Abstract

Solar powered vehicles are currently being developed as entirely self-sustaining vehicles that harness their energy directly from the sun. This paper tackles the problem that a crucial aspect of energy consumption for solar vehicles is driving them in as much solar exposed areas as possible. With increased energy absorption these vehicles can become more widespread and aid in reducing energy consumption through fossil fuels in the transport industry.

This project derives and implements a model that can predict the most energy efficient route for a solar powered vehicle in a variety of different conditions. Unlike previous work, this project focuses on building a model using aspects of other research in areas of weather, mapping and energy management. The goal is to build a model that can be applied to any city using a digital surface model.

This project uses the ArcGIS tool and the open weather API to develop a model that predicts the solar potential of a vehicle by taking into account shade based on surrounding topography, vehicle type, weather, distance and time of day.

This model was then implemented into a user mobile application; 'Drive Solar' that can calculate the optimal route for the user based on their preferences. A data management application was also built to support the transfer of data from ArcGIS and help this application be scalable for larger road networks.

The prediction model was then tested using a solar irradiance sensor on the bonnet of a car in Dublin city. This test aids in understanding the effectiveness of the model in a variety of conditions.

The results found that the model designed in this experiment predicts the route with the most energy absorbed with a 51.65% accuracy and chooses the route with the most energy consumed with a 86.65% accuracy. It was found that some vehicle types such as Aptera and Lightyear One could be self-sustaining with the help of some solar parking. Other vehicles such as solar vans or buses could currently only support energy consumption in a hybrid vehicle. By increasing the energy absorbed by a solar vehicle, Drive Solar can aid in the transition to the widespread use of self-sustaining solar vehicles.