

Integrated Product Development



Exploring New Horizons for the Leading Bus Door Manufacturer

Team VaporX



Hardik Patel



Swarna Srimal



Vance Jones



Xuan Liang



Xuejiao Liu

Agenda

- > *Phase Summaries*
- > *Problem Statement*
- > *Opportunity*
- > *Final Solution*
- > *Business Model*



Vapor Bus International
A **Wabtec** company

“

*Radically **transform** bus door systems
to broaden horizons and shift focus
from ‘**Owning the door** to owning the
doorway and beyond.’*

Phase One



Initial research and insights



Initial set of opportunities

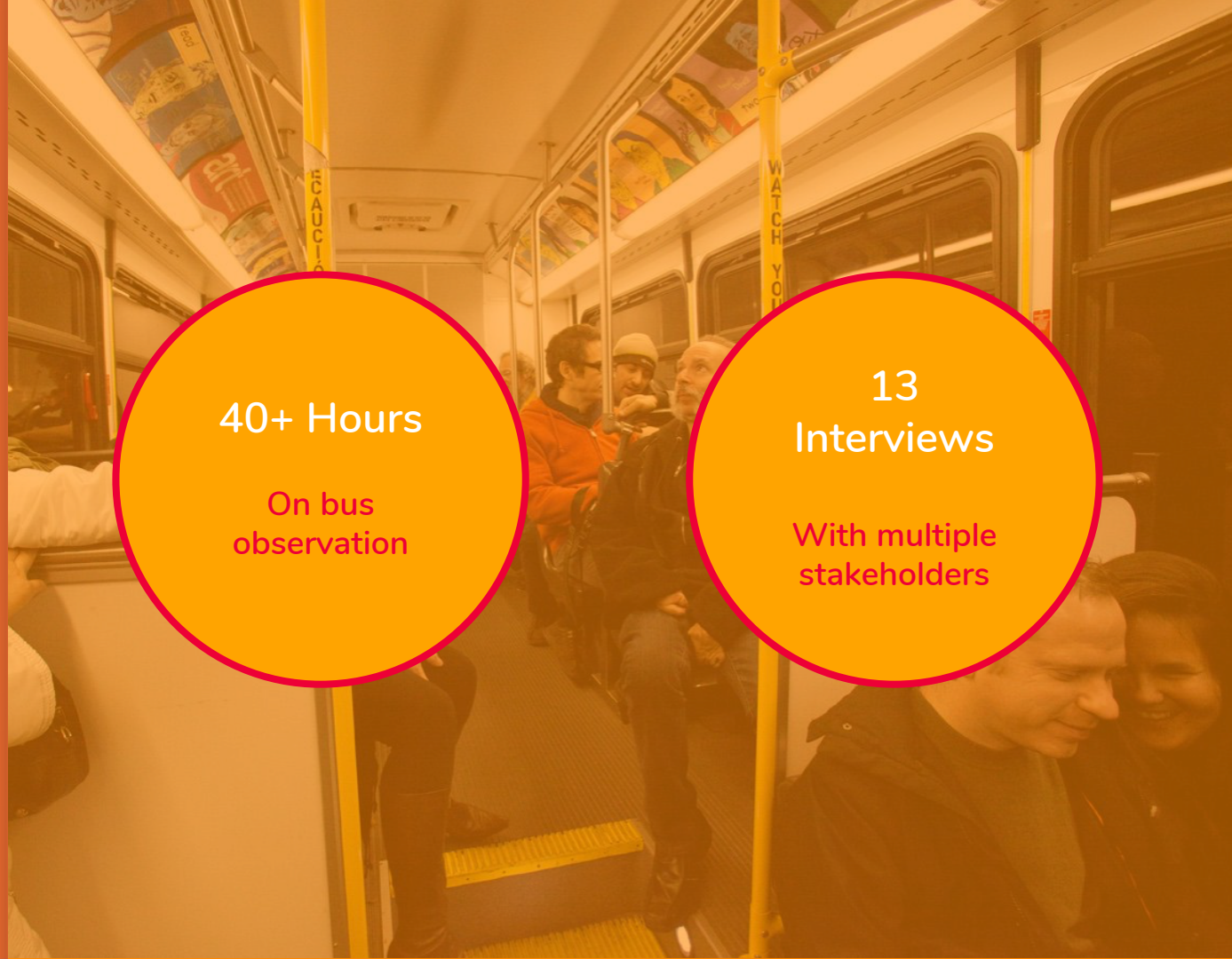
Phase Two

40+ Hours

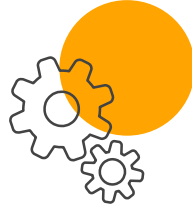
On bus
observation

13
Interviews

With multiple
stakeholders



Phase Two



Product Requirements Document

- Enabling
- Ease of Use
- Sense of Safety
- Sense of Independence



Must, Should and Could

- Must fit into existing as well as new buses
- Should work with other systems on the bus
- Could prepare for a driverless future.

“

*How might we **reduce confusion** for riders and bus drivers during bus rides to **improve efficiencies** in bus operations.*



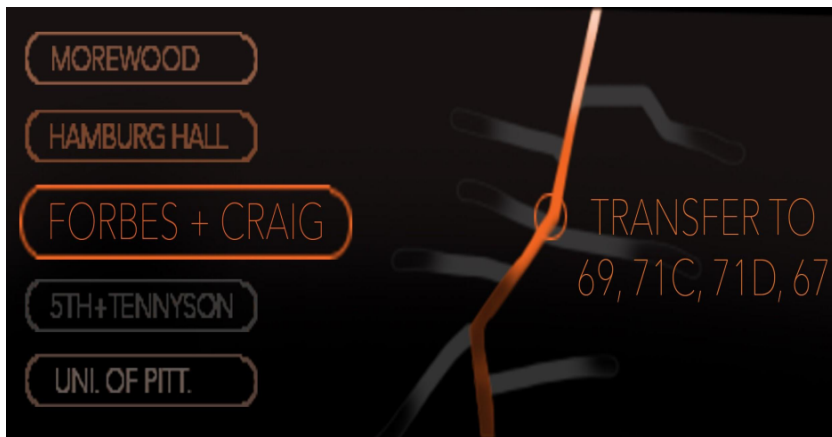
Focus Area: Alighting Experiences



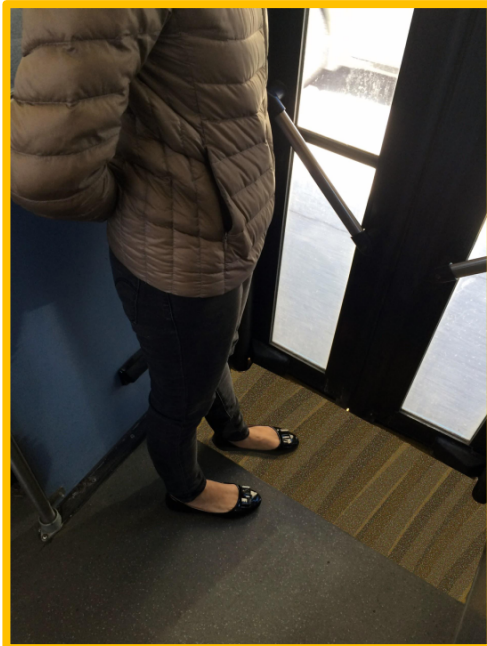
Phase Three



Phase Three: Top Ideas



Phase Three: Top Ideas

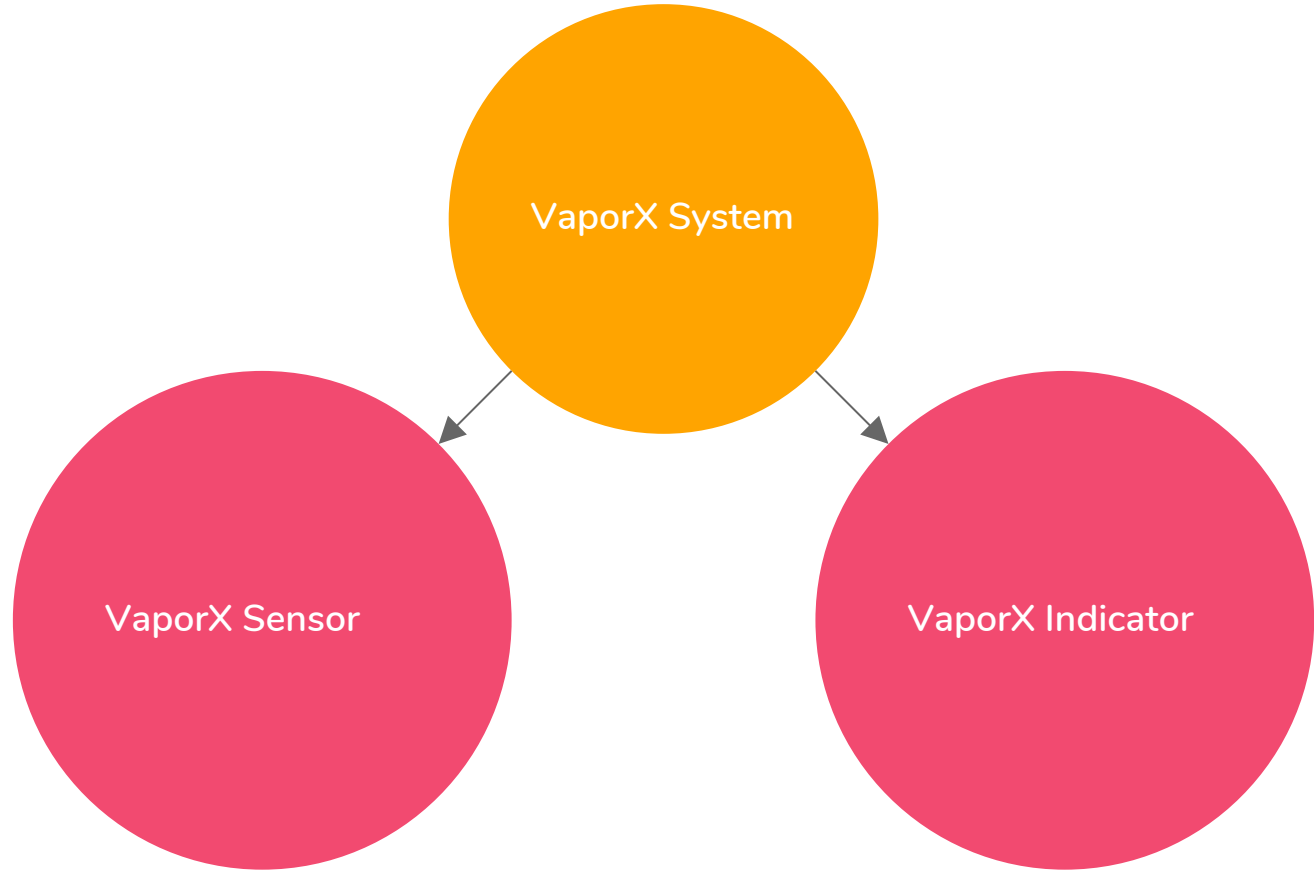




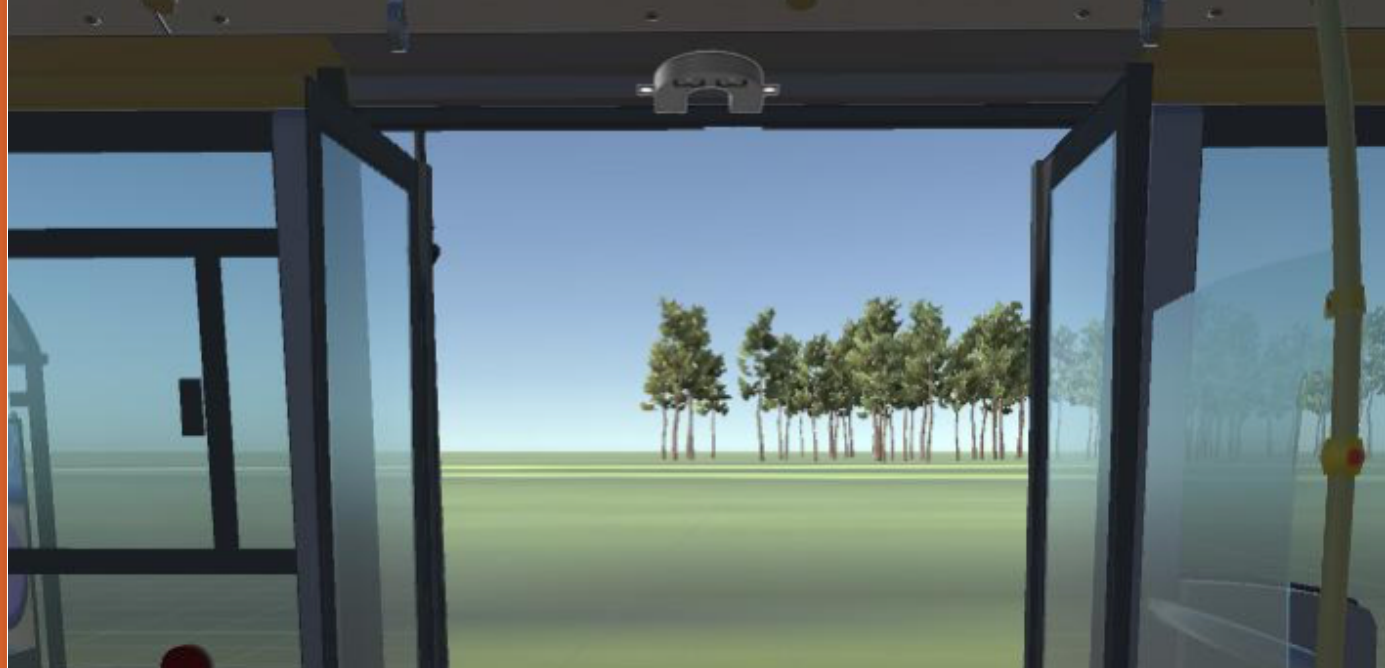
Final Solution

Introducing the VaporX System

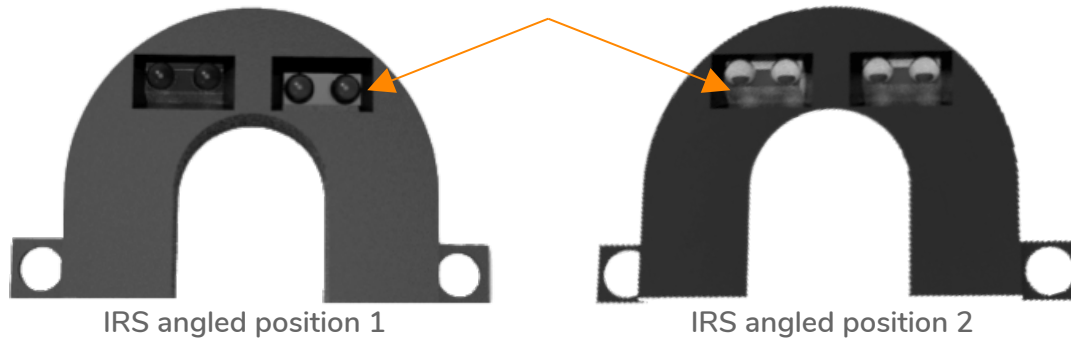
The VaporX System



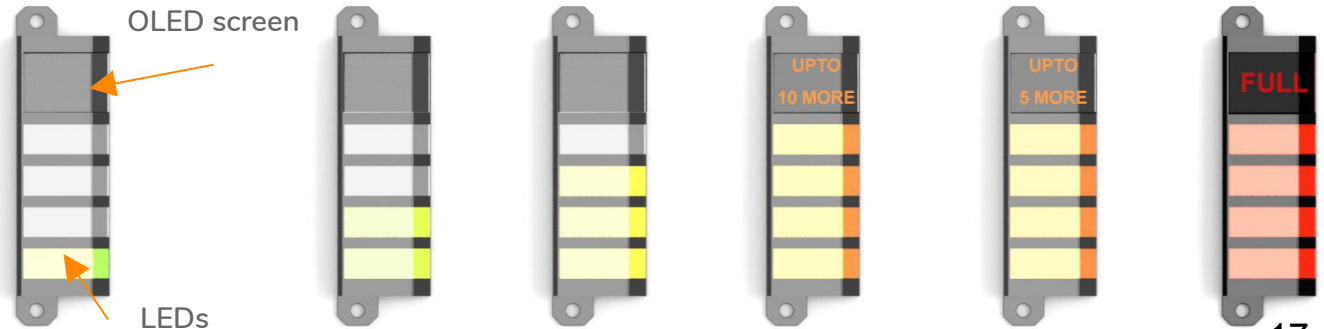
The VaporX Sensors



Infra-red Sensors (IRS)

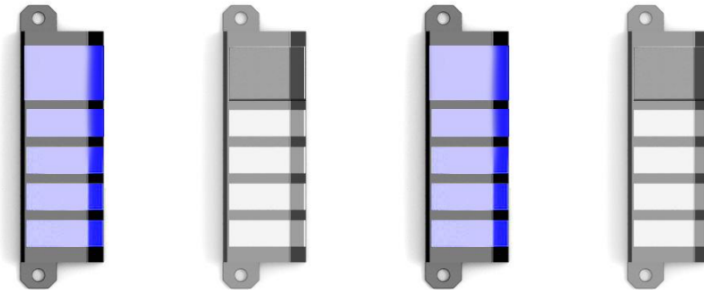


VaporX Indicator



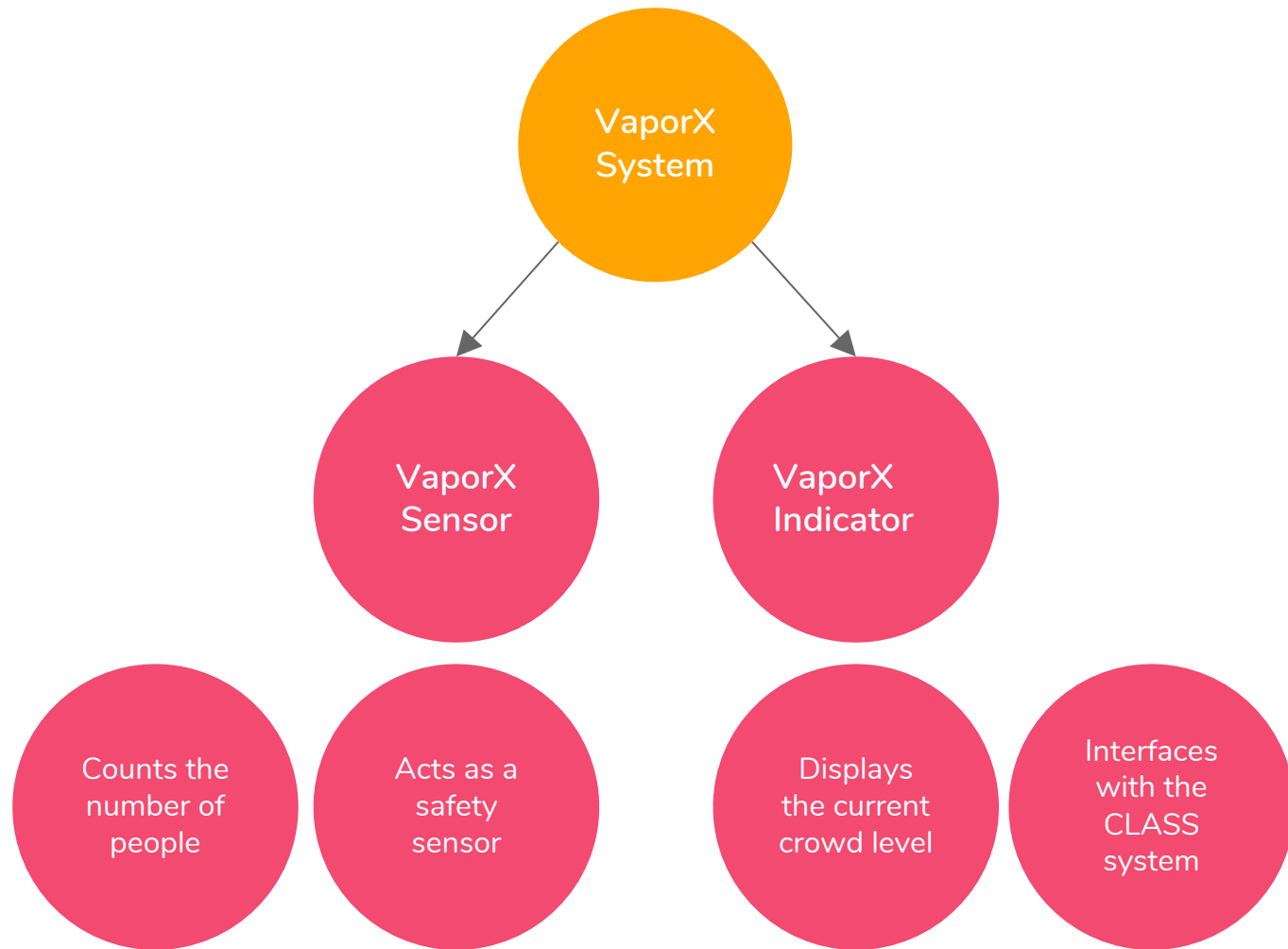
VaporX Indicator:

Interfacing with
CLASS System

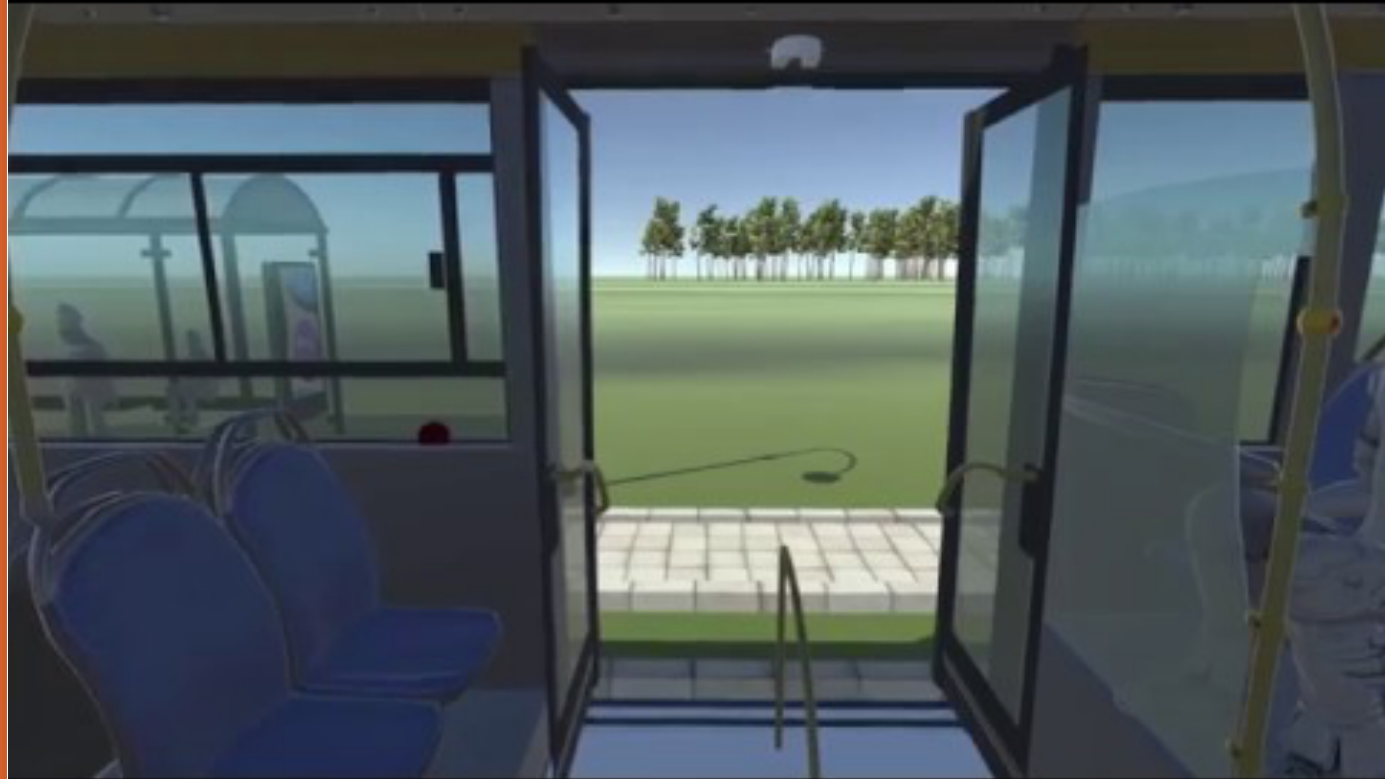


Blinking Feedback

Features



The Experience



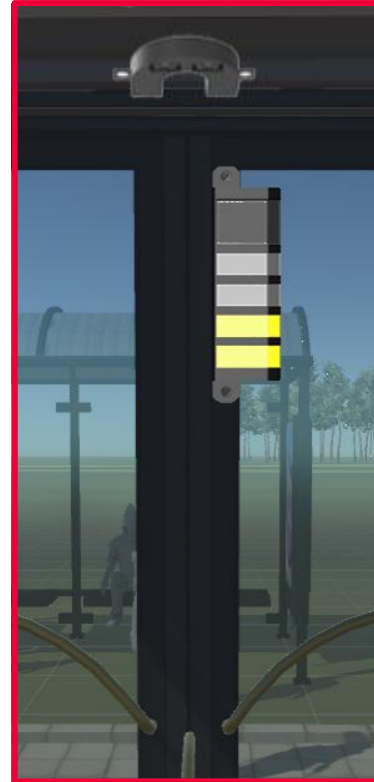
Differentiating Factors

- Primary function
- Technology
- Connectedness

VBI's CLASS System



VaporX System



Automatic Passenger Counter





Business Model

Whoa! That's a big number, aren't you proud?

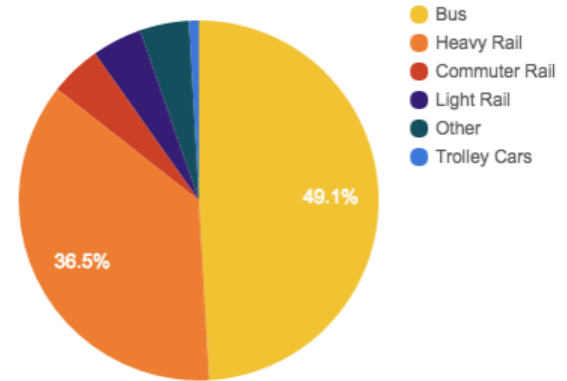
Public Transportation Industry

Total public transportation revenue \$66B
with 2% annual growth rate

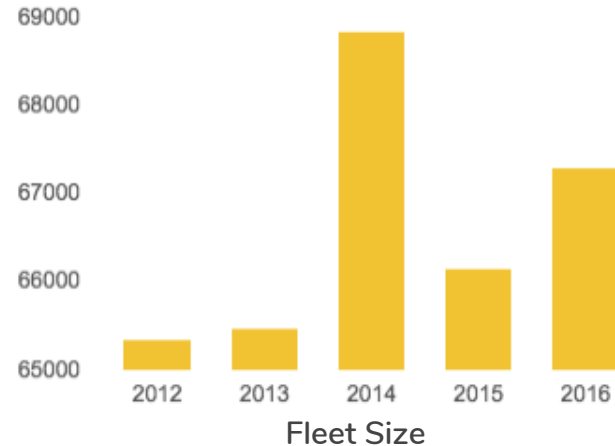
Bus segment is the largest with 6000
transit buses demand annually

Total transportation mileage and urban
population increased

Yet, fleet size remains flat



Revenue by Segment



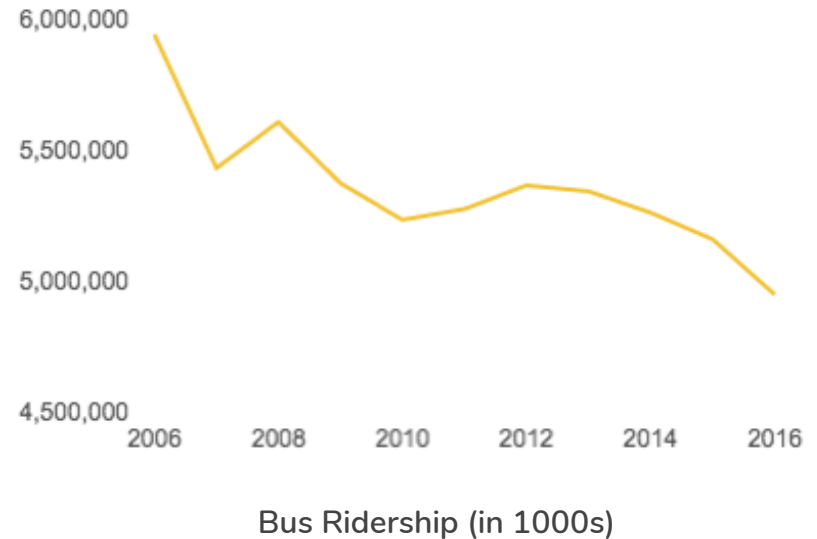
1. Ridership Sustainability

Since 2006, average bus fare increased by 40% from \$1

Urban core populations increased by 12%

And yet, a total \$1B revenue loss for TAs

Equivalent to ~400 buses per year

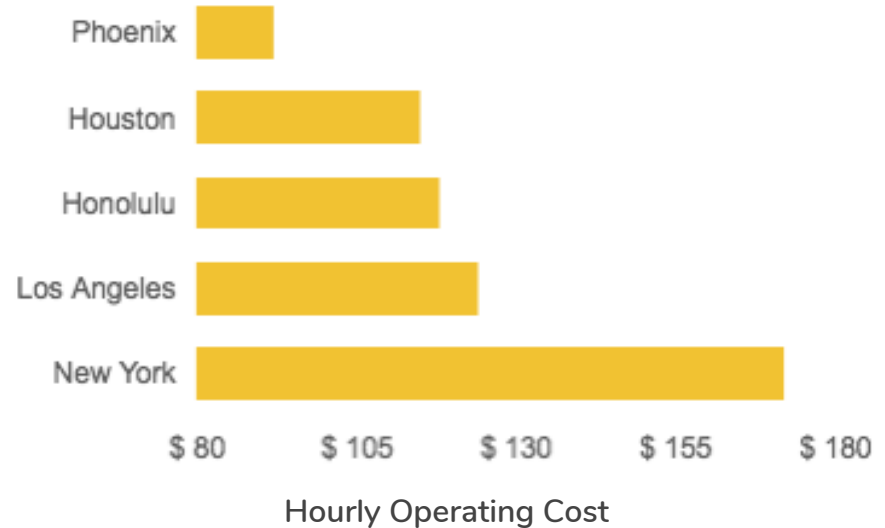


2. Operating Efficiency

High bus operating costs remain primary burden on Transit Authorities

4.5 million hours serving alighting passengers

5% improvement in efficiency during peak hours will lead to \$10M dollars in saving.



3. Accident Prevention

4,530 bus related accidents per year with
236 fatal or severe



\$ 3M

settlement per severe accident

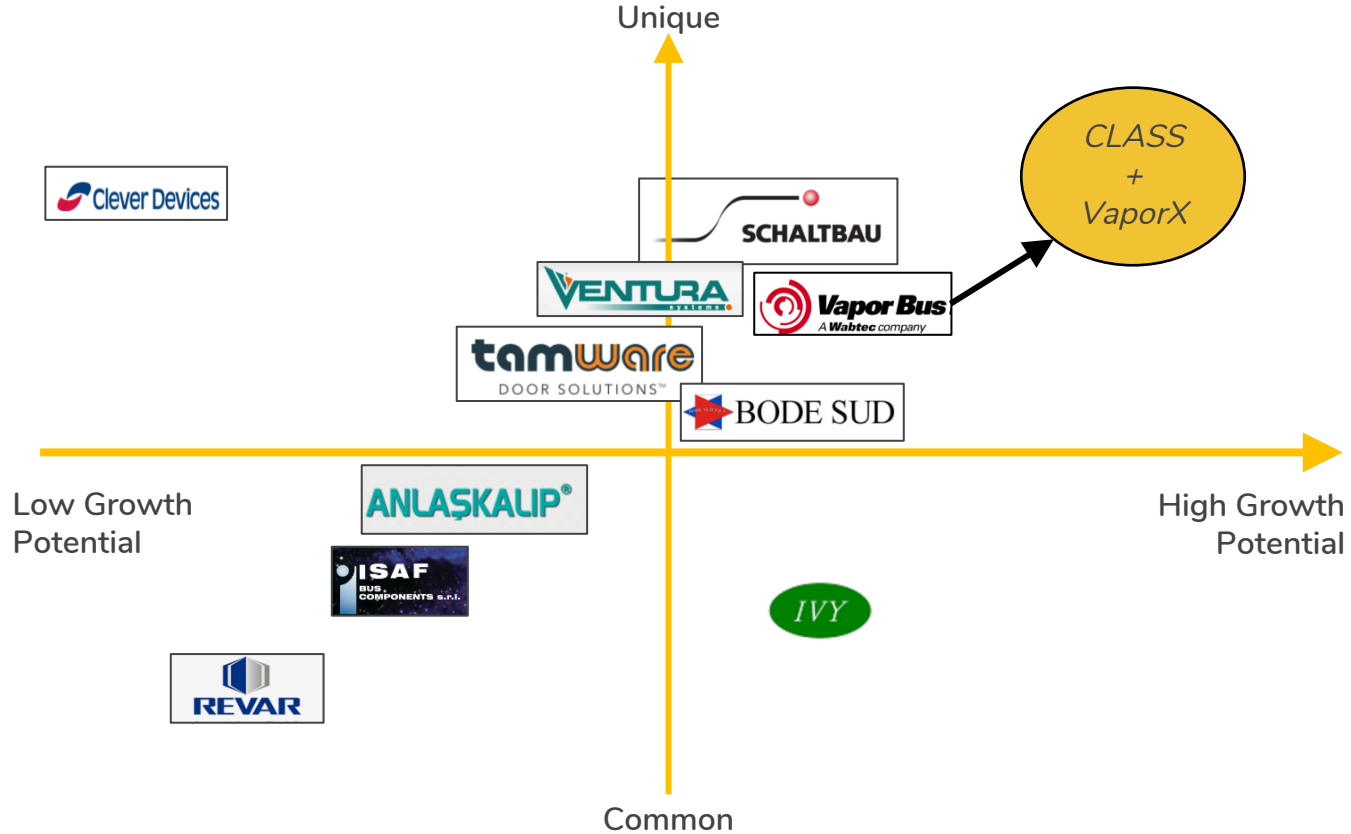


5% improvement in safety accounts for

\$ 35M savings



Competitive Analysis



Why Vapor Bus and why now?



Clever Devices

Clever Device, smart transit technology company, is innovative but has very limited access to TAs. It is not in the established business value chain.



CityMapper

The App company just launched a bus service in London, not yet in America



INRIX

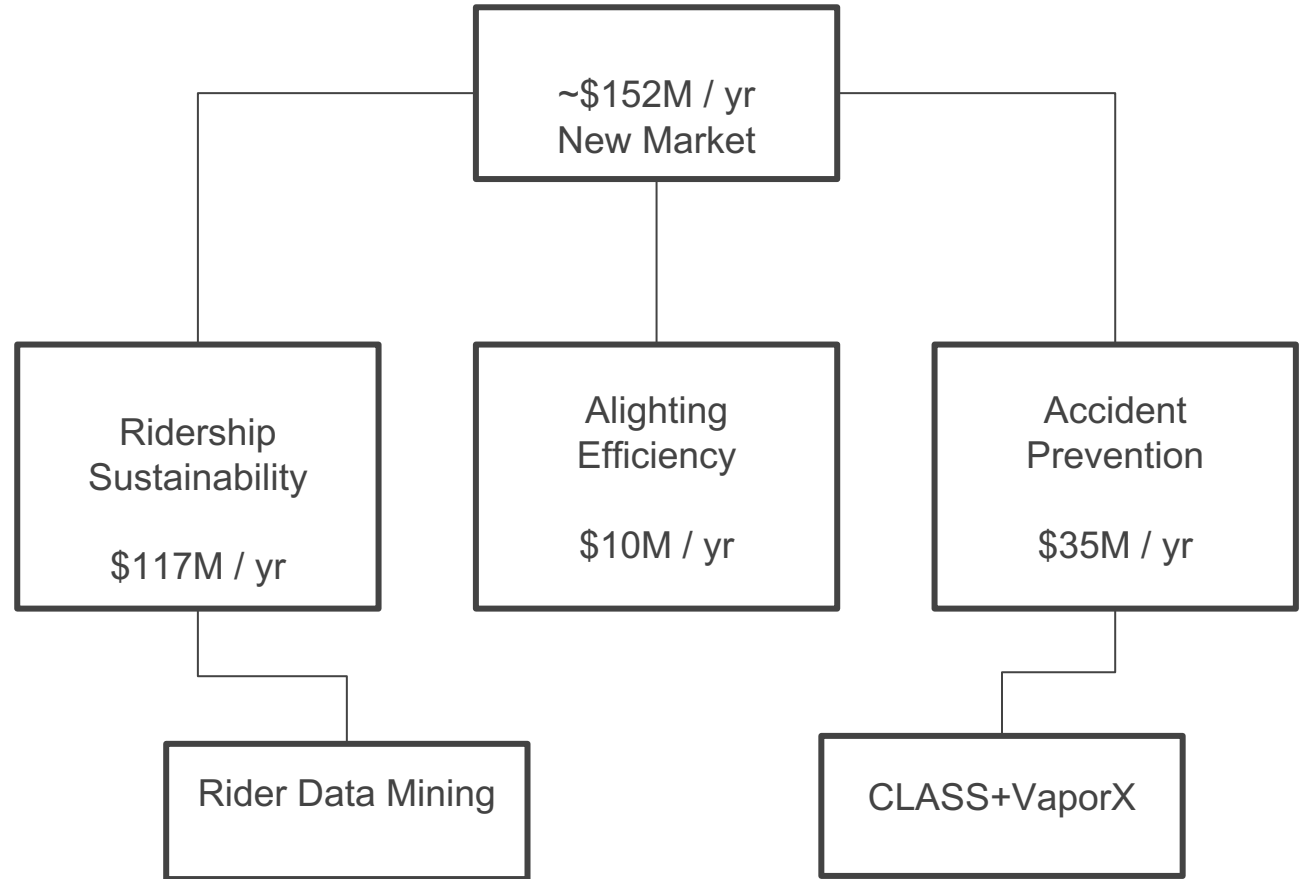
A real-time traffic startup, raised \$133M since its founding years and started collaborating with Google; But only has access to private transportation mode



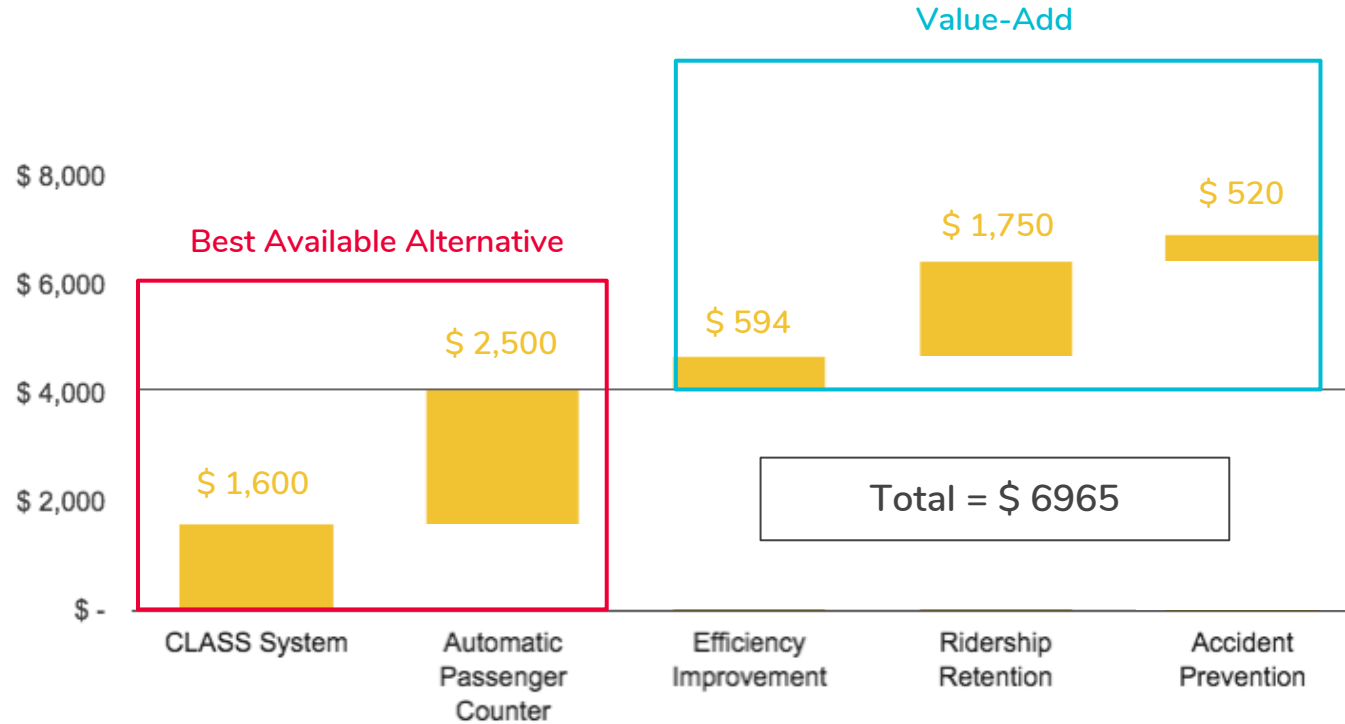
Proterra

Proterra has partnered with UNV-Reno to collect data on their electric buses, mostly for academic purposes

Potential Markets



VaporX System Value-Based Pricing



5 Year Revenue Forecast

Small scale trial with 100 units out in the field

Pricing at \$5,000 with manufacturing cost at \$3000

10% adoption rate for procurement of new doors

1% growth for existing buses

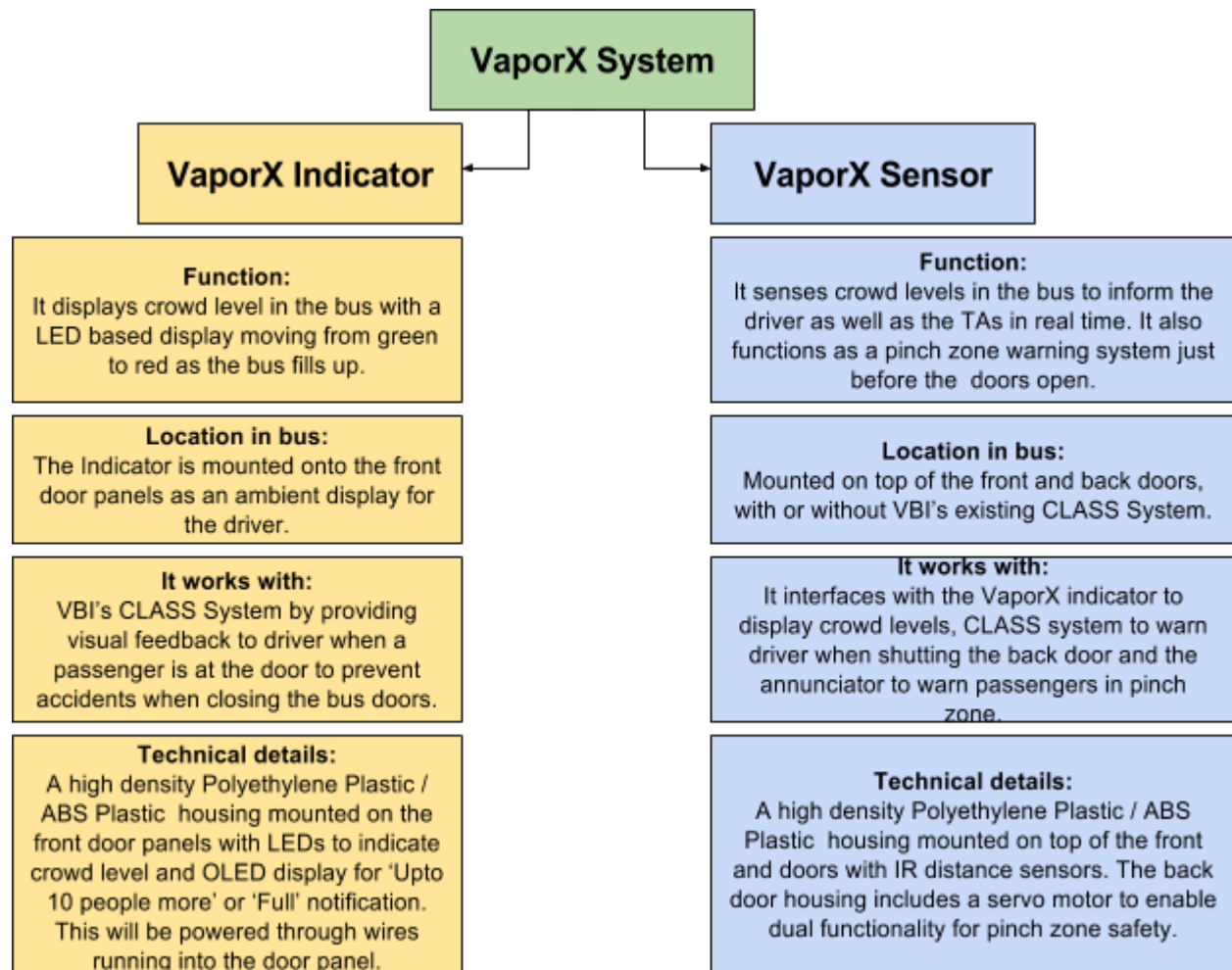


End of year 5, greater than 20% of buses in the US are equipped with CLASS+VaporX system

Thank you!

Appendix

VaporX Subsystems



VaporX CLASS and APC Systems

	VaporX system	CLASS system	APCs (Automated Passenger Counters)
Primary functions	VaporX sensor counts the number of people getting on and off the bus	Detects people in the doorway when doors are open	Counts the number of people getting on and off the bus and dumps the data at the end of the day
	VaporX sensor detects people standing in the pinch-zone as the door is about to open	Passengers can actuate the backdoors by themselves.	
	VaporX indicator displays the current crowd level to the driver		
Communications	Indicator communicates the current crowd-level to the driver, TA's and outside passengers (through App)	CLASS system communicates the presence of a person in the doorway to the driver via indicator	Does not communicate the data in real-time
	Sensors communicate the crowd level to the indicator.		
	Sensors communicate the presence in pinch-zone to the passenger via annunciator		
Technology	IR distance sensor or Time of Flight sensor in the VaporX sensor	Acoustic sensors	IR or laser break beam sensors
	LED lights and OLED display on the VaporX Indicator		

Value Opportunity Analysis:

Existing Scenario

Value Attributes

Emotion

Low

Medium

High

Very High

Sense of Adventure

Sense of Independence

Sense of Security

Sense of Time

Luxury

Confidence

Power

Aesthetics

Visual

Tactile

Auditory

Olfactory

Product Identity

Personality

Point in Time

Sense of Place

Impact

Social

Environmental

Ergonomics

Ease of Use

Safety

Comfort

Core Technology

Enabling

Reliable

Quality

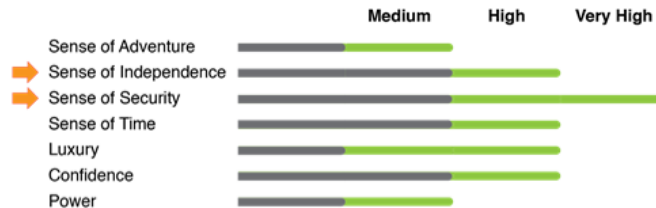
Craftsmanship

Durability

Value Opportunity Analysis: Target Scenario

Value Attributes

Emotion



Aesthetics



Product Identity



Impact



Ergonomics



Core Technology



Quality



User Tests & Feedback



Weighted Matrix

VaporX Team POGs Decision Matrix		Driver Engagement	Payment	Way finding	Data & Automation	Rider Engagement	Accessibility	Ads & Local Culture
Criteria for Evaluation	Criteria Weight (1-5) Range: (11-55)	Opportunity Groups Factor (1 being the least, 5 being the most)						
Feasibility	4	4	5	5	3	5	4	4
Team Interest	4	3	4	5	4	4	4	4
Long Term Potential	3	3	5	5	5	4	4	4
Uniqueness	2	1	3	3	4	3	2	5
Target Audience (Addressing more stakeholders)	3	2	5	4	4	3	3	4
Scalability Across Platform	5	5	5	5	4	4	3	4
Desirability (Could someone please fix this?"	5	3	5	5	2	3	4	3
Timeline for implementation	3	4	4	4	3	4	4	4
Core Competency	4	5	4	3	2	3	4	5
ROI (Attractiveness to Consumer)	4	3	5	5	4	5	4	4
Low Barrier To Entry	4	5	2	3	2	4	2	3
Total	41	149	178	179	134	158	144	161

Pugh Chart

Factors	Shouting and mirror	Floor sensors near door	Crowd level indicator	Sensors on door	Wait-to-close sensors	Curb distance indicator	Rear door cameras
<i>Must</i>							
Sense of security	0	1	0	2	2	1	2
Visual	0	0	1	0	1	1	1
Safety	0	2	1	2	2	2	1
Reliable/durable	0	-1	-1	-1	-1	-1	-1
Affordability	0	-1	-1	-2	-1	-1	-2
<i>Should</i>							
Independence	0	1	0	0	1	1	0
Confidence	0	1	0	2	2	1	1
Auditory	0	1	1	1	1	0	0
Point in time	0	1	1	1	1	1	1
Latest tech	0	2	2	2	2	2	1
Comfort	0	1	1	1	1	1	1
<i>Could</i>							
Luxury	0	0	2	0	1	1	1
Environmental	0	-1	-1	-1	-1	-1	-1
Craftsmanship	0	1	2	0	1	0	0
Total:		8	8	7	12	8	5

Pugh Chart

Factors	Gazing longingly	Phone app	Door panel display	Projector system
<i>Must</i>				
Visual	0	1	2	2
Tactile	0	1	0	0
Ease of use	0	2	1	1
Reliable/durable	0	-1	-1	-1
Affordability	0	0	-2	-1
Sense of place	0	0	0	-1
<i>Should</i>				
Independence	0	2	1	2
Confidence	0	2	2	2
Auditory	0	2	1	1
Point in time	0	2	2	1
Social inclusion	0	0	-2	-1
Latest tech	0	1	2	1
Comfort	0	2	1	1
<i>Could</i>				
Excitement	0	1	2	2
Luxury	0	0	1	1
Environmental	0	0	-2	-1
Craftsmanship	0	0	1	1
	Total:	15	9	10

Pugh Chart

Factors	LED and annunciator	Highlighting path to door	Rolling stop display	Projecting bus route	Seat and phone	Phone only
<i>Must</i>						
Visual	0	1	2	2	0	1
Affordability	0	-2	-1	0	-2	0
Tactile	0	0	0	0	2	0
Ease of use	0	1	2	1	-1	-1
Reliable/durable	0	-2	0	0	-1	-1
Sense of place	0	1	2	2	0	0
<i>Should</i>						
Inclusion	0	1	0	1	-1	-1
Independence	0	0	1	2	1	1
Confidence		1	2	2	1	1
Auditory	0	0	1	2	0	0
Point in time	0	1	1	2	1	1
Latest tech	0	1	0	1	1	1
<i>Could</i>						
Luxury	0	1	1	2	2	1
Environmental	0	-1	-1	0	-2	0
Craftsmanship	0	2	1	2	2	1
Total:		5	11	19	3	4

The Design Principles of the Solution

Must:

- ▶ Prevent injuries and unwanted contact
- ▶ Easily communicate its use visually
- ▶ Be ADA compliant
- ▶ Support use by >95% of passengers

Should:

- ▶ Inspire confidence during alighting
- ▶ Utilize technology that simplifies stakeholder tasks
- ▶ Be socially inclusive
- ▶ Provide a comfortable alighting experience

Could:

- ▶ Excite passengers about riding the bus
- ▶ Reduce bus energy consumption