**Pseudo-noise based Impedance Spectroscopy for Battery Health Monitoring**

**Dr. Khawaja Arsalan Habib & Dr. Hassan Abdullah Khalid (NUST)**

### BACKGROUND

- The penetration of hybrid and electric vehicles is expected to increase in the Pakistan market. The battery pack is the most expensive component of these vehicles whose efficiency and long life can only be insured by an accurate estimation of State of Charge (SoC), State of Health (SoH) and Remaining Useful Life (RuL) estimation in a Battery Management System.

- This presents a dire need for a scalable battery monitoring system. Especially for the local industry that are developing an indigenous Electric Vehicles and battery management system. These batteries require a carefully designed Battery Management Systems to provide long life and safety.

### FACTS AND FIGURES

![Prototype layout design](image)

- **Tesla Car fires due to battery issues**
- **Samsung Galaxy note explosion due to Li-ion battery defect**

### METHODOLOGY

- Sensor signal acquisition system design
- Identification of data logger and processor
- Impedance spectroscopy simulations
- Develop Instrumentation Chain for signal acquisition
- Prototype to generate excitation with enough SNR to acquire battery response
- Applying estimation algorithms for parameter extraction
- Integration of the prototype and estimators
- Revise and optimize design

### PROJECT ESSENCE

- Develop a scalable, handheld battery impedance self-test and tracking system which can display the battery critical parameters.
- Successful implementation of the research will develop a prototype system that measures the battery impedance over the range of frequencies will be designed.
- The battery critical parameters like SoC and SoH values be displayed to user.
- Portable to all the batteries to measure the performance.
- Scalable, low power consumption hardware for the industries, can be used in Heavy Electric Vehicles applications or Uninterruptible Power Supplies.

### RESEARCH IMPACT

- Since this will be first of its kind system in Pakistan. It will enable the local car industry in developing state of the art Battery Management System for their Electric Vehicles
- It will also enable the NUST researchers to incorporate these functionalities for developing fully functional Battery Management System for hybrid and Electric Vehicles

### STAKEHOLDERS AND COLLABORATORS

- **ECONOMIA Ageco Limited**
- **Professor Dr. Bertan Bakkaloglu (IEEE Fellow) and his research group at Arizona State University**
- **Battery charging and management system manufacturers**