



D25 Electrical Bike (E-Bike) Deceleration Analysis Using Advanced Electronic Systems

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Learning Overview: After attending this presentation, attendees will be more familiar with E-bikes, the operating system of the tested Greyp bike, and possible ways of E-bike examination in digital forensics and road accident analysis areas.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing information about smart E-bikes, as well as the road accident examiners in their daily work with similar cases.

The goal of this presentation is to explain forensic acquisition of E-bike memory in closed and factory-created systems (such as embedded Linux in Greyp E-bike), as well as the memory analysis using commercial and open source forensic software.

In the area of road accident analysis, deceleration of a vehicle is one of the most important factors to calculate initial speed of the vehicle before a crash. Providing braking tests, this study was able to establish the minimum stopping distance of a vehicle in testing conditions and by using such data, calculate the vehicle deceleration. Yet, testing conditions could be slightly different in comparison with the real road conditions. While the asphalt surface in a test area is usually new and rough, real road asphalt surfaces are often totally different (usually smooth with some cracks and other types of damage, covered with dust or mud).

In the Forensic Science Centre “Ivan Vucetic,” two different methods were used for determining braking distance of a vehicle: static measurement using the ASFT t2Go device and dynamic measuring using the XL meter. Using both methods separately or together, this study could establish or calculate deceleration of a vehicle.

The idea of using data from the Engine Control Unit (ECU) of E-bike Greyp came up as a logical follow-up in this area. By reading the data from the bike ECU, it is possible to get information such as the bike speed, acceleration/deceleration, time and way of braking, route of driving (using Google® Maps or a similar app), and many other data. Data given from the Greyp is automatically stored in the operating system of the bicycle and on the storage server. Some data also gets stored on the user’s mobile phone device paired with the bicycle, making it accessible to the user for viewing through the mobile user application.

This presentation will show the process of the Greyp E-bike physical memory acquisition and Read-Only Memory (ROM) structure of the extended file system (ext). Forensic examination and memory analysis will be conducted with the commercial and open source software. Information obtained from the Greyp ECU and from the Greyp operating system will be compared with the data collected and analyzed by the usual forensic methods after conducting vehicle dynamic tests of the given bicycle.

Using digital forensic techniques (acquisition and extraction) and methods (parsing and analysis), this study can confirm (or deny) results of a road accident expertise and maybe discover new data relevant to similar cases.

Road Accident Expertise, E-Bikes, Braking Distance