



# **Digital Image Processing: A Viable Tool for Insecurity in Nigeria**

**Idiong, Uduak-Obong<sup>1</sup> and Adebajji, Samuel Abiodun<sup>2</sup>**

Department of Electrical/ Electronic Engineering, The Federal Polytechnic, Ilaro.

<sup>1</sup>uduak-obong.idiong@federalpolyilaro.edu.ng <sup>2</sup>samuel.adebajji@federalpolyilaro.edu.ng

## **ABSTRACT**

The issue of security is very important in any given society as it enable people to live and go about their businesses with ease without any fear of attack. Without security people's lives and properties at risk. As the world is changing in terms of technological advancement, there exist modern facilities which can help security agencies to reduce the various security threats facing our country presently. Therefore, this paper seeks to emphasize on the need of digital image processing system through the use of closed circuit television(CCTV) to tackle these security threats which ranges from common theft., arm robbery, Boko Haram banditry, insurgency and kidnapping which is turning into a daily affair in most part of the country. The paper looks at the usage of this digital processing system in some parts of the world and how it has helped to reduce crime rate in those countries and therefore see the need to use it in Nigeria. Therefore, with the continuous security threats listed above, it is therefore necessary for government to embrace the idea of digital image processing as these cameras mounted in strategic locations would be able to monitor and record every activities going on in those areas, thereby helping in no small measure to reduce the level of security attacks and other crimes in the country because without security, Nigeria cannot achieve any meaningful sustainable development.

**KEYWORDS:** Boko Haram, CCTV, Nigeria, Security.

## **1 INTRODUCTION**

Security threat is a serious issue being faced all over the world both by developed and developing countries. In the last few years Nigeria has been besieged with various security threats which has led to many lives lost and properties worth millions of Naira destroyed and also causing many to become refugees in their own country as their homes are no longer safe. Available data has shown that these security threats which has increased over time is hindering business activities and discourages both local and foreign investors, thereby stifling and retarding the socio-economic development of the country (Olabinji. O & Ese.U,2014).

Nigeria has one of the highest terrorism threat level in the world and has the second highest number of deaths from terrorist attack after Afghanistan (Statistica,2021). The spate of these attacks is so alarming as both private and government institutions has been targeted for attack, especially the security agencies of which the army and police has been greatly affected with many personnel lives and equipment lost. This therefore demands for immediate action by the government to do more in order to counter this attacks by putting in adequate security measures that will help the security agencies to do their work with ease. Therefore, the need for modern security equipment would be the right step in the right direction, through the use of digital image processing system like the Closed Circuit Television(CCTV) to tackle this problem. Although it is on record that the Nigerian government had awarded a contract of \$470m in 2010 (The Guardian, 2016) for the installation of CCTV in the country's capital – Abuja and Lagos but this project had been abandoned. But with the recent security threats in the country there is need to revive this project in order to safeguard lives and properties. The installations of CCTV in major cities will help for monitoring, easy detection and apprehension of suspects. Doing this will help reduce the incidence of insecurity challenges to the barest minimum.

## **2 DIGITAL IMAGE PROCESSING**

Digital Image Processing is the analysis and manipulation of digital images by means of a digital computer in

order to its improve quality. It is a subfield of signal and systems which focuses mostly on images. It focuses on developing a computer system that is able to perform processing on an image. It consists of discrete picture elements called pixels, with each picture lying in a particular row or column. Each pixel has a digital number (DN) where the DN represents the average radiance for a given band.

## 2.1 MOTIVATION BEHIND DIGITAL IMAGE PROCESSING

- i. Improvement of pictorial information for human interpretation.
- ii. Processing of image data for storage, transmission and representation for autonomous machine perception.

## 3.0 DEFINITION OF TERMS

- a. Image: This is the projection of a 3D scene on a 2D plane. It is a 2 dimensional function,  $f(x,y)$  where  $x$  and  $y$  are spatial coordinates and  $f$  at any pair of coordinate is called the intensity or gray level of that image at that point.
- b. Digital image: A digital image is an image that is composed of a finite number of elements called pixels, each of which has a particular location and value. When  $x,y$  and  $f$  are all finite discrete quantities, the image is called a digital image.

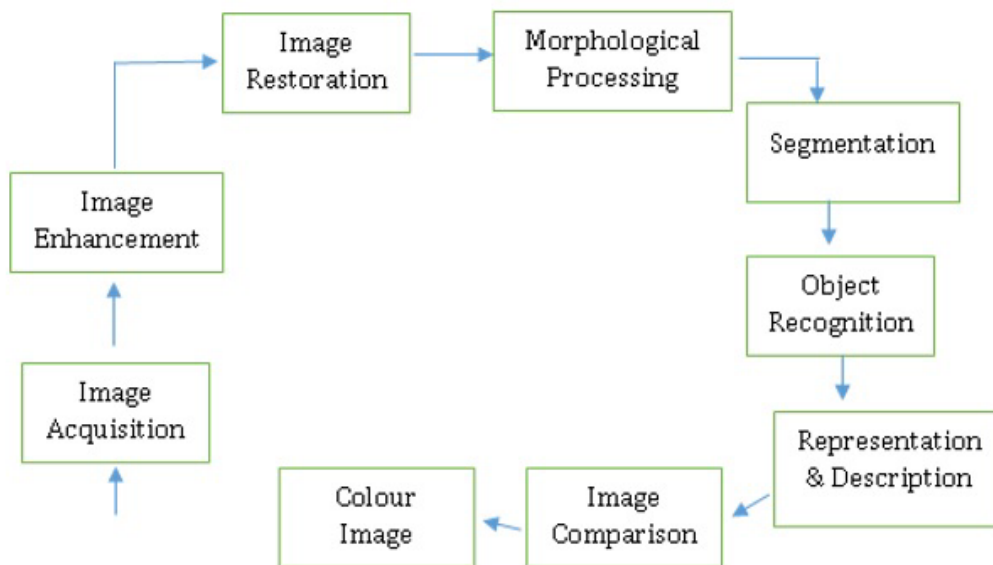


Fig. 1: Key Steps in Digital Image Processing

- I. Image Acquisition: This is the capturing of image by a sensor e.g. camera and digitalizing it, If the output of the sensor or camera is not in digital form using analogue to digital converter.
- II. Image Enhancement: This is the process of manipulating an image in order to have a result which is more suitable than the original for specific application. Enhancement brings out the hidden details of an image and also highlight certain features.
- III. Image Restoration: It is the process of improving the appearance of an image. This include mathematical or probabilistic models of image degradation instead of human subjective preferences as used in enhancement. E.g. photograph taken in space which will require certain procedures to improve the appearance of the image.
- IV. Morphological Processing: This deals with tools used for extracting image components that are useful in the representation and description of shape. E.g. finger print recognition.



- V. Image Segmentation: This is the process of partitioning an image into its constituent parts. The more accurate the segmentation, the more likely the recognition is to succeed.
- VI. Image Recognition: This is the process of assigning a label to an object based on the information provided by the description for easy identification.
- VII. Representation and Description: Representation is part of the solution of transforming a raw data into a form that can be processed by a computer. Representation are of two types- boundary and regional representation. It depends on the part or portion of the image that is to be emphasized on or represented. Description is also called feature selection and it deals with extracting attributes that results in some information of interest.
- VIII. Image Compression: It includes techniques used in reducing the storage required to save an image or the bandwidth required to transmit it.
- IX. Colour Image Processing: This is the process of using the colour of the image to extract features that are of interest in the image.

#### 4.0 SECURITY CHALLENGES IN NIGERIA

- i. Boko Haram: This militant group which started 2009 in the North-East of Nigeria has killed tens of thousands and displaced millions of people. According to reports, about 2.5 million people have fled their homes for safety and as at 2018, 7.7 million people are in need of humanitarian aid making it one of the worst humanitarian crisis in the world (Njoku, 2019). Even though the government has tried to reduce the rate of death caused by Boko Haram but the crisis still rages on as there still exist significant attacks both on civilian and military targets, especially the attack on the Nigerian Defence Academy where two officers were killed and one kidnapped on Tuesday, 24 August, 2021 (voanews, 2021). If the security architecture of the Nigerian Defence Academy can be so easily breached, then the government need to brace up in order to tackle this hydra-headed monster before it consumes the whole country. States mostly affected by Boko Haram include; Borno, Zamfara, Kaduna, Adamawa, Benue, Yobe and Plateau.

**Table 1. States mostly affected by Boko Haram's attacks from 2011-2021**

STATE	DEATH TOLL
Borno	34,181
Zamfara	4,793
Kaduna	4,619
Adamawa	4,071
Benue	3,583
Yobe	3,069
Plateau	3,017

Source: Statistica.com (2021).



II. Kidnapping and Banditry: This is another threat common now in Nigeria, as people are abducted from their home or offices. Even passengers travelling on the roads and school children are not spared. More than a thousand students and prominent individuals have been abducted across the country, and some who are lucky have been released after huge ransom has been paid while others have been killed even when ransom has been paid. Some of these kidnapers are commonly referred to as bandits when they raid villages, burning down houses and kidnapping the villagers (Aliyu Tanko). These set of criminals operate mostly in the Northern part of the country with Zamfara state the worst hit with 3000 people killed in 2012. With every passing day, the kidnapping industry is booming and slowly expanding into other parts of the country with an average of 13 people kidnapped daily within the first half of 2021 totaling 2,371 kidnapped victims and with a total of \$19.96 million (N10 billion) paid as ransom (Vanguard Newspaper, 2021). The chart in Fig.2 shows the number of kidnapped victims within the month of January to June, 2021 with the highest record of victims being February (665) closely followed by March and the least being June (277).

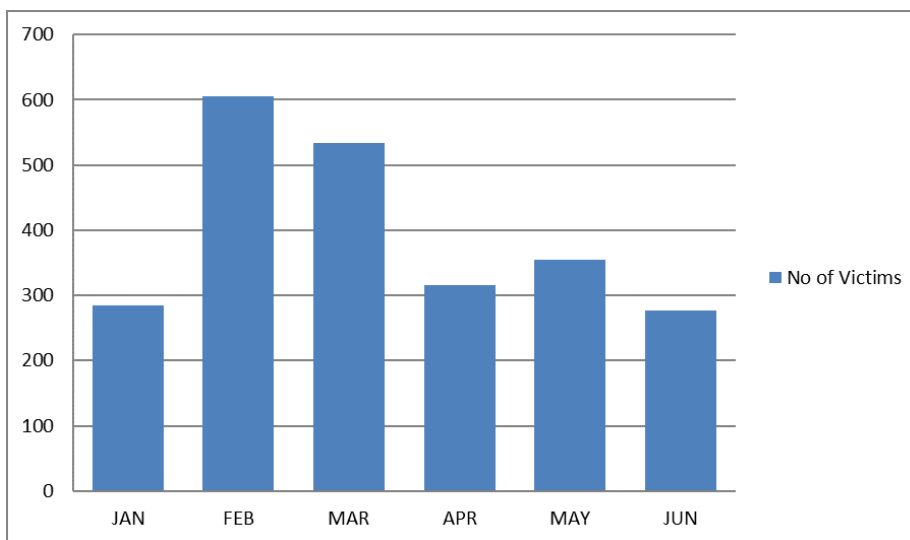


Fig. 2: No of victims kidnapped in 1<sup>st</sup> half of 2021

Source: Vanguard Newspaper

Further statistics shows the number of kidnapped victims abducted as well as those killed in each states in the country.

Table 2: **Number of victims killed/ kidnapped across the country in 2021**

STATES	No of Victims Kidnapped	No of Victims Killed
Niger	643	58
Zamfara	519	22
Kaduna	360	41
Katsina	236	N/ A



Kebbi	81	N/ A
Oyo	61	N/ A
Delta	51	N/ A
Abuja	50	N/ A
Taraba	46	N/ A
Nasarawa	44	N/ A
Kogi	31	N/ A
Ogun	26	N/ A
Imo	25	N/ A
Osun	23	N/ A
Edo	18	N/ A
Ondo	17	N/ A
Enugu	15	N/ A
Anambra	14	N/ A
Ekiti	14	N/ A
Rivers	14	N/ A
Sokoto	10	N/ A
Kwara	10	N/ A
Plateau	10	N/ A
Bayelsa	7	N/ A
Lagos	6	N/ A
Abia	6	N/ A
Benue	6	N/ A



Ebonyi	5	N/ A
Yobe	4	N/ A
Cross River	4	N/ A
Kano	3	N/ A
Bauchi	3	N/ A
Adamawa	2	N/ A
Jigawa	2	N/ A
Akwa Ibom	2	N/ A
Borno	1	N/ A
Gombe	1	N/ A
<b>Total</b>	<b>2371</b>	

Source: Vanguard Newspaper

- III. **Farmers-Herders Clashes:** This is a problem that will take time to go away especially due to climate change, as the herders are constantly moving in search of water and pasture to feed their animals and in most cases many farmlands have been destroyed leading to violent clashes between the farmers and the herders, with most of the clashes leading to death. In 2016 alone 3,600 people lost their lives with a further 2,000 deaths in 2018 ([Armesty International, 2018](#)) This problem has generated a standoff between the Federal government and majority of the states in the southern part of the country as they have passed bills prohibiting open grazing within their locality in order to stop this act of violence (Vanguard Newspaper, 2021).
- IV. **Secessionism/ Unknown gunmen:** This is another security threat mostly taking place in south eastern Nigeria. The agitation for independence by the South-east people in Nigeria has led to a collision course between some separatist groups and the military, with this giving birth to a faceless group called "Unknown gunmen" with their main target being security structures and government offices in the region, with the attack on police stations raging on almost on a daily basis as reported in various media houses in the country. Even some private businesses and individuals has not been spared

## 5.0 CONCEPT OF CCTV

Closed-circuit television is a video system that consist of video cameras that are strategically placed around and area for the purpose of recording and monitoring activities within that area using limited number of surveillance monitors. The CCTV system comprises of camera, wires, video storage device (cloud or digital video recorder) and monitors. They are of two types wired or wireless.

Although, almost all video cameras can be used as CCTV cameras but those mostly used must have high

definition for accuracy in monitoring any activity taking place within that area. CCTV systems comes in various shapes and sizes and complexity depending on their purpose and the defined security operational requirements. There had been significant advancement in both hardware and software technology in this field with the capability of facial recognition being a standard in the industry. Even in the case of offenders trying to cover their faces, modern CCTV, have the capability to developed algorithms that can still detect people's faces. However, the basic purpose of any CCTV system is to observe a particular area and the activities that is going on in such area. These observations may be overt or covert.

I. Covert – This means that the camera is hidden.

II. Discreet – The camera may be known to some people, but its appearance will not automatically suggest its purpose.

III. Overt - the appearance of the camera will be designed to clearly indicate its function and attract a deterrent effect. (Ogunleye et al, 2011).

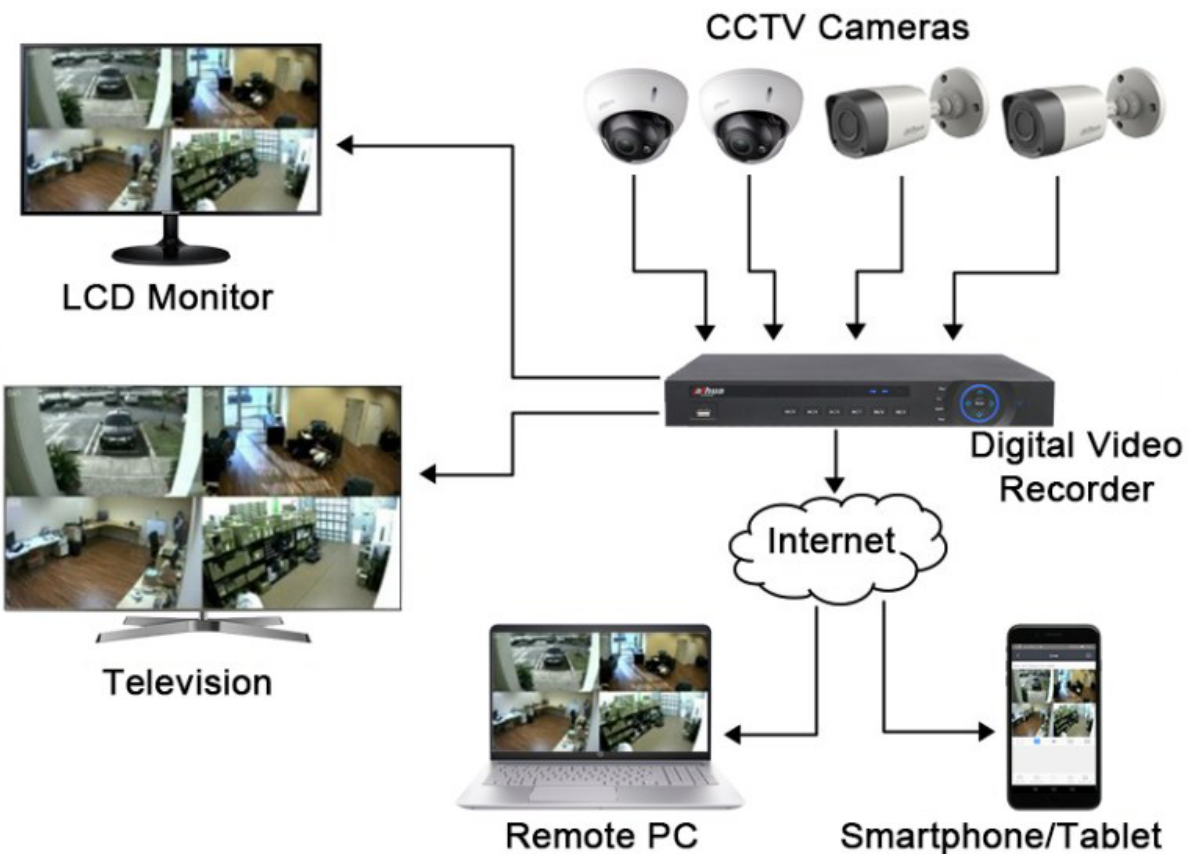


Fig 3: CCTV connection Diagram

### CCTV as a Crime Prevention Tool

For crime prevention, overt CCTV systems are usually more suitable whereas discreet or covert systems are more appropriate for crime detection and prosecution (Ogunleye et al, 2011).

Many studies have shown that CCTV installation has helped to reduce crime rate in some countries around the globe; South Korea (47%), Medellin, Colombia (23.5%). (saferspaces, n.d) and as well assisted the police in apprehending those involved in criminal act. Report by the London Borough of Hackney (2016) shows that within a 12-year period, the CCTV has helped the police authority to make 27,000 arrest. Also in Scottish town it was found out that after 2 years of CCTV installation the proportion of crime solved by police increased from 50 to 58%.



This paper seeks to evaluate the role of CCTV as a crime prevention reduction mechanism using some few countries around the world and therefore see the need of it been used to tackle the current security issues in the country. Using a report by Matthew & Ashby (2017) of the British Transport Police as a comparative case study, information available for a 5-year period (2011-2015) showed that out of a total of 111,608 offences, CCTV was classified as been useful in 72,390 investigations i.e. 29.4% recorded crimes and 64.9% of crimes for which CCTV was available. A report by David and Jeffery on the effectiveness of CCTV in two towns in the United States – Peter Cooper Village and Stuyvesant Town which was obtained from the public safety records management system operated by PCV/ ST management and the Compsat program operated by the New York Police Department (NYPD) was also used.

Table 4; Mean Monthly Crime Counts Before and After CCTV

	PCV		ST	
	Before*	After**	Before	After
Murder	0	0	0.08	0.04
Rape	0	0	0.06	0
Fel.assault	0	0	0	0
Robbery	0.06	0.13	1.75	1.08
Burglary	0.08	0.08	0.33	0.46
Larceny	0.72	0.21	5.69	4.42
Auto theft	0	0.04	0.11	0.08
Assault	0	0.08	0.72	1.08
Harassment	0.36	0.33	1.44	1.46
Trespass	0.08	0.38	0.61	0.67
Vandalism	0.75	0.58	4.36	2.75
All crimes	2.06	1.83	15.17	12.04

Source; David & Jeffery

Notes; PCV= Peter Cooper Village

ST= Stuyvesant Town

\* 36 months of observation

\*\* 24 months of observation

Fel= felonious

CCTV= closed-circuit television

## **CONCLUSION**

With Nigeria being currently ranked 17<sup>th</sup> less peaceful state in the world with a 2.7 index according to Global Peace Index and third on the most terrorist country ranking in the world next to Iraq and Afghanistan with an





indexing of 8.31 according to Global Terrorism Index, it is therefore high time that the government to work towards combating the various security challenges being faced all over the country.

It is therefore imperative for government to embrace the idea of digital processing through the use of CCTV which will go a long way in preventing, reducing as well as identification of suspects. It will also help the security agencies in apprehending the actual culprits and also in the area of quick dispensation of justice. From the statistics shown above there should be no too much doubt in the functionality and effectiveness of CCTV in handling even serious crimes around the country. A recent success in the use of CCTV is on the identification of four suspects of the "7 July London bombings" 2005. CCTV footages from the scene of the incident made it possible for Scotland Yard Counter Terrorism Command to identify the culprits after 5 years (bbc, n.d).

## **REFERENCES**

Adams, O.K(2016). The Role of Information Technology in National Security: A Case Study of Nigeria. Global Journal of Computer Science & Technology: information & Technology , 16(3).

Bright, E.A, "Insecurity and Economic Growth in Nigeria: A Diagnostic Review"  
[http:// dx.doi.org/ 10.19044/ esj.2018.v14n41377](http://dx.doi.org/10.19044/esj.2018.v14n41377).

Closed circuit television (CCTV) and crime prevention. Retrieved 6 November 2021 from  
[https:// www.saferspaces.org.za/ understand/ entry/ closed-circuit-television-cctv-and-crime-prevention](https://www.saferspaces.org.za/understand/entry/closed-circuit-television-cctv-and-crime-prevention).

Greenberg & Roush (2008) "The Effectiveness of an Electronic Security Management System in a Privately Owned Apartment Complex".  
[http:// doi.101177/ 0193841X08326468](http://doi.101177/0193841X08326468).

Njoku, C. (2019). "Here are 5 security challenges Nigeria's leader must tackle" Retrieved 6 November 2021 from World Economic Forum

Ogunleye, G.O et al. (2011). "A computer-based security framework for crime prevention in Nigeria" Nigeria Computer Society, 10<sup>th</sup> International Conference.

Shammi.S, Mohammed. S & Suraoya.B(2014). "Fundamentals of Digital Image Processing and Basic Concepts of Classification". International Journal of Chemical and Processing Engineering Research. 1(6), 98- 108.

Ugwumba, E (2018), "Understanding the Herder-Farmer conflict in Nigeria" . Retrieved 6 November 2021 from  
[https:// www.accord.org.za/ conflict-trends/ understanding-the-herder-farmer-conflict-in-nigeria/](https://www.accord.org.za/conflict-trends/understanding-the-herder-farmer-conflict-in-nigeria/)