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Development of A Surveillance Threat Analysis Software To Improve Security In Urban And Rural Settings

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Abstract
Research and statistics regarding the use of CCTV systems have shown that their presence decreases criminal activities over a certain period in both the cities and the countryside. Using qualitative and quantitative data collection, this study evaluates one division of the Nigerian police force with dwindling operational capacity due to a lack of resources and manpower. The research attempts to offer new architectural systems bearing in mind the environmental factors that affect the functioning of CCTV systems in heavily populated urban areas and remote rural areas based on the views from this police unit. The aim is to increase the effectiveness of law enforcement agencies by reallocating resources more effectively and having more crime monitoring cameras. Use of the OPNET Modeler program, which is a popular computerized program used when simulating networks was also used to test the feasibility and the scale of the model. The experiments showed what the application of the policy strategy would be in practice at the level of the police which would increase their effectiveness and reduce criminal activity. This paper's computational perspective helps in resolving the operational challenges faced by Nigerian law enforcers and finally leads towards enhanced police operations and safer communities.

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I. INTRODUCTION

Background Information of the Study

The study called "Development of a Surveillance Threat Analysis Software in Improving Security Threats in the Urban and Rural Setting: A Proposal" seems to be a useful academic undertaking in this time where security issues are dynamic in nature. Urban and rural area security threats exist therefore there is the need for prompt measures that go beyond conventional visualization techniques. The current project seeks to devise a sophisticated Surveillance Threat Analysis Software (STAS) that is intended to refine the security systems.

The metropolitan setting is defined by a high population concentration, greater hazards vectors, thus there is the need for more sophisticated and flexible monitoring systems for that population. At the same time, the rural areas having their own topographical challenges and poor infrastructure most of the time also require tailored measures to curb various potential threats. Such requirements are catered for in the proposed Science and Technology Advancement System (STAS) which integrates contemporary technology such as Artificial Intelligence and Machine Learning algorithms. [1] [3]

The security of the subject area is relevant research problem considering the vulnerability of existing measures and supplemented with other measures.

The project's goal is to revolutionize the surveillance paradigm by developing software that proactively anticipates and reduces future hazards in addition to detecting current threats. Incorporating advanced analytics and real-time threat assessment improves the efficacy of a complete security system that can adapt to the dynamic nature of contemporary threats. Through the use of technology, this research aims to create safer urban and rural environments and build a strong defense against emerging security threats.'

II. METHODOLOGY

Model Design

The model utilizes IP-based CCTV cameras driven by solar energy, guaranteeing scalability and sustainability. These cameras are carefully positioned in urban and rural "cell sites," each encompassing critical areas with live video feeds transmitted to a central control room using wireless connectivity. This control room, or "situation room," contains an AI-enabled system that conducts real-time threat analysis, notifying field officers of probable criminal activities. [2]

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 aggregates on the video recorder and where treat analysis is carried out by the AI. At this point field officers or response team are being 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. [3] [4]

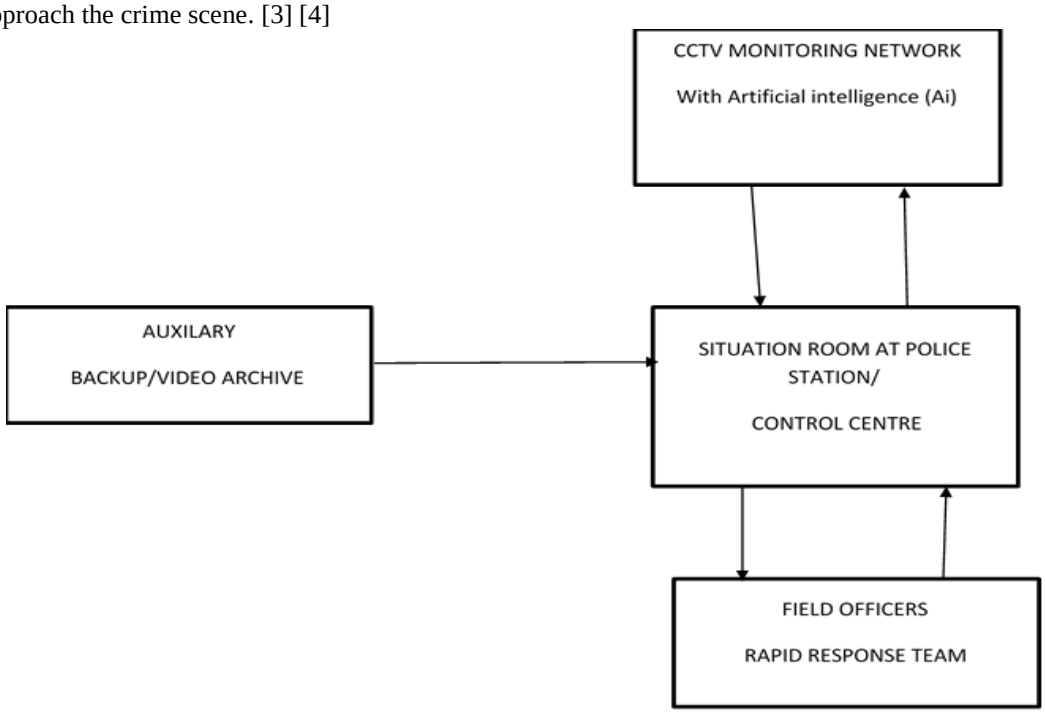

Figure 1: The designed model

Model Simulation

In order to test the 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 Figured 2.

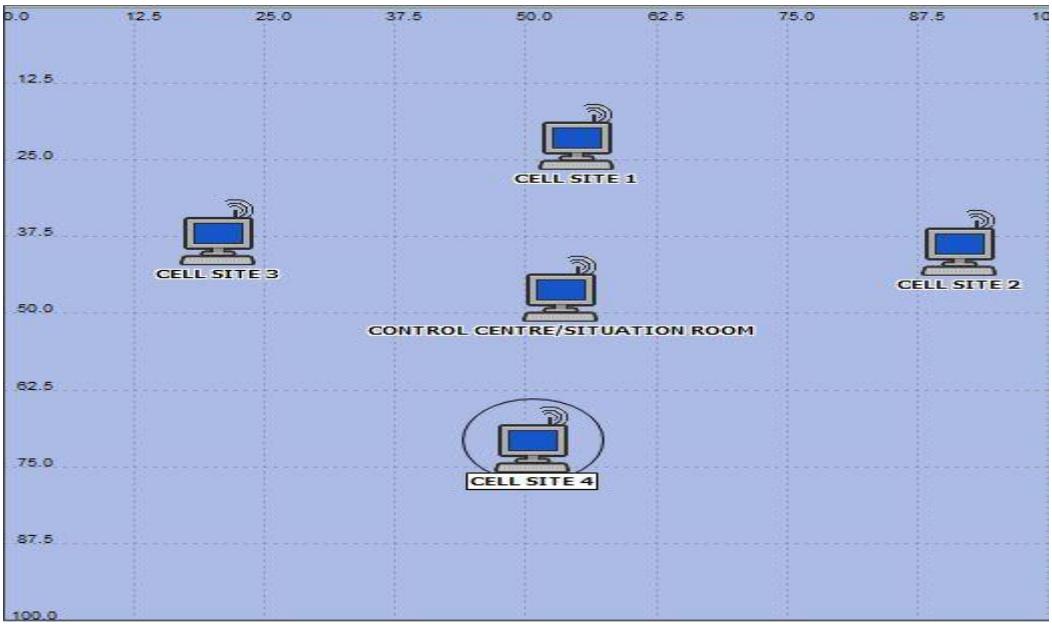

Figure 2: Wireless network of CCTV CAMERA

We employed the OPNET Modeler to simulate the real-world implementation of this model in Ilaro, Nigeria. This simulation assessed the network's performance by taking into account the traffic and bandwidth requirements necessary for ongoing, real-time monitoring. The surveillance area is divided by the model into many cell sites, each of which has 16 cameras and is linked to the central monitoring hub.

Software Development

A custom software platform designed to increase real-time threat analysis and monitoring effectiveness forms the basis of the surveillance system. This program makes use of MySQL for data management, PHP for server-side scripting, and Python for back-end processing. When taken as a whole, these technologies allow the system to gather video footage, evaluate it for possible threats, and instantly provide law enforcement with crucial information.

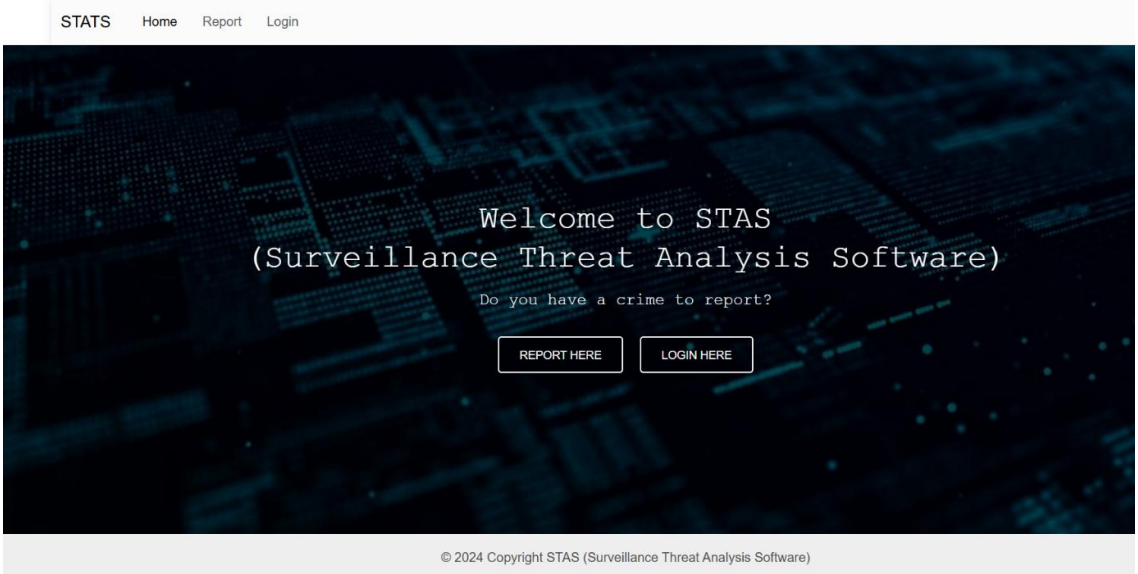

Figure 3: The STAS platform

Figure 3 above depicts the Surveillance Threat Analysis Software platform that enhances security and crime prevention through advanced monitoring, analysis, and alert mechanisms.

III. RESULT AND DISCUSSION

Expected Findings

'The simulation illustrates that the approach can markedly decrease response times and enhance threat identification precision. The system automates danger detection, so reducing dependence on human oversight and enabling law enforcement to allocate resources more effectively. Simulation data indicate a possible decrease in crime rates attributed to expedited threat reaction times and enhanced surveillance coverage.'

The test results indicate that traffic is created and there is connectivity among the four cell sites utilised in this model. The throughput and load on the control centre demonstrate that the load level is modest, and the control centre is not overloaded, hence capable of managing the incoming traffic. The results indicate that the model, if implemented, will operate effectively, as illustrated in Figure 4.

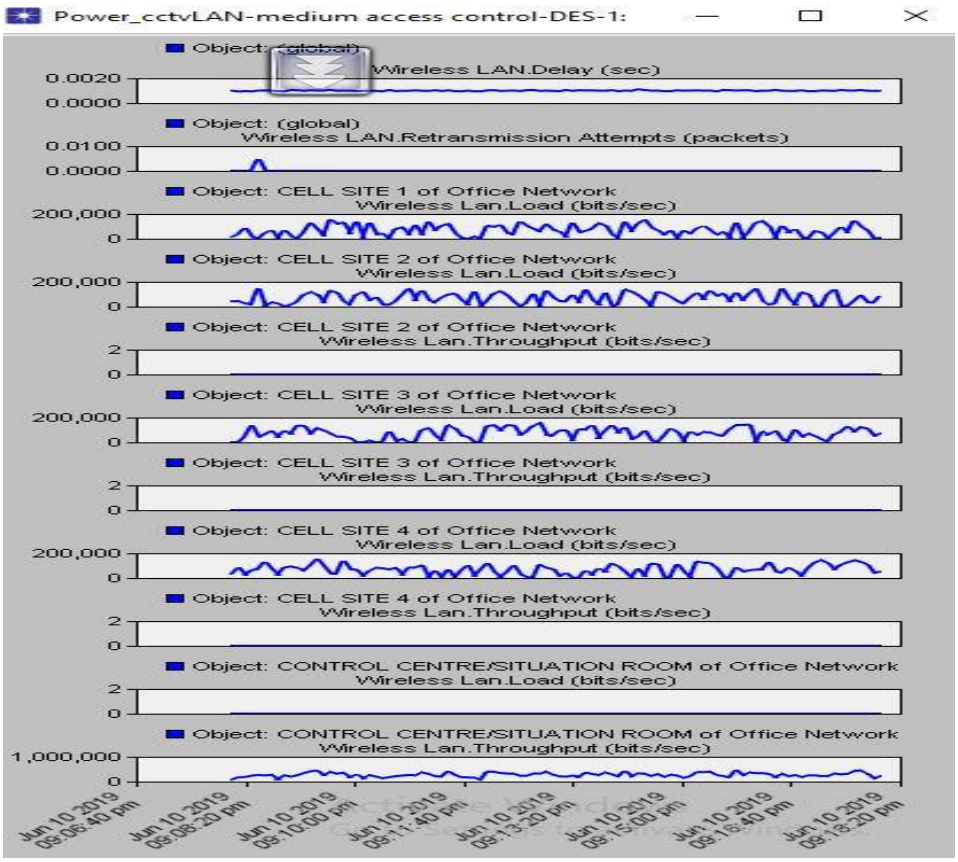

Figure 4: Test result of simulated model.

Performance Metrics

The preliminary results suggest that the AI model functions with considerable precision in detecting anomalous behaviour, with minimal false-positive rates and elevated responsiveness. With adequate bandwidth, the system ensures an uninterrupted data transmission between cameras and the control centre, crucial for rapid threat analysis.

Discussion

The integration of AI with CCTV networks presents significant enhancements in surveillance, especially in areas with constrained law enforcement resources. By automating threat assessment, the method reduces the lengthy reaction times and coverage limitations that are major drawbacks of traditional CCTV surveillance. However, in remote areas, the system's dependence on reliable network infrastructure and enough bandwidth might pose challenges. The establishment of offline threat detection capabilities and data compression optimization may be the main goals of future improvements. [5] [6]

IV. CONCLUSION

This paper develops a hybrid surveillance i.e. video-based surveillance supplemented with a state of the art artificial intelligence technology in a bid to solve the crime prevention problems in various urban and rural settings. The deployment of real-time AI based threat evaluation enhances the existing infrastructures of CCTV systems, shortens response time, and increases resource allocation efficiency within law enforcement agencies. [6]

The simulation outputs suggest that the use of "very suspicious" algorithmic alerts… would improve security by allowing for rapid responses while reducing the disadvantages of reliance on humans. Due to its effectiveness, supervision is very relevant in areas with limited development and personnel as it maximizes the use of existing monitoring systems without having to fully or partially overhaul or extend them. Despite these positive results, it should be noted that many challenges remain. This subdivision of the model suggests a potential problem for areas with poor or intermittent.

In addition, issues of data protection and ethical concerns should be addressed in this context, since the possibility of abuse may be present with the uncontrolled AI enabled monitoring system. This approach is linked with data privacy issues, controlled access, and meta data management.

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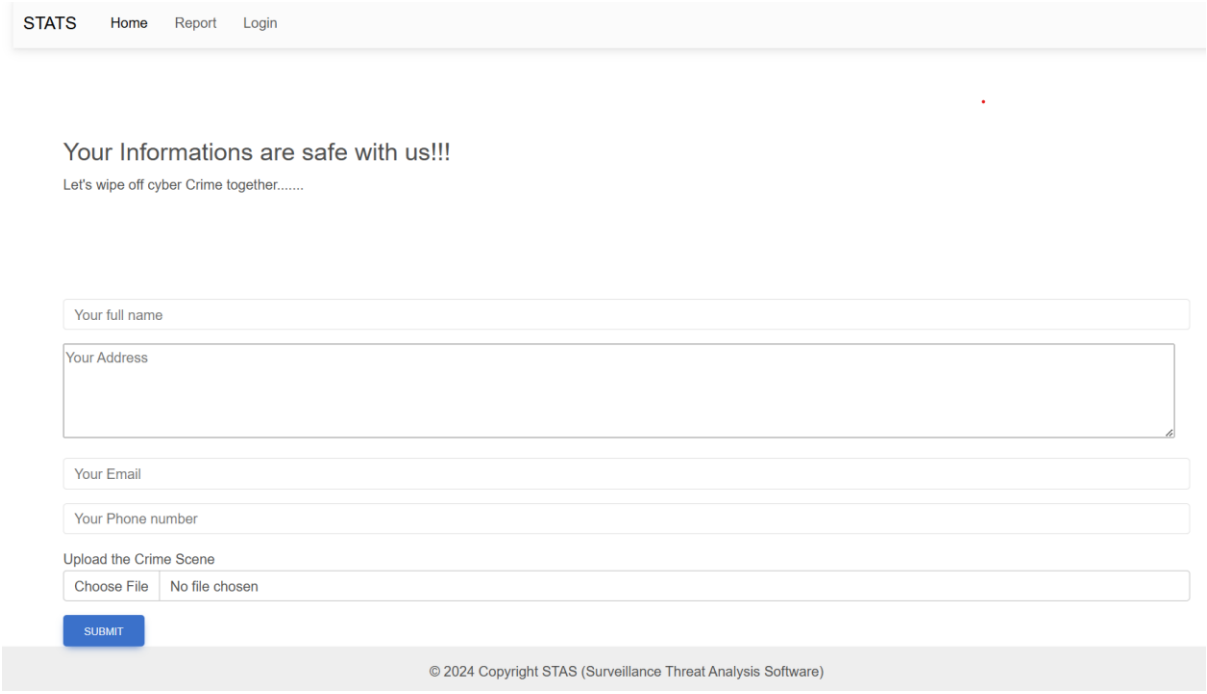
APPENDICE

The camera and the solar panel used

Mounted camera type



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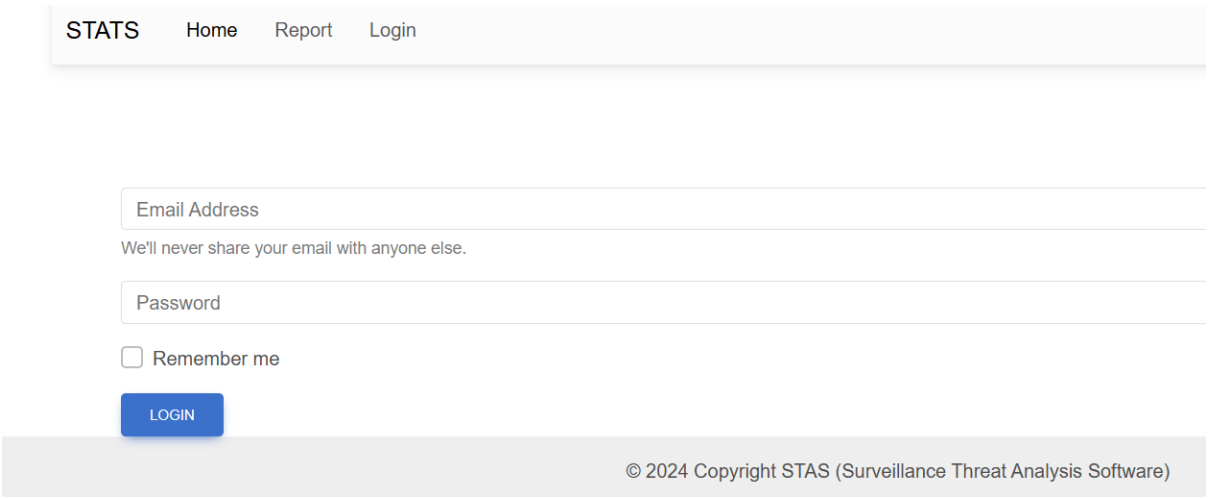

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