Design of a Modular Mechanical Data Acquisition System for Assembly Stations

GKN Automotive

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Overview

Objective:

Design and fabricate a modular machine data acquisition system to detect potential failures in Station 190 on the C1-PTU assembly line.

Specifications

Measurements
- Humidity
- Ambient temperature
- Vibration

Analysis
- Graphical plots of live measured data to spot unusual activity

Data Access
- Wi-Fi or Bluetooth access to microcomputer

Mounting
- Modular system with easy install

Sensors
- Quick and easy installation
- Minimal interference to system if a sensor fails
- As close as possible to point of action

Unit
- Able to run on electrical power or battery power
- Quick and easy to replace any failed parts
- Designed to withstand industrial environment

Description of Design

All sensors from NCD
- Wall-Mounted or Magnet Mounted
- IP65 Rated Enclosure
- Includes battery level with every transmission

Vibration & Temperature Sensor
- Sample rate up to 25,600 Hz
- Calculates RMS, MAX g Vibration, Velocity Vibration, Displacement, Peak Vibration Frequency
- External probe option for vibration sensor
- Up to 500,000 transmissions from 6 AA batteries
- Measures temperature within 1°C

Humidity and Temperature Sensor (x2)
- Sensor resolution of ±0.2°C and ±2%RH (relative humidity)
- Up to 500,000 transmissions from 4 AA batteries

USB Modem
- Communicates wirelessly with all sensors
- No power adapter, runs off USB
- Range of two miles
- Maximum load of 128 sensors

Microcomputer: Provided by GKN

Implementation

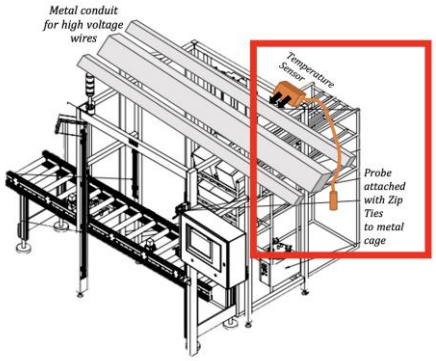
- Connect Modem to Microcomputer to communicate to all sensors
- Node-red process the data, displaying it visually and storing it in CSV files for later analysis
- Monitor data for abnormalities and set thresholds for temperature, humidity, and vibration
- Predict failures in both the station 190 and the product it is manufacturing

Placement of Sensors

Vibration Sensor

Station 190 Press View

Temperature Sensor



Station 190 Birds Eye View

User Manual

- Installation and Setup
- Node-RED Operation
  - Full system setup for each sensor
  - How each node works
- Sensor placement, battery replacement, setting limits
- Troubleshooting
  - Several online resources
- Bill of Materials
  - Links to each component

User Interface Tabs

Current
- Shows data from the last 30 minutes as well as battery voltage

History
- Shows historic data for the last 24 hours

Files
- Shows all the files for each sensor for each day
- Data can be graphed or downloaded if needed

Data Analysis

- After reviewing the provided data there were no distinct outliers to indicate any fault in the sensors' readings or a failure in Station 190