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Reducing Misuse of Data in Motion through Surveillance of Logs

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Abstract

This paper explores the reducing misuse of data in motion through surveillance of logs in Uganda. Using a descriptive cross-sectional research design, this study sampled 184 participants comprised of car trackers experts and owners/ drivers of cars with tracking systems and collected data using structured questionnaires. Various analyses and tests including correlation and regression were conducted.

The findings revealed that H1a, H1b and H1C are accepted with respect to surveillance of logs and reducing misuse of data in motion. Conversely, surveillance of log techniques was observed to explains around 64.4% of the variations, leaving the remaining 35.4% be explained by others, e.g., internet tracking, cell phone triangulation, satellite tracking etc.

However, a critical look at the explanatory potential of each variable (the standardized Beta co-efficient), revealed that surveillance of logs techniques predicts reducing misuse of data in motion negatively. The researcher recommends undertaking mediation and interaction effects amongst variables and well as establishing the longitudinal results of the relationship between study variables.

Background and Contextual

World-over, location–tracking technologies are an essential part of today's business environment, with different types of tracking technology performing crucial function in many companies' business processes (Jung., Kim & Hwang, 2018). For example, fieldwork relies on real-time asset tracking technology to track inventory across a wide area. Modern CCTV, drones, and dashboard cameras provide diverse metadata including Global Positioning System (GPS) as well as time stamping. GPS has been fully accepted in USA in 2000s where capabilities of GPS technology were installed into commercial vehicles. In addition, plate number and moving direction can be easily detected from the captured images using popular image processing or machine learning techniques.

In the past decades, with the increasing of vehicles in developed countries like US, traffic management is facing an accumulation of ever-growing pressure; more and more intelligent surveillance systems employing computer vision and pattern recognition techniques have appeared (Tomer, 2017). Intelligent surveillance system can provide intelligent video analysis, such as the cases of jumping the red light or illegally turning around, so as to improve the efficiency of traffic management. GPS technology boasts sophisticated monitoring capabilities, and helpful analytics to extend vehicle's longevity and improve safety as well as driver whereabouts, and vital diagnostics such as critical feedback on fuel consumption, oil, tire pressure and other concerns.

In Africa, with the rapid advancement of IT technology, a number of logs surveillance devices have entered a wide use for surveillance and security purposes in daily life. Recently, many countries in Sub-Saharan Africa have emphasized installation of dashboard camera, car DVR or car black box, that is one or a pair of onboard cameras that continuously record (loop recording) the view through the windscreen (Tomer, 2017).

In recent years, with the rapid development of video surveillance infrastructure, more and more intelligent surveillance systems have employed computer vision and pattern recognition techniques. Dashboard cameras can provide video evidence in the event of the road accident or vandalism (Abaho, 2017). For this reason, numerous cars are now equipped with dashboard cameras and, in a number of countries, dashboard cameras are mandatory on public transport, such as buses and taxis. License plate number is also a unique sign of the vehicle, so license plate recognition is an important part of vehicle recognition in modern intelligent surveillance systems (Abaho, 2017). Car tracking based on surveillance videos suffers from poor quality and significant installation costs limiting its applicability.

According to the Uganda Vision 2040 which was approved in 2007 by the cabinet; "A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years" However, much as "Uganda Vision 2040" provides development paths and strategies to operationalize the vision statement, it is clearly still being challenged by lackluster advances in the technology and transportation sectors. Moreover, the current solutions that have been proposed by the government still face major challenges. For example, the intrusive application of surveillance of logs harms the right to privacy of Ugandans. This contravenes with the rule of law where privacy is a fundamental

right enshrined in the 1995 Constitution and numerous international human rights treaties and other legal instruments. The right to privacy is also a central pillar of a well-functioning democracy (Mukasa, 2021). But in the quest to surveil its population, the Ugandan government and individual partners or organizations has either underplayed or ignored the violation of human rights.

And that is not all, in 2018, the Ugandan government contracted the Chinese firm Huawei to install CCTV cameras in all major cities and on all highways, spending over $126million USD on these cameras and related facial recognition technology (Mukasa, 2021). In the absence of any judicial oversight, there are also concerns about backdoor access to this system for illegal facial recognition surveillance on potential targets and the use of this system to stifle all opposition to the regime (Mukasa, 2021); where Huawei technicians assists the Ugandan government to spy on political opponents, and this is taking place in a wider context of attacks on human rights defenders. Although, such logs surveillance systems have proven to be very useful, they are usually deployed as an isolated application only under restricted and particular environment settings. GPS controllers always have access to the car driver movements without his/her consent or notification which eventually interfere with one's privacy and security (Katushabe, 2021). In view of this inconclusive information, it was from such information gap that the researcher's felt a need to find out relationship and prediction potential of surveillance of logs and reducing misuse of data in motion in Uganda.

Problem Statement

GPS tracking arms vehicles with advanced and effective theft protection, and could possibly help law enforcement identify and apprehend alleged perpetrators (Abaho, 2017). GPS technology boasts sophisticated monitoring capabilities, and helpful analytics to extend your vehicle's longevity and improve safety. This includes vehicle/driver whereabouts, and vital diagnostics, such as critical feedback on fuel consumption, oil, tire pressure and other concerns (Mukasa, 2021). The problem is that, even with presence of surveillance of logs, the privacy and guaranteeing of security to car owners, occupants, drivers and assets have not been granted henceforth undermining human rights. Consequently, this research sought to study the relationship and prediction potential of surveillance of logs and reducing misuse of data in motion in Uganda.

Objectives

The following objectives guided this study:

1. To examine the relationship between surveillance of logs techniques (Advanced GPS, cell phone triangulation and internet frequency identification) and reducing misuse of data in motion in Uganda.
2. To find out whether surveillance of logs techniques predicts company's reducing misuse of data in motion in Uganda.

Literature Review

Intelligent Transportation Systems (ITS) and Connected Vehicles

An intelligent transportation system is an emerging transportation system which is comprised of advanced telecommunications and information network for users, roads and vehicles. It integrates the application of advanced technologies using electronics, computers and advanced sensors (Abaho, 2017). It includes technologies such as dedicated short-range communications (DSRC), Continuous Air Interface long and medium range (CALM), sensing technologies like pavement loops and pressure pads and also an inductive loop detection technology. These applications provide travelers with important information while improving the safety and efficiency of the transport system.

Since its inception, the background situations promoting ITS include the need to:

- Curb recurrent vices/problems along the road,
- Activate the economy,
- Reach an advanced information and tele-communication society,
- Coordinate different transport modes, among others.

The significant breakthrough of ITS lies in its ability to solve road transport problems, while also creating new industries and spearheading a new era in advanced information and telecommunications (Jung., Kim & Hwang, 2018). ITS systems offer various applications like emergency vehicle notification systems, automatic road enforcement, traveler information service, collision avoidance systems-reducing crashes, fatalities and injuries thereby improving public health and improve efficiency, reliability and mobility; and reduction in fuel consumption and greenhouse gas emissions.

Vehicle GPS Tracking

GPS tracking was originally developed for commercial vehicle fleet management, and has since become common among personal vehicles. Satellites measure geo positioning data to pinpoint real-time locations. Such diagnostics can be stored and accessed via mobile devices with the Alarm.com app. GPS tracking devices can identify vehicle location as well as other diagnostics and safety data. It can also determine whether the car has been moved or tampered with (Mukasa, 2021). Additionally, when synced with mobile devices, GPS tracking provides vital, real-time data such as location, emissions, mileage and speed. This includes maintenance diagnostics and history of oil changes, fuel consumption, battery life, and more. Vehicle and equipment are some of the most valuable assets of any organization (Jung., Kim & Hwang, 2018). Therefore, it should come as no surprise theft recovery is one of the top benefits of GPS tracking. Get instant alerts when a vehicle is operating outside its designated location or hours of operation. If a vehicle is stolen, location tracking can help authorities recover the asset, reducing expensive replacement and insurance costs.

Internet Tracking

Internet tracking has a very specific application. It is most commonly used to track and recover stolen laptops and other computing devices, and now-days in computerized cars. This tracking technology is integrated into the device's BIOS and can be activated by accessing these settings on

the BIOS menu (Qingwu., Haisu., Yan & Guanying, 2015). When the feature is active, the device shall then be capable of sending location data to central servers in the form of an IP address or wireless data that can be used for triangulation to help recover the lost or stolen car.

Cellphone Triangulation

Cell phone triangulation is a tracking method that is similar to GPS tracking in many ways. It is built upon the concept that the authorities or service providers can track the location of your device even when it doesn't have GPS or other forms of tracking capabilities. In this case, service providers rely on your mobile phone's signal and analyze the signal strength of the source tower, with the assumption that the tower giving off the strongest signal is closest to your location. They can then estimate one's location sing this data (Jung., Kim & Hwang, 2018). Although, it may not be as effective as GPS or other technologies, it can be helpful when no other forms of tracking are available and in areas where cell towers are far apart, and signals are relatively weak.

Therefore, from the above definitional rhetoric, there seems to be an indication that some appears to be traces of surveillance of logs techniques relating with reducing misuse of data in motion. I thus pose a hypothesis that:

H1: Surveillance of logs techniques (advanced GPS, cell phone triangulation and internet frequency identification) are positively and significantly correlated with reducing misuse of data in motion.

H1a: There is a significant and positive relationship between advanced Global Positioning Systems and reducing misuse of data in motion.

H1b: There is a significant and positive relationship between cell phone triangulation and reducing misuse of data in motion.

H1c: There is a significant and positive relationship between internet frequency identification and reducing misuse of data in motion.

Surveillance of Logs and Reducing Misuse of Data in Motion

GPS is a navigation system that uses signals from satellites to determine the location of a receiver. GPS satellites constantly send out a signal that contains the position and the exact time. A GPS receiver captures the signal from at least four satellites. It determines its own coordinates by taking into account the time it took to receive the signal. The receiver's location can then be shown on a moving map display or sent to some other system e.g. vehicle guidance system (Mukasa, 2021). GPS can build into dedicated devices for example, independent navigation systems, but they are often also integrated into cars, phones and watches.

From the above review, I present the second research hypothesis as follows:

H2: Surveillance of logs positively and significantly predicts reducing misuse of data in motion.

Methodology

According to Cohen (2011), research design can be defined as a general plan that gives an outline on how data was collected and data analysis procedures. The study used a descriptive cross-sectional research design. It also employed descriptive statistics due to the need of making inferences about possible relationships between variables.

The study used a mixed method of research approach (triangulation) that employed both qualitative and quantitative methods. The target population included; car trackers experts and owners/drivers of cars with tracking system, all equivalent to 184 respondents, and these were selected basing on Morgan and Krejcie (1970) table.

Simple random sampling was used in selection of respondents. Questionnaires were used in data collection. Data was majorly analyzed quantitatively.

Results

The findings of the survey are presented thematically below.

Response Rate

The sub section presents the summary of the statistics for the response rates. Details are presented in Table 1 below.

Table 1: Summary of study response rates

Category	**Targeted respondents**	**No. actually involved**	**Percentage of response rate**
Questionnaire			
Car trackers experts	50	44	88%
Owners/drivers of cars with tracking system	150	140	97.2%
Sub Total	**200**	**184**	**96%**

Source: Primary data, 2023

As presented in the table 1 above, a total number of 200 questionnaires were distributed to the targeted respondents to participate in the study, but 184 questionnaires were picked and fully completed; and these were the respondents actually participated to make a response rate of 96%. This response rate is above the 70% response rate as recommended by the Guttmacher Institute (2006) for a study to be considered as one with satisfactory results.

Duration of Using Tracking System

Table 4: The periods have been using tracking system

Period	Frequency	Percent
Less than 3yrs	19	10.4
4 – 6yrs	35	18.2
7 – 10yrs	73	38.5
11yrs & above	57	32.8
Total	**184**	**100.0**

Source: Primary data

Results from above show that majority of the respondents 38.5% have been using tracking system for a period between 7-10 years, 32.8% of respondents have been using tracking system for 11 years and above, 18.2% of the respondents have been using tracking system for 4-6 years and finally 10.4% of the respondents have been using tracking system for less than 3 years.

Testing Research Hypothesis

From the correlation matrix below (Table 5), a statistically significant and positive correlation between Advanced Global Positioning System and reducing misuse of data in motion ($r = .916$, $P<0.01$) was found, thus accepting H1 and rejecting its null hypothesis. That is, there is sufficient evidence at 99 percent level of significance ($P<0.01$) to accept H1.

However, this hypothesis had three sub hypotheses (H1a, H1b, and H1c) and responding them required finding the relationship between the independent variables (advanced GPS, cell phone triangulation and internet frequency identification) and dependent variables (reducing misuse of data in motion). Henceforth, a bi-variate zero order correlation in Table 5 aided in establishing the relationship between the variables using a Pearson Correlation. Correlation analysis was useful in establishing the relationship between Advanced Global Positioning System (Advanced Global Positioning System are small, effective and portable devices that allow a car to monitor and locate their car when needed. They also have the potential to offer instant location, speed and direction of data) and misuse of data in motion.

Table 5: Correlations Analysis results

Study Variables	(1)	(2)	(3)	(4)	(5)
Advanced Global Positioning System (1)	1				
Cellphone triangulation (2)	.852**	1			

Internet frequency identification (3)	.969**	.879*	1		
Misuse of data in motion (4)	.992**	.845*	.962*	1	
Advanced Global Positioning System (5)	.969**	.879*	1.000**	.962*	1
***Correlation is significant at the 0.01 level (2-tailed).*					

Source: Primary data

H1a: Relationship between Advanced GPS and misuse of data on motion

Findings from Table 5 (correlation matrix), show a significant positive relationship between Advanced Global Positioning System and misuse of data in motion as shown by the correlation coefficient (r = .969, P<.01). This means that increase in surveillance of longs brings about a 0.969 increase in '*proper usage of data on motion.*' therefore an improvement in the surveillance of logs is positively associated with the reduction on the misuse of data. We hereafter accept H1a. However, these findings don't robotically imply that a decline in surveillance of logs is associated with the same magnitude of decrease in misuse of data in motion.

Relationship between free samples and customer loyalty

Correlation results in Table 5 further show a significant positive relationship between cell phone triangulation and reducing misuse of data in motion (r = .852, p<.01). In essence, this means that a unit improvement in cell phone triangulation is associated with a 0.852 reduction in misuse of data in motion, hence, we accept H1b

H1c: Relationship between internet frequency identification and reducing misuse of data in motion

Results in Table 5 statistically show that a significant and positive relationship between internet frequency identification and reducing misuse of data in motion (r = .962, p<.01). This means that reduction in misuse of data in motion is positively associated with internet frequency identification. That implies that well-managed internet frequency identification brings about a positive of 0.853 units. Henceforth, we accept H1c.

H2: Surveillance of logs positively and significantly predicts reduction in misuse of data in motion

Answering hypothesis two (H2) required running "*Regression Analysis*" as this might help in establishing the degree to which the alteration in reducing misuse of data in motion is predicted by surveillance of logs. Therefore, multiple regression analysis was done. The analysis aided in establishing the significance of the variation and contribution of each of the independent variables making up surveillance of longs (*that is,* Advanced GPS, cell phone triangulation and internet frequency identification), on reducing misuse of data in motion (notifications, and monthly logs). The results that were obtained are shown in table below:

Table 6: Regressions summary for Testing Hypothesis H2

Coefficients[a]

Model		*Unstandardized Coefficients*		*Standardized Coefficients*	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.007	.009		.763	.446
	Advanced GPS	.997	.026	.992	38.666	.000
	Cellphone triangulation	-8.141E-15	.015	.000	.000	1.000
	Internet frequency identification	-4.530E-14	.029	.000	.000	1.000

R = .992; R Square = .985; Adjusted R Square = .985; F statistics = 8213.542; Sig. (F statistics)= .000

Dependent Variable: Companies having a good policy on surveillance of logs

Source: Primary data

The multiple linear regression model in *Table 6* above was produced to determine the extent to which surveillance of logs predicts reduction in misuse of data in motion. Regression results show that the recipe of Advanced Global Positioning Systems, cell phone triangulation and internet frequency identification (all being dimensions of surveillance of logs) positively and significantly (P<0.000) predicted up to 64.6% (Adjusted R square .985) of the variance in the reducing misuse of data in motion. This means that 35.4% of the variance in reduction in misuse of data in motion is clarified by other factors outside model 1 as stated in Table 6. Furthermore, when Advanced Global Positioning Systems, cell phone triangulation and internet frequency identification are looked at as independent variables, the findings show that the impact of 'advanced GPS' was the most significant predictor of reducing misuse of data in motion (Beta .992, P<.05), this implies that a positive change in Advanced Global Positioning Systems leads to a 0.992 change in 'reducing misuse of data in motion.' In addition, 'cell phone triangulation negatively and significantly predicts reducing misuse of data in motion (Beta = .000, P<.05). This means that a negative change in cell phone identification leads to a 0.000 change in 'reducing misuse of data in motion.' Additionally, 'internet frequency identification negatively and significantly predicts reduction in misuse of data in motion (Beta = 0.000, P<.05). This therefore means a unit positive change in internet frequency identification leads to a 0.000 change in reducing misused of data in motion. These results therefore indicated that the overall model was well specified (F = 8213.542, P<.01). The Significance of this F-ratio means that the overall outcomes in 'Model 1' are reliable. Henceforth, from these regression results, we can see that isolated and aggregated. Surveillance of logs dimensions impact positively on usage of data in motion as emphasized by Jung., Kim & Hwang (2018). Also, the 'Adjusted R

Square' gives an impression that all the surveillance of logs dimensions are positively and significantly predicts 64.6% % of reducing misuse of data in motion.

Conclusions and Recommendations

Conclusions

Surveillance of logs techniques are positively and significantly correlated with reducing misuse of data in motion: Findings revealed that H1a, H1b and H1c are accepted with respect to surveillance of logs techniques and reducing misuse of data in motion. That is H1a (There is a significant and positive relationship between cell phone triangulation and reducing misuse of data in motion as shown by the correlation coefficient ($r = .969$, $P<.01$); and H1b (There is a significant and positive relationship between internet frequency identification and reducing misuse of data in motion ($r = .852$, $p<.01$), and H1c (There is a significant and positive relationship between advanced GPS and reducing misuse of data in motion ($r = .962$, $p<.01$), all accepted. Therefore, surveillance of logs techniques is an effective tool used by individuals, companies or organizations in monitoring of their cars' movements.

Surveillance of logs techniques positively and significantly predicts reducing misuse of data in motion: Surveillance of logs techniques was observed to explains around 64.4% of the variations in reducing misuse of data in motion, leaving the remaining 35.4% be explained by others, e.g. cellphone triangulation, internet tracking, radio frequency identification, satellite tracking etc. However, a critical look at the explanatory potential of each variable (the standardized Beta co-efficient), revealed that surveillance of logs techniques predict reducing misuse of data in motion negatively.

Recommendations

The study recommended that the government of Uganda should legislate or formulate institutional and legal framework that governs the proper use of tracking systems in motion to ensure privacy and human rights of the car owners and drivers.

Lastly, the study recommended that further research is therefore needed in areas such 'Application of Surveillance Notification of Logs on the Reduction of Data Misuse in Motion in Uganda'.

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