

Towards a Framework for Adopting Thermal Imaging Systems for Counter-Terrorism in North Eastern Nigeria

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ABSTRACT

The issue of national security in North-east Nigeria has been making headlines over the past decade. The region has been terrorized by the Boko-Haram sect since 2009, making Nigerians worry because of the havoc caused by the terror group. Many efforts have been put in place by the government in order to tackle the terror caused by the group. The use of military, civil and international help among others have been implemented in this cause. Even though the problem has been mitigated drastically over the years, there are still terror elements of Boko-Haram in the region. Technology has equally played a critical role in this battle; both for and against Boko-Haram. It is left for the Nigerian government to invest in technology and use the necessary funds, ideas and manpower at their disposal in this battle. This paper proposes the adoption of the thermal imaging surveillance systems and also highlight the importance of how thermal surveillance system play a role in counter-terrorism. Thus there is a need to adopt these technologies for monitoring and controlling insurgency in these region. The paper will look at this issue from an interpretivist point of view.

Keywords: Forecourt Operations Management System, Oil Marketing Companies, Software System Design

CISDI Journal Reference Format

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1. INTRODUCTION

Technology has played a major role in the war between Boko-Haram and the Nigerian military forces; being beneficial to both parties. With the involvement of technology used by the Boko-Haram forces (i.e. communications, weaponry etc.), it is very challenging for the military to tackle every single mishap caused by the terror group. The military however, did a wonderful job in restraining the enemies down only to operate in the rural areas of Maiduguri and Yobe states. Looking at rate at which technology grow every day, it is only encouraging for the military to adapt to these emerging technologies for the nation's betterment. Surely Boko-Haram insurgents find a way or the other to get hold of some advanced technologies, but whatever the case might be; they are fighting against a nation which has more resources and experience to cripple their cause. Typically, there are two types of security – physical security and electronic security system (Joshua & Olu-Owolabi, 2015, as cited in Purpura, 2011). The conventional surveillance methods by which the Nigerian army have relied upon are; (1) physical security (soldiers) to observe the area either by being present physically, which can be very challenging and even unmanageable to watch a very wide area and also maintain permanent presence in distant locations (Dorn, 2007) and (2) by monitoring the closed-circuit television (CCTV) that covers the interested area.

Nevertheless, the traditional system (physical security) are prone to human error due to lapses in observation (Wong, Chew, Loo, & Lim, 2010). In fact even as a trained personnel, a person's visual concentration drops tentatively below an acceptable level when tasked with visual monitoring (Hampapur et al., 2005).

1.1 Thermal Imaging Camera

Thermal imaging cameras are devices that can be used to produce images that depicts things by using their heat temperature instead of their physical nature. The camera formulates a heat image by using infrared light properties. Thermal imagers can be used as tools to arrest many security challenges in many ways. Bisbee and Pritchard (1997) stated that the technology is mostly associated with the protection of assets that are of high significance. E.g. military cantonment and commercial facilities. Thermal imaging possess the ability to infiltrate some harsh environmental conditions such as extreme darkness, fog, smoke, snow and rain (Akula, Ghosh, & Sardana, 2011). Infrared cameras had been in existence for quite a while, mainly used in the military domain. But it recently broke extensively into industrial and civil markets.

1.2 Forward Looking Infrared (FLIR)

Forward looking infrared (FLIR) made headlines because unlike other thermal imagers, it is not influenced by light conditions and object surface features (Sanna & Lamberti, 2014). FLIR is an advanced type of thermal imaging. However, tracking and detection in FLIR cameras are complicated by other factors. Images captured are normally considered to be of poor contrast and low resolution ratio.

1.3 Unattended Ground Sensor

Stationary and mobile solutions combining thermal cameras, radars and other sensors.

1.4 Problem Statement

The importance of using thermal imaging as a surveillance system has long been recognized by several military forces in advanced countries. However, the Nigerian army are yet to embrace this innovation. The use of physical presence and CCTV cameras are the methods of surveillance used by the Nigerian army. These methods are still not reliable enough to foresee potential attacks on army bases in remote locations. Firstly, when attacks are not sensed in due time, subsequent casualties are suffered inevitably. Terrorist sects are becoming more and more inventive in their methods of terrorism. Secondly, the conventional methods – physical and CCTV can be tricked in terms of camouflaging. On the other hand, although a thermal camera cannot show a clear and visible image, hence no amount of camouflage can trick a thermal system.

In summary, there is a need to understand the effectiveness of thermal imaging as a method of surveillance in the north east to ensure pro-activeness in responding to ambushes. More specifically, this paper seeks answers to the following questions:

1. What are the necessary steps to adopt thermal imaging systems to be used in counter-terrorism in the north east?
2. How does thermal imaging surveillance help in eliminating potential threats to army formations?

2. LITERATURE REVIEW

What follows is a tabulated presentation of related literature

Table 1: Literature in Perspective

Paper	Focus	Theory	Research Method	Gap Identified
Lele (2011)	Virtual reality and its military utility		Qualitative	Paper presents an assessment about the relevance of VR for the militaries.
Akula, Ghosh & Sardana (2011)	Thermal Imaging And Its Application In Defence Systems		Quantitative	The paper describes an algorithm for detection of moving targets in thermal imagery.
Naz, Marty, Hengy & Miller (2009)	Acoustic Detection and Localization of Weapons Fire via Unattended Ground Sensors and Aerostat-borne Sensors		Quantitative	Purpose of the field test was the assessment of acoustic sensors for the detection and localization of weapon fire events
Stone, Keller, Popescu & Spain (2011)	Buried explosive hazard detection using forward-looking long-wave infrared imagery.		Quantitative	
Joshua, Olu-Owolabi (2015)	Governance and Security Management in Nigeria: Need for ESecurity Approach	Rational choice theory	Qualitative	The chapter suggests that, since equipment advocated for in the fight against insecurity are electronic gadgets that must be powered by energy, there is need to explore the option of solar energy to keep the gadgets functional in view of epileptic power supply in the country post-deployment.
Oghorodi (2014)	Deployment of Information and Communication Technology Tools as a Means of Combating National Insecurity in Nigeria		Qualitative	The paper then proffers functional ICT education security personnel, use of closed circuits television camera for surveillance of public places, creation and use of national identity database management system, use of facial recognition technology, use of lawful interception of information of suspected person, and protection of communication networks with firewall as for solutions to the insecurity situation precipitated by unemployment in the country.
Bisbee and Pritchard (1997)	Today's Thermal Imaging Systems: Background and Applications for Civilian Law Enforcement and Military Force Protection		Qualitative	This paper discusses recent advances in thermal imaging technology including uncooled and cryo- cooled. Applications of Forward Looking InfraRed (FLIR) systems are also discussed, including integration with a high-speed pad tilt mount and remote control, video frame storage and recall, low- cost vehicle-mounted systems, and hand-held devices

Paper	Focus	Theory	Research Method	Gap Identified
Ogedebe and Jacob (2012)	The Role Of Information Technology In Combating Security Challenges In Nigeria		Qualitative	This paper addresses the role of IT in combating security challenges in Nigeria. It proposes adequate modern intelligence gathering devices must be acquired and deployed by security services, like the police, the SSS, the Army, the Navy, the Air Force and other Para – military. The use of Emergency Communication Systems, GPS-enabled devices, Social Networking Tools, emergency-operation centers (EOCs), Intelligent Monitoring systems, Data Mining and Database Tracking systems and Information Sharing will greatly improve the ability of the security agencies to combat security challenges in Nigeria.

With the fast changing and dynamic world of IT, it is believed that IT will strengthen Nigeria’s national security against future attacks. The telecommunication industry, worldwide web, new technological advancements all seem to be highly valuable in terms of national security. Ogedebe and Jacob (2012) explained with the help of IT, security agencies would be able to detect potential threats, share credible information, implement materials to protect the nation and develop response proficiencies. They further highlighted that for national security services to address security issues adequately, three research areas are needed to be focused on. – Security (authentication, availability, containment, detection and identification, privacy and new security models); Information fusion (includes research data, data integration, language technologie, image and video processing); Critical infrastructure-based. Over the years, closed-circuit television (CCTV) has been a method of surveillance by the military, banks, organizations, stores and various areas in which security is needed. Joshua and Olu-Owolabi (2015) mentioned that CCTV, anomaly detection systems for unusual patterns, can be installed for surveillance all over state capitals across the country for observing illegal activities. There should be a CCTV controlling and monitoring wing positioned under the office of the National Security Adviser to the president of Nigeria in which these cameras could be operated through the unit (Ogedebe, Dasuki & Makinde, 2014). In regards to thermal imaging surveillance system in the military, this method can also be implemented and monitored in operational headquarters.

Surveillance is not only limited to CCTV and human presence. It can also be done through telecommunication. It became very clear to the government that insurgents use mobile communication to share information. This made the Nigerian government to come up with the idea of mandatory registration for every phone user across the country. This will aid security agencies to work closely with service providers to track and listen to potential wrongdoers by listening to phone conversation (Joshua & Olu-Owolabi, 2015). Several types of thermal imaging technologies for surveillance have been studied and implemented over the decade. Some of the technologies are still in research labs and yet to be fielded. Akula, Ghosh and Sardana (2011) highlighted that thermal imaging systems is a boon to military forces because of its resistance to all weather conditions and its day and night working capabilities. They mentioned that thermal imaging has the ability to capture infrared heat discharged by any object above absolute zero temperature. This further explained that some level of thermal energy is emitted from living things, materials and objects. Their work explained that thermal imaging systems are capable of look over broad areas and works well when mounted on aircrafts and satellite devices.

3. RESEARCH DIRECTIONS

3.1 Research Gaps

Boko-haram insurgents in one way or another find ways to ambush military formations and personnel around the bushes of north east Nigeria. These series of attacks put soldiers and other para-militaries around the region of whom are also involved in the fight in chaos. There have been various suggestions and strategies used to counter insurgents around isolated military formations in that region, but all seem to be of minimal gain. As said by scholars; Information is key. This paper will look to provide an alternate solution to the ambushes on isolated military formations by adopting an unattended ground sensor to help with surveillance in areas prone to attack. This research demonstrates that ambushes by insurgents should be minimized to a certain amount with the help of thermal imaging surveillance. The system would give a competitive edge over the attackers by providing credible intel on intruders.

3.2 Research Aims

The aim of this research is to propose another method of surveillance technique to be used by the Nigerian military in the North-east. This paper looks to recommend the use of thermal imaging as an additional surveillance method to be used by the Nigerian military in the fight against insurgency.

3.3 Research Objectives

The objectives of this paper will analyze how two surveillance technologies can be introduced into the Nigerian army in order to help with counter-terrorism in red zones in the North-east. These are

1. Forward-Looking infrared (FLIR)
2. Unattended Ground Sensor (UGS)

4. RESEARCH FRAMEWORKS

4.1 Theoretical Underpinnings

Different studies have explained the three philosophical assumptions (school of thoughts) that exist in IS. Namely;

1. Positivism:
2. Interpretivism
3. Critical Realism.

Looking at the three philosophical assumptions, this research will be an inductive research and will go by an interpretivist perception. This perceptions is being driven by an individual's social construct. Merton (1995) explained that this phenomenon could be traced back to the thoughts of ancient Greek stoic philosopher and sociologist Epictetus. Epictetus mentioned that, "it is not actions that alarms or disturbs man, but it is their opinions and fancies about actions". Ever since, this idea has been persistent by philosophers in understanding and interpreting the social world (Chowdhury, 2014). Interpretivism by definition is the approach in which emphasizes the meaningful nature of people's involvement and personality in both their social and cultural life (Elster, 2007; Walsham, 1995). It represents the methods of research in the position to which goes with people's awareness of reality as social constructions by human actors (Eliaeson, 2002). This automatically defies the methods and rule of natural science. Interpretivists look for meanings behind an individuals' actions.

Nigerian army only approves new technologies only if the innovation proves its credibility and endurance in their working environment. This school of thought would be perfect in understanding why they have this attitude towards technology. Interpretivism promotes the value of qualitative data. This research paradigm is concerned with the outstanding nature of a particular situation (Chowdhury, 2014).

4.2 Theoretical Framework

4.2.1 Unified Theory of Adoption and Use of Technology (UTAUT)

Although there are several models of technological innovation adoption consisting new ideas as the concept of innovation, it has become a prerequisite for organizations to incorporate computer-based information technologies. This idea grew gradually into its own division of adoption research. The fast changing nature of technologies means that organizations, institutions, educational centers etc. are encouraged to implement different approaches to ensure stakeholder awareness on the use of new and existing technological innovation. A study by Venkatesh (2003) examined eight of the most applied theoretical frameworks used to understand what makes individuals adopt the use of a particular technology. Each of the framework models had their unique characteristics. The more relevant ones amongst them were summed up to form a unified model for understanding technology acceptance.

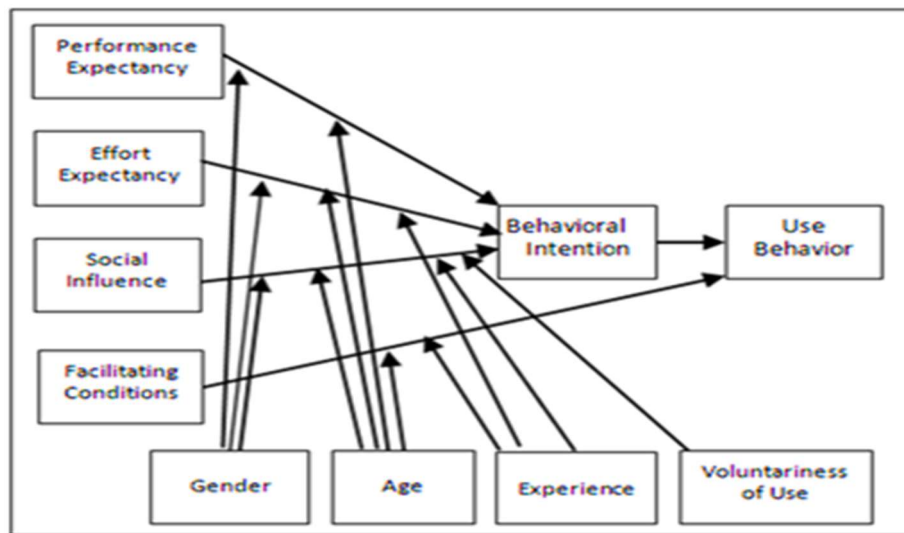


Fig. 1: The UTAUT Model
 Source: Venkatesh et al, 2003

The UTAUT model consists of two primary characteristics; Key Determinants and Moderators

Key determinants;

Performance Expectancy: This is the degree to which users believe that using the system will help them to retain gains in job performance. It measures things like;

- a. Improvement through the use of system.
- b. Enhancement of productivity.
- c. Positive impacts on performance.
- d. Usefulness for company and employees.

Effort Expectancy: This is the degree of ease associated with the use of the system. It measures things like;

- a. Ease of use.
- b. Stress free interaction.
- c. Importance of use.

Social Influence: The degree to which an individual perceives others believe he/she should use the new system. It measures things like;

- a. Usefulness for coworkers.
- b. Use by coworkers.
- c. Encouragement by managers.

Facilitating Conditions: This is the degree to which an individual believes that an organizational and tactical infrastructure exist to support the use of the system. It measures things like;

- a. Availability of the system.
- b. Knowledge to operate the system.
- c. Good placement within the corporate culture.

Moderators;

Gender: Measures Male and Female.

Age: Measures age by range.

Experience: Measures years of work experience.

Voluntary Use: Measures voluntary use of the system.

Behavioral Intention: This measures the intention to use the system.

Performance expectancy, effort expectancy and Social Influence directly affects the Behavioral intention, which in turn affects the use behavior. Facilitating behavior directly affects the use behavior.

Gender affects and it is affected by performance expectancy, effort expectancy and social influence. **Age** affects and it is affected by performance expectancy, effort expectancy, social influence and facilitating conditions. **Experience** affects and it is affected by effort expectancy, social influence and facilitating conditions. **Voluntary use** affects and is affected by social influence.

Technology Readiness Index

Technology readiness as explained by Parasuraman and Colby (2001) is the tendency of people to adopt and make use of new technologies for accomplishing tasks at home and at work.

CONCLUDING REMARKS

Primary data for this research will be qualitative gathered by conducting interviews. Some elements of the research will also rely on past researches. The scope of this research will consider the Nigerian army surveillance systems in the north east as the end-users of this technology. The study will be conducted within a time frame depending on responses and saturation. The study only considers the technology readiness of unattended ground sensor and forward looking infrared imaging by the Nigerian army.

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