FootfallCam Smart Bus Solution

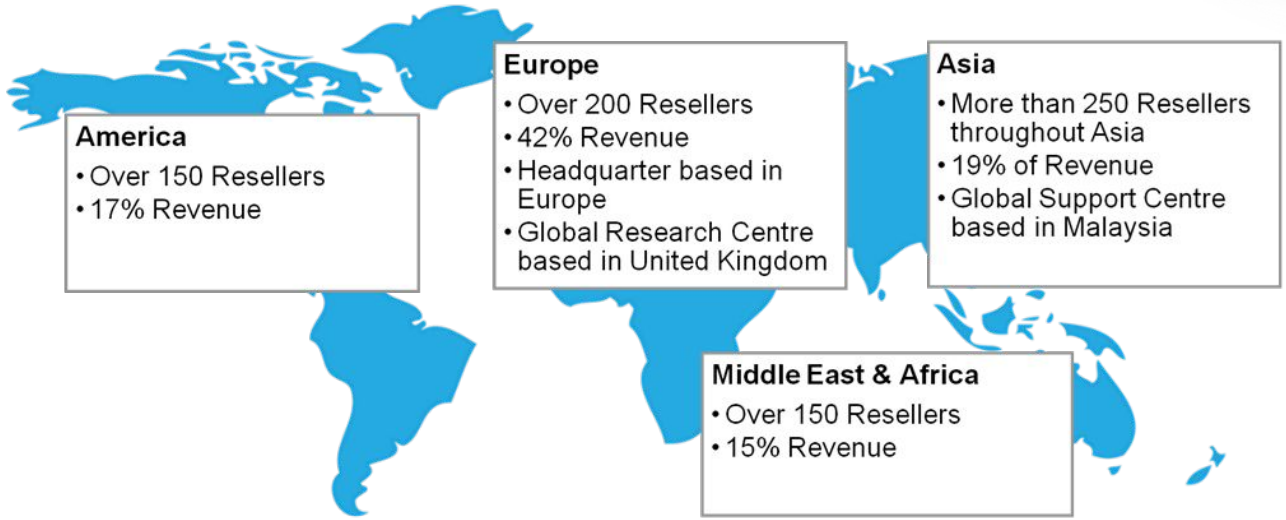
Passenger counting for bus service planning

FootfallCam™

About FootfallCam™

Global Leader in People Counting System

Headquartered in the **United Kingdom**, FootfallCam started with a team of experienced engineers with the vision of creating the most advanced people counting system in the market. We are the **manufacturer** of both hardware and software; all the design and development are 100% in-house made.

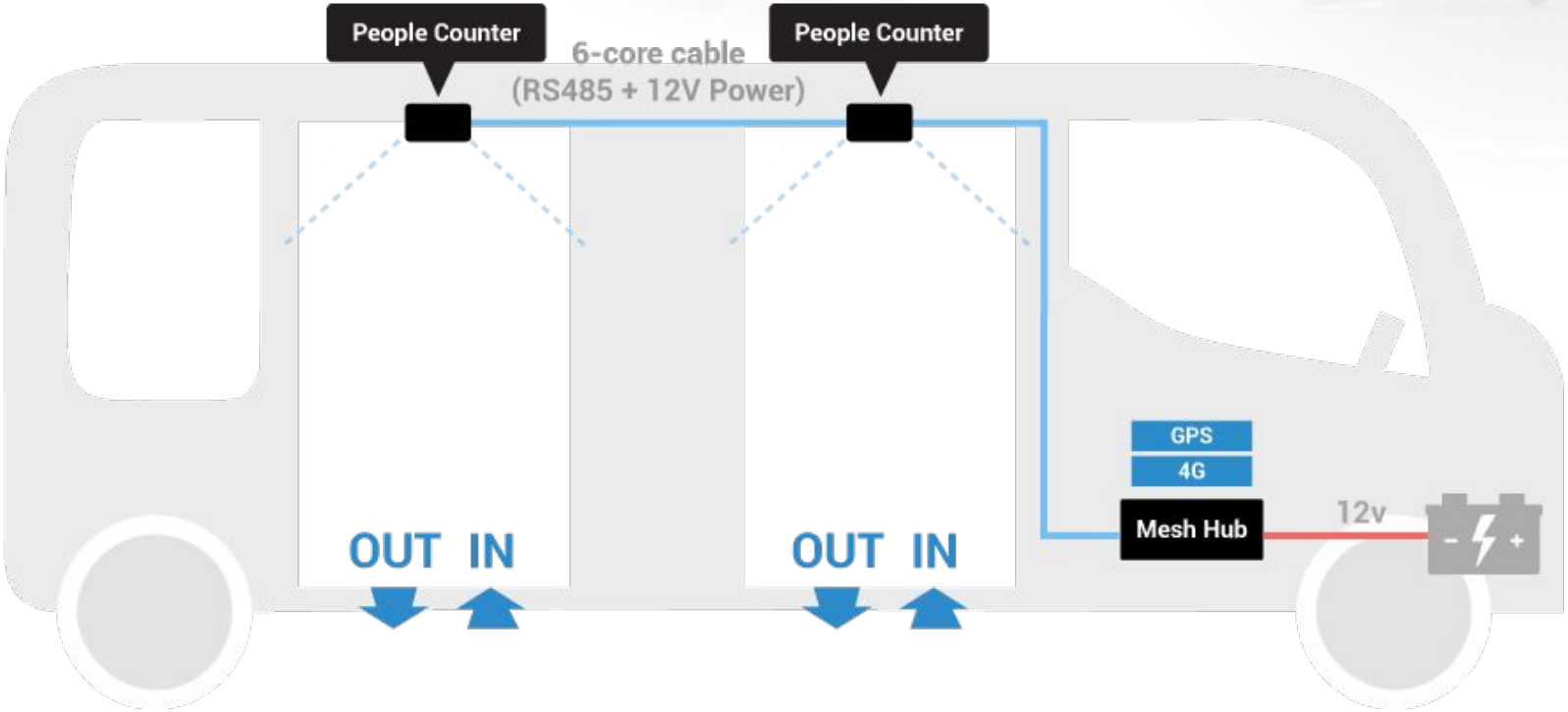


- Continuously reinvesting more than 24% revenue into research and development
- **In-house R&D team** dedicated to the development of both hardware and software platform
- Combined **over 100 years industry experiences** in developing people counting solution
- **Serving multiple sectors** varying from retail, fast food, restaurants, museums to smart buildings and airports.

Agenda

- FootfallCam Smart Bus Solution - Overview
- Why passenger counting for bus operators?
- What are the key features?
- System Design & Architecture
- Case Studies
- Enterprise Class Software

FootfallCam Passenger Counting System

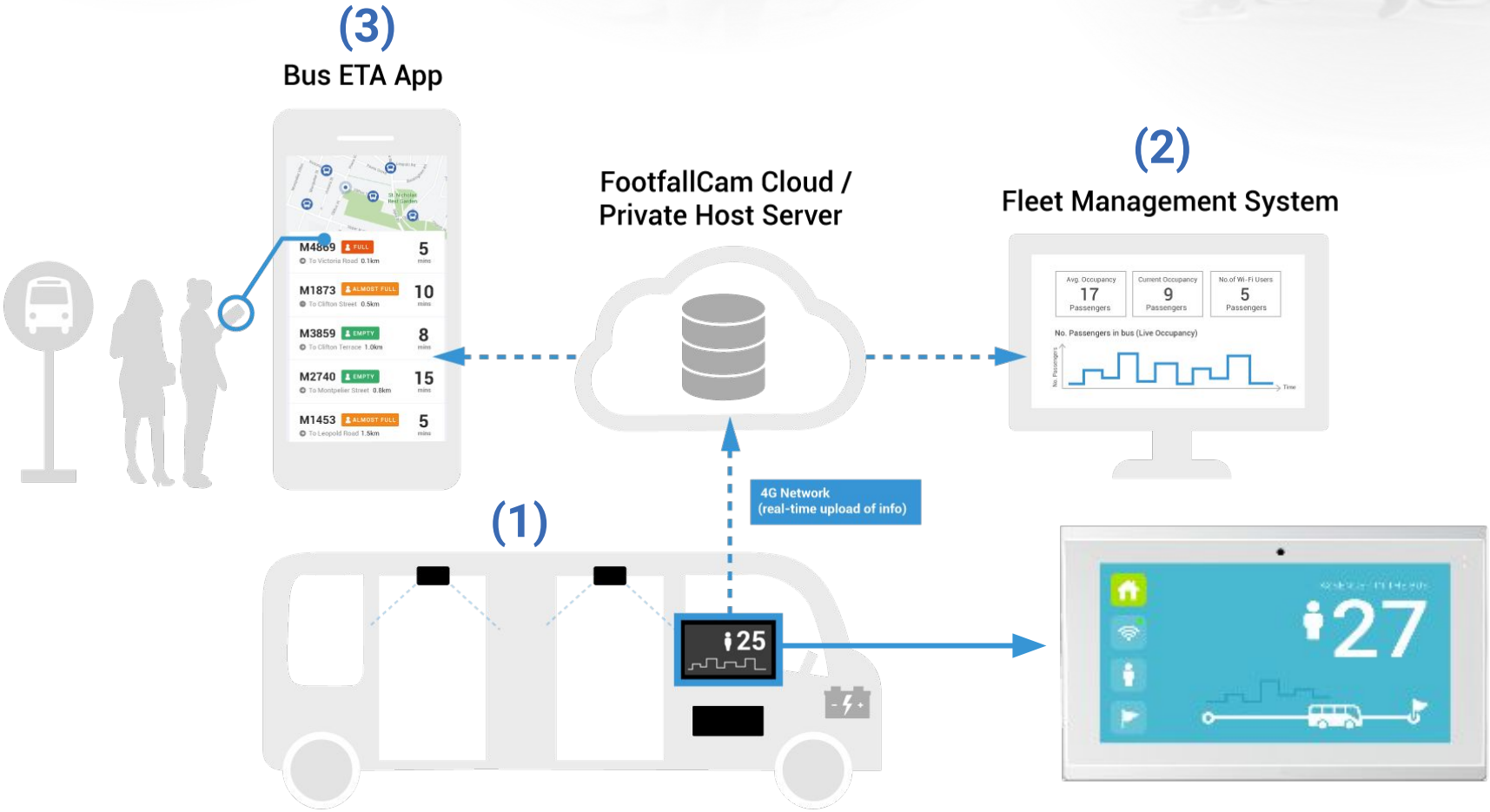


How it Works?

- **Count** passengers going **IN & OUT** of the bus
- Display live occupancy on the driver's dashboard
- Built-in GPS and 4G network
- Measure bus occupancy **at different locations at different timestamps**

Watch how it works: https://youtu.be/HoG8YGMsicM

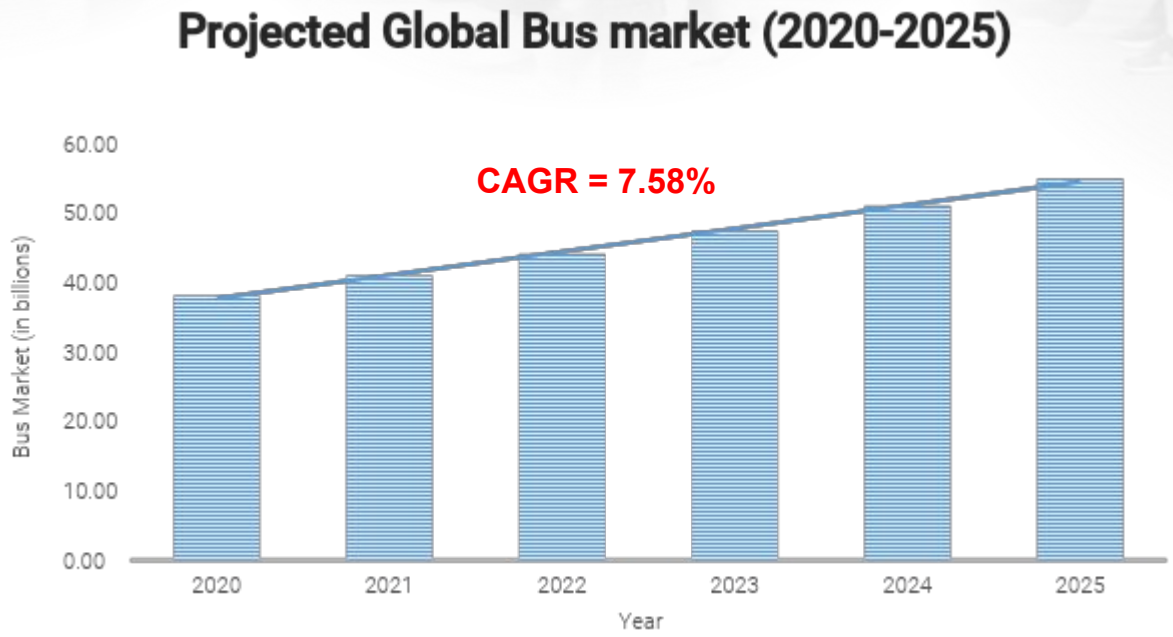
FootfallCam Smart Bus Solution - Overview



1. Count the **Occupancy of Bus** in real time
2. Upload the Occupancy Data into your **Fleet Management System**
3. Show Passengers Bus Occupancy Level on your **Bus ETA App**

Why Passenger Counting for Bus Operators?

Potential Market for Buses

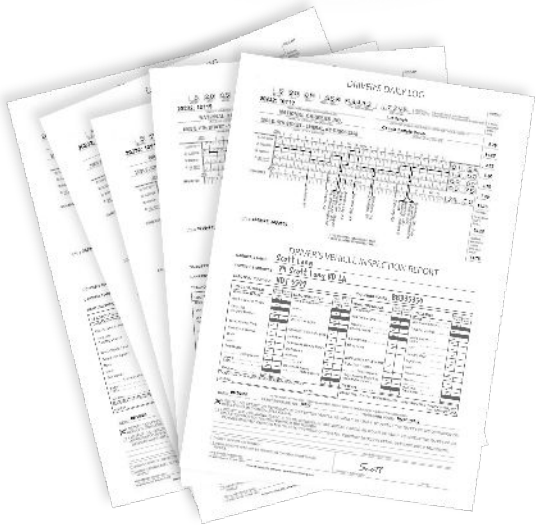


- According to Bloomberg New Energy Finance, around **3 million city buses** were in operation worldwide as of 2017 [1]
- Global bus market is projected to reach **$ 54.92 billion by 2025** with a Compound Annual Growth Rate (CAGR) of 7.58% due to improvements in infrastructure & increasing population [2]
- In view of the recent trend of Intelligent Transportation System (ITS), bus companies are looking for ways to better **control and manage its transport system** [3]
- Passenger IN/OUT count data can be utilized to make informed business decisions:
  - E.g. Effective route planning
  - E.g. Optimize allocation of resources
- This creates a **growing need** for the implementation of people counters in buses

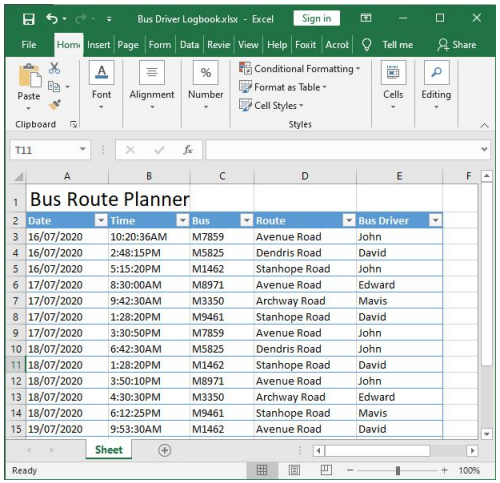
Sources:

[1] https://www.sustainable-bus.com/electric-bus/electric-bus-public-transport-main-fleets-projects-around-world/
[2] https://www.mordorintelligence.com/industry-reports/bus-market
[3] https://www.researchgate.net/publication/279277478_Recent_trends_in_intelligent_transportation_systems_a_review

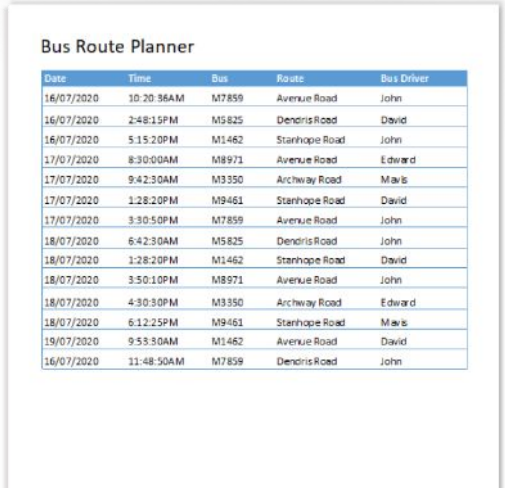
Pain points for Bus Operations Management



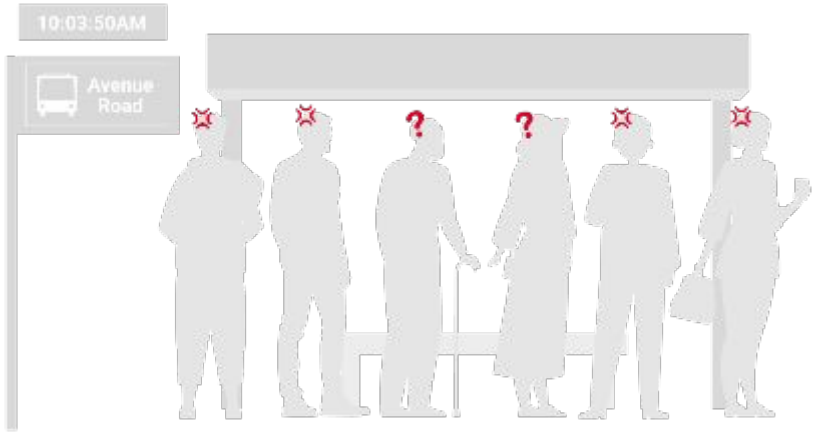
Traditional bus driver logbook



Manual planning on Excel



Printed Bus Schedule for driver

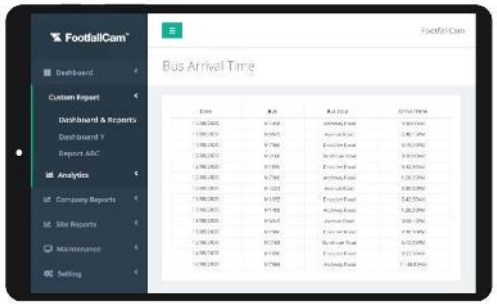


Key Concerns:

Lack of concrete data to make informed business decisions

- *What is the arrival time at each bus stop?*
- *What is the utilization rate of bus routes?*
- *What is the occupancy of bus at different periods?*
- *At which point of the route do passengers enter/exit the bus?*
- *Can the frequency of bus rides cope with the demand?*
- *How effective is the bus route planning?*

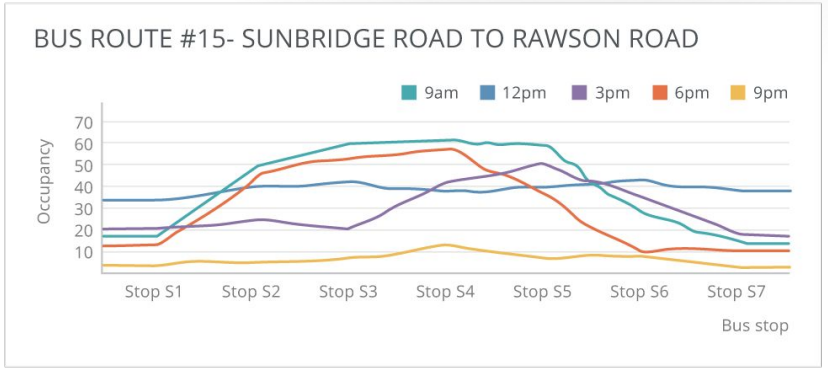
How would people-counting help?



Integrate

Export

CSV XLS



Electronic log book with arrival time at each bus stop:

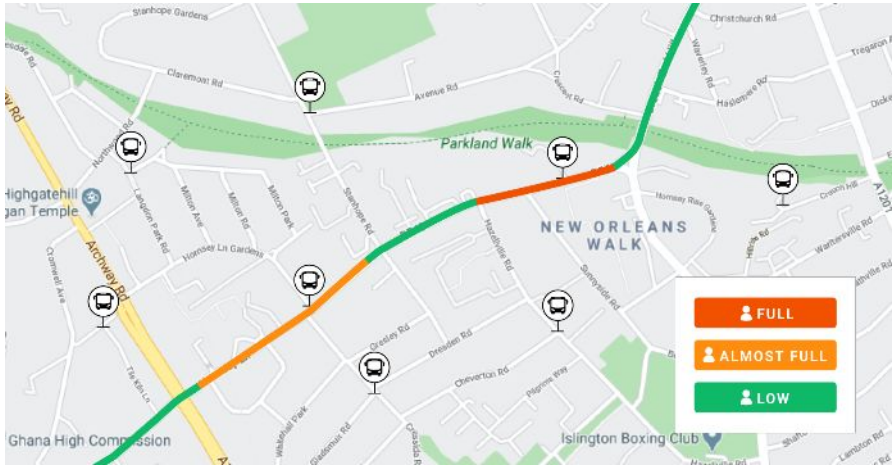
- **GPS** locations
- Live bus tracker with **4G network**
- **Occupancy** at each bus stop of the route

Key Results:

- Visibility on **real-time occupancy**
- **Maximize** the **utilization** of each bus
- Reduce cost by having **effective bus route planning**
- Enhance passenger experience

Key Features for Smart Bus Solution

- Live Occupancy of Bus
- Integrate with your Fleet Management System
- Integrate with your Bus ETA App
- Occupancy Dashboard for Bus Control Centre
- Occupancy Reports for Management
- Integrate Data to Ticketing System for ticket sales audit



FootfallCam Passenger Counting System

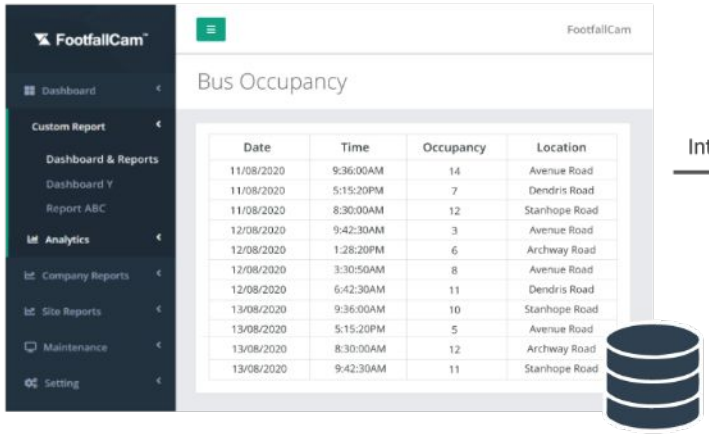
Accurate Passenger Counting

- **Measuring live occupancy** of the bus via people counters
  - Above **95% accuracy** with Time-of-Flight (ToF) technology
  - Automatically stop counting when doors are closed for **noise prevention** using GPIO function
  - Wide coverage at low entrance height
- Monitor bus load through Driver Dashboard
  - **Alert** when overcrowded

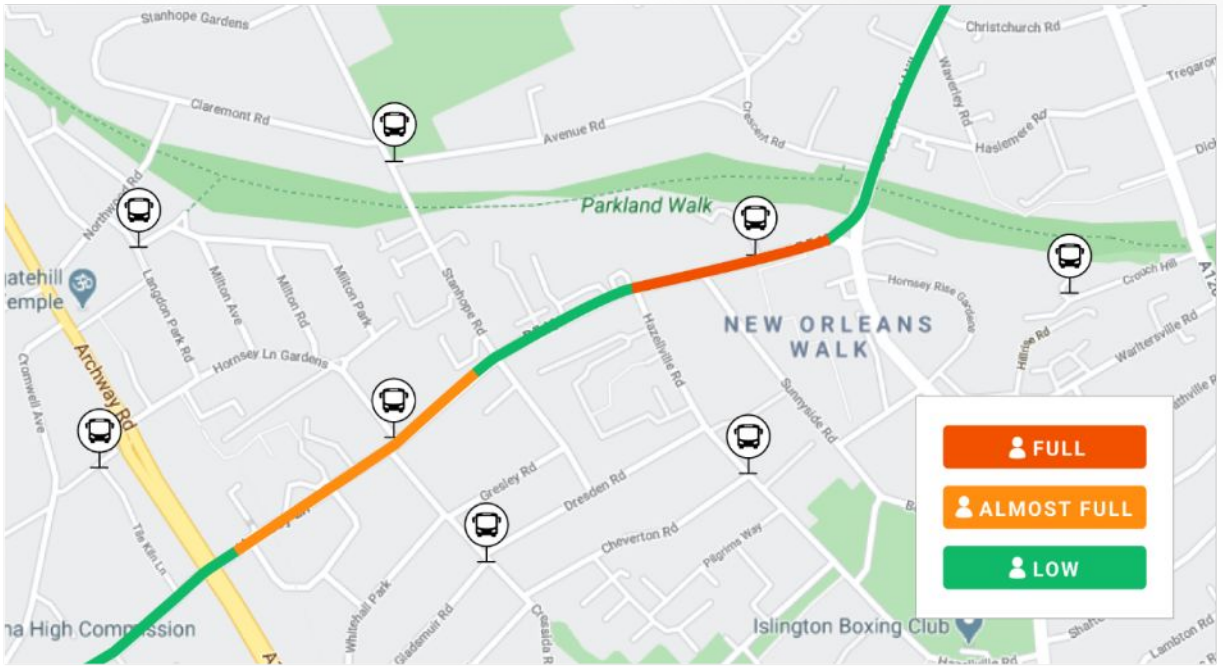
Watch how it works:
https://youtu.be/gB4yj8FZLe4

Integrate with Your Fleet Management System

People Counting Data with GPS Location



Integrate

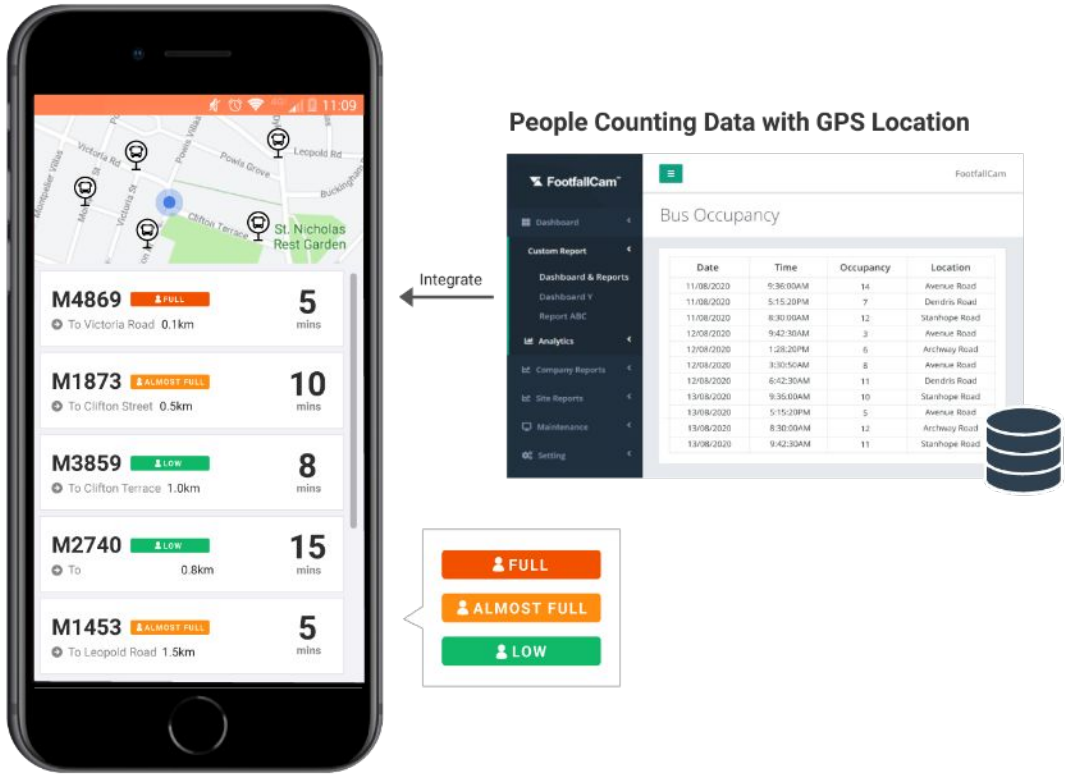


- Input occupancy data into your system through API
- Know bus occupancy over **different timings at different locations**
- Identify key trends and make informed decisions:
  - **E.g. Optimize Route Planning** by knowing which part of the route is busy or under-utilized
  - **E.g. Optimize Allocation of Resources** by knowing when are the peak periods

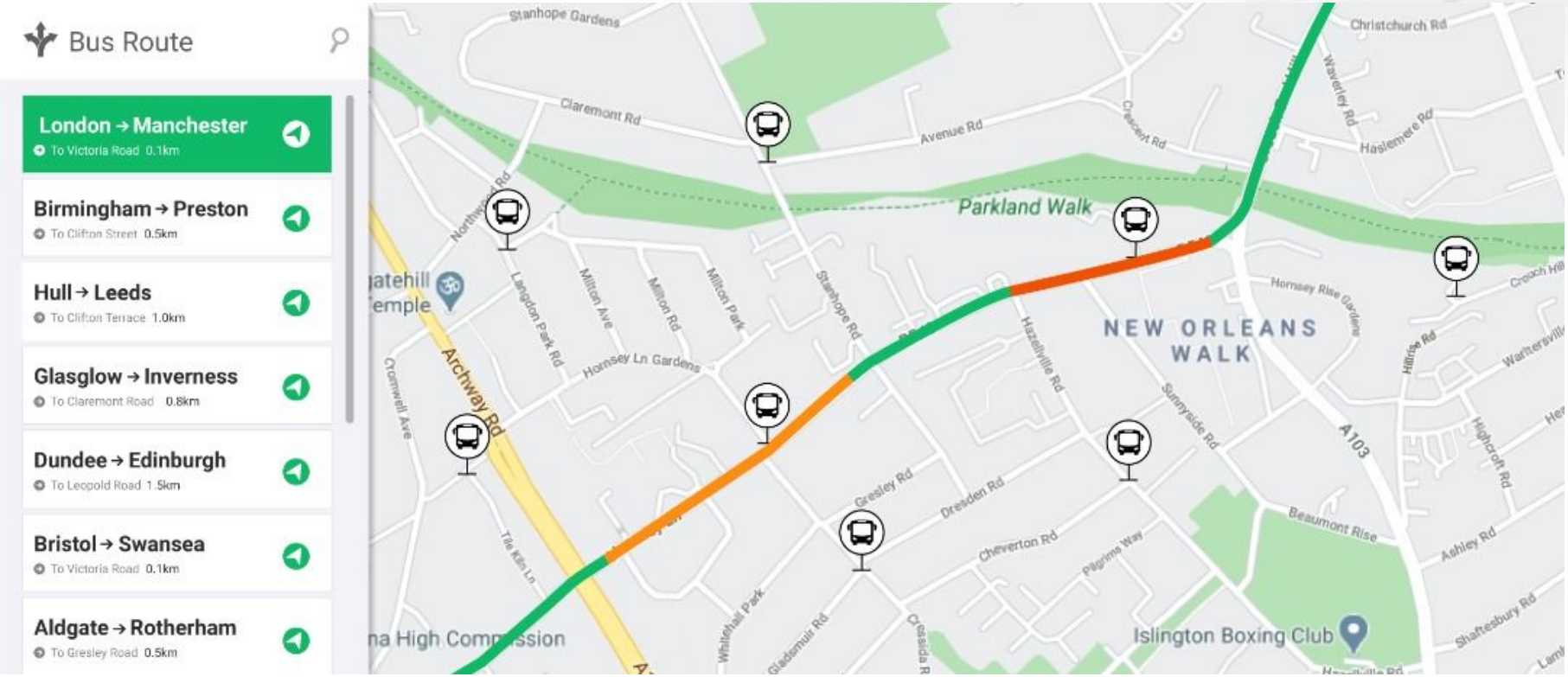
Integrate with your Bus ETA App

Display Bus Occupancy Level at your Bus App

- Passengers can have easy access to the Occupancy Level for each bus:
  - Full
  - Almost Full
  - Low
- Help passengers to **pre-plan their journey** better
- Better **manage passengers' expectation** on number of empty seats, thereby improving customer's experience



Occupancy Dashboard for Bus Control Centre



Monitor Live Occupancy of Buses

- **Receive alert** when routes are over-utilized
- Bus operator can assign more buses to highly-occupied routes
- Ensure frequency of bus rides can **cope with real-time passenger demand**

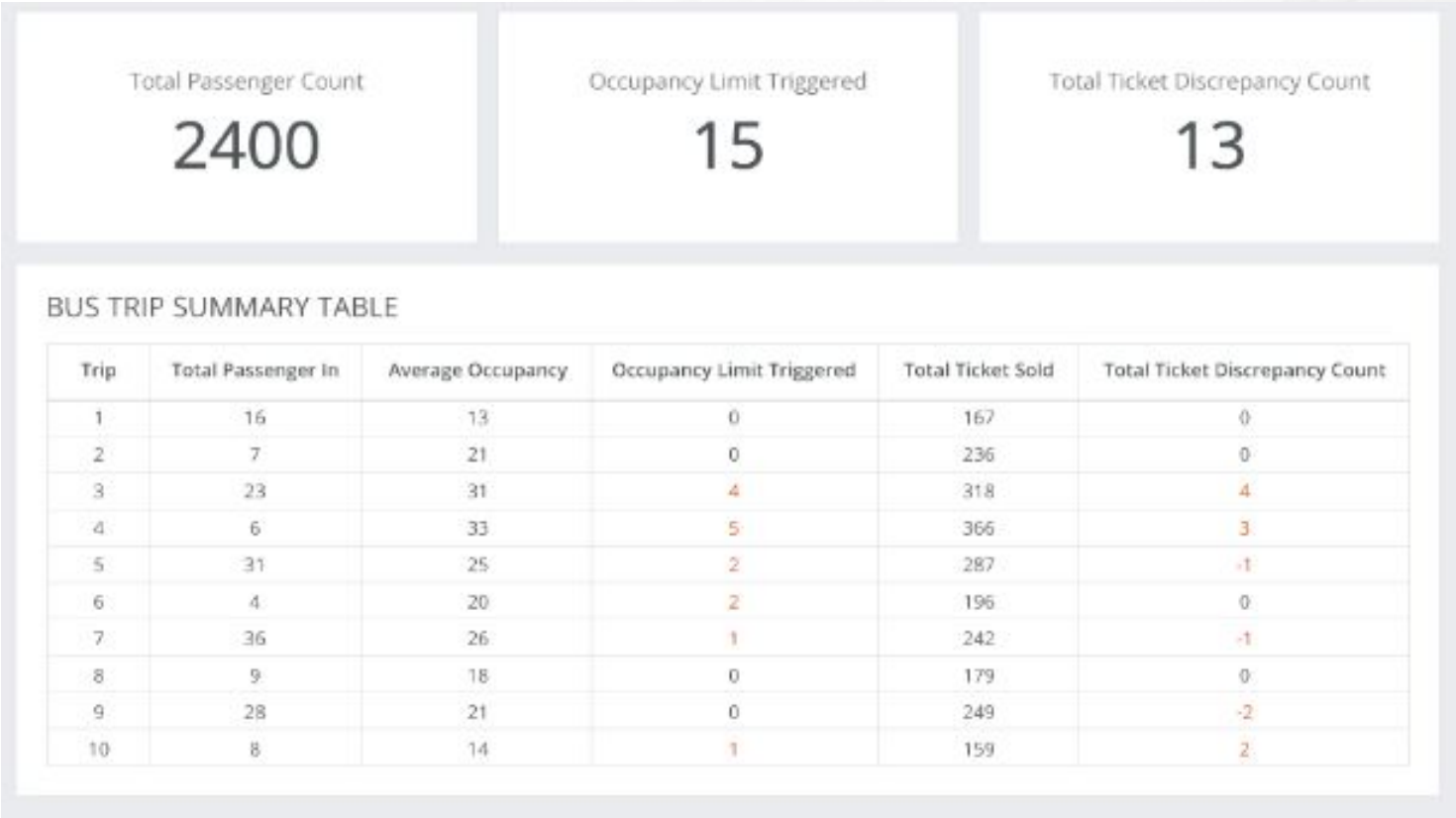
Occupancy Reports for Management

View Bus Occupancy Report HERE

Display Bus Occupancy Level at your Bus App

- **Clear insight into occupancy** trend based on historical data
- Management can view the occupancy reports on
  - Company-level
  - Route-level
  - Bus-level

Integrate to Ticketing System for Audit Purpose



Total Passenger Count	Occupancy Limit Triggered	Total Ticket Discrepancy Count
2400	15	13

BUS TRIP SUMMARY TABLE

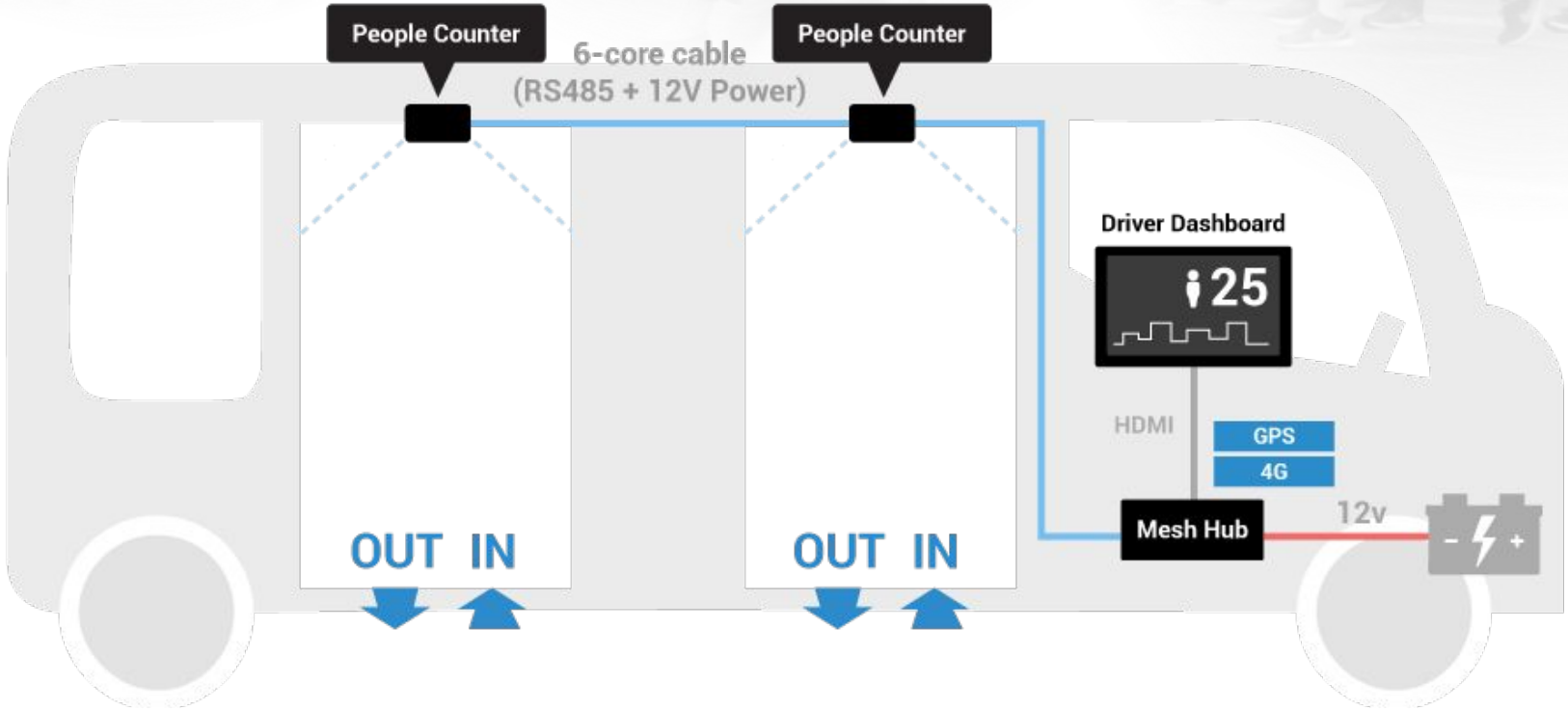
Trip	Total Passenger In	Average Occupancy	Occupancy Limit Triggered	Total Ticket Sold	Total Ticket Discrepancy Count
1	16	13	0	167	0
2	7	21	0	236	0
3	23	31	4	318	4
4	6	33	5	366	3
5	31	25	2	287	-1
6	4	20	2	196	0
7	36	26	1	242	-1
8	9	18	0	179	0
9	28	21	0	249	-2
10	8	14	1	159	2

Identify any significant discrepancies between ticket sales and actual passenger count

- Prevent drivers from falsifying ticket sales
- Analyse statistics on amount of no-show passengers

System Design and Architecture

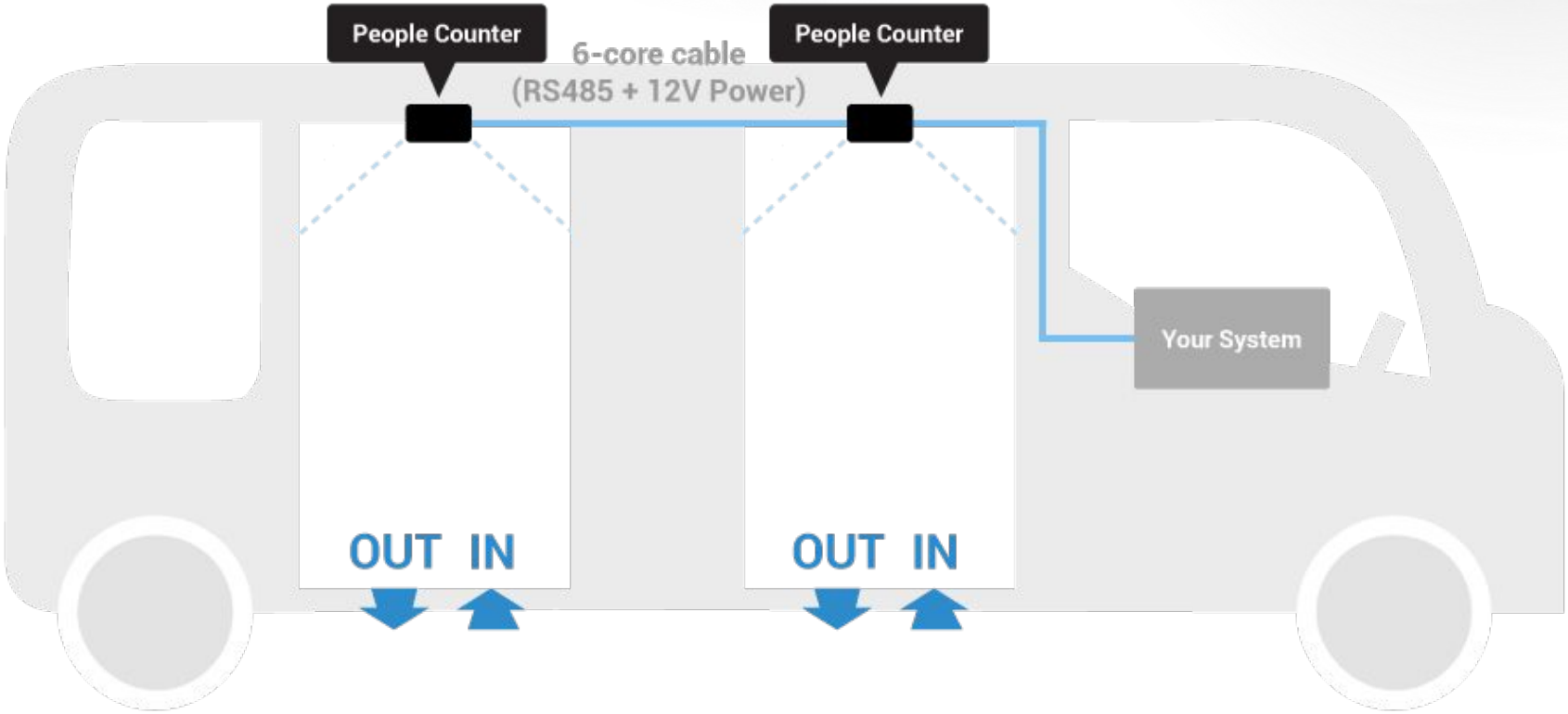
Option #1: Smart Bus Solution - Complete System



System Components

- People counters
  - **Counting** people coming **in and out** of the bus
- Mesh Hub
  - Connected to vehicle's battery, which **powers** the whole system
  - Provides **4G network** connectivity
  - Built-in **GPS** to track the location of bus
- Driver Dashboard – Displaying the **live occupancy data**

Option #2: People Counting Only System



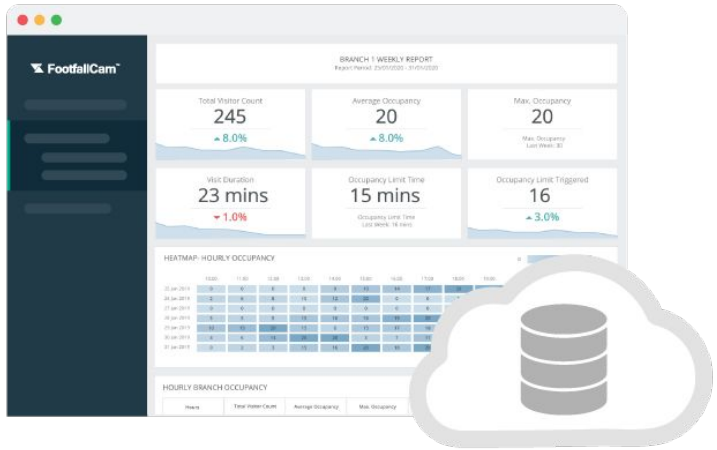
Work with any of your existing system

- Integrate our people counters to your own existing system
  - On-board processing unit
  - 4G network connection
  - GPS location
- Upload Bus Occupancy data to your system for extra business insights

Enterprise Class Software

FootfallCam™

FootfallCam Analytic Manager V9™

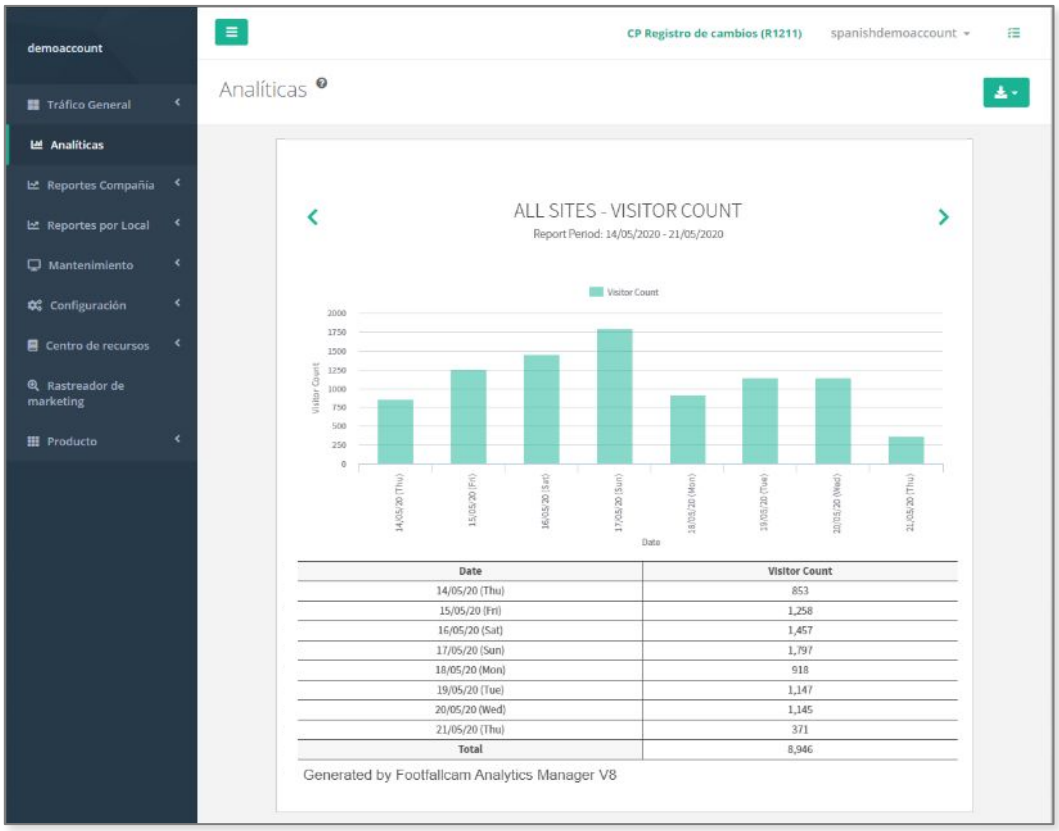


Functions:

- Staff alert if capacity limit is breached
- Centralized Management Analytics Software
- API Available for Data Integration
- Pre-defined Report Set
- Health Check Report
- User Account Management
- Automated Email Scheduler

Software Specifications	
Interface	Http; Https
Compatible Browser	IE7 or Later Mozilla Firefox or Later Chrome Version 4.0 or Later Safari
User Levels	2 levels: Administrator, Standard User
Ethernet	10/100 Mb Ethernet
Time	NTP, Adjustable time zone, automatic day light saving adjustments
Data Delivery	TCP/IP
Database Type	SQLite
Report format	csv, .xml, .txt
Data Storage	5 Years storage with auto sync
Data Backup	Yes
Backup Frequency	Daily Full Backup of Data and Configuration Weekly Backup to Sub Server for Contingency Purpose
Software Version Upgrade	Auto Upgrade

#1: Enterprise Class Software



Date	Visitor Count
14/05/20 (Thu)	853
15/05/20 (Fri)	1,258
16/05/20 (Sat)	1,457
17/05/20 (Sun)	1,797
18/05/20 (Mon)	918
19/05/20 (Tue)	1,147
20/05/20 (Wed)	1,145
21/05/20 (Thu)	371
Total	8,946

Multi-language Interface

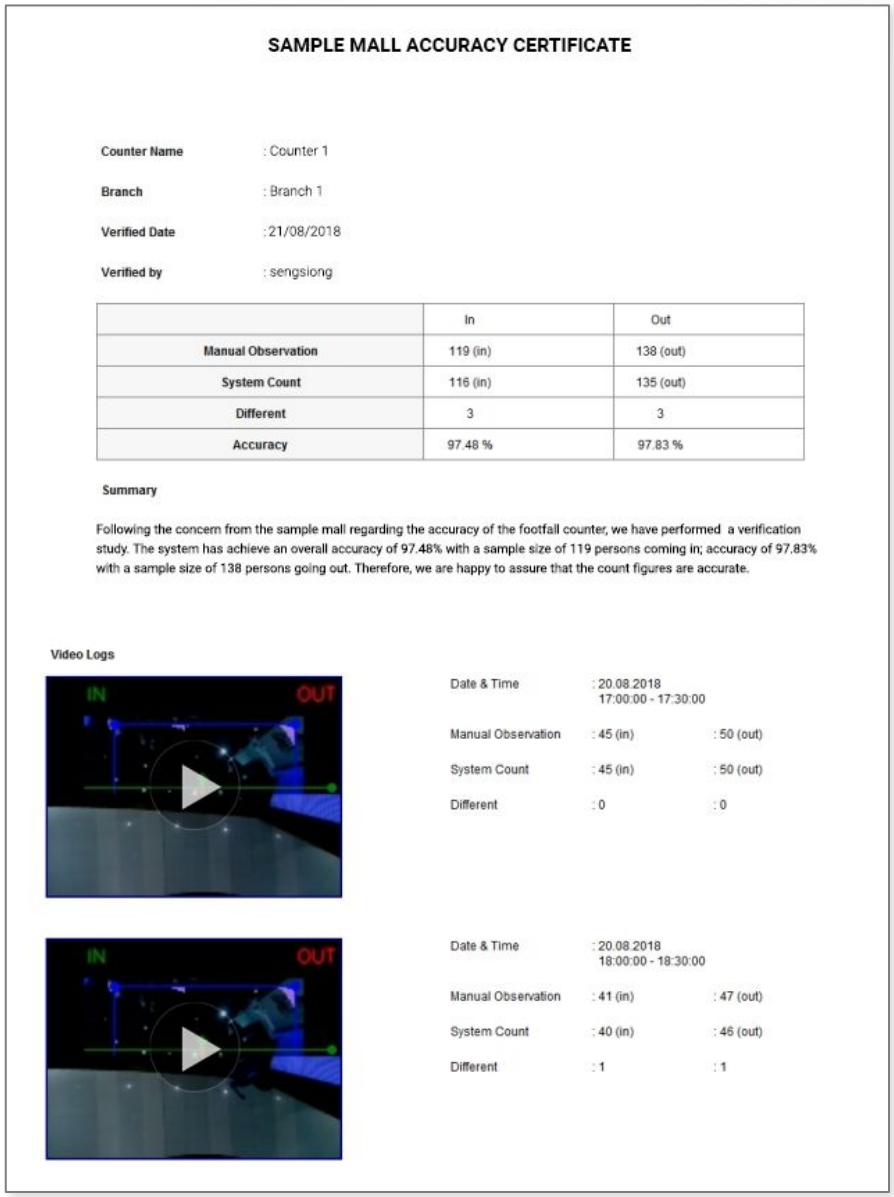
Different languages available such as:

- English
- Dutch
- Spanish
- French
- Italian
- German
- Arabic
- Japanese
- Chinese

Customise dashboard design

- FootfallCam will customize the language and images in the dashboard
- Provide us with the translated text and graphics, then we will help you handle the configuration

#2: Video Proof



SAMPLE MALL ACCURACY CERTIFICATE

Counter Name : Counter 1

Branch : Branch 1

Verified Date : 21/08/2018

Verified by : sengsiong

	In	Out
Manual Observation	119 (in)	138 (out)
System Count	116 (in)	135 (out)
Different	3	3
Accuracy	97.48 %	97.83 %

Summary

Following the concern from the sample mall regarding the accuracy of the footfall counter, we have performed a verification study. The system has achieve an overall accuracy of 97.48% with a sample size of 119 persons coming in; accuracy of 97.83% with a sample size of 138 persons going out. Therefore, we are happy to assure that the count figures are accurate.

Video Logs

Date & Time : 20.08.2018 17:00:00 - 17:30:00

Manual Observation : 45 (in) : 50 (out)

System Count : 45 (in) : 50 (out)

Different : 0 : 0

Date & Time : 20.08.2018 18:00:00 - 18:30:00

Manual Observation : 41 (in) : 47 (out)

System Count : 40 (in) : 46 (out)

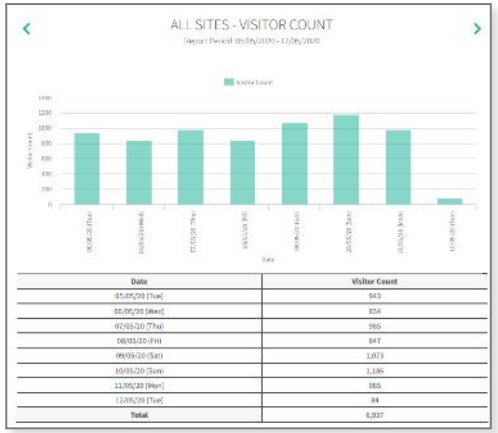
Different : 1 : 1

Ensure 95% and above data accuracy

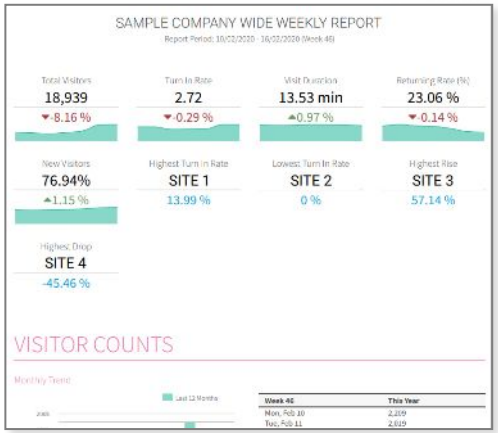
- Automated reports give the valid data and overview of their facility (e.g. visitor movement and peak time).
- They will schedule video recordings to collect a sample size of 20 and above
- After that, they will configure the counter to ensure that it is able to detect the visitors in the video recording
- Once it is completed, the team will generate an Accuracy Certificate which will showcase the counter accuracy and summarize their finding.

(Verification report: Sample 1 & Sample 2)

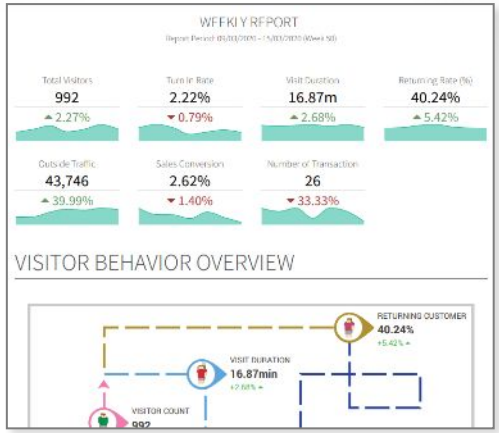
Reporting Suite



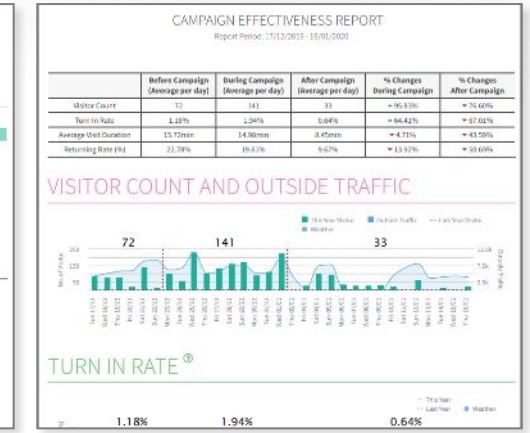
[Analytics Center]



[Company Weekly Report]

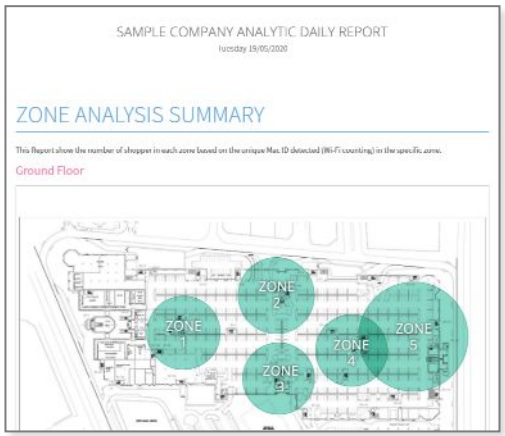


[Site Weekly Report]



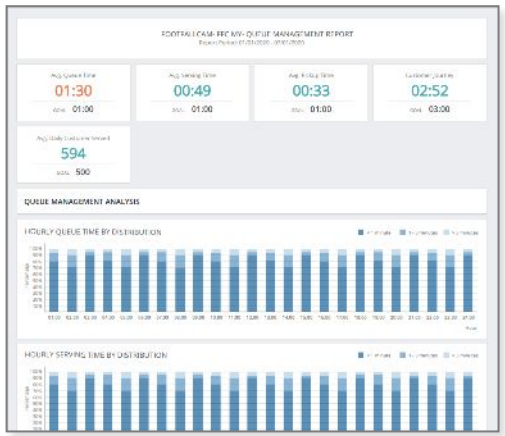
[Marketing Effectiveness]

[Live Occupancy]



[Zone Analytics]

[Mecca Occupancy]

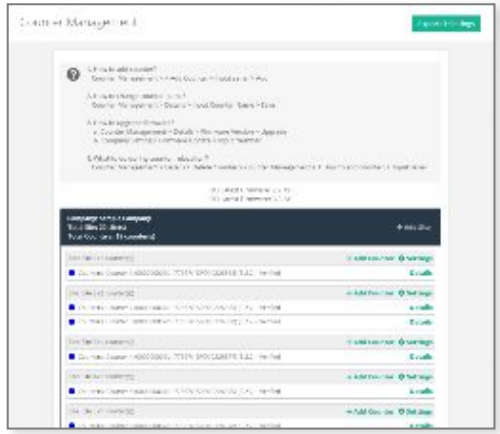


[Queue Counting]

FootfallCam™

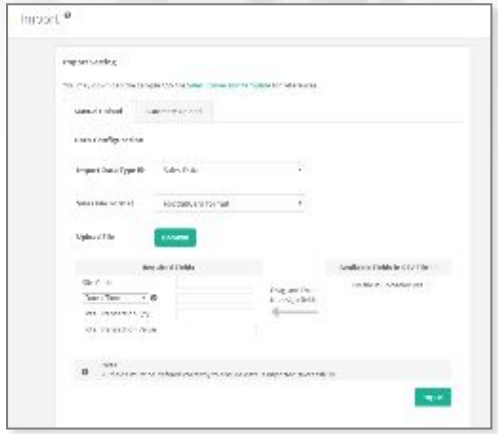
Management Control

User Control



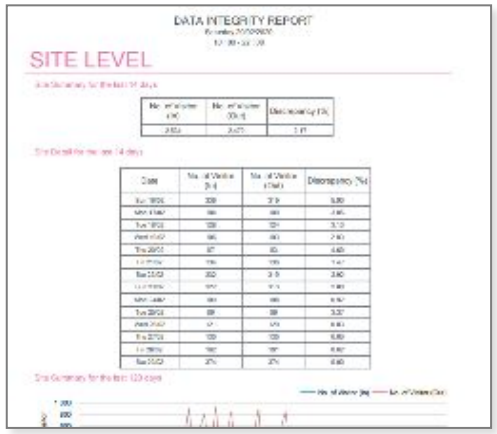
Branch Control

Email Scheduler

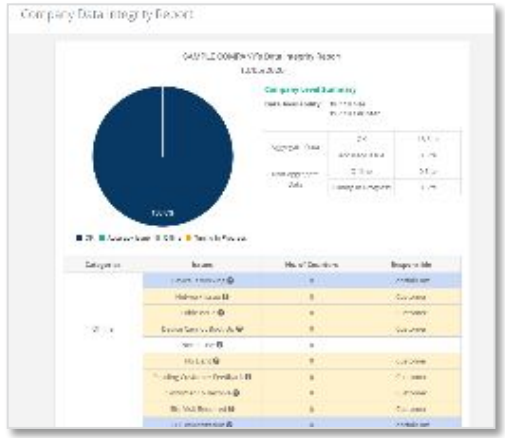


Import/Export

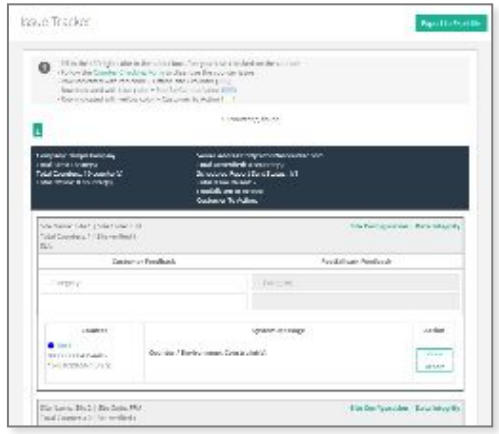
Health Check and Maintenance Tools



Data Integrity



Company Data Integrity



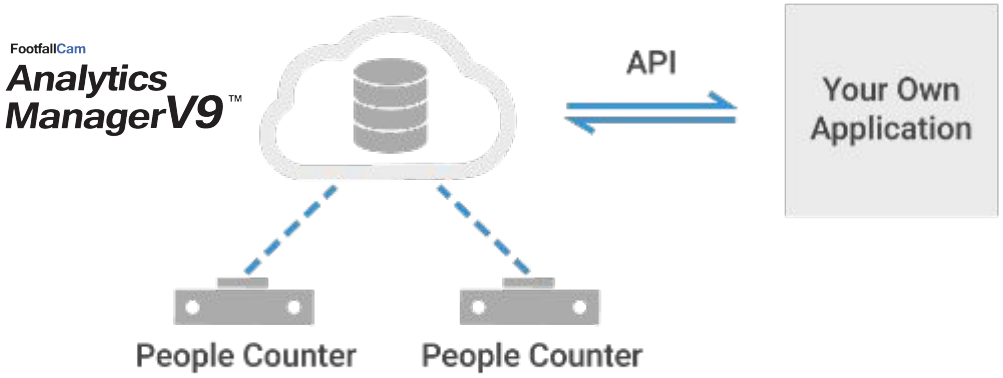
Issue Tracker

Support Portal

API: Integrate with your Applications

Option 1: API directly from the counter

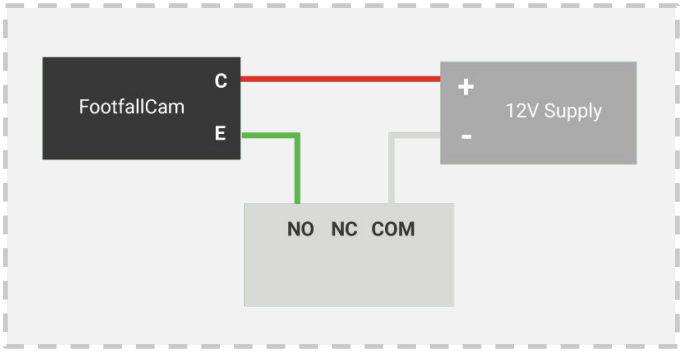
Option 2: API through the server

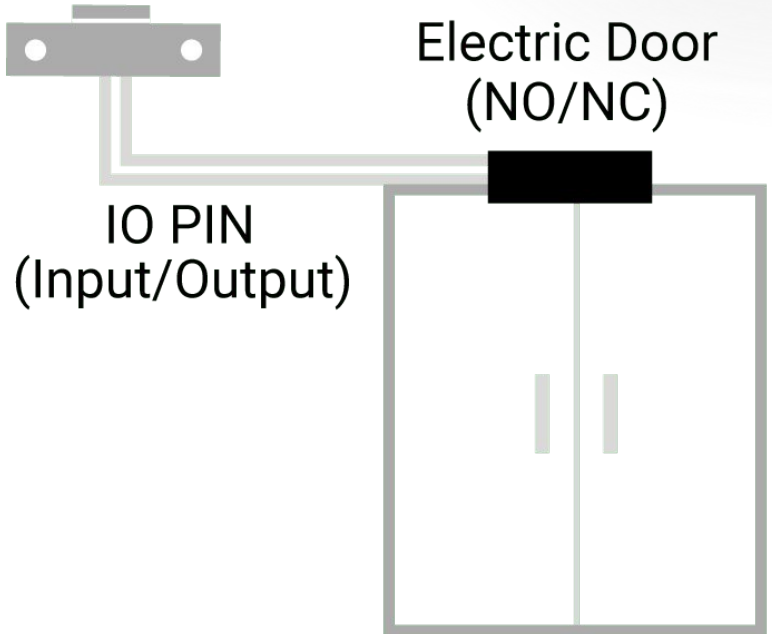


The XML-based interface allows people counting data to be integrated into third-party software platform via API or data push features. The people counting system combined with the customer's own data to give valuable insights such as performance KPIs & etc.

- Allow you to **integrate your data** with other source
- **Real-time** data retrieval
- Data in aggregated or raw format
- The data will be packed into a convenient JSON/XML data
- Other Methods available through the API:
  - FTP
  - Automated E-Mail
  - Manual
  - FTP

Using IO Pin to Regulate Counting





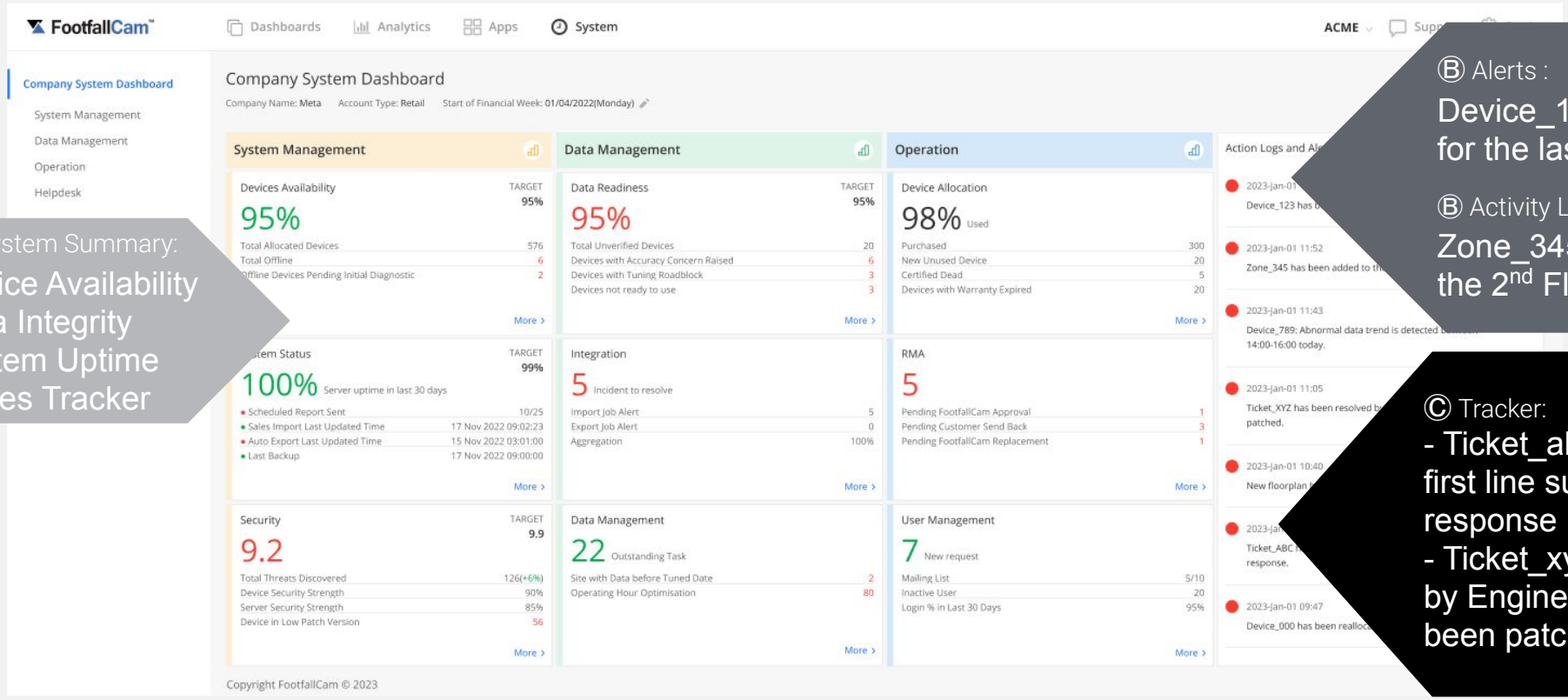
Integrate occupancy counting with all entrances and exits

- Read CAN bus data through GPIO Integration
- The system starts counting only when the door is opened
- People counter will automatically stop counting when door is closed to prevent noise.
- FootfallCam 3D Mini V3 comes with NO/NC port
    - IO pins are available for clients to integrate with their bus doors

Data Integrity

360° System Dashboard

- Ⓐ *360° summary -* of all aspects of the system; including availability, accuracy, alerting, and tracking of issues.
- Ⓑ *Reduced Training Costs* - Maintain optimal system availability during personnel changes
- Ⓒ *Faster Response Time* - To minimise the impact of the issues on data integrity.



360° System Dashboard - View

FootfallCam Devices

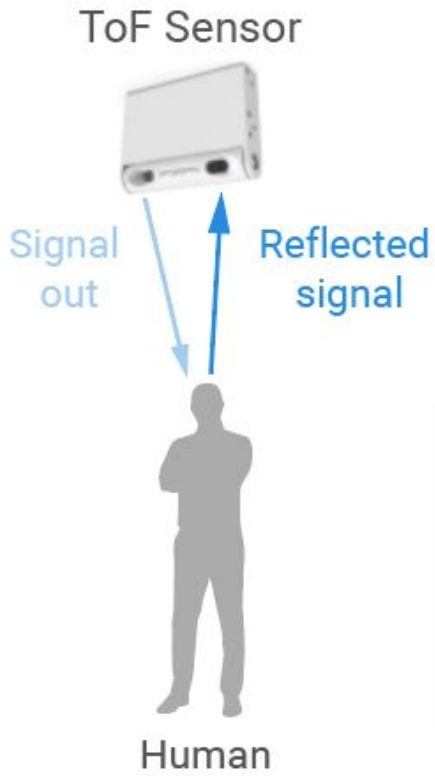
FootfallCam 3D Mini V3™

Features:

- Anonymous counting with Time-of-Flight Technology
- Bi-directional counting with **95% and above accuracy**
- Designed for **Low Ceilings**, as low as 1.9m
- Extra low power consumption

Key Specifications	
Device Dimensions	(WxDxH): 100mm x 30mm x 54.5mm Weight: 0.360 kg
Cameras	2 x Time-of-Flight (ToF) Sensor 86°, 45°
Mounting Height	1.9 metres – 3 metres
Casing	Made by ASA Plastic.
Connectivity	RS485
Tracking Technology	Depth-sensing Time of Flight Technology. Collects anonymous depth image data.

3D Mini



- Time of Flight technology
- Narrow coverage: 85°
- Mounting height < 2.7m
- Cost effective
- Anonymous - no camera

Datasheet	FootfallCam 3D Mini Datasheet	Document

FootfallCam 3D Mini™

FootfallCam Mesh Hub™

Features:

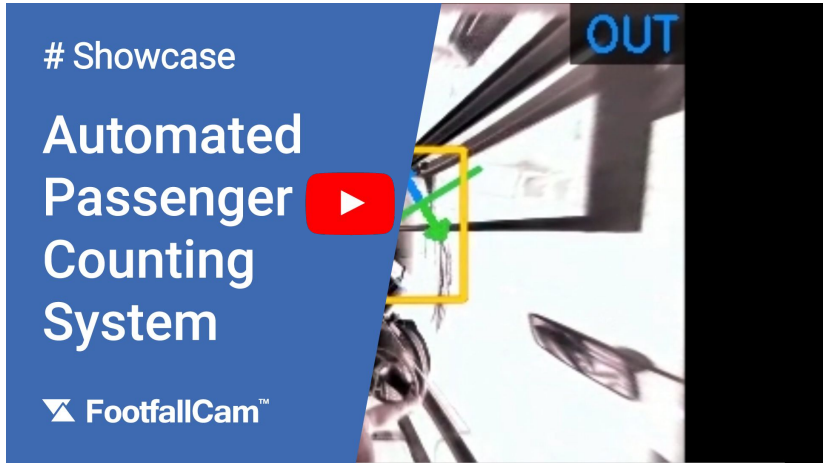
- Supports RS485, Bluetooth, Zigbee, LoRa, 4G
- Can support up to 200x IoT devices
- A separate network - not compromise the corporate security
- Works all FootfallCam IoT devices and other 3rd party IoT devices

Key Specifications	
Device Dimensions	(WxDxH): 146mm x 52mm x 27.15mm Weight: 0.400 kg
Casing	Made by ASA Plastic
Wireless Connectivity	Bluetooth 5.3 with Mesh Topology; AES-128 Encryption; +4 dBm TX Power; Supports a network of up to with 20 concurrent
Wire Connectivity	Ethernet: 100 Mbps; RS485 (Half Duplex) up to 200
Power Consumption	6W
Average Data Transfer Rate	10.0 kilobytes/hour (is measured with a predefined sample size of 20)

Case Studies

#1 Tourist Bus - Sentosa Bus Services, Singapore

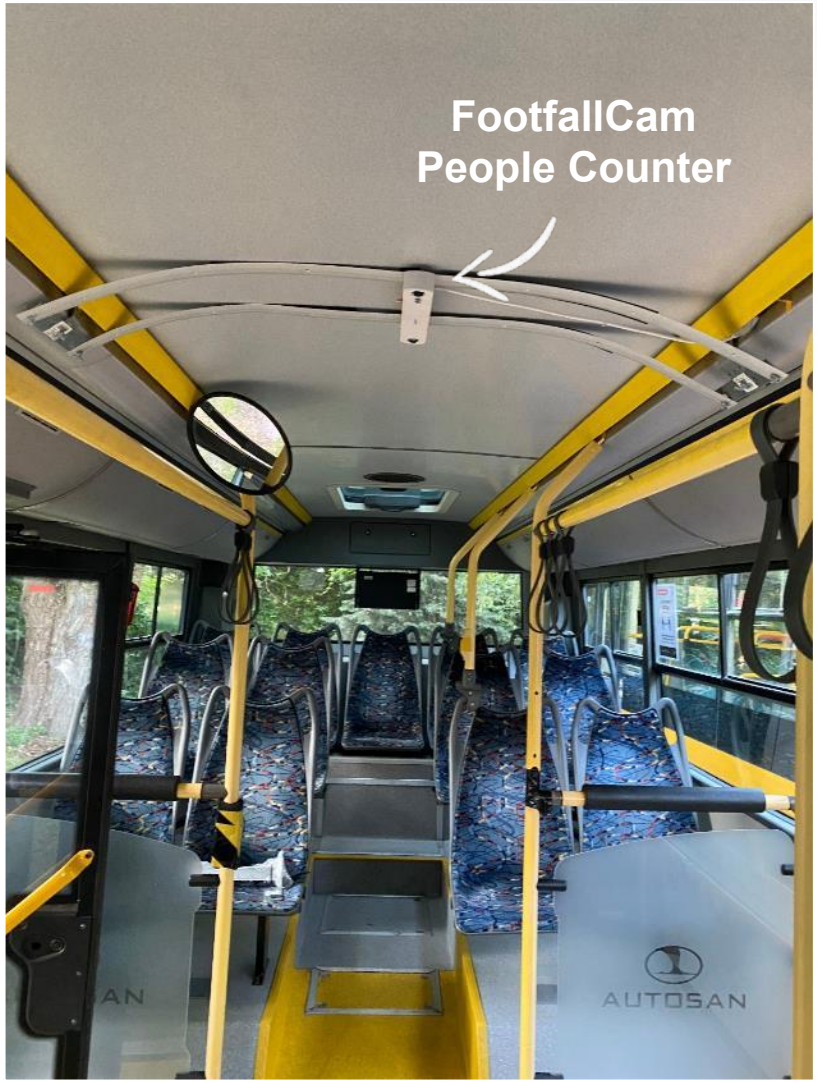
- Sentosa Bus Services wanted **to measure the number of tourists** travelling between **different attractions** within Sentosa
- FootfallCam **integrated** our people counters to **their own server system**
  - Bus occupancy at different parts of the route over time was measured
- They used Footfall Data to
  - Optimize route planning & day to day scheduling for tourists



Watch how it works:
https://youtu.be/gB4yj8FZLe4

#2 Public Bus - HEMC-Tech, Poland

- Reseller approached us to **develop a people counting system** for bus service providers
- FootfallCam provided people counters specially designed for **low ceiling height**
- Tablet display for drivers to monitor bus load
- Bus operators used Footfall Data to:
  - **Forecast Peak Periods** & Optimize Allocation of Buses
  - **Justify Government Funding**



#3 McGills Bus Services, UK

- McGills Bus Services wanted to count the number of passengers boarding/alighting at each bus station for better route planning.
- FootfallCam integrated their bus schedule into our system to provide route & trip level reports
- They used the data to:
  - **Identify** parts of the **route** which are **under-used**
  - Redesign Routes and Trips to **optimise bus schedule planning**

#4 Floralia, Belize

- Floralia approached us for a people counting system that will also allow them to conduct audits on their bus operations.
- FootfallCam perform integration with their ticketing system and produce reports for ticketing sales and schedule adherence audit
- Additional metrics that they obtained:
  - **Ticket Discrepancy** (Comparison between actual passenger count and sales data)
  - **Arrival Time Discrepancy** (Comparison between Bus actual arrival time and scheduled time)

Q&A Session

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