Abstract

In the current US electrical infrastructure, there is little emphasis placed on ensuring the integrity of street-side utility poles. These poles carry our electric distribution lines as well as other equipment such as pole-top transformers, solar panels and telecommunication equipment. Collapses of these poles not only damage equipment and create costly outages for utility providers, but they prove very dangerous to the public as well. These poles carry high-voltage lines that can sometimes end up on the ground when the poles fail. These poles can be deadly and destructive to anyone and anything in their path. Our proposed Wireless Utility Pole Integrity Sensor (WUPIS) utilizes a Raspberry Pi to collect and organize data from the sensing sources [1]. Attached is a gyroscope/accelerometer sensor that gives real-time information about the tilt and orientation of the pole [2]. The sensor information is then wirelessly routed to a Machine Learning (ML) program based in MATLAB that compares the real-time information with a library of test data to determine if the pole is operating within safe structural margins. All data is transferred over wirelessly using XBee Digimesh technology, which allows for wireless communication between the Raspberry Pi devices at functionally long ranges [3]. The device would also need a power source, so a method of powering the device via solar panel was also developed as part of the scope of this project. Although the WUPIS project has many future developments that would improve practicality, scalability and functionality in application, initial testing is highly promising. The device is able to detect tilt and wobble characteristics and transmit this data wirelessly over the XBee modules. Machine learning code has been successfully developed that takes into account gyroscope data, accelerometer data, and wind speed to make a judgment on the poles stability based on a library of previously tested readings. From a cost standpoint, initial prototypes operate at a price point of roughly 135 dollars per unit. This price point stands to drop as low as 30-40 dollars or even much lower with future improvements to design and bulk manufacturing. The idea of having cost-effective sensors on utility poles on a mass scale for the time being seems highly plausible.