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PROFESSIONAL PAPER

Insurance Telematics Using GPS Tracker and Smartphone

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Abstract: Insurance telematics is widely used in Europe by young and first-time car drivers[1] [1]. It relies on an insurance premium that is based not only on static measures, but also on dynamic measures. The dynamic measures are the current position of vehicle, the current speed at that position, time spent on the road, the driver's style of driving etc. When we talk about insurance telematics, we refer to insurance schemes pay-as-you-drive (PAYD), pay-how-you-drive (PHYD) and manage-how-you-drive (MHYD). Telematics could be smartphone based insurance with technology which relies on insurance premiums that reflect the risk profile of drivers and the traditional in-car mounted devices for insurance telematics. This telematics work is experience from a recent insurance telematics validation and analyst pilot run in England on motorway around the Heathrow airport. In this telematics test, the global positioning system (GPS) and smartphone is used as receiver.

The small global positioning system (GPS) transmitter is a small tracker in-car mounted devices with SIM card with is set up for sending SMS to smartphone every ½ minutes. The smartphone is the receiver equipment which is used to collect telematics data which is ready for analysis. There are many companies around with data analytics expertise who use the latest big data analytics technology such as Hubio Dynamic Data Warehouse[2] [2]. They analyse data from a wide range of different data sources, including databases, sensors, smartphones and social media.

Keywords: Insurance, Insurance telematics, smartphones, GPS tracker.

TELEMATICS GPS DATA

This research shows the example of telematics model processing GPS data in order for an insurance company to bring a number of important decisions on the insured vehicle. One of the important indicators is vehicle speed, that is, whether the driver is speeding and exceeds speed limit on the road. This test was executed in London and it was used on different types of roads such as regular roads and highway around the Heathrow airport.

EQUIPMENT USED IN RESEACH

The following equipment was used in this research:

GPS Tracker Car Vehicle Tracking Device TK102 [3][3]. This device is a global positioning system (GPS) transmitter, a small tracker in-car mounted device with a SIM card.

Any smartphone which is enabled to download data could be used in this test. The smartphone is set to receive SMS from in-car tracker and process the data to SQL server.

GPS Tracker Car Vehicle Tracking Device TK102 CITATION htt6 \l 2057 [3][3]

Type:	Compact magnetic GPS Tracker
Model:	TK102
Cover:	MAGNETIC BASE
Functions:	SHOCK SENSOR, MOTION SENSOR, LISTENING DEVICE
Brand:	iTrack UK
Battery capacity:	000 mAh
Manufacturer Part Number:	TK102
GPS sensitivity:	-159dBm

SMS MESSAGES

GPS box is located in the vehicle and sends to the Centre for Management of sms message for processing messages, every 30 seconds as shown in the attached list. GPS tracking box can be controlled from a distance, sending a certain message from the Centre for Management (Telematics office insurance). The parameters from the GPS tracker are set to send messages to a collection centre including vehicle position, vehicle speed and current time.

lat:51.46907 long:-0.32860 speed:010.4 T:06/13/16 19:14
http://maps.google.com/maps?f=q&q=51.46907,-0.32860&z=16
lat:51.46815 long:-0.32939 speed:039.4 T:06/13/16 19:14
http://maps.google.com/maps?f=q&q=51.46815,-0.32939&z=16
lat:51.46711 long:-0.32959 speed:030.4 T:06/13/16 19:14
http://maps.google.com/maps?f=q&q=51.46711,-0.32959&z=16
lat:51.46453 long:-0.33094 speed:043.3 T:06/13/16 19:15
http://maps.google.com/maps?f=q&q=51.46453,-0.33094&z=16
lat:51.46149 long:-0.33184 speed:039.3 T:06/13/16 19:15
http://maps.google.com/maps?f=q&q=51.46149,-0.33184&z=16
lat:51.46074 long:-0.33164 speed:002.8 T:06/13/16 19:16
http://maps.google.com/maps?f=q&q=51.46074,-0.33164&z=16

SMS GATEWAY DATA

SMS messages are collected via the SMS Gateway and logged into to the database (SQL Server). The table No.1 shows the data which are supposed to be automatically loaded into the SQL Server.

The data loaded into database:

1. LAT - Latitude
2. Londe - Longitude
3. Speed - vehicle speed
4. DATE - date
5. TIME –time
6. MAP - map (position of the vehicle on the road)

This research showns import data from SQL Server to Excel where it is possible create various forms of graphs and diagrams to analyze the data.

Microsoft SQL Server is a relational database management system developed by Microsoft which is used in this resarch. As a database server, it is a software product with the primary function of storing and retrieving data as requested by other software applications, which for this research is run either on the computer across a network (including the Internet).

Table 2. GPS data imported into Xcel

Telematic GPS vehicle details					Road route		
DATE	TIME	SPEED [KM]	LAT	LOND	ROAD	ROAD SPEED	KM
06/13/16	19:14	10	51.46907	-0.3286	A310	30	48
06/13/16	19:14	39	51.46815	-0.32939	A310	30	48
06/13/16	19:14	30	51.46711	-0.32959	A310	30	48
06/13/16	19:15	43	51.46453	-0.33094	A310	30	48
06/13/16	19:15	39	51.46149	-0.33184	A310	30	48
06/13/16	19:16	3	51.46074	-0.33164	A310	30	48
06/13/16	19:16	0	51.46056	-0.33157	A316	30	48
06/13/16	19:16	34	51.46045	-0.33215	A316	30	48
06/13/16	19:17	47	51.45987	-0.33738	A316	30	48
06/13/16	19:17	19	51.45867	-0.33921	A316	30	48
06/13/16	19:18	1	51.45878	-0.3399	A316	30	48
06/13/16	19:18	1	51.4588	-0.33977	A316	30	48
06/13/16	19:19	1	51.45878	-0.33978	A316	30	48
06/13/16	19:19	0	51.45879	-0.33982	A316	30	48
06/13/16	19:34	75	51.40097	-0.52949	M3	70	113
06/13/16	19:34	61	51.39922	-0.53589	M3	50	80
06/13/16	19:35	60	51.39905	-0.53793	M25	50	80
06/13/16	19:35	74	51.40267	-0.53892	M25	70	113
06/13/16	19:35	94	51.40916	-0.54108	M25	70	113

Table 1. Telematic test data

Telematic Test5 13-06-2016					
LAT	LOND	SPEED	DATE	TIME	MAP
51.46907	-0.3286	10.4	06/13/16	0.801388889	http://maps.google.com/maps?f=q&q=51.46907,-0.32860&z=16
51.46815	-0.32939	39.4	06/13/16	0.801388889	http://maps.google.com/maps?f=q&q=51.46815,-0.32939&z=16
51.46711	-0.32959	30.4	06/13/16	0.801388889	http://maps.google.com/maps?f=q&q=51.46711,-0.32959&z=16
51.46453	-0.33094	43.3	06/13/16	0.802083333	http://maps.google.com/maps?f=q&q=51.46453,-0.33094&z=16
51.46149	-0.33184	39.3	06/13/16	0.802083333	http://maps.google.com/maps?f=q&q=51.46149,-0.33184&z=16
51.46074	-0.33164	2.8	06/13/16	0.802777778	http://maps.google.com/maps?f=q&q=51.46074,-0.33164&z=16
51.46056	-0.33157	0.1	06/13/16	0.802777778	http://maps.google.com/maps?f=q&q=51.46056,-0.33157&z=16
51.46045	-0.33215	34.2	06/13/16	0.802777778	http://maps.google.com/maps?f=q&q=51.46045,-0.33215&z=16
51.45987	-0.33738	46.9	06/13/16	0.803472222	http://maps.google.com/maps?f=q&q=51.45987,-0.33738&z=16
51.45867	-0.33921	18.7	06/13/16	0.803472222	http://maps.google.com/maps?f=q&q=51.45867,-0.33921&z=16
51.45878	-0.3399	1	06/13/16	0.804166667	http://maps.google.com/maps?f=q&q=51.45878,-0.33990&z=16
51.4588	-0.33977	0.7	06/13/16	0.804166667	http://maps.google.com/maps?f=q&q=51.45880,-0.33977&z=16
51.45878	-0.33978	1.4	06/13/16	0.804861111	http://maps.google.com/maps?f=q&q=51.45878,-0.33978&z=16
51.45879	-0.33982	0.4	06/13/16	0.804861111	http://maps.google.com/maps?f=q&q=51.45879,-0.33982&z=16
51.45872	-0.3398	0.2	06/13/16	0.805555556	http://maps.google.com/maps?f=q&q=51.45872,-0.33980&z=16
51.45869	-0.33979	0.1	06/13/16	0.805555556	http://maps.google.com/maps?f=q&q=51.45869,-0.33979&z=16
51.45872	-0.33981	1.2	06/13/16	0.80625	http://maps.google.com/maps?f=q&q=51.45872,-0.33981&z=16
51.45874	-0.33984	0.4	06/13/16	0.80625	http://maps.google.com/maps?f=q&q=51.45874,-0.33984&z=16

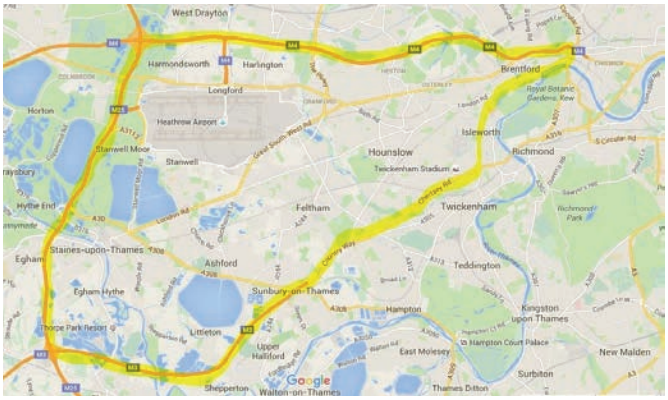
GPS DATA IN XCEL

Using the data from SQL Server, it is possible to make data analysis and comparison with other relevant data.

VEHICLE ROAD MAPS

The map shows the route of the vehicle (Isleworth, Twickenham, Sunbury-on-Thames, Egham, Stanwell

Moor, around airports Heathrow, Brentford, Isleworth). The road tags on these routes are: A310, A316, A317, M3, M25, M4, A315, A310.



Map 1: The map with route of the vehicle

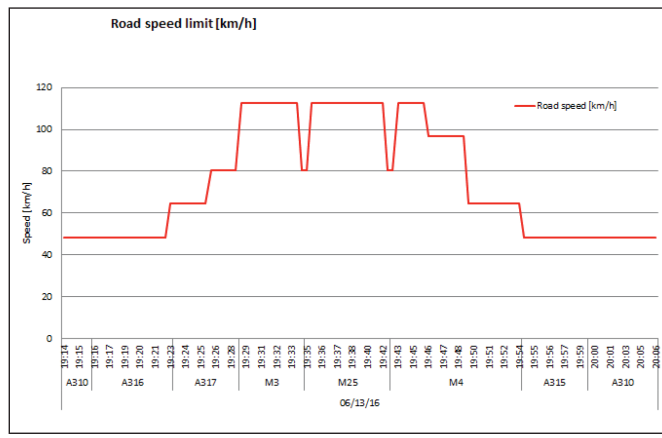
This map shows the route (OpenStreetMapCITATION htt7 \l 2057 [4] [4]) of the same vehicle with the vehicle speed limit. On the map there are different colors representing speeds that are allowed on these routes. For example, black color shows the speed limit on the highway is 110 km / h (70 m / h). The permitted speed of the vehicle in the country is used for comparison with the real speed of the vehicle and on this basis can be determined vehicle speeding at the time. These data could be dowloaded from OpenStreetMap CITATION htt7 \l 2057 [4][4]forthe entire country and uploaded to SQL Server. There is other possibility of determining the permissible speed of the vehicle based on the LAT - Latitude and Londa – Longitude.

Map 2. The route of the same vehicle with the vehicle speed limit

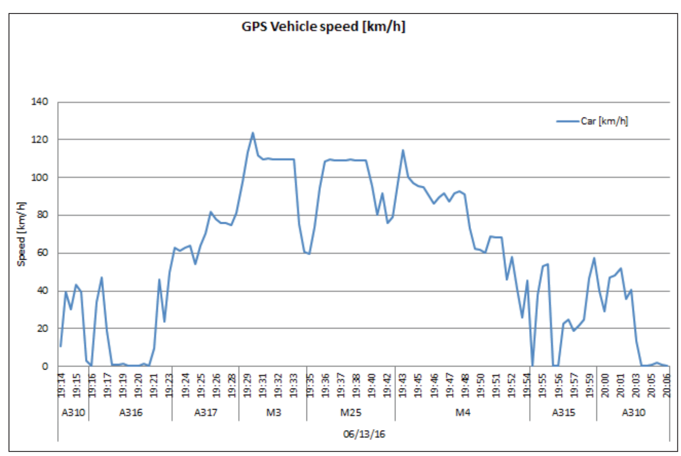
Key 1. Speed limit in [m/h] and [km/h]

GRAPHS & DIAGRAMS

Graph 1 shows the speed of the vehicle during the period of driving the vehicle. The diagram shows the time intervals to drive on certain categories of times. As an example, the vehicle was on the highway M25 in the period between 19:35 and 19:42 and driving from one to another highway is shown and the speed limit reduces from 110 km / h to 80 km / h. This diagram is presenting a reference for determining whether the vehicle was in the permitted speed limit. This parameter is essential for the insurance company to determine the behavior of drivers in driving on the basis of which it may determine an increase or decrease in the premium of the insurance policy in the next year.



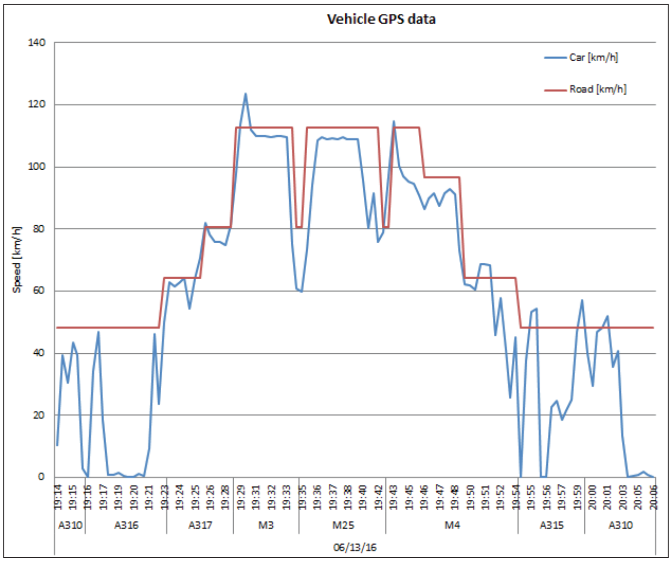
Graf. 1. The speed limit on the road in the test drive period



Graf. 2. The speed of vehicles in the test drive period

Graph 2 shows the real speed of the test vehicle in the time period and position of vehicles on the road.

Graph 2 shows permeted speed limit of the vehicle (in red) and the real speed of the test vehicle (blue). This graph shows that the driver speed limit is several times in certain intervals.



Graf. 3. Permeted speed and the real speed of the test vehicle

ANALYSIS OF DATA

From the data collected it is now posible extract data speeds of vehicles that exceed the speed limit of vehicles at a particular possition on the road.

Table 1 shows the speeds limit exceeding in the time and the particular vehicle position on the road. From this table it is possible to determine the vehicle speed which was exceeded in the time period, the percentage of speeding and other important data for analysis. If set percentages that represent the limit speed for example up to 10% the data from table shows that the overspeed occurred in two time intervals 19:55 and 19:59. Other important parameters are how the driver drives the vehicle in the period (year), where the vehicle is parked, how often breaking the vehicle etc.

Time	Car speed	Speed limit	Road	%
19:26	71	64	A317	8.82
19:26	82	80	A317	1.75
19:28	81	80	A317	1.15
19:29	114	113	M3	0.75
19:30	124	113	M3	8.78
19:43	115	113	M4	1.70
19:51	69	64	M4	6.16
19:51	69	64	M4	6.02
19:51	68	64	M4	5.61
19:55	53	48	A315	9.42
19:55	54	48	A315	11.09
19:59	57	48	A315	15.59
20:01	52	48	A310	7.33

Table 3. Speeding vehicles in a certain period of time

ALGORITHM

Using data analysis is possible to determine the pattern of driver's behavior on the road and hence use algorithm that directly affect the increase or decrease in the price policies in the coming insurance driver year.There are many companies around with data analytics expertise who is using latest big data analytics technology like Hubio Dynamic Data Warehouse CITATION Dat17 \l 4122 [2] [2]. They analyse data from a wide range of different data sources, including databases, sensors, smartphones and social media.

Input parameters used in analytics technology:

1. The road number
2. Vehicle position
3. The time of vehicles movement
4. Vehicle speed
5. Exceeding the speed limit of vehicles
6. G-force (braking sharply and rapidly changing direction and reversible driving)

CONCLUSION

Using telematics with GPS tracker and smartphone is good example where the Information and telecommunication technology enables new applications for intelligent transportation systems. This technology has the capability to improve existing business models in the insurance industry. This researchdiscussed the technical challenges and highlighted the main obstacles for successful applications in terms of information quality, integrity and availability. This paper has discussed of how to measure driver behavior and how to present a scoring procedure, described the risk profile base on parameters as road number, vehicle position, time of vehicles movement, vehicle speed, exceeding the speed limit of vehicles etc.In this research is highlight and discuss the challenge involvedtransferring data (sms message) from the communication devices such as GPS tracker to smartphone what showing that is possible use cheap and available equipment of low cost to gather telematics data and successfully use in insurance industry.

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