VEHICLE SERVICING AND REPAIRING

NTQF Level II

Learning Guide-#11

Unit of Competence: - Use Garage Information System

Module Title: - Using Garage Information System

LG Code: EIS VSR2 M04 LO2-LG-11

TTLM Code: EIS VSR2 TTLM 0919v1

LO2.Identify operation of system

Instruction Sheet	Learning Guide 11

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Identify characteristic of surface of System
- Identify operation of system
- Apply for Information

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Identify characteristic of surface of System
- Identify operation of system
- Apply for Information

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 22 to 28.
3. Read the information written in the “Information Sheets 4”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 4” in page 29__.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 4).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 4”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #2.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Read the information written in the “Information Sheet 4”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the “Self-check 4” in page 29__.
10. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 4).
11. Read the information written in the “Information Sheets 4 ”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
12. Accomplish the “Self-check 4” in page 29
13. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks.

Information Sheet- 1	Identify operation of system

Identify operation of system

Identify components of system to be Research

A lot of research has been done on both vehicle, tire and road modeling. While the vehicle dynamics modeling is more straightforward than the tire and road modeling, and mainly varies in complexity, there are many different attempted approaches in describing the road.

- **Vehicle Information Systems (Vehicle IS)**

It is the mission of the IS academic community to *'advance the knowledge and excellence in the study and profession of information systems'* (Association of Information Systems, 2017). The IS discipline has a more than 40-year history evolving through four eras with considerable diversity amongst its members in terms of research interests and believes what belongs and what does not belong into the field, spanning a wide variety of themes like decision support systems, organizational impact of IS, IS adoption, IS evaluation, or knowledge management to name a few (Hirschheim and Klein, 2012). Ac-cording to Nun maker and Briggs (2011), one major purpose of the IS discipline is to *'to understand*

Vehicle Information Systems Research Agenda and improve the ways people create value with information', while studying the *'understandings people require so they can create new value, and of the analysis, design, development, deployment, operation, and management of systems to inform these understandings'*.

While there has been a lot of attention within the IS community to investigate how IS as an academic discipline – has evolved over time, there still seems to be no ultimate definition of what the tangible part of an information system (i.e. the system – not the discipline) factually is. Surprisingly, even many renowned scientific papers on IS dealing with the tangible part – the information system –

neither review prior definitions of this term nor provide an own definition. For instance, both highly cited papers from Deleon and McLean (1992 and 2003) on measuring the success of an information system within an organization introduce an IS success model without providing a sound definition on what the information system actually is. What seems to be a common practice in IS makes it more than challenging for us to provide a sound scientific definition of a *vehicle information system*. However, some rather practical definitions in the literature have proven to be helpful: For example, from a Management Information Systems (MIS) perspective, Laud on and Laud on (2013) define an information system *'technically as a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization'*. Another example is from Neumann et al. (2014) who define a business information system as a *'socio-technical system containing human beings and machines, which use and produce information to sup-port and enable the processes and operations of an enterprise'*. Taking into account the cited work, we understand information systems as *socio-technical systems, supporting users to execute tasks by providing task-relevant information*. Information provision typically is supported by hardware and software capable to process digitized input efficiently (which increasingly is available due to digitalization) that in turn creates opportunities for increased automation or new business models.
Before going towards a definition of a 'vehicle information system', we deem it important to distinguish Vehicle IS from a series of *vehicle automation systems* (Stanton and Young, 2010), including in particular automotive safety systems (e.g. anti-lock braking system – ABS, or electronic stability con-troll – ESP) and advanced driver assistance systems – ADAS (e.g. adaptive cruise control – ACC, or lane assist), which directly influence the driving process increasing safety and/or comfort. Vehicle automation systems even influence vehicle dynamics while keeping the driver fully out of the loop. In contrast the factual interaction of the driver with the information processed by an information system is one fundamental property of Vehicle IS. Hence, we understand Vehicle IS as a class of *software applications processing vehicle data and/or other relevant data from different sources to finally pro-vide valuable and action-relevant information to the vehicle driver and/or to other stakeholders*.

- **examples of Vehicle IS**

In order to describe the transformation and enrichment of (vehicle) data to enable Vehicle IS a data
value chain can be applied. The Vehicle Data Value Chain adapted from Curry et al. (2016) shown in the figure below outlines the data process from vehicle data generation to usage in Vehicle IS.

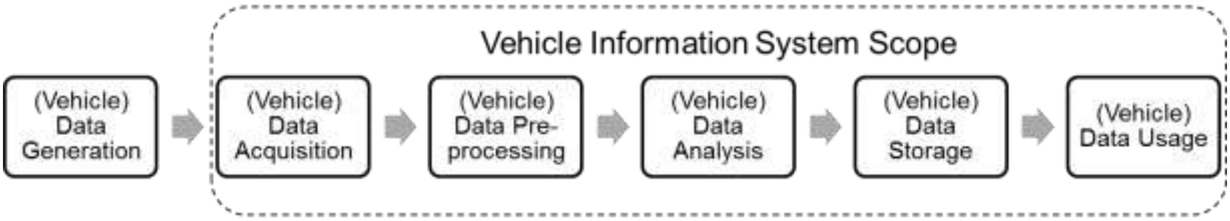

Figure 1. Stages of a Vehicle Data Value Chain.

A Vehicle IS is an IS providing information to users (e.g. the vehicle owner, the vehicle driver, or co-drivers who are granted the rights to access this information) during different phases of vehicle operation, most notable before a trip, during a trip, and/or after a trip has been completed. Depending on the

Vehicle Information Systems Research Agenda particular vehicle

operation phase, Vehicle IS can be used from inside a car (often referred to as *in-vehicle information systems*, e.g. by Ryder et al. (2016), Pengetal. (2014) and in a patent of Banskibband Faenger (2017)) as well as from outside the car. Vehicle IS may directly use the dashboard of the vehicle, but may also extend the system border of the vehicle and establish a second dashboard (Stevens et al., 2017). The following visualization provides two examples of Vehicle IS for each operation phase.

Examples for Vehicle Information Systems		
Optimization hints	Live visualization	Driver behavior statistics
No acceleration approaching a red light	Average speed of 74km/h, 4230 rpm	Number of safety relevant brake events
Routing suggestions	Driver tutoring	Road statistics
Based on known driving style & traffic	Approaching a crossing, release gas pedal now	Number of hard brakes per road/city/area

Figure 2. Examples for Vehicle IS to be used before, during, and after a trip.

➢ A Research Agenda for Vehicle IS

Our preliminary literature investigation of the AIS Electronic Library has retrieved few relevant publications from the academic IS community related to Vehicle IS: Ryder et al. (2016) present an in-vehicle information system prototype for drivers providing warnings of upcoming accident hot spots based on data collected from service users. Nastjuk et al. (2016) investigate the impact of in vehicle IS on perceived range stress (fear of a discharged battery). Brandt (2013) reviews the past, present and future of IS in automobiles, especially paying attention to IS linked to electric vehicles. Taking a wider viewpoint, Brandt provides a categorization for Vehicle IS in convenience, communication, and entertainment (CCE), vehicle monitoring, geo IS and navigation, and finally safety and collision avoidance. Kolbe et al. (2015) investigated the influence of technological and socio demographic factors on perceived stress, resulting from human interaction with Vehicle IS.

Wacker et al. (2014) investigated what information green IS should provide to the individual users of electric vehicles. Our preliminary analysis has shown that research is scattered and diverse. In accordance to Rehmetal.(2017), we therefore argue that structuring research directions in three different domains, the technical domain (e.g. the technology enabling the Vehicle IS), the governance domain (e.g. a Vehicle IS has to be designed in accordance to legal and ethical standards), and the human domain (e.g. a Vehicle IS has to provide value to the human driver in order to be used) is a feasible approach when aiming towards a research agenda

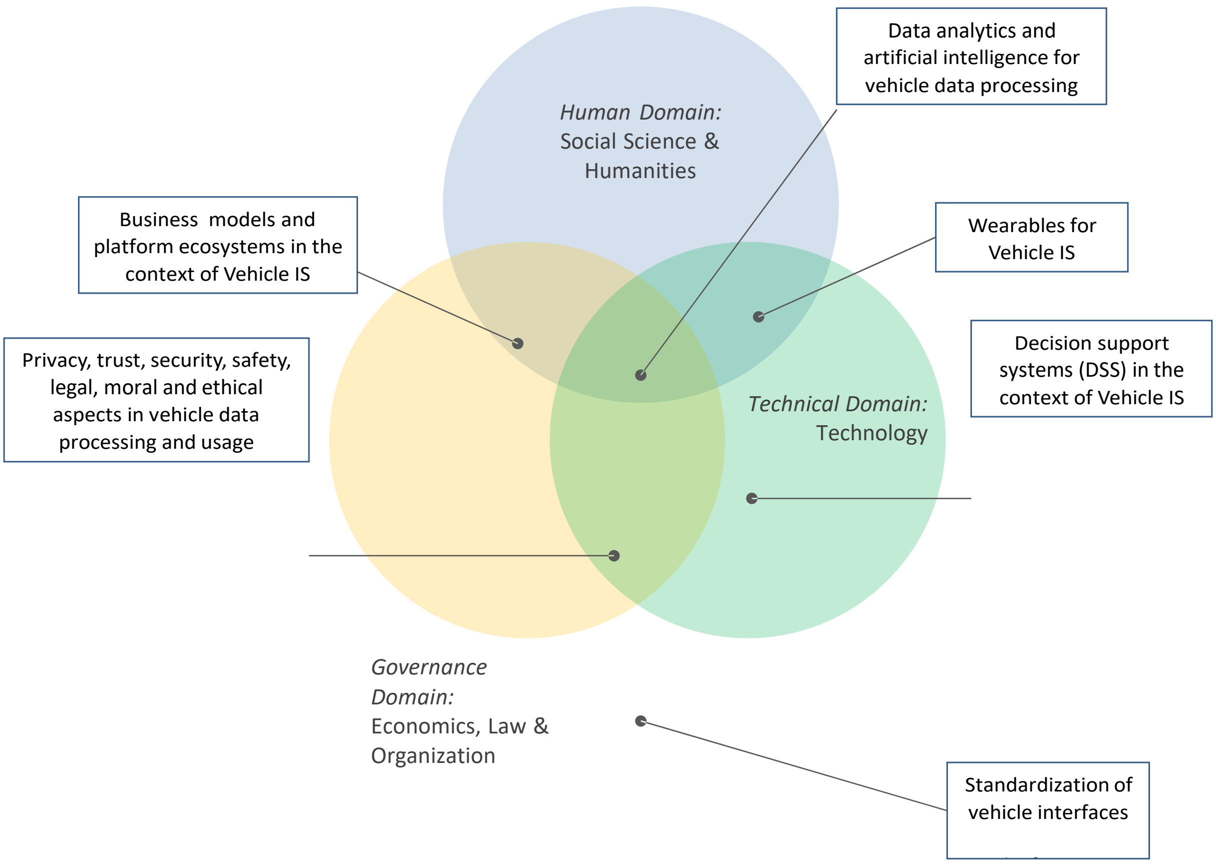

Figure 3. Characterizing research directions for Vehicle IS.

➢ Data analytics and artificial intelligence for vehicle data processing

Data is one key source for Vehicle IS – and data analytics is the key to leverage its value. The data generated by modern vehicles is of enormous size and often describes very volatile processes(Auto-Mat, 2017). It can thus not easily be interpreted by humans in raw form. Instead, it is necessary toei-ther transform the data, i.e. to compute meaningful and interpretable properties of the data (e.g. fuel consumption) or to assess the driving metric of interest by statistically describing it with a (machine learning) model. The metric "aggressiveness of driving" may serve as an example for the latter case:

It cannot easily be computed directly, but only by complex interactions of many other, simpler parameters (Toledo et al., 2008). In contrast, many of the parameters in-vehicle IS present to the driver are exactly computable by some formula derived from physical or chemical system properties and in most cases easily interpretable. Machine learning models, on the other hand, seem to be rarely used. Algorithms to build ("train") such machine learning models are typically not directly leveraging the raw data, but use so called *features*, i.e. calculated properties of data which are related to the parameter of interest. For many applications, especially in the context of vehicles, it is not straightforward to choose the right set of features: If you want to model a property of the driver, you need to ensure that the chosen features do indeed capture those properties and non-properties of the vehicle or of environmental conditions as road type or traffic volume. While other disciplines, like image recognition have developed de-facto standard sets of robust features for different tasks (Lowe, 1999; Rosten and Drummond, 2006; Alcantarilla et al., 2012), comparative feature sets for Vehicle IS are still missing. When machine learning models for Vehicle IS become more common, additional challenges will arise, especially ones related to safety and reliability. To ensure proper, correct and save behavior of the models, the development of suitable testing procedures will become inevitable. It is however un certain if such procedures can be based on classical machine learning quality metrics which give information on one model at a time only. Suitable testing will need to take the possible interactions between multiple models in to account, and, to make things even harder, a ground truth to compare the results against is often not available or hard to obtain.

Privacy, trust, security, safety, legal, moral and ethical aspects in vehicle data processing and usage

Whenever data from human behavior is captured and leveraged in IS, ethical aspects have to be dis-cussed, as the data might be exploited for other purposes, too. For example, thousands of smartphoneapplications are available for "free", if users agree terms and conditions, which include access to per-sonal information like search terms, or even the ability to record sound from the microphone. As a re-sult, users of free applications often pay indirectly through data they provide to the application, whichthen can be sold on the digital data market. At the moment, a majority of users does not care aboutprivacy. However, this situation might change if their initial trust is destroyed. Especially with behavior-revealing information including speeding, accelerations in kick-down-mode,or hard breakings, it is important that users can trust the IS to only use the data to improve their end user experience, e.g. to defuse dangerous crossroads instead of exploiting it for other purposes like automating the detection of speeders for the police.

Consequently, regarding vehicle data and Vehicle IS, privacy and trust are related to each other, while security has to ensure that data and information is kept within defined boundaries, e.g. that no intruder can get access to a vehicle. This is safety relevant as well, as there will be services which also write data to the vehicle interface, and thereby possibly – depending on the setup – can have a negative im-pact on vehicle behavior.

Standardization of vehicle interfaces and information

Vehicle usage data is produced if a vehicle is operated, therefore it could be concluded that this data belongs to the person operating (be it manually or autonomously) and/or owning it. Currently, most of the produced raw data is not accessible to the driver at all. In turn, we believe that vehicle usage data, collected from a mass of vehicles, can lead to the development of novel services for various stake-holders, if it were publicly accessible. Consequently,

it has to be decided which stakeholders (e.g. vehicle manufacturers or public transport departments) are in charge of playing the governmental role in order to push standardization and execution. According to Pillmannetal. (2017), standardization is required since in the current state parameters vary from engine type to engine type and from manufacturer to manufacturer. The amount of signals which are currently accessible and in fact available across all passenger vehicle types and manufacturers is quite small (e.g. the signals defined in OBD-II standard to be found in ISO 15031-5) and thus not much greater than what one can find out using sensory of a smart phone mounted in the vehicle. Another critical point is the anticipated amount of data to be sent and the querying frequency used bythe data logging device, as stressing the vehicles' bus system for information exchange with this low-priority information retrieval might hinder more important actions.

Vehicle information Vehicle details, Equipment, important Info

Evaluation Question: Does your automotive repair operation recycles used oil as well as used oil filters?
Performance: Waste fluids from improper disposal of used oil and oil filters combines with other chemicals to contaminate ground water when disposed of in most landfills. The Van Batenburg Garage drains oil filters for 2-5 days into a collection system, then crushes the filters and sends them for recycling. Used motor oil from the drained filters is combined with the used oil from automobiles and pumped directly to an on-site oil burner.

A technician performs antifreeze recycling after initially testing the antifreeze by directly pumping radiators through a mobile pump station. By directly pumping antifreeze through this system, no spillage occurs. This service procedure is similar to an air conditioning service system.

Final Horsley & Witten, Inc. Business Troubleshooting: What is the source of the problem?

Case Study: Van Battenberg's Garage, Worcester, Massachusetts

a) Background

Craig Van Battenberg owns and operates an auto repair garage in Worcester, Massachusetts, which includes many service features to control fluids and prevent spills. These services include recycling waste oil, antifreeze and filters through innovative systems. Although the garage is located outside of a wellhead protection area for a backup well for the City of Worcester, the garage owner educates many area automotive technicians about proper fluid and hazardous waste handling operations through a regional automotive repair education association.

Some of the basic management measures implemented and encouraged by the Van Battenberg Garage which protect nearby ground waters and surface waters that may serve as drinking water supplies are:

b) Management Measures Applied at Van Battenberg's Garage

BMP: Recycling Service for Used Motor Oil, Oil Filters and Antifreeze

Evaluation Question: Does your automotive repair operation recycles used oil as well as used oil filters?

Performance: Waste fluids from improper disposal of used oil and oil filters combines with other chemicals to contaminate ground water when disposed of in most landfills. The Van Battenberg Garage drains oil filters for 2-5 days into a collection system, then crushes the filters and sends them for recycling. Used motor oil from the drained filters is combined with the used oil from automobiles and pumped directly to an on-site oil burner.

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Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next Page:-

1. Define the term research?
2. Identify and discus terminology and work choice?
3. What is Standardization of vehicle interfaces and information ?
4. Write the Vehicle Information Systems Research?

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = ____________

Rating: _____________

Name: ___________________________ Date: ________________