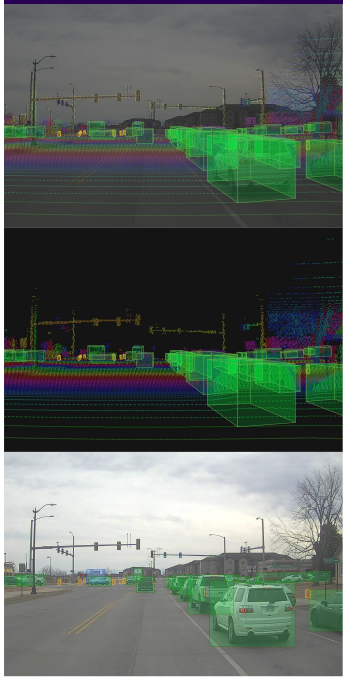

## Merging on a Dense Urban Road

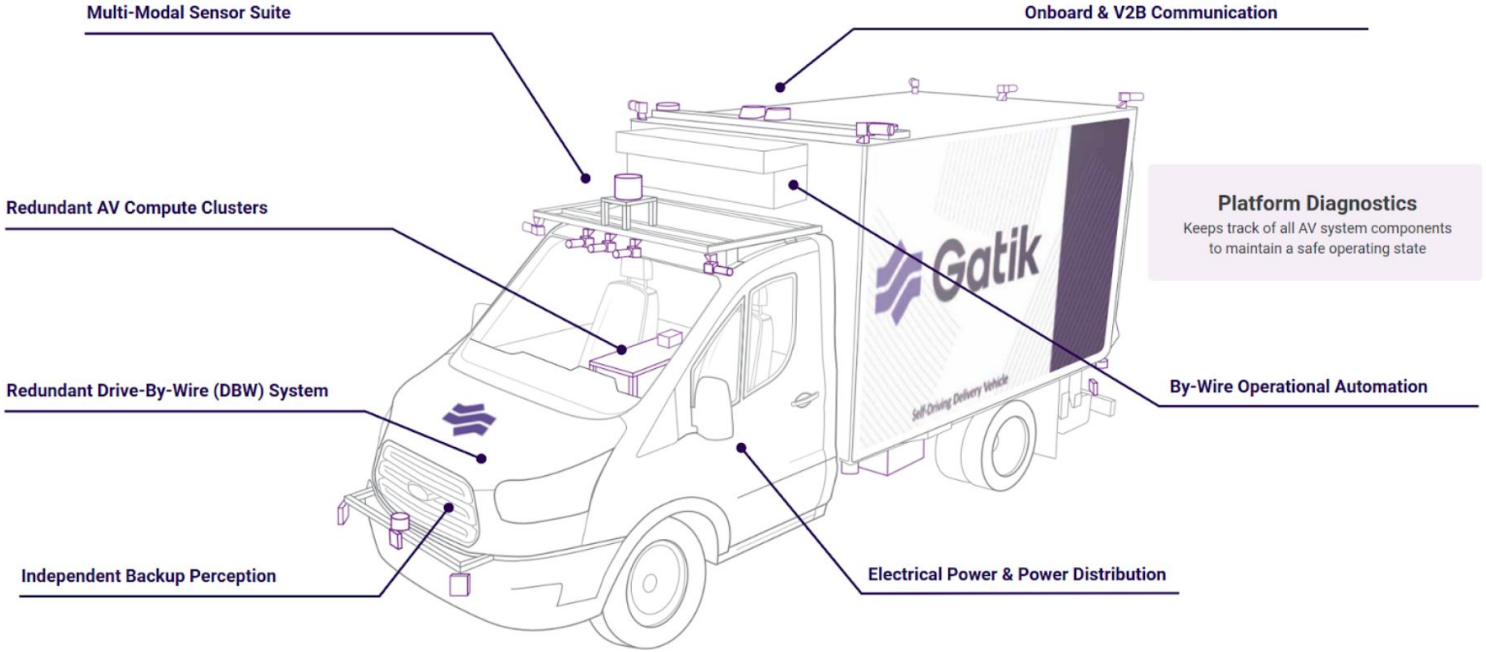

## Busy Parking Lot Navigation



# Key Elements of Gatik's Approach to Autonomy

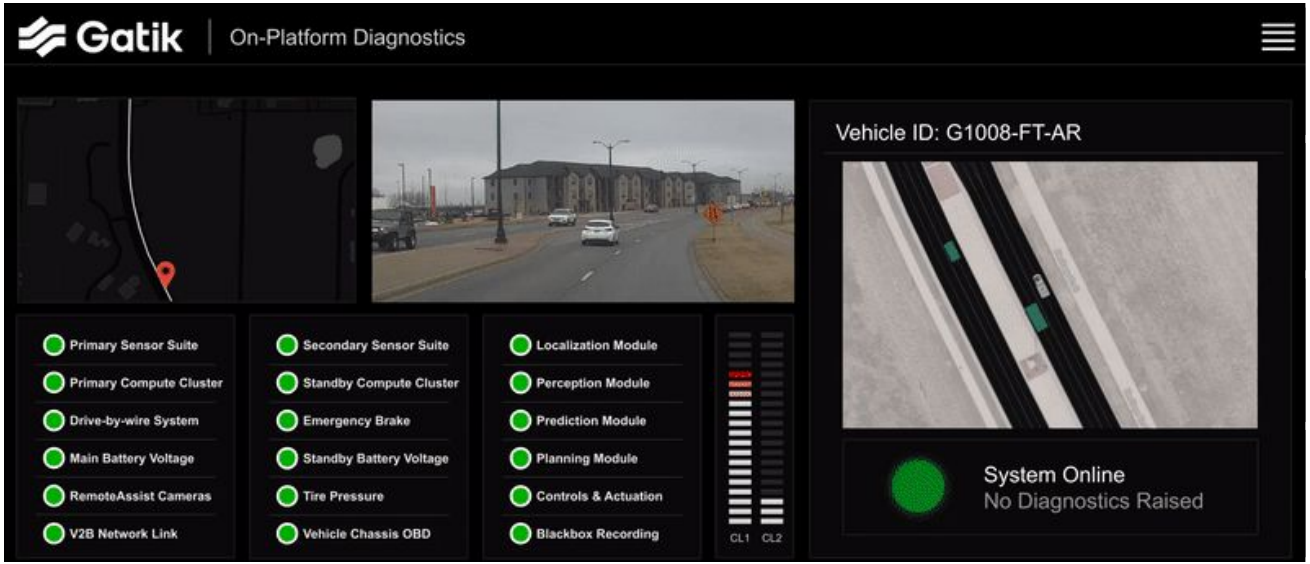
**Data From Multiple Sensors**





# Diagnostics and Recovery Behavior

Custom-tiered diagnostics system that proactively catches hardware, software or vehicle issues




## Sample Diagnostics

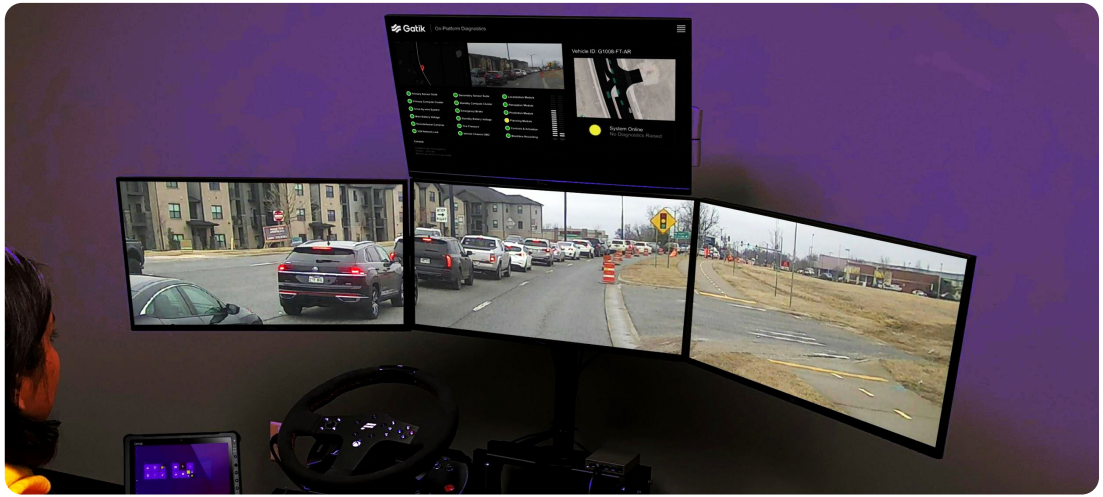
Built-In Self Tests (BISTs) - Tier vs Action

| | |
|---|---|
| **Tier I** | • Engage emergency brakes<br>• Request on-site Help |
| **Tier II** | • Remote-decision override<br>• Slow-down & override control<br>• Pull-over to curbside<br>• Graceful creeping stop |
| **Tier III** | • Record Logs & Tag Events |

- Custom-tiered diagnostics system inspired by automotive & aviation **built-in-self-tests (BISTs) approach**
- **These diagnostics also enable capturing real-time vehicle issues such tire deflation, engine/transmission errors, etc.** Our trucks trigger one of the fail-safe states such as pulling over to curbside with hazard lights flashing, requesting further assistance from our remote monitoring centers.

# Remote Assist — Human-in-Loop Decision Making

## Graceful hand-off for fallback human-in-loop remote assistance in challenging cases




| Recovery Type | Sample Behaviours |
|---|---|
| Creeping Stop | AV comes to a gradual stop within a safe distance instead of slamming brakes |
| Pullover | AV slows down & pulls over to a predefined safe spot along the route |
| Reroute to Predefined Safe Spot | AV reroutes to a predefined safe location like covered parking lots, gas station, etc or return to base/origin location |
| Alternate Route | AV uses alternate route (e.g. in case of road closures) |

- Gatik currently has a **ratio of 1 Remote Supervisor to 1 vehicle**. Remote Supervisors are located in operational centers at every deployment site.
- Each Remote Supervisor holds the class of license required for the vehicle they are supervising.
- If there is any ambiguity on road (e.g. construction, accidents, lane closures, officers or worker directing traffic, etc), the vehicle slows down / comes to a graceful stop & requests for a **high level decision or command from a human-in-loop** in our remote monitoring centers.
- **PA systems on the vehicle** that allow communication between the law enforcement authorities and Gatik's remote supervisors.

# Verification & Validation

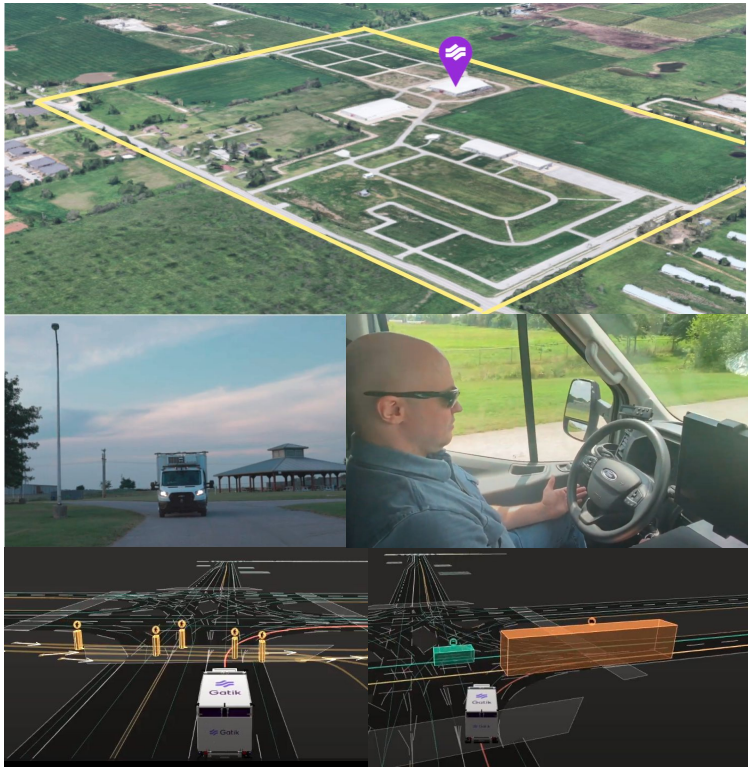
## Simulations, Testing in Closed Course Facilities and on Public Roads

The system is tested through an exhaustive process of:

- Verification in **simulation** through Model in the Loop (MIL), Software in the Loop (SIL), Hardware in the Loop (HIL) and fault injection at every level.

- **Closed-course track testing** to test the system's ability, including deliberate fault injection and recreation of rear world situations where our Safety Drivers are behind the wheel, to be able to retake control at any time.

- After an exhaustive verification & validation process, our trucks are introduced for **public roads testing** with highly trained & vetted Safety Drivers behind the wheel.



# Level 4 Automation For Gatik Trucks (vs. ADAS)

| L0 | L1 | L2 | L3 | L4 | L5 |
|---|---|---|---|---|---|
| NO AUTOMATION | DRIVER ASSISTANCE | PARTIAL AUTOMATION | CONDITIONAL AUTOMATION | HIGH AUTOMATION | FULL AUTOMATION |
| Manual Control. Human performs all driving task (steering, acceleration, braking, etc) | Vehicle features a single automated system (e.g. it monitors speed through cruise control) | The vehicle can perform certain steering and acceleration control to assist the driver. The driver must constantly supervise and be ready to steer, accelerate or brake to maintain safety. | The vehicle can perform most driving tasks under some conditions. However, the human driver is needed to intervene if requested by the system. | The vehicle performs all driving tasks for specific use-cases (e.g. fixed routes, geofenced areas, etc). Human driver is not needed in the vehicle and the vehicle can handle any faults to maintain safety on it's own. | The vehicle performs all driving tasks under all conditions. Zero human attention or interaction is needed. |

# Worldwide First Fully Driverless With Walmart in AR

Real-world fully driverless operations for over 6 months in AR with zero active interventions

# Gatik's Proposed Operations in Kansas

**Class 3-6 vehicles only**

Gatik does not operate Class 7 or 8 trucks, i.e. vehicles do not weigh more than 26,000lbs

**Deliver groceries and essential household items**

Ensuring essential goods are available to Kansans quickly and efficiently


**Creating jobs in Kansas**

Gatik's operations are anticipated to create 20-25 jobs in Kansas within 18 months of commencing operations

**Improve safety and establish reliability**

Protect against driver shortages and establishing long-term safety and reliability on the supply chain


# Gatik

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