



Revolutionizing Law Enforcement Efficacy: A Novel CCTV Surveillance Framework

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Abstract

Over the course of time, the utilization of closed-circuit television (CCTV) surveillance has exhibited a capacity to diminish the incidence of criminal activities in both urban and rural settings. In response to the challenges faced by a division of the Nigerian police force, grappling with inadequate infrastructure and personnel leading to decreased efficacy, this study presents a novel framework aimed at amplifying the utility of this surveillance system. The genesis of this research emanates from feedback provided by a Nigerian police division, which underscored the need for a solution applicable across diverse landscapes, whether urban or rural. The resultant model, meticulously crafted, offers a promising avenue to elevate the effectiveness of law enforcement. To validate its viability, the proposed model underwent simulation using the OPNET Modeler software, allowing for a comprehensive assessment of its potential impact when deployed. The empirical findings garnered from the simulations distinctly indicate that the implementation of this model holds substantial promise in significantly enhancing the overall efficiency of policing efforts. Furthermore, the adaptability of this model suggests its potential for broader implementation within other police forces, transcending geographical boundaries.

Key words: Crime, CCTV, Infrastructure, model, Video, Surveillance.

Introduction

In recent decades, the utilization of closed-circuit television (CCTV) surveillance has become a widespread approach to preventing crime on a global scale. This trend originated in Great Britain, where a significant portion of the Home Office budget, spanning from 1996 to 1998, was allocated to CCTV-related initiatives (Armitage, 2002). This strategic allocation of resources led to a substantial increase in the number of CCTV systems in the country, soaring from approximately 100 systems in 1990 (Armitage, 2002) to over four million within a mere two decades (Farrington *et al.*, 2007). Concurrently, cities across the United States have also made substantial investments in CCTV systems, with 49% of local police departments employing them, a figure that rises to 87% for agencies serving populations exceeding 250,000 (Reaves, 2015). The proliferation of surveillance cameras in public spaces has led to the concept of CCTV being regarded as an unremarkable "banal good," ingrained in daily life and rarely scrutinized by the media or the public (Goold, et al., 2013). During the initial expansion of CCTV technology, its growth was often attributed to political motivations and public enthusiasm. (Painter *et al.*, 1999) suggested that the rise of CCTV in Britain was influenced by its apparent plausibility as a crime prevention measure and the political advantages of being visibly responsive to crime concerns. However, critics such as Piza, (2018a) noted that scientific evidence wasn't consistently consulted during policy decisions, leading to concerns about the rapid deployment of CCTV systems. While research on CCTV was once limited, the landscape of academic literature has evolved (La Vigne *et al.*, 2011). The number of CCTV evaluations has grown significantly, with an increasing focus on rigorous research designs. Rigorous methodologies, including randomized field trials (Hayes *et al.*, 2011), place-based patrol strategies (Piza, *et al.*, 2015), and matching techniques (Farrington *et al.*, 2007), have been employed to study the crime deterrent effects of CCTV (Piza, 2018a). Researchers have also capitalized on natural social events to minimize issues related to endogeneity (Alexandrie, 2017). This heightened rigor within the CCTV literature has yielded valuable insights to inform policy and practice. The primary objective of this article is to present the findings of an updated systematic review and meta-analysis focused on the crime prevention impact of CCTV. In addition to the evaluations previously included in reviews by (Welsh *et al.* 2008, 2009a), the current review incorporates newly identified studies. The expanded dataset encompasses 80 distinct evaluations, representing an 82% increase from the previous count of 44 studies. To enhance comprehension of the contextual factors influencing CCTV effectiveness, this review employs an approach akin to prior systematic reviews (Welsh & Farrington, 2002, 2008, 2009a). It delves



into how CCTV effects vary across settings, types of crimes, and countries, while also introducing additional moderator variables to assess variations based on different camera monitoring methods and the integration of complementary interventions alongside CCTV systems (Caplan *et al.*, 2011). In the ever-evolving landscape of security and crime prevention, the utilization of closed-circuit television (CCTV) surveillance has demonstrated remarkable potential in curbing criminal activities, both in urban and rural environments. This paper delves into a pioneering study that seeks to address the challenges faced by a specific division of the Nigerian police force. These challenges, stemming from inadequate infrastructure and personnel, have led to a noticeable decline in operational effectiveness. To counter these issues, the study introduces an innovative framework designed to amplify the utility of CCTV surveillance systems.

Methodology

The methodology is focused on a model that will boost crime reduction in any rural or urban setting. The criteria for developing the model is hinge on the following premises to counter the inadequacy of infrastructure and personnel in this case the Ilaro township and environs;

- i. Real time surveillance to provide rapid response.
- ii. Coverage area, that is area of interest
- iii. Backup Archive (availability of Playback system when needed.) and
- iv. Connectivity infrastructure

Figure 1 describe the model developed base on the premises listed above it comprises of network of Internet protocol (IP) base camera solar powered and riding on the wireless infrastructure provide by the existing GSM cell site to the area of interest, each cell site host a minimum of 16 unit of camera to providing video feed to the control center where the incorporated artificial intelligent (Ai) which carryout treat assessment base on known variables that depict a form of treat or possible crime. The situation room/control center is where the video feed aggregate on the video recorder and where treat analysis is carried out by the AI. At this point field officers or response team are been altered of possible crime or crime in progress. Auxiliary backing storage (video archive) this unit stores day to day video feed for future references and possible evidence. This storage can be done both online (cloud) and at the control center on a Network Access Storage/server (NAS). The field officers/rapid response team This are officers in designated location either on patrol or on standby that attend to possible crime when altered from the control unit/situation room. They also get feedback on real time situation as they approach the crime scene.

The propose model

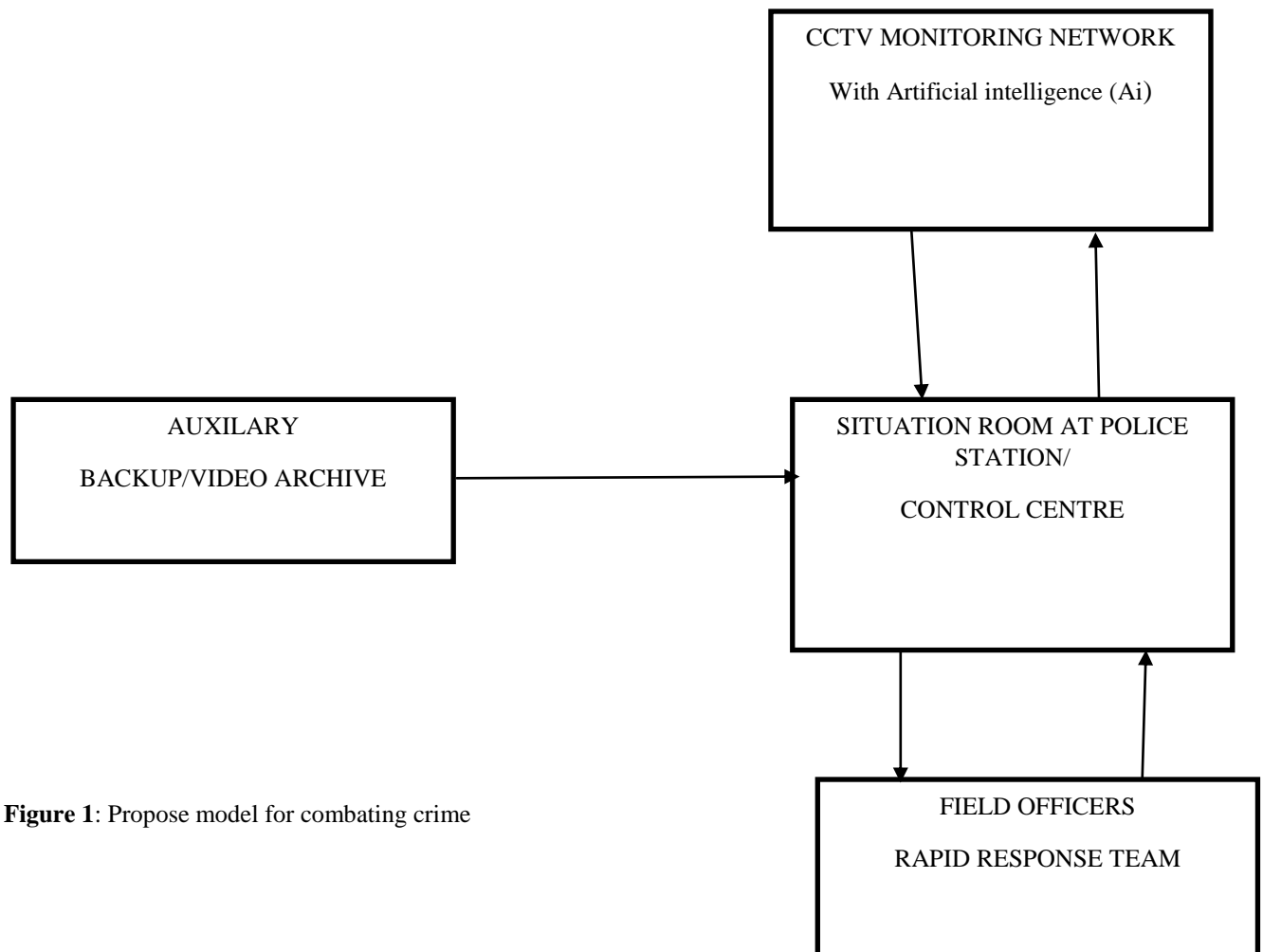


Figure 1: Propose model for combating crime

Model simulation

In order to test the propose model a wireless network is setup to show the wireless scenario Base on the propose model the Ilaro township was divided into four cell site each cell site is made up of 16 unit of cameras, each camera is solar powered and runs on internet protocol (IP) each cell site supplies its video feed to the control centre (situation room). In simulating the network infrastructure bandwidth was adopted from the existing GSM providers bandwidth rating. The estimated aggregated bandwidth needed was used as the parameter to determine the traffic capability over the network. The model as shown in Figure 2.

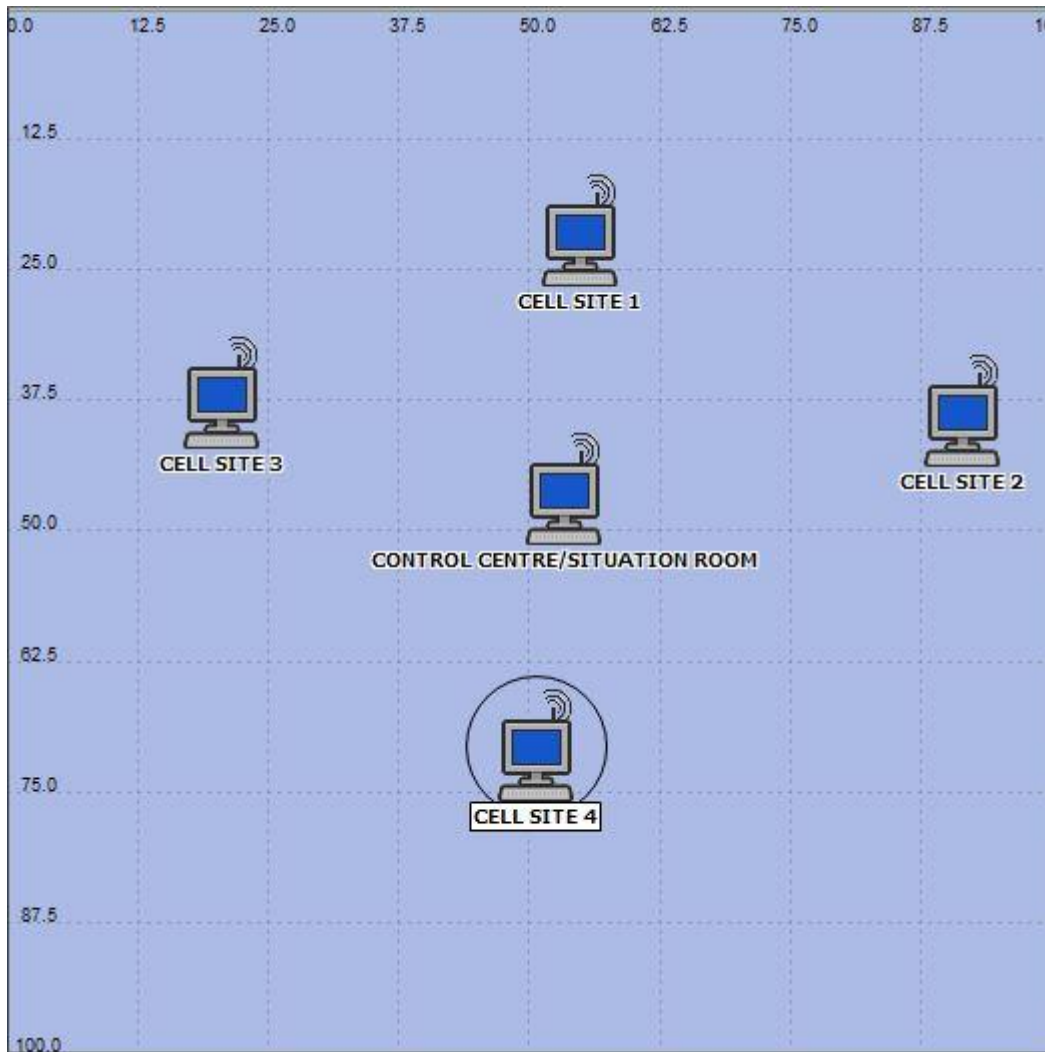


Figure 2: Wireless network of CCTV CAMERA

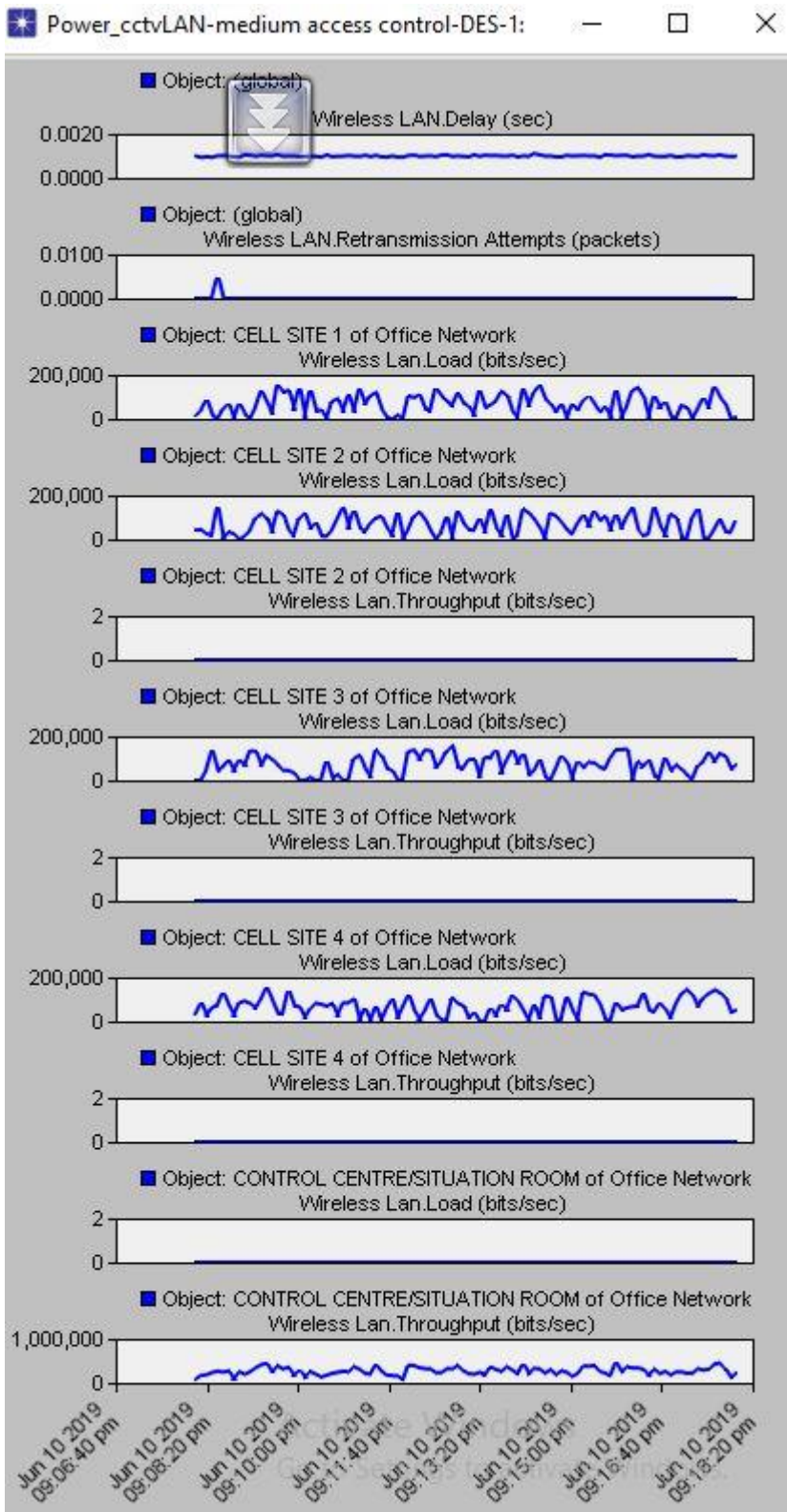


Figure 3: Test result of simulated model.



The test result shows that traffic is generated and there is flow between the four cells sites used in this model the throughput and the load on the control center clearly shows that the load level is low and the control center is not overloaded and can handle the traffic flowing to it., which The result shows that the model if adopted will be able to function effectively as shown in figure 3.

Conclusion

In an era characterized by dynamic security challenges, the presented framework marks a transformative leap for law enforcement. By fusing the power of CCTV surveillance with innovative methodologies, this research bridges the gap between evolving technology and the demands of effective crime prevention. As the model's potential reverberates beyond a single division, it opens doors to safer communities worldwide, poised to combat crime across diverse landscapes.

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