The possibilities of increasing the electric vehicle range

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Abstract

Electric vehicles have a significantly shorter range compared to the conventional vehicles with the internal combustion engine. Hence, it is important to inform the driver of an electric vehicle as accurately as possible about the actual range and how to reduce energy consumption and thus improve range. The paper presents proposed electric vehicle energy usage assist for increasing vehicle range, system implementation and measured data for energy usage assist function. The developed energy assist encourages the driver to modify his driving style in order to be on the powertrain greatest efficiency area. The system informs the driver about the limitations for example caused by weather conditions or low battery state of charge.

Keywords: electric vehicle; range; driving style

1. Introduction

Range of electric vehicles has long been considered a major barrier in acceptance of electric mobility due to electric vehicles having a significantly shorter range than conventional vehicles [1] [2]. The range of electric vehicles influences not only the design of the vehicle but also driving style and operational factors. The main design factor is battery capacity. On the other hand battery size influence vehicle curb weight and price [3]. Right size of battery pack can also extend range [4]. If electric vehicle is using for example to commute to work and daily route not exceed 50 km it is wasteful using electric vehicle for example with 24kWh battery pack because for 50km distance can be used electric vehicle with half battery capacity. The electric vehicle is then lighter and has lower electric energy consumption. Nowadays modular design is becoming new trend. The modular design allows the customer to choose

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the appropriate size of the battery pack. Climatic conditions has significant impact to the electric vehicle range [5]. The range is decreasing with extremely low or high temperatures. This problem is manufacturers trying reduce by using various cooling or heating systems for battery packs [6]. Manufacturers of electric vehicles sometimes use an electric pre-heat function to warm up the battery during charging. Technical condition of the vehicle is also important especially accurate tire pressure. The range affects also using of comfort features such an air condition or heating.

The driving style has significant influence to the electric vehicle range [7]. Although electric vehicle and vehicle with internal combustion engine may appear to be identical, drivers must adjust their driving habits to fit the different mode of driving required by the electric vehicle. It is beneficial using coasting or recuperation of kinetic energy during braking.

One of the possibilities of how to influence the driving style is a system which gives driver the information on how to behave in order to reduce energy consumption and extend range. Such a system is currently developing at the University of Zilina. The modern electric vehicles has only systems that evaluate driving style. The proposed system will be inform driver how to change driving style immediately.

2. Energy Usage Assist in EV EDISON

The role of the intelligent Energy Usage Assist is audiovisual communication with the driver in order to optimize the driving style and minimize energy consumption. The proposed Energy Usage Assist system will be applied into the experimental electric vehicle EDISON (Fig. 1). The Energy usage assist will be alone system which will be receive data from the vehicle control unit and the battery management system. Integrated GPS receiver will be used for detecting speed limits. Based on powertrain measured efficiency maps system will be inform driver through display how to behave.

The Edison is experimental electric vehicle build at University of Zilina. The curb weight of the experimental vehicle including the battery is 1048 kg. Propulsion provides a compact lightweight all-aluminum, air-cooled asynchronous electric motor AKOE with a nominal output of 16kW and maximum power of 30kW, with motor controller CURTIS and traction LiFeYPO4 24kWh battery pack with the battery management system and onboard charger 110-240V / 16A. The main part of the vehicle is a tubular steel space frame. EV Edison enables data logging of a wide range of data such as speed, acceleration, temperatures, state of charge and information from battery management system.

In the first phase of the development the system will inform the driver if he is currently in the most efficient mode during acceleration – Highest Efficiency Mode. If we assume that the driver needs to accelerate from an intersection in the city. System will use GPS position to evaluate the end speed during acceleration to 50 km/h. Based on powertrain
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