IoT based Hybrid Green Energy Driven Highway Lighting System

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ABSTRACT

The worldwide concern to mitigate the soaring energy crisis introduces us to the small-scale renewable energy generation as a preferred enabling source for highway lighting. However, the extensive cost and performance inconsistency of the pure solar panel based solutions further motivate efforts in designing a hybrid energy solution for highway lighting in which Internet of Things (IoT) is envisioned to play a pivotal role in controlling multiple energy sources to provide an effective environment for such a small-scale application context. This paper proposes an IoT-enabled intra-network solution to organize the energy sources for improving the battery performance in a hybrid energy driven highway lighting system. More specifically, we consider the solar panel and Vertical Axis Wind Turbine (VAWT), which utilizes energy from the aerodynamic losses produced by vehicles in the highways, as two main sources for energy generation. This hybrid system allows for generating uninterrupted energy by solar during the day and by VAWT at all day and night times whenever a vehicle passes the lamppost. For maximum effectiveness, a micro-controller is employed in this system to sense the internal requirements for utmost performance. A test-bed prototype is developed to evaluate the performance of the proposed system over a pure solar based lighting system via a projected cost analysis. The result demonstrates withdrawal of solar dependency followed by a less energy requirement in the hybrid lighting system according to different busyness level of the highway.