FORMULATION OF A ROBUST CLOSED-CIRCUIT TELEVISION SYSTEM DESIGN FOR OWERRI MUNICIPALITY

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Abstract
In this research study, a thorough field survey was conducted to ascertain the actual outlook of Owerri Municipality. The road-map of the city in question, which served as an aid towards preparing the survey, was obtained from the Works Department of the Owerri Municipal Council Headquarters. The survey was carried out using the Google cloud-based survey software. The outcome of the field work was holistically analyzed and evaluated using the Google cloud-based Spreadsheet. The required engineering design for installation of a Closed-Circuit Television (CCTV) system in the area was eventually realized.

Keywords:
Owerri Municipality, Closed-Circuit Television, Road map, Design, Google, Software.

1. Introduction

Internet of Things **(**IoT), such as the CCTV, is currently changing the entire outlook of the world, thereby making it a global village. It reduces stress, cost and time of doing work in every aspect of human endeavour. IoT devices, especially contemporary and generic like CCTV and smartphones, are obviously fast transforming various sectors on earth, namely: the industry, banking, education, health, agriculture, security, transport, and even the household [5].

1.1 Background : The fundamental part of the CCTV system is a reliable image evaluation by a human observer, whose effectiveness is influenced by many variables [6]. CCTV features include creating a safe environment, protection, legal compliance and audit, management and support, deterrence, investigation and evidence [1]. Indeed, cameras have had effects on crime, even more consistent effects on disorder [2].

1.2 Problem Statement: Criminality and/or insecurity has been on the rampage in recent years, having every country or locality affected. In Nigeria for instance, there is no day that unfolds, the news regarding crime would not be heard in some quarters within the country. If it does not happen in the market square, it would occur on the street, or elsewhere. The victims of streets' criminalities are often deprived of moveable properties such as mobile phones, cash, credit/debit cards, and vehicles; the victims' precious lives are sometimes taken during the occurrence of these incidents [4]. Preventing crime in the city center is basically a question of influencing routine activities generating temptations and friction, and of developing focused strategies of policing and surveillance [7]. This is the reason the presence of some vital and sensitive electronic devices like the CCTV has become inevitable in most corners across every length and breadth of any concerned society, particularly the urban areas. Hence, the Owerri Municipality is not exceptional.

1.3 Research Objectives: The main aim of this research is to formulate a robust and sustainable CCTV design for Owerri Municipality. The specific objectives are: to conduct a thorough field survey of the city as well as carry out a data analysis and evaluation of the survey result.

1.4 Study Scope: The research focuses on the major intra-city roads within the Owerri Municipality. Hence, there is a limit (boundary) peg on the inter-urban routes situated in the area.

1.5 Research Justification: The importance of this study is justified by the need to conduct a holistic field survey on the crime-prone localities in Owerri Municipality, coupled with the urgent need to design a CCTV installation in the city

2. The Study Area

The Owerri Municipality forms a Local Government Area (LGA) known and addressed as Owerri Municipal Council, reckoned as the capital of Imo State, Nigeria right from when the State was created on 3rd February 1976. On 15th December 1996, the city attained municipal status. Its headquarters is located at the famous Douglas Road by the popular Ama JK bus/stop. It occupies an area capacity of 58km^2. According to the 2006 census, it has a population of about 127, 213; as at 2022, it was projected to be 174, 200 [3]. The postal code of the city is 460. It sits at the intersection of major roads leading to Onitsha, Port-Harcourt, Orlu, Okigwe, Umuahia, and Aba. The town is basically made up of

five main villages, namely: Umuororonjo, Amawom, Umuonyeche, Umuodu, and Umuoyima; these 5 urban settlements are collectively recognized as 'Owerri Nchi Ise' [Personal communication, 2024]. From all indications, the Douglas Road seems to be the heartbeat of the metropolis [8].

3. Materials and Methods

The data used for the purpose of this research are as follow:

i. Core i5, 8GB RAM, Laptop computer.
ii. Road map of Owerri Municipality.
iii. Internet facilities.
iv. Google Cloud-based survey App.

3.1 Field Survey of Owerri Municipality

To ascertain the actual overview of Owerri Municipality, the Road Map of the city (as shown in Fig. 1) was obtained from the Head, Department of Works at the Owerri Municipal Council Headquarters situated along Douglas Road by Ama Jk, Owerri in Imo State. The map showcases the major intra-city roads situated within the Owerri metropolis, such as: Obinze/Port-Harcourt road, World-Bank road, Orogwe/Onitsha road, Amakohia/Orlu road, Orji/Okigwe road, MCC/Uratta road, Egbu/Mbaise road, Wetheral road, Douglas road, Old-Nekede road, Tetlow road and Bank road, among others. It's noteworthy that some of these roads are equally inter-city roads, meaning literally that they are also leading to other cities outside Owerri/Imo.

Fig. 1: The Road Map of Owerri Municipality

Source: Owerri Municipal Council

The obtained road map gave an insert on how to prepare the required research questionnaire. Hence, an electronic Research Interest Form was created with the aid of Cloud-based Survey Software as provided by Google. The link and the QR Code of the online Questionnaire, which were consequently generated, are as shown in Fig. 2 and Fig. 3, respectively. Similarly, the screenshots of some samples of the form content are showcased in Fig. 4.

Fig. 2: The link of the Online Survey

https://docs.google.com/forms/d/e/1FAIpQLSdUy7GyUabFPbmYqTbY38pTc9MtebQUNo2gJ4DMsd6VXQmK8g/viewform

Owerri Municipal Survey

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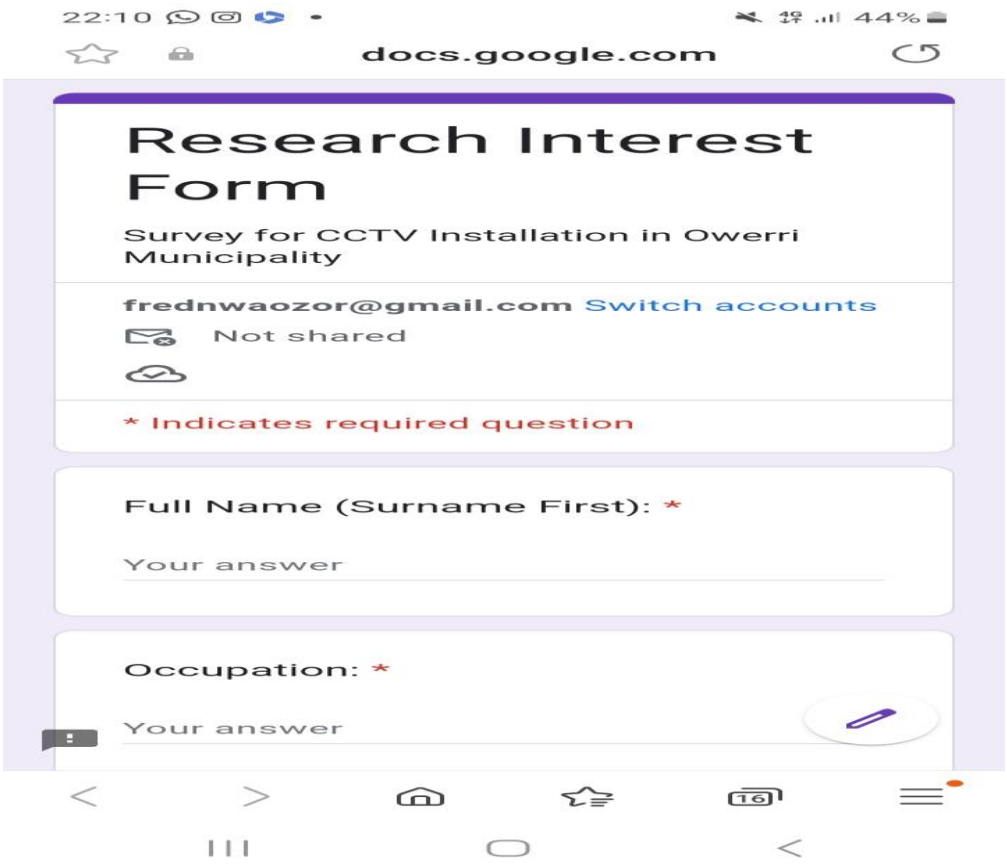
Fig. 3: The QR Code of the Survey



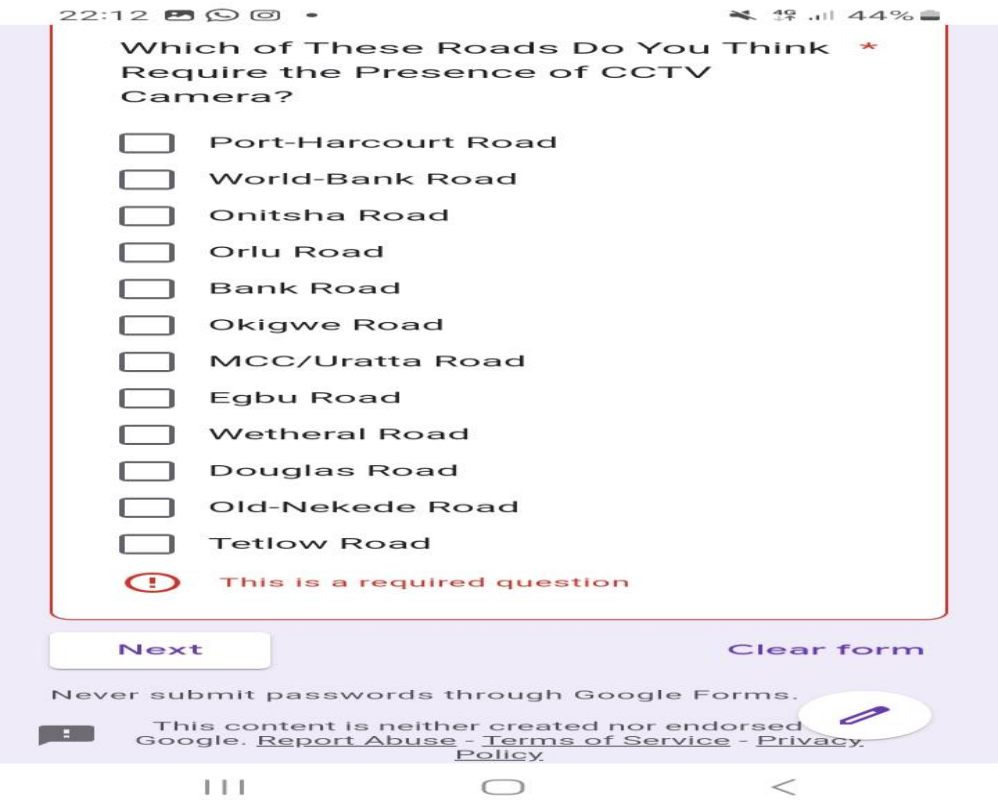


Fig. 4: Samples of content of the electronic form

3.2 **Data Analysis and Evaluation**

The generated link and QR Code of the created Google Form, encompassing direct technical questions, was disseminated to various online fora and platforms comprising mainly resident of Owerri, for onward completion. The received responses from over fifty respondents, as figuratively shown in Figure 4.1, coupled with physical interactions with key stakeholders in Physical Planning & Urban Development in the affected area, served as a leverage. Hence, the engineering CCTV design of Owerri Municipality was obtained via thorough analysis and evaluation of the survey results using the Google cloud-based Spreadsheet.

To provide a befitting and sustainable design that would stand the test of time, a limit/boundary was drawn to cut across each of the inter-city (inter-urban) routes, thereby focusing on the major region (points) that sits within the Owerri Municipality. This limit (end-point) was also specified while carrying out the online field survey. For instance, the junction of the popular and ancient Arugo Park was tagged as the end-point along the Onitsha road. Table 1 showcases the limit for the entire inter-city/urban roads.

Table 1Boundary of the Sampled Inter-Urban Routes

S/N	Inter-Urban Road	Boundary
1	Port-Harcourt road	Hospital Junction
2	World-Bank ”	World Bank Market
3	Onitsha ”	Arugo Park
4	Orlu ”	Teaching Hospital (FMC)
5	Okigwe ”	IMSU Junction
6	Mbaise ”	Shoprite Supermarket
7	Old Nekede ”	West-End
8	Uratta ”	Federal Housing, Aladinma

Statistically, the survey responses – which were received electronically – showcased the roads that require installation of Closed-Circuit Television. Furthermore, it gave an overview of the actual points/areas on the recommended routes that deserve the presence of a CCTV camera. For instance, both Douglas and Wetheral roads were selected (recommended) by almost all the respondents. On Douglas, the areas of interest by most of the respondents were: Ama JK, St. Paul’s Catholic Church (Eke Ukwu Market), Mbaise Road Junction, Ama Hausa, and Emmanuel College. On Wetheral, most points of interest were Government House Roundabout, Cherubim Junction, and Fire Service. Meanwhile, MCC, Onitsha and Egbu Roads were the least recommended routes in the survey. Table 2 is the statistical report on the recommended routes, showcased in their order of importance.

Summarily, all the respondents agreed on the need to have CCTV device in Owerri Municipal area. The CCTV Design, which was yielded by the analyzed and evaluated results, is as shown in Fig. 7.

4. Results and Discussions

This chapter showcases the results obtained in the research work, coupled with the corresponding discussions.

4.1 Survey Results: The various outcomes of the field survey are showcased herein.

Table 2Statistical Report on the Recommended Routes for CCTV Design

6. Which of These Roads Do You Think Require the Presence of CCTV Camera?

RESULTS

Options	%	Count
Port-Harcourt Road	10.59	18
World-Bank Road	10.00	17
Onitsha Road	3.53	6
Orlu Road	10.00	17
Bank Road	10.59	18
Okigwe Road	5.29	9
MCC/Uratta Road	4.71	8
Egbu Road	4.71	8
Wetheral Road	10.59	18
Douglas Road	17.65	30
Old-Nekede Road	5.29	9
Tetlow Road	7.06	12

Fig. 5 and Fig. 6 are the Bar Chart and Pie Chart, respectively, of the Survey result.

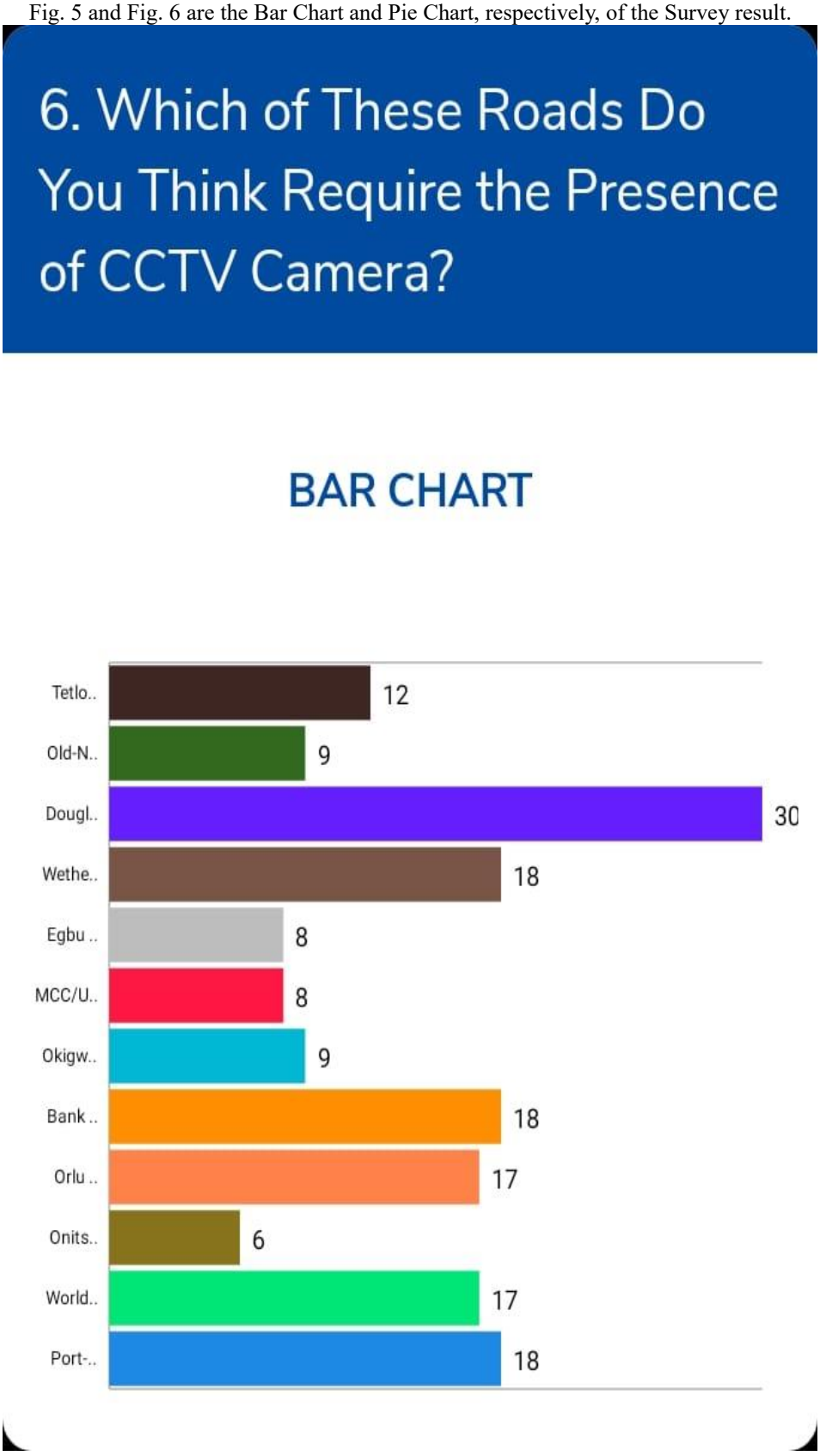


Fig. 5: Bar Chart of the Research Survey on Owerri Municipality

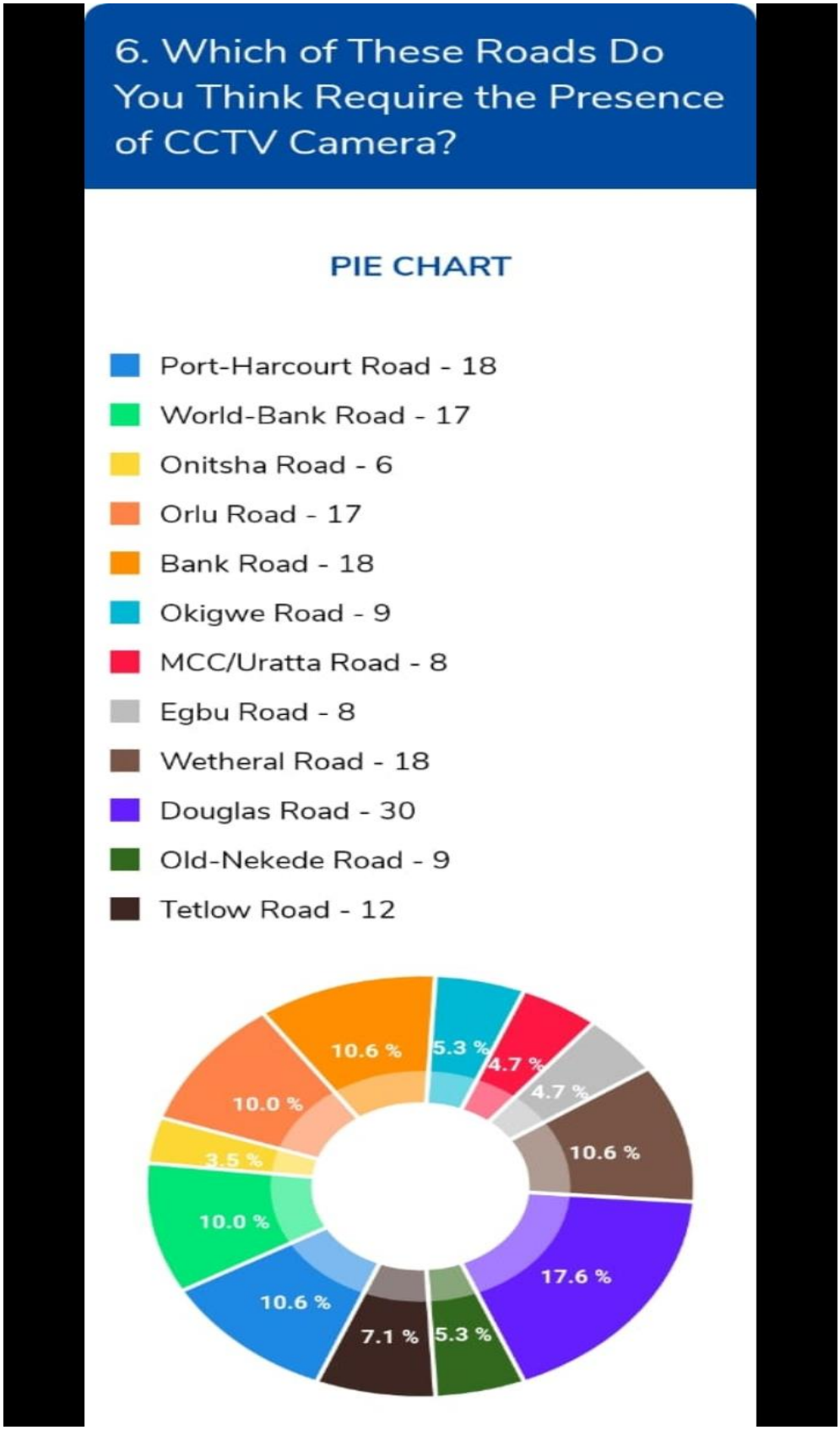


Fig. 6: Pie Chart of the Survey Result on Owerri Municipality

4.2 CCTV Design: Figure 7 showcases the CCTV design of Owerri Municipality, which was derived from the analyzed overall results.

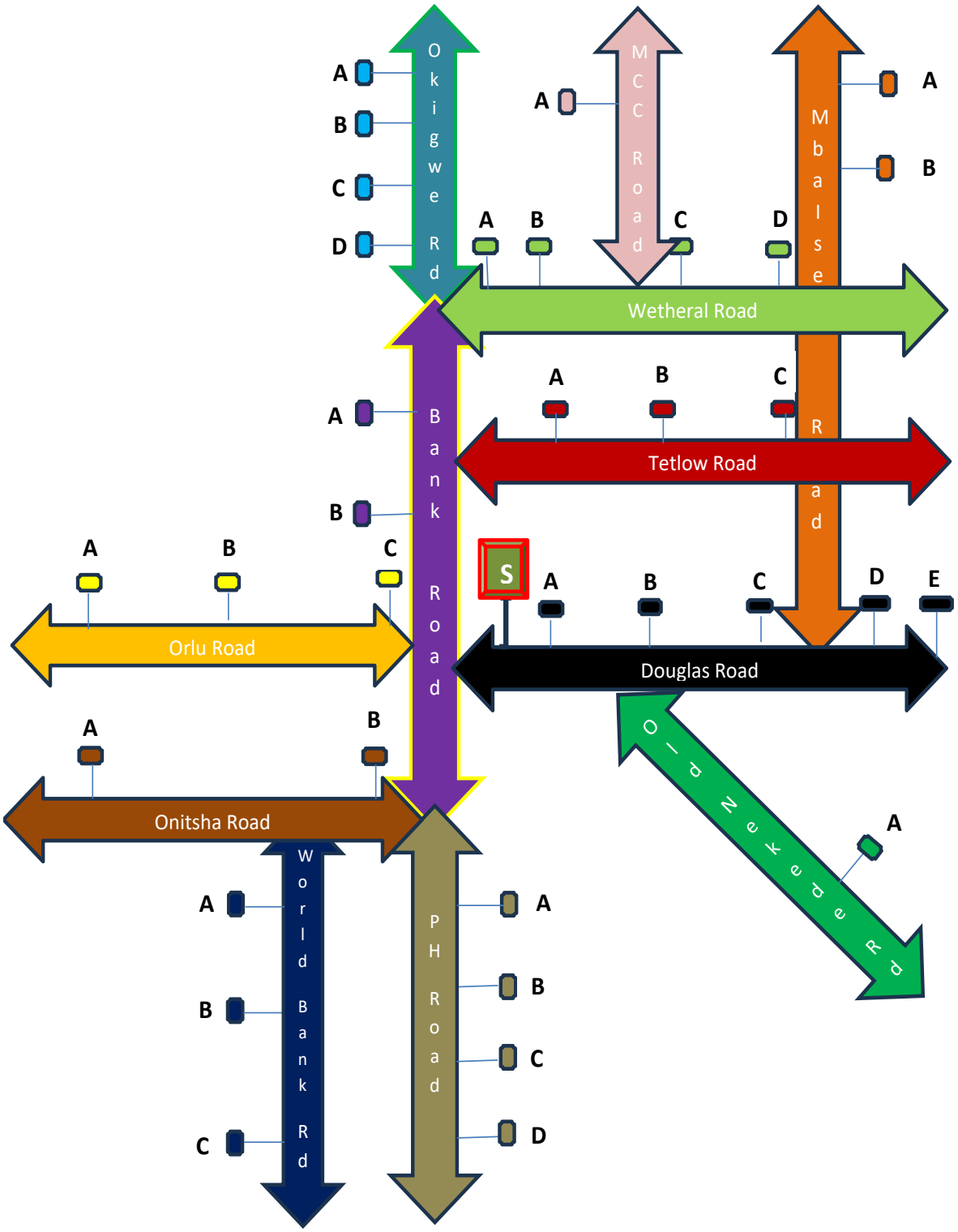


Fig. 7: CCTV Design of Owerri Municipality

Consequently, Table 3 indicates the key that is required to fully comprehend the design. The key discloses the **localities (A, B, C, D & E)** on each of the routes that deserves the presence of a CCTV camera, while the **Control Server** labelled "**S**" is located at the Owerri Municipal Council Headquarters situated along Douglas Road, by Ama JK bus/stop.

Table 3Overview of Localities in the CCTV Design

S/N	Road	Point A	Point B	Point C	Point D	Point E
1	Douglas	Ama JK	St Paul	Mbaise Junction	Ama Hausa	Emmanuel College
2	Wetheral	Government House	Cherubim Junction	MCC Junction	Fire Service	
3	Port-Harcourt	Concorde Junction	House of Assembly	Ebere Link	Hospital Junction	
4	Okigwe	IMSU Junction	Bala Suya Junction	Civil Defence	Prison	
5	Tetlow	By Njamanze	Old Stadium	By Mbaise Road		
6	Orlu	Teaching Hospital	Alvan	Warehouse		
7	World-Bank	Everyday Supermarket	Ideal Suite Hotel	Market Bus/Stop		
8	Onitsha	Arugo Park	Control Post			
9	Bank	Bank Cluster	Bank Cluster			
10	Mbaise	Shoprite Mall	Relief Market			
11	MCC	Aladinma Fed. Housing				
12	Old Nekede	West End				

5. Conclusion

A well-structured and thorough field survey was conducted using the Google online software coupled with oral interviews with key professionals. Afterwards, a robust and sustainable CCTV design suitable for Owerri Municipality was eventually realized having painstakingly analyzed and evaluated the survey results acquired from over 50 respondents. The actualized proposed design can usher in a befitting installation of the IoT device, which would help to avert many kinds of criminal activities occurring within the shores of the city, thereby guaranteeing a safe environment. Summarily, any constituted authority within Nigeria and beyond, particularly Owerri Municipal Council, will learn from the project a reliable approach to actualize a feasible, formidable and sustainable CCTV Design for implementation.

However, understanding that the proposed system needs to be properly safeguarded at all cost, both the physical and digital/data security parameters ought to be critically considered by future researchers.

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Ethical statement: The paper replicates the author's research and investigation in a straightforward and holistic pattern.

Conflict of interest: The author declares that there is no any form of conflict of interest in respect of this research paper.

Data availability statement: Every data deployed in this research study was locally sourced, and was available on request.

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