Changing Recycling Behaviors:
Solid Waste Management

IoT (Internet of Things) and
Predictive vs. Preventive Maintenance

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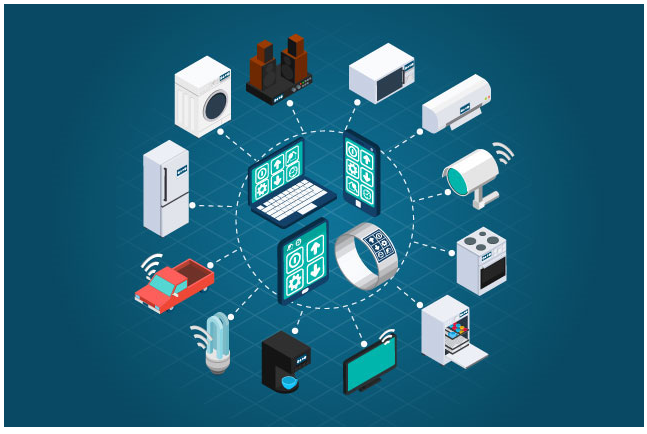
The Internet of Things (IoT)



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The Internet of Things (IoT)

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IoT and Equipment Maintenance

Preventive (or Preventative) Maintenance

- *General upkeep of device or equipment*
  - Allows for near optimal performance
  - Reduces other failures by maintaining critical parts

Predictive Maintenance

- *Using previous Data to estimate failure of a part or device*
  - Predicting part or equipment failure before it occurs
  - Reduces catastrophic failure and extended downtime

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IoT and Equipment Maintenance

Preventive Maintenance Examples

- *Greasing Bearings*
- *Cleaning Air Filter / Belly Pans*
- *Blowing dust from Motors/Radiators*
  - Failure to perform preventive maintenance can result in:
    - *Reduced performance*
    - *Premature failure of other components*
    - *Reduce life of equipment*

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IoT and Equipment Maintenance

Predictive Maintenance Examples

- *Changing timing belt after 90,000 – 120,000 miles*
- *Changing Motors after 10 years*
- *Replacing Conveyor Belt after 100,000 processed tons*
  - Utilizing Predictive maintenance can result in:
    - *Increased Uptime*
    - *Reduction of Catastrophic Failures*
    - *Efficient Inventory*

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IoT and Equipment Maintenance

Industry Usage

- *Preventive used extensively on both collections and processing*
  - Tire Rotation, Oil Changes, Filters
  - Greasing of Bearing, Cleaning Rotating Shafts, etc.
- *Predictive less common in collections, almost non-existent in processing*
  - Oil Changes (!?), Belt Replacement, Shaft Change-outs
  - Can also be applied to Carts and Bins

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IoT and Equipment Maintenance

IoT Relationship with Preventive and Predictive Maintenance:

- *Comes down to Data and how to record and interpret the trends in the Data*
  - Initial trends can modify the needs of preventive maintenance for better efficiency
  - The more Data collected over time, the more predictions can be made on part failure and equipment performance

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IoT and Equipment Maintenance

IoT Maintenance Challenges

- *Data collection limited or non-existent*
- *Collected Data not integrated into singular, readable format*
- *Software for certain applications limited*
- *Cost of additional sensors, difficulty of retrofit*
- *Time needed to collect meaningful Data*

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IoT and Equipment Maintenance

IoT Maintenance Benefits

- *Downtime is the bane of all collections and processing systems!*
  - *Streamline Preventive Maintenance needs*
  - *Reduce catastrophic failures*
  - *Streamline Inventory to potential predicted needs*
  - *Reduce overall per-ton cost with these increases in efficiency*

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IoT and Equipment Maintenance

Conclusions:

- *Most of us already use preventive maintenance*
- *Predictive maintenance increases efficiency*
- *Predictive maintenance is less expensive over the long term*
- *IoT Data will be more frequently available but will need to be utilized to make the Data useful*
- *Without the right software, the Data is useless*
- *IoT is not a solution, but a tool for increased efficiency*

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Thank you!!

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