MADDEN ELEVATOR

Relationships. Precision. Results.

How Elevator Contractors & Suppliers can uses IoT & Technology

Sean Madden - Madden Elevator Company

Sean Madden - Madden Elevator Company

- Started as a technician in 1990 – servicing elevators out of a Jeep CJ5 in Daytona Beach
- Dad came from Airforce then go out in New York and worked for Otis 20+ years – helped install WTC units
- 1/3 Career in Field, 1/3 in Management, 1/3 Executive Leadership & Owner 11+ years
- QEI – CETS – CAT – KY/IN License – Board NAEC
- Membership Committee & Former Chair Certification Committee

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What is the IoT – The Internet of Things

What is the Internet of Things

In a nutshell, the Internet of Things is the concept of **connecting any device** (so long as it has an on/off switch) to the Internet and to other connected devices. The IoT is a **giant network of connected things** and people all of which collect and share data about the way they are used and about the environment around them

How does IoT Technology Work?

The IoT Technology

Devices and objects with built in sensors are **connected** to an Internet of Things platform, which **integrates data** from the different devices and **applies analytics** to share the most valuable information with applications built to address specific needs.

Features of IoT

What are the features of IoT?

Some of the **most important** features of IoT on which it works are:

- Connectivity
- Analyzing
- Integrating
- Active engagement
- & Many more

Function of IoT

Function of IoT

These powerful IoT platforms can **pinpoint** exactly what **information** is **useful** and what can safely be ignored. This information can be used to

- Detect patterns
- Make recommendations
- Detect possible problems before they occur.

Concerns in IoT

What is the major concern in IoT?

Top **5 concerns** in development of IoT projects

1. Connectivity
2. Integration of hardware devices
3. Interoperability between platforms
4. Security
5. Total cost

In fact, almost 90% agree that choosing the right connectivity is one of the most difficult decisions to take.

IoT is all around us

How is IoT used in everyday things?

Examples of how we use Internet of Things in our everyday lives include:

Smart appliances (stoves, refrigerators, washers and dryers, coffee machines, slow cookers)
Smart security systems, smart locks, and smart doorbells.
Smart home hubs (that control lighting, home heating and cooling, etc.

- Smart Phones
- Apple Watch
- Amazon Alexa
- Just to name a few
- Many Many More

Example Scenario #1 of IoT

Example IoT – WHAT IF…

Scenario #1: IoT in your home

Imagine you wake up at 7am every day to go to work. Your alarm clock does the job of waking you just fine. That is, until something goes wrong. **Your train's cancelled** and **you have to drive to work** instead. The only problem is that it takes longer to drive, and you would have needed to get up at **6.45am to avoid being late**. Oh, and it's **pouring with rain**, so you'll need to drive slower than usual.

A connected or **IoT-enabled alarm clock would reset itself** based on all these factors, to ensure you got to work on time.

It could:

- ✓ Recognize that your usual train is cancelled
- ✓ Calculate the driving distance and travel time for your alternative route to work
- ✓ Check the weather and factor in slower travelling speed because of heavy rain
- ✓ Calculate when it needs to wake you up so you're not late.
- ✓ If it's super-smart, if might even sync with your IoT-enabled coffee maker, to ensure your morning caffeine's ready to go when you get up.

Exmaple Scenario #2 of IoT

Scenario Example IoT

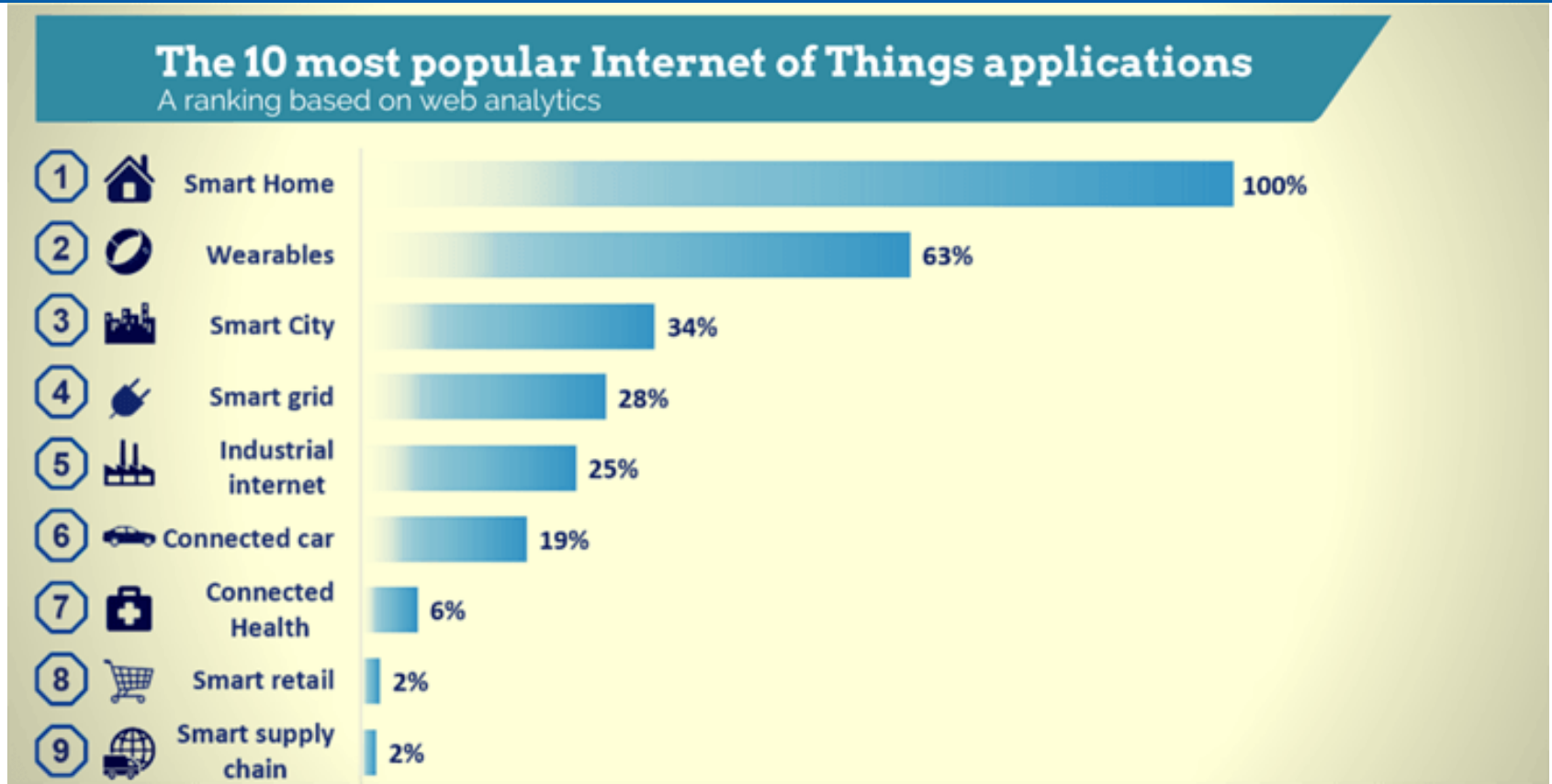
Scenario #2: IoT in transport

Having been woken by your smart alarm, you're now **driving to work**. On comes the **engine light**. You'd rather not head straight to the garage, but what if it's something urgent?

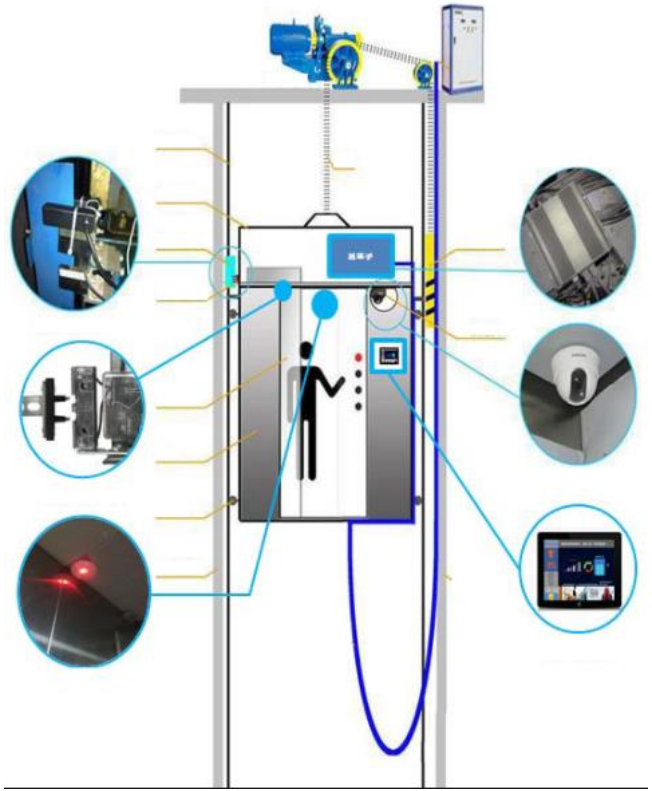
In a connected car, the sensor that triggered the check engine light would communicate with others in the car. A component called the **diagnostic bus collects data** from these sensors and passes it to a gateway in the car, which sends the **most relevant information** to the **manufacturer's platform**.

The manufacturer can use data from the car to **offer you an appointment** to get the part fixed, **send you directions** to the nearest dealer, and make sure the **correct replacement part** is ordered so it's ready for you when you show up.

Top 10 Popular IoT



How big is the Smart Elevator Market



How big is the market for smart elevator?

The smart elevator technology market was valued at **USD 18.75 billion in 2019** and is expected to accrue a revenue worth USD **38.27 billion by 2027 (6 YEARS from now)**, with a CAGR of 9.1% during the forecast period.

The Big Question???

How can we use IoT in the elevator industry?

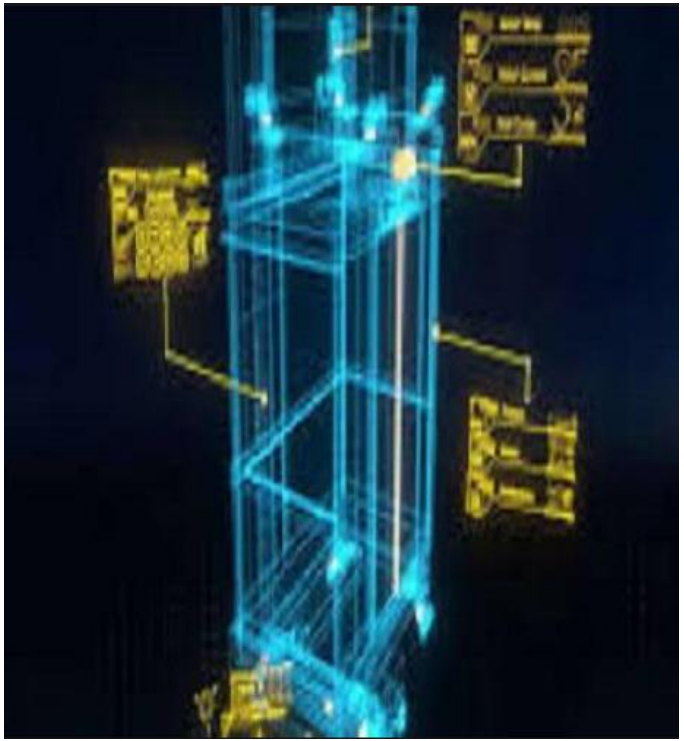
- Through a variety of ways, here are a few:
  - AI (Artificial Intelligence) & Machine Learning
  - Automating Business Systems & Processes
  - Embracing & Utilizing Advances in Technology

5 IoT Trends in Elevator Market

- Over 12 Million Elevators Worldwide
- Move 1 Billion People a Day
- Most used transportation in the world

Here are 5 IoT Elevator Trends

1. Connectivity
2. Predictive Maintenance
3. Smart Touchless Panels
4. Cable Free Elevators
5. Dispatching Technology



Connectivity to Elevator

Connectivity

- Connectivity in elevators is going to continue to grow in our market
- Internet-connected smart elevators are here to stay.
- Elevators are being installed in smart buildings, connecting them to the buildings internal “Building Management Systems” in various ways.
- Some of this technology proactively alerts companies on faults when they appear or when things appear to be developing
    - This proactively allowing building managers to save time & money on equipment repairs and downtime.

Predictive Maintenance

Predictive Maintenance

- Collected data is sent to the Cloud and analyzed by developing algorithms.
  - Anomalies are detected & compared with all available data from the **entire elevator database in their portfolio** .
  - Comparison is made to determine whether similar readings have indicated that a component is about to fail. This all takes place in a matter of **seconds.**
  - A engineers receive messages on their smart devices in real time indicating what component(s) need to be replaced.
  - Engineers can then effectively address and rectify the issue before the elevators breaks down, reducing time.
  - And ensure parts availability for repair
- Continuously monitors and analyzes on all elevator's data:
  - What is the status of all its components?
  - How quickly elevator is accelerating, decelerating, stopping?
  - How quickly are doors opening, closing, anything in between cycles?

This is just to name a few things that is possible with machine learning algorithms.

Interactive Touch Panels

Interactive Touch Panels

- Availability of interactive touch panels in elevators
  - Provide passengers entertainment
  - Cab indicator functionality – change design moods
  - System functionality and use by riders
  - Emergency Detection & Automated Call Technology

This is all to increase the riding public's comfort

What – No Cables???

Cable-Free Elevators

- Cross-industry innovation has helped lead to cable-free elevators
- A variety of elevator suppliers have developed cable-free elevators that can move both vertically and horizontally.
- These types of units are typically made of carbon fiber-reinforced plastic & are powered by linear motors.
  - Move cabs up and down, forward and backward & left or right
    - All on **magnetic rails**
- Cable-free elevators are energy efficient & reduce carbon footprint impacts dramatically.

They are coming, better be prepared

Dispatching Elevator Technology

Dispatching Elevator Technology

- Elevator manufacturers have developed various new dispatching elevator technologies with the intent to increasing the overall rider's experience.
- Some elevator technologies include smart grouping and destination-based models with modern aesthetics to organize lobby movement more effectively.
- Smart grouping technology organizes riders by grouping them based on their floor preferences
    - Example, passengers going to the similar destination are assigned to those elevators that serve that group of floors.
    - This results in faster & better organized passenger movement
    - In a 50-floor building, this smart grouping, statistics have shown a 40% reduction in overall traveling time as compared to conventional dispatch systems.
- It can also reduce energy consumption by up to 27%

Some other ways to use IoT Technology

ERP Automation using IoT

Here are a few idea on how to use IoT in your daily Business Systems

- Link processes between departments
  - Reduce communication breakdowns
- Reduce repetitive tasks – AR, AP, Checks, etc.
  - Connected AI to learn and adjust cycles – Systems get smarter over time and adapt to working environments
- Connecting Elevator Machine Learning sensor devices to ERP systems
  - Automating field work process

Link Processes between departments

ERP software contains integrated applications—such as financials, human resources, sales management, and inventory management, among others—that enable interactions between and across departments, and the automation of those interactions.

Example:
New **sales order gets processed**, the software may **automatically prompt interactions with the inventory, finance, and shipping departments**. This automation of ERP software has multiple benefits.

- Fewer routine errors
- Unintended duplication of data
- Streamlined communications

All leading to time savings and lower operational costs.

The consolidation of data in a central database enables companies to perform data analytics and provides data for more informed business decision-making throughout all areas of the organization.

Reduce Repetative Tasks

- ERP automation involves the incorporation of new technologies, such as artificial intelligence (AI) and other features, like the Internet of Things (IoT).
- These emerging technologies can be incorporated into ERP systems to provide companies a deeper and more seamless handling of their business processes.
  - One strength of these emerging ERPs is **automating routine processes** & integrating transactions between different departments
- Newer ERP systems offer a variety of solutions including but not limited to:
  - Improved automated workflows
  - Advanced record keeping
  - Future forecasting abilities
  - Actionable reports automatically in your inbox

AI intends to integrate these processes more tightly and enable increased automation.

- The incorporation of AI within ERP systems will shift employees away from performing repetitive and routine tasks like processing sales orders to handling analytical and creative tasks that can't easily be handled by AI.
- One of the main benefit to embracing automation is it allows your employees build new skills for their personal development & allows them to be more engaged contributing to the organization's goals ensuring its success.

ERP Sensor Based IoT

Another type of technology incorporated within ERP software as a feature is **sensor-based technology** using the Internet of Things (IoT). The availability of both inexpensive broadband internet and sensor technology has made it easier to place internet-connected sensors in more components & products.

Manufacturers & suppliers' benefits

- Reduced maintenance
- Increased uptime
- Longer product lifecycles

End users benefits

- Reduced product failure rates due to early detection of a problem
- Reduced operating expenses such as by powering down equipment during periods of inactivity
- Ultimately lead to improved product design because the information collected is about how products are being used by real-world customers

Elevator Performance Data

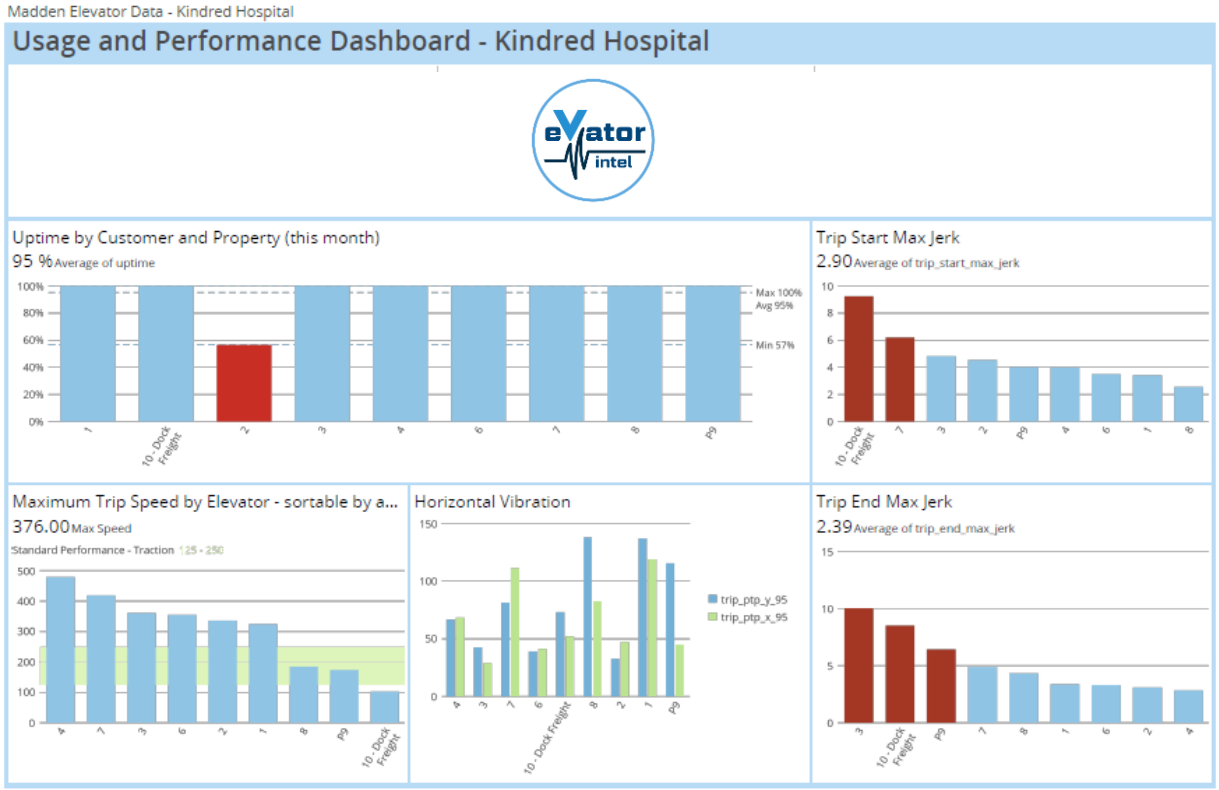
eVator Intel

- **Data** provides insights
- Allows us to focus maintenance in the right areas
- **MCP** – Maintenance Control Program **adjusted** program based on usage and needed area of focus
- Results is less **downtime**
- **Reduce** maintenance expenses

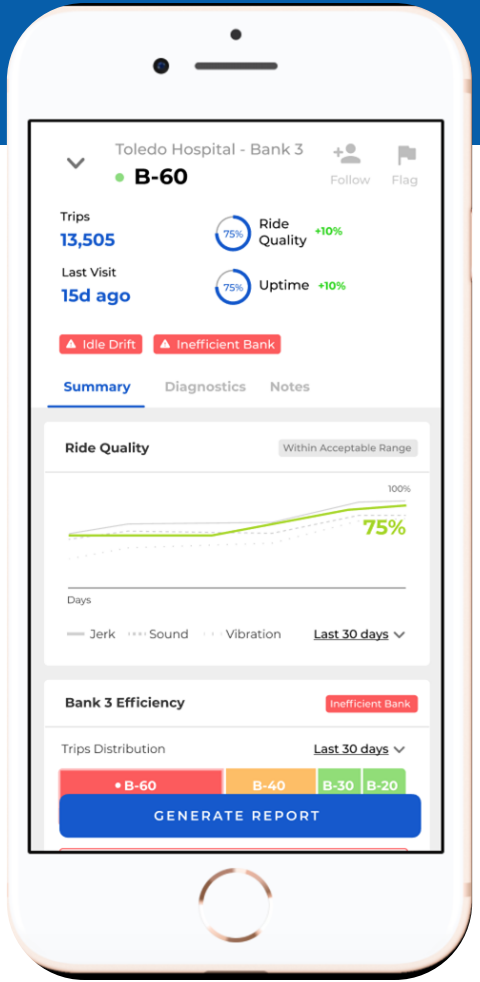
Report Examples

Examples of reports using the Data to show Usage & Performace Criteria

- Uptime by Customer
- Uptime by Unit
- Trip Jerk Rates
- Trip Speed Variations
- Horizontal Vibrations



Tech Phone Access



Technicians can get onboard with using information from sensors to guide them in troubleshooting

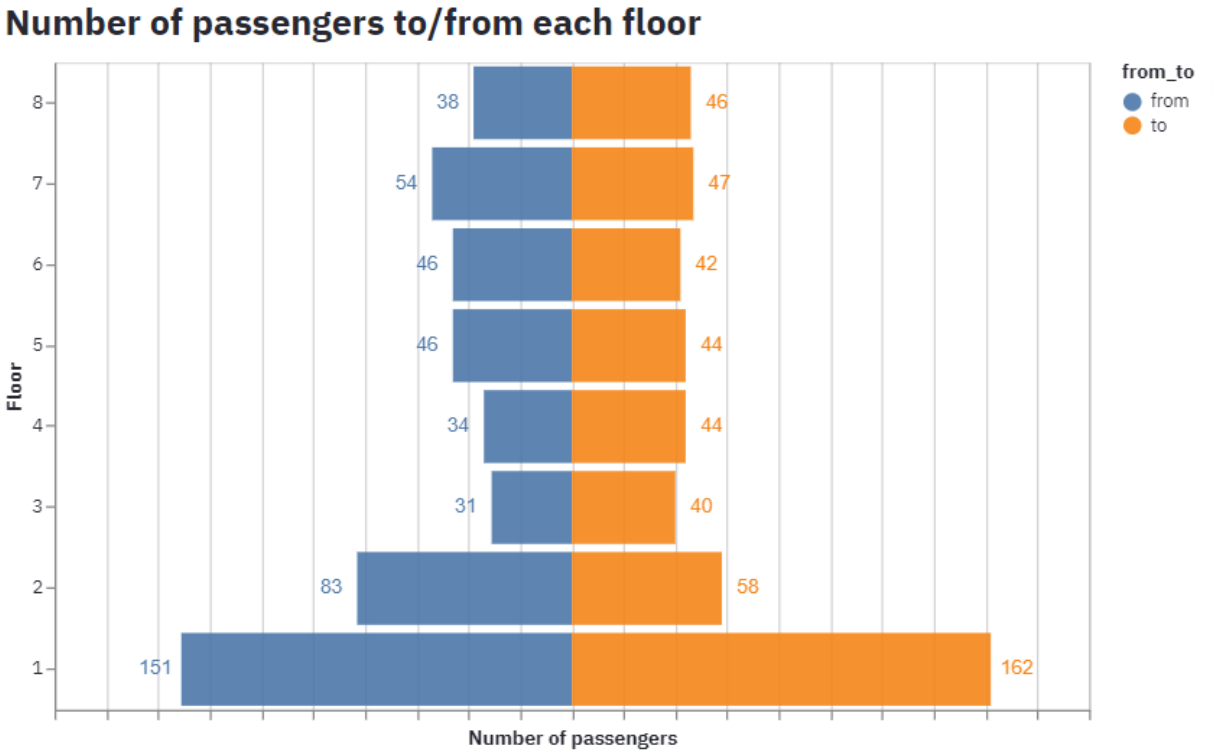
- What is ride quality, vibration, noise
- Are their any anomolies detected from normal riding unit
- What floors are services the most and need the most PM
- When might I need to service a starter based on number of starts
- Much Much More

AI will never replace Look-Listen-Feel from Techs

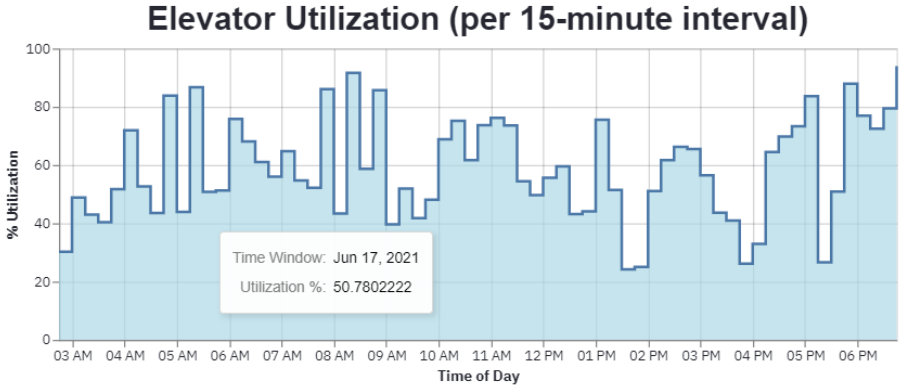
Behind the Scenes Data Review

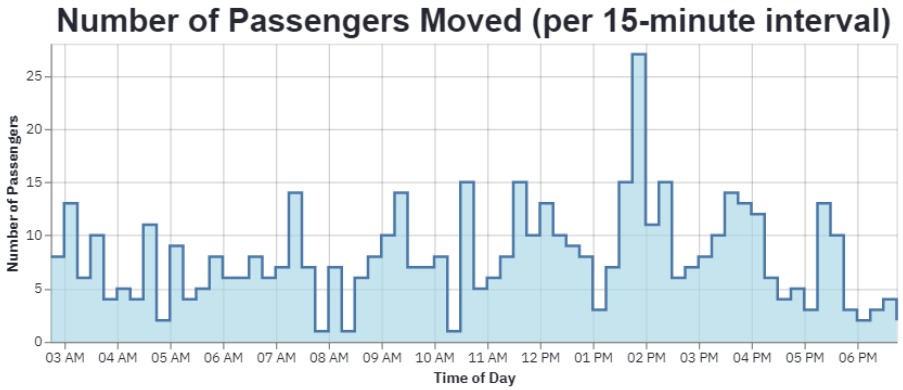
Camera Sensors

- How many passengers riding
- What floors are they going to & are they getting off or ghost runs
- Reviewing and analysing traffic paterns allow for better management of MCP



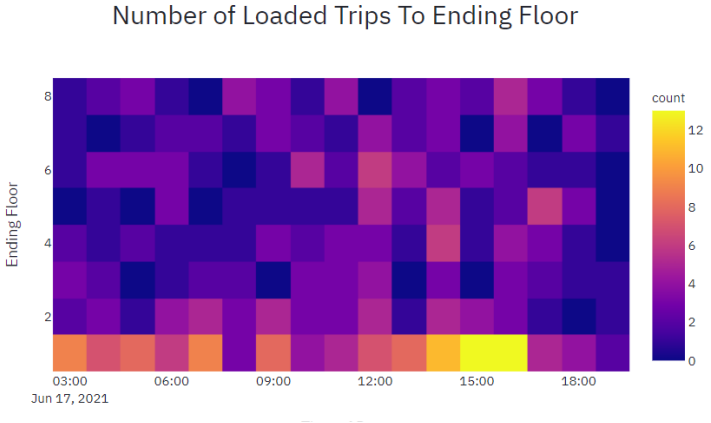
Behind the Scenes Data Review

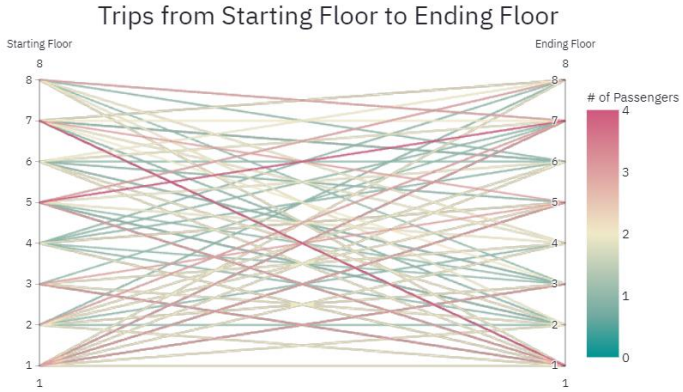




Camera Sensors

Many graphical reports available to analyze.





Summary

There are many IoT and Technological Advances

3 Key items to summarize:

1. Consider ways to embracing technology
2. Know it don’t have to happen overnight
3. Determine what small steps in AI Technology can help your business

Thank you for your time.

Questions?

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