A FRAMEWORK FOR E-PAYMENT AND FINES NOTIFICATION FOR TANZANIA TRAFFIC POLICE OFFENCES

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Abstract

This research critically investigates the efficiency of the existing e-paying system in use by the traffic police in Tanzania, in an attempt to come up with an enhanced approach. A convergent parallel approach to a mixed-methods design was used to seek the quantitative elements of the research by carrying out an online survey of 100 participants comprising drivers, traffic police, and the Tanzania Revenue Authority. A key part of the research methodology was to seek the opinions of key experts through the use of in-depth interviews. This was done in areas of high traffic in Dar es Salaam, Arusha, Dodoma, Mbeya, and Mwanza. Results have established key weaknesses in the current system, whereby the system fails to be interoperable with the Tanzanian government system, allow real-time responses, or be user-centric. To address the challenges encountered, the research presented an innovative API-based e-payment and fines notification system that incorporates mobile and web interfaces, real-time fines allocation and payment verification, central and secured management of user and system data, and automated reporting and user-friendly interfaces that would be ideal on a global scale. Even though research on e-payment and fines notification systems had previously been conducted by the research work in order to address the discrepancies in the current system and pose an effective solution to the challenges reported by the study, the research faced some limitations. For instance, the research relied on specific urban locations and prototypes to test the system. This indicates the need to conduct nation-wide trials. This research work on e-payment and fines notification system serves as a solution to provide effective traffic enforcement and digital payment systems in the Republic of Tanzania..

Keywords: E-payment systems; Traffic enforcement; API integration; User experience; System interoperability; Digital governance; Tanzania

1.0   INTRODUCTION

The globe has, over the last few decades, experienced unprecedented advancements in digital technology, transforming how people interact with each other and institutions (Alhaddad, 2018). The advent of communication technologies, social media platforms and online business has transformed the way people carry out everyday activities, like buying, banking, and payment (Azhar Susanto, 2019). Among all these innovations, the development of electronic payment (e- payment) systems is one of the most significant developments of the digital era. E-payment systems enable users to conduct financial transactions electronically without using physical cash or cheques. These systems have introduced convenience and flexibility to users and have made them able to make payments anywhere at any time.

E-payment systems are so popular because they are quick, secure, and geographically flexible. Their origins can be traced back to the 1990s when online debit and credit card transactions were initiated (Yaakub et al., 2016). However, initial limitations like manual input and the absence of standard gateways led to more powerful systems like PayPal and Google Wallet in the early 2000s (Bett1 et al., 2014). E-payment systems are today an integral part of the global economy, used by millions to facilitate several transactions.

The rapid development of e-payment systems has been driven by enhanced online purchasing, mobile commerce, and expansion in digital currencies (Clemes et al., 2021). Convenience is their biggest asset consumers can purchase goods or services without visiting physical spaces. This not only benefits the users but also allows businesses to expand their spread and sales (Pilk et al., 2017). E-payment systems also offer instant processing, such as being able to confirm the transaction immediately and faster access to services. They also offer more security, with less exposure to fraud by minimizing exposure of sensitive financial data (Alraja et al., 2019).

From the provision of public services, the e-payment platform has been worth it, particularly in terms of enforcing traffic regulations. They offer the platforms on which drivers can be levied fines through means like mobile money, bank online, or credit cards in order to enhance compliance as well as customers' satisfaction (Smith, 2022). Research suggests that the jurisdictions implementing e-payment channels for traffic offences have minimized the rate of defaulting in paying the penalties (Jones & Roberts, 2021). Besides, computerized systems increase administrative efficiency, reduce paperwork, and facilitate real-time updating of data, which can be useful for enforcement and case tracking (Chen, 2023). Such technologies have even caused a redefinition of traffic fine nature from punitive to administrative measures (Garcia, 2024).

The government sector, including the police, has adopted computerized innovations such as Traffic Police E-payment Systems to improve service delivery (Haque et al., 2020). They enable electronic payment of fines by motorists and can also connect to the government database to provide improved accuracy and efficiency in information. Countries that have implemented such systems have increased levels of transparency, reduced corruption levels, and improved revenue collection. Tanzania is among the countries that implemented the e-payment system for payment of traffic fines with the objective of eliminating problems such as corruption, inefficiency, and inconveniences that come with traditional payment channels (Mollah et al., 2012).

Tanzania launched its Traffic Police E-payment System in 2018 together with the Tanzania Revenue Authority (TRA) and the National Identification Authority (NIDA) (Manyerere & Manyerere, 2018). The system was operational across the country by 2019 (TCRA, 2019). The system allows drivers to pay their fines via mobile money or credit/debit cards by just entering a unique citation number received upon committing a traffic offence. The system verifies payment and provides an electronic receipt on the motorist's phone or email.

This system has brought immense progress. It has substantially restrained corruption by closing cash payments to officers, increased revenue transparency and accountability, and increased convenience through making payments anywhere without the need to go to a traffic station. Challenges notwithstanding, challenges persist. Low digital

literacy, disparate technology access, cyber-security risks, and the inability of the system to provide real-time notification capability constrain the efficacy and inclusiveness of the system (Taylor & Nguyen, 2022).

Although electronic payment systems for traffic enforcement do exist in many jurisdictions, most of the current systems are mere generic payment platforms with limited integration, notification, and enforcement-specific functionalities. This study differs from the existing approaches by proposing an API-based e-payment and fine notification framework tailored to the specific needs of Tanzania's traffic enforcement ecosystem, which addresses interoperability, real-time communication, and user accessibility challenges.

Although the system brings about more transparency, a decline in corruption levels, and ease in access and payment, there are still some challenges that exist. These may be lack of digital literacy among citizens, lack of access to devices and the internet, cybersecurity threats, and the lack of a real-time notification system regarding the issuance of fines (Taylor & Nguyen, 2022).Though the existent e-payment services are universal around the globe, they are often common platforms without in-depth integration, notification, or enforcement-specific capabilities. Additionally, the existing system in Tanzania does not have capabilities such as automated notification, inter-operability with the governmental database, or user-centricity. In this regard, the research fills the existing gap by proposing an API-driven platform for the payment process and notification of the traffic fines in the traffic enforcement context in Tanzania.

1.1   Research Objectives

This study fills in the gaps in the redesigning of the traffic fine e-payment system by developing an adequate architecture and implementation model with integrated notification features suitable for the Tanzanian traffic police context with three specific goals:

1.1.1   To analyze the existing processes and determine the key requirements for an

effective e- payment and fines notification system tailored to the context of Tanzania Traffic Police.

1.1.2   To develop a framework for an integrated e-payment and fines notification system aimed at improving efficiency, transparency and compliance of traffic offences.

1.1.3   To provide recommendations for the adoption and implementation of the framework within the Tanzania Traffic police System.

1.2 Research Questions

Based on the objectives of this study, the following research questions guide the investigation:

1.2.1   What are the key challenges and limitations of the current Tanzania Traffic Police e-payment and fines notification system?

1.2.2   What requirements and features are necessary to design an effective and user-friendly e-payment framework for traffic fines?

1.2.3   How can the proposed API-based e-payment and fines notification system be adopted and implemented to improve efficiency, transparency, and compliance among stakeholders?

2.0   LITERATURE REVIEW

The literature review conducted establishes the context for the study by providing the conceptual definitions and reviews the supporting theory followed by the related works. It also provides the conceptual framework for the study.

2.2 Theoretical Review - Diffusion of Innovation Theory

Based on Rogers (2003), the theory explains how innovations spread across social systems. It highlights a number of variables that affect how quickly an innovation or product is accepted including communication, compatibility, simplicity,

and observability as key factors influencing user adoption. The main contribution of this theory is that, it emphasizes the awareness among users as one of the challenges observed among the motorists are not aware with the current system (Rogers, 1962). This theory worthy enough to guide this study based on the strengths explained above.

2.3 Related Works

2.3.1 Rwandan's SMS-based Utility Payment System

The Rwandan's SMS-based utility payment system was developed by CePRC (2018). Customers in Rwanda can use this system to pay their electricity bills using cash power cards made by SMS media in Rwanda in a variety of values (Ngendahayo et al., 2024). The system works using mobile phones both smarts and feature phones by issuing the SMS to customers which is similar to the proposed police traffic e-payment fine system (Zaragosa, 2022). However the system has not considered on the issue of customer notification as a reminder to customers about due fine payment and amount. Additionally it focused mainly on payment of utility services unlike the proposed police traffic e-payment fine system. Despite these strengths, the system is primarily designed for utility billing rather than enforcement-related transactions. It lacks integrated real-time notification mechanisms for payment reminders and does not support interoperability with law enforcement or regulatory databases. Unlike traffic fine systems, utility payments are voluntary and recurring, which reduces the need for enforcement-driven features such as compliance monitoring and automated escalation. Consequently, while the Rwandan system informs the communication component of this study, it does not address the unique requirements of traffic offence management

2.3.2 Architecture for SM-Based Utility Services Mobile Billing System

Umar (2009) designed architecture for SMS-based utility services mobile billing system in Uganda. The system captured both customers with smart and feature phones as the strength. However, the system lacks notification feature for customers who delay to pay their bills on time and do differs with the proposed system framework in the context of its
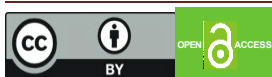
application. However, the architecture did not incorporate automated notification workflows for overdue payments, nor did it address system interoperability with other government databases. Additionally, the framework focused solely on billing and payment processing, overlooking enforcement-specific requirements such as citation tracking, audit trails, and institutional coordination. These limitations reduce its applicability to traffic fine management, which demands real-time communication, multi-agency integration, and enhanced security features.

2.4 Research Gap

While there is some literature on e-payment and mobile billing systems, these are general utility payment systems; for example, the SMS-based utility payment system of Rwanda by Ngendahayo et al. (2024) and Uganda's mobile billing architecture by Umar (2009). No major features about traffic enforcement are included in such systems. Likewise, large-scale automation of notifications, real-time alerts on overdue fines, and integration with government databases are lacking, thus decreasing user awareness, compliance, and operational efficiency, as noted in the studies of Zaragosa (2022) and Clemes et al. (2021). Moreover, earlier studies stress technical functionality but give little attention to user-centered design and the accessibility of rural and urban users and security safeguards of sensitive financial data, as explained in Alraja et al. (2019) and Haque et al. (2020). From a theoretical standpoint, though the Diffusion of Innovation theory explains adoption challenges, few studies, such as Rogers (2003), have applied them in guiding the design of e-payment systems specific to enforcement. This paper, therefore, addresses these gaps by developing a context-specific API-based e-payment and fines notification framework for Tanzania, matching technical integration, real-time notifications, security, and user accessibility, hence addressing the weaknesses of previous systems and offering a contextually appropriate, empirically informed solution.

2.5 Conceptual Framework

The conceptual framework for the design of the Tanzania traffic police e-payment fine system
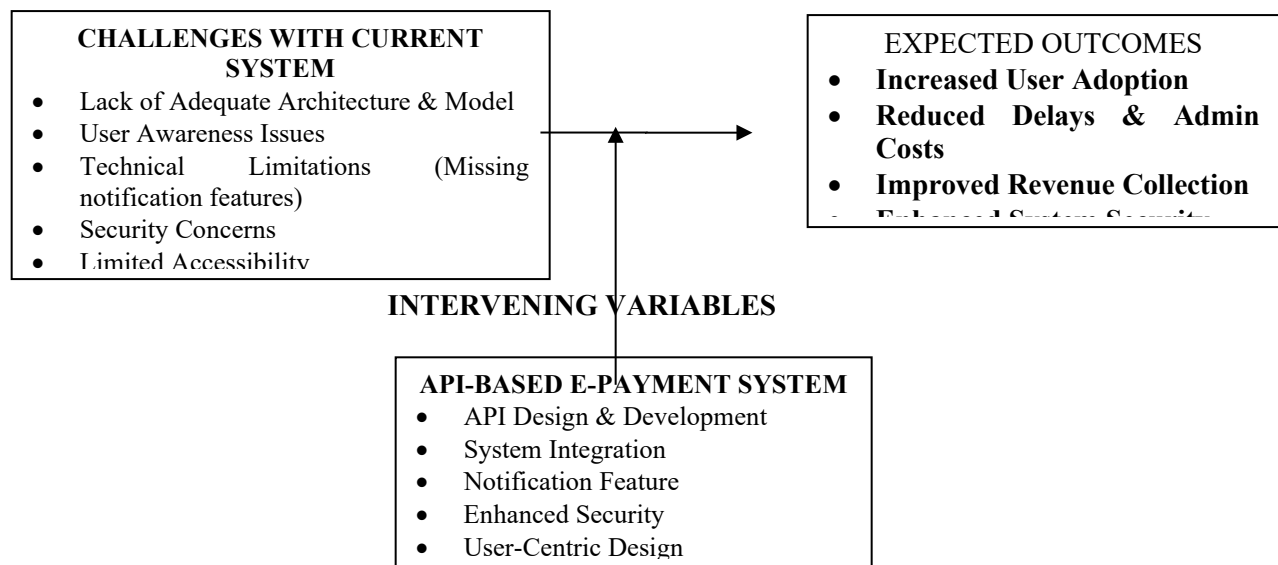
redesign is founded on three key factors: issues with the current system (independent variables), the proposed API-based e-payment system (intervention), and expected outcomes (dependent variables). There are a number of challenges to the existing system, including the lack of appropriate architecture and model, low awareness among end-users, technical problems such as the lack of notification functionality and poor system integration, security problems in the form of data breaches, and accessibility issues because of internet and device constraints, particularly in rural areas. To address these issues, the intervention planned is to develop an API-based e-payment

system that is integrated with government platforms, enhances security through encryption and authentication, provides automated notifications via SMS and mobile apps, and makes it convenient for both smartphone and feature phone users. This systematic plan is anticipated to improve system functionality and end-user experience. As such, the expected outcomes are faster user adoption, reduced administrative cost and payment arrears, improved revenue collection, and a more secure system, leading to a more efficient and trustworthy traffic fine payment system in Tanzania

INDEPENDENT VARIABLES   **DEPENDENT VARIABLES**

CHALLENGES WITH CURRENT SYSTEM
- Lack of Adequate Architecture & Model
- User Awareness Issues
- Technical Limitations (Missing notification features)
- Security Concerns
- Limited Accessibility

EXPECTED OUTCOMES
- **Increased User Adoption**
- **Reduced Delays & Admin Costs**
- **Improved Revenue Collection**
- ~~Enhanced System Security~~

INTERVENING VARIABLES

API-BASED E-PAYMENT SYSTEM
- API Design & Development
- System Integration
- Notification Feature
- Enhanced Security
- User-Centric Design

Figure 1: The Conceptual Framework

3.0   MATERIALS AND METHODS

This study adopted a convergent parallel mixed-methods design way of arriving at a model for the Tanzania Traffic Police E-Payment and Fines Notification System. The study employed a combination of a conceptual framework, survey, and system development (Nunamaker et al., 1996). The theory framework involved theory-building, and as a result, various methods, tools, and techniques were reviewed to provide a solution to

the existing problems facing motorists and other stakeholders in the payment of traffic offence fines. These decision problems were examined by a literature review that investigated existing models, frameworks, tools, and techniques. The review compiled a snapshot of how a model for traffic police e-payment and fines notification system can be designed and implemented effectively. The survey approach was mainly used for gathering user requirements and coming up with specifications that would suit the model for handling the issues in the police traffic e-payment fines system. The survey made sure the needs of the respective stakeholders

were met by the model created.

In systems development, the research made use of a prototyping methodology, which was particularly recommended in the development of APIs (Wu et al., 2004; Elgarah et al., 2002). The methodology was applied in the development of the API, which was employed to pilot the model and derive a tangible solution to problems where user requirements were not fully known beforehand. On these bases, the research employed mixed methods to maximize expected outcomes and results.

In this study, the population consisted of three groups of respondents: motorists, police traffic officers, and Tanzania Revenue Authority (TRA) officers. Motorists were selected randomly because they were the ones paying the traffic offence fines. Police traffic officers were selected because they managed the e-payment system, offenders were committed to them, and fines were imposed by them. TRA officers were also involved because they were responsible for collecting revenue, and the e-payment fine system needed to be integrated into the TRA revenue collection system. A purposive sampling technique was used in identifying the sample size of the study.

An in-depth interview supplemented by focus group discussions (FGDs) was used to collect information from the respondents, involving a total of 100 individuals from the study districts. Both techniques were used to gather the opinions of the respondents regarding the user requirements needed for re-designing the model of the Tanzania police traffic e-payment and fine notification system. The data collection also considered gender balance to ensure capturing the requirements from users of different groups.

Qualitative data obtained from in-depth interviews and focus group discussions were analyzed using

content analysis. The analysis process involved transcribing responses, reading the data repeatedly to achieve familiarization, and identifying recurring patterns and themes related to system challenges and user requirements. Codes were developed inductively from the data and grouped into broader thematic categories aligned with the study objectivesData collected were presented in tables and charts depicting specific frequencies and percentages grading the requirements.

A descriptive method was used to present data under the research questions that guided the conduct of the study. Charts and tables were also used to provide a clear picture of the magnitude of the findings as depicted by percentages and ratios, and conclusions were drawn accordingly. Finally, the results depicted the specific requirements needed to design the framework and develop the e-payment fine model for implementation.

To guarantee that the data collected via the survey tool was consistent, reliability tests were performed via the use of Cronbach's alpha. Cronbach's alpha was used as it is considered the standard for measuring internal consistency. This measure ensures that the data being collected via different variables is consistent in trying to measure the construct. This is important for producing composite scores that are valid.

The results in the Table 3.1 below revealed adequate to excellent reliability on each construct, which supported that the survey questionnaire successfully represented each concept. With the results obtained, the use of composite scores for summarizing the data from the stakeholders on how they perceive the system and designing the e-payment system for fines notice was appropriate.

Table 3.1: Reliability Analysis of Survey Constructs

Construct	Number of Items	Cronbach's Alpha (α)	Interpretation
Security	5	0.84	Excellent reliability
Interoperability	5	0.81	Good reliability
Scalability	4	0.78	Acceptable reliability
User-Centric Design	6	0.86	Excellent reliability
Data Accuracy	5	0.83	Good reliability

4.0   FINDINGS AND DISCUSSION

4.1 Key Requirements for an Effective E-Payment and Fines Notification System Tailored to the Context of Tanzania Traffic Police

To identify the key requirements of an effective e-payment and fine notification system for the Tanzania Traffic Police, data were collected using questionnaires and interviews. The questionnaires used a five-point Likert scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5) in measuring the levels of respondents' agreements on various system properties. Responses were computed using descriptive statistics to determine the most significant technical and functional properties that are needed. Subsequent are the factors which have been deemed pivotal.

4.1.1   Security Requirements

This study used five likert scale questions to evaluate stakeholders' perception and expectations about system security. From the findings as indicated in Table 4.2, a clear consensus has been reached on the main system security requirements. Protection of data through the use of HTTPS or SSL protocol stood as the most prominent requirement with a mean score of 4.80 and a 98% level of agreement at level 4 and above, indicating the need to ensure confidentiality and security of information when transferring money. Effective authentication mechanisms, especially those that use OAuth2 or tokens, stood as the second most prominent requirement (mean = 4.70, 95%), indicating stakeholders' concern to ensure that users' credentials are secure and that no one else can access the system without authorized users' approval. This was closely followed by recording all transactions connected to payments (mean = 4.65, 93%); this indicates the need to ensure system auditability to prevent any fraud or dispute that may arise. Also, the study found that stakeholders are aware of the need to ensure that the system shields itself or the users against cyber attacks, such as Distributed Denial of Service (DDoS) attacks (mean = 4.40, 88%). Lastly, role-based access control (RBAC) ranked as the fifth security requirement (mean = 4.75, 96%); this signifies that stakeholders wanted to ensure that authorized users, through their roles, can see or modify specific information that would otherwise be sensitive to others.f.

Table 1: Security Requirements

Likert Statement	Mean	Std. Dev.	% ≥ 4
The system should use data encryption (HTTPS/SSL) to protect information.	4.80	0.41	98%
User authentication using OAuth2/token-based methods must be enforced.	4.70	0.50	95%
Every payment transaction should be recorded in the system logs.	4.65	0.55	93%
The system should include protection against cyberattacks (e.g., DDoS).	4.40	0.68	88%
Access to personal information should be restricted based on permission levels.	4.75	0.46	96%

4.1.2 Interoperability and System Integration

Adequate interoperability and seamless system integration are a pre-condition to a successful roll-out of the Tanzania Traffic Police e-payment and notification of fines system. In an attempt to quantify stakeholder sentiment toward such issues, the study employed five carefully worded Likert-scale statements. Descriptive statistics of these responses are presented in Table 3.

The results clearly indicate that stakeholders view system integration as the central pillar for the proposed e-payment system. Interestingly, the demand to enable payments using widely used mobile money platforms elicited the maximum level of support with a mean rating of 4.78 and an overwhelming 98% of the respondents scoring it 4 and above. This highlights the central role that mobile money services such as M-Pesa, Airtel Money, and Tigo Pesa play in the economy of Tanzania. Easy access and widespread adoption have ensured that they become the preferred mode of payment for the majority of Tanzanians, including those involved with government institutions. Including these platforms, therefore, will help to maximize user access and minimize

barriers to collaboration with traffic fines.

Of similar importance is the harmonization with the Tanzania Revenue Authority (TRA), which also scored an average of 4.68 and 94% consensus. The harmonization will enable automatic and accurate tracking of revenue received from fines that will guarantee transparency and accountability in revenue collection. Real-time data exchange with TRA minimizes the risk of revenue leakages and promotes efficient fiscal management. Substantial support was also given to integration with Traffic Management System (TMS) with a mean rating of 4.55 and 90% agreement.

In addition, stakeholders emphasized the importance of transmitting data in real-time through system APIs, which had a mean value of 4.62 and agreement rate of 92%. Real-time updates allow for immediate reflection on payment status and offence clearance, which is crucial to both user satisfaction and operational efficiency. This feature allows immediate notification to offenders and accurate record-keeping by authorities. Finally, integration with local banking institutions was also favorably rated (mean = 4.50, 89% agreement). Qualitative interviews reinforced the need for integration with multiple platforms to ensure operational continuity and minimize revenue leakages.

Table 2: Integration Requirements

Likert Statement	Mean	Std. Dev.	% ≥ 4
The system should integrate with the Tanzania Revenue Authority (TRA) for revenue tracking.	4.68	0.47	94%
Direct integration with the Traffic Management System (TMS) is important for data accuracy.	4.55	0.52	90%
The system should allow payments via popular mobile money platforms such as M-Pesa, Airtel Money, and Tigo Pesa.	4.78	0.43	98%
The system should have APIs capable of real-time data dissemination.	4.62	0.49	92%
Integration with local banks will improve payment options for users.	4.50	0.60	89%

4.1.3   Scalability and Performance

The success and sustainability of the Tanzania Traffic Police e-payment and fines notification system depend on sustaining scalability and optimal performance. Because the system would have to process potentially numerous users ranging from everyday traffic offenders to administrative staff it must be capable of processing concurrent requests, processing transactions in an efficient manner, and providing constant availability, especially during peak hours such as after public holidays or mass traffic enforcement operations. To capture stakeholder priorities in this domain, the study utilized five targeted Likert-scale statements, presented in Table 3 below.

The highest rated quote with a mean score of 4.72 and 96% of users having a strong agreement (score 4 and above) emphasizes the greatest need of the system to be capable of supporting numerous simultaneous users and requests without its performance being affected. This is coupled with an appreciation by stakeholders of the national reach of the system, arguably serving thousands of simultaneous users both in urban and rural areas, especially considering Tanzania's growing mobile and internet penetration. Use of asynchronous processing was also greatly valued, with a mean of

4.48 and 89% agreement. Asynchronous operations enable the system to autonomously and simultaneously execute multiple transactions or notifications in batches, rather than sequentially. This enhances responsiveness as well as reduces waiting times, particularly for operations like payment processing or sending notifications, which might otherwise lead to bottlenecks in synchronous designs. Intrinsically related to this is the application of caching mechanisms, which received an average of

4.40 and 87% agreement.Finally, stakeholders insisted that the system provide quick response times in instances of heavy usage, as reflected by a mean score of 4.68 and 94% agreement. The findings indicate that system performance must be proactively maintained, and qualitative comments suggested including automated performance monitoring dashboards for early detection of bottlenecks.

Table 3: Scalability and Performance

Likert Statement	Mean	Std. Dev.	% ≥ 4
The system should support a high number of simultaneous users and requests.	4.72	0.45	96%
Load balancing techniques must be implemented to ensure consistent performance.	4.55	0.53	90%
The system should use asynchronous processing to improve responsiveness.	4.48	0.56	89%
Caching mechanisms should be incorporated to reduce server load and latency.	4.40	0.60	87%
The system should maintain fast response times during peak usage periods.	4.68	0.48	94%

4.1.4   User-Centric Design

User-centered design is a fundamental requirement in the design of the Tanzania Traffic Police e-payment and notification of fines API system. Owing to the heterogeneity of digital literacy among road users in Tanzania, the system must be designed with simplicity, accessibility, and responsiveness as key considerations. A user-centric strategy ensures that the enforcement officers and the public at large benefit from an efficient interface with the system, thereby fostering adoption of the service and impeding resistance to digital processes. Table 4.5 consolidates descriptive statistics that the highest rated item was that the system must be easy to use even for users with low digital skills, with a mean of 4.75 and 96% agreement (responses ≥ 4 on Likert scale). This highlights one of the most important design imperatives: the system must be user-friendly enough to accommodate persons regardless of age, education, or technological orientation. In the Tanzanian context where most of the users would employ the mobile phones only and have a minimum exposure to the online services his requirement is not only beneficial but necessary for equitable access.

Following closely is recognition that the interface must be simple and user-friendly with a mean of 4.65. This means that the system needs to embrace logical navigation, consistent design patterns, and visual signals that guide the users naturally without necessarily having to tell them. An efficient interface minimizes cognitive loads, which is especially critical in situations where the users are stressed such as when trying to pay an urgent fine or access traffic information real-time. Accessibility in language also came out high, with a mean of 4.72. This means that bilingual support (English and Swahili) is not merely an added bonus but a user's right. Since Kiswahili is a national language that most individuals speak, it is important that users are not linguistically disadvantaged so that they can be capable of understanding legal or monetary implications.

Device flexibility is equally important. Stakeholders were in agreement with a firm average of 4.70 that the system was to be optimized for mobile phone use, given that these are the most used access points in Tanzanians. Compatibility with Android and iOS phones, responsive screen layouts, and low data usage should all be given priority in system design. Finally, prompt user support was a need that rated 4.60 on an average, meaning that users would want to be given help immediately whenever they experience an issue.

Table 4: User-Centric Design

Likert Statement	Mean	Std. Dev.	% ≥ 4
The system should be easy to use even for individuals with low digital literacy.	4.75	0.44	96%
The interface should be simple, clear, and guide users intuitively through the process.	4.65	0.50	94%
The system should support both Swahili and English languages for inclusivity.	4.72	0.48	95%
The system should be accessible on smartphones and other mobile devices.	4.70	0.47	94%
Users should be able to receive timely help or guidance when encountering challenges.	4.60	0.53	91%

4.1.5   Data Accuracy and Validation

Precision and validation of the information constitute a basic requirement for integrity and credibility of the Tanzania Traffic Police e-payment and notification of fines system. Precision in records of offenses, payment, driver data, and vehicle data is necessary in order to provide fairness, avoid disputes, and facilitate effective enforcement of road safety measures. A reliable system not only needs to capture and keep correct information but also prevent wrong, redundant, or forged data from entering through automated validation mechanisms.

Table 5 presents stakeholder responses towards Likert scale items indicating perceptions of the significance of data correctness and validation procedures in the system.

The highest rated item with a mean of 4.73 emphasized the need for real-time verification of offense records before issuance. This finding reflects a general feeling among the stakeholders that lost time in validating information may result in mistakes leading to erosion of public trust or unfair fines. Authenticating in real time can be achieved by connecting the system to handheld or mobile devices carried by traffic police to verify information in real time prior to issuing tickets. Next in priority was the need for automatic prevention of errors, having an average of 4.68. All parties were overwhelmingly in consensus that the

system should bring out anomalies while inputting data, e.g., incorrect vehicle registration numbers or absent personal details. Smart forms, validation rules, and input restrictions ensure that solely logically accurate and valid data are allowed into the system. Another most significant finding is the support for mandatory cross-validation of data against TRA and TMS systems with a mean of 4.70. This inter-agency data synchronization is important in checking tax compliance, driver validity, and ownership. For example, the violation of an automobile can be verified through TRA records to check whether the vehicle is duly registered or whether there are already paid fines.

Further, the system should be designed to avert and detect duplicate entries, as shown by high agreement level of 4.66. This feature minimizes the chances of double charging of the offenders or filling their records with redundant data. It further increases efficient reporting and analysis by the traffic authorities. Finally, there was considerable

support (mean = 4.60) for the inclusion of an option to enable users to review and approve their data before submission. This increases transparency and provides users with a final opportunity to rectify any mistakes that foster feelings of responsibility and ownership.

These findings are supported by qualitative evidence emphasizing fairness, dispute avoidance, and public trust.

Table 5: Data Accuracy and Validation

Likert Statement	Mean	Std. Dev.	% ≥ 4
Offense records should be verified in real time before issuance.	4.73	0.45	95%
The system should have automated checks to prevent data entry errors (e.g., wrong license plate).	4.68	0.49	93%
Cross-checking data with TRA and TMS systems should be mandatory for validation.	4.70	0.48	94%
The system should prevent duplicate offense or payment entries.	4.66	0.51	92%
Users should be able to review and confirm their information before final submission.	4.60	0.54	90%

4.1.6   Legal and Regulatory Compliance

Adherence to the law and regulation is a built-in necessity in designing and implementing the Tanzania Traffic Police e-payment and fines notification system. The system must be fully in accordance with existing national laws and regulations that touch on data protection, financial transactions, police processes, and public service delivery. Compliance with the law not only gives the legal mandate but also enhances public trust, accountability in institutions, and integration with other government websites under statutory specifications. As from Table 4.9, stakeholders attach high priority to total compliance with the law, particularly under the acts governing the digital systems. The strongest consensus (mean = 4.80) was accorded to the statement that the system must adhere to the Electronic Transactions and Cybercrimes Acts, highlighting concerns of secure digital conduct, fraud security, and authentic digital communication.

Compliance with the Data Protection Act was also necessary, where stakeholders called for the documentation and safeguarding of privacy rights

(mean = 4.68). This indicates an expectation that users' payment and personal data must be handled openly and securely, for instance, proper consent, limited retention, and legal access procedures. The traceability requirement in law of payments and fines also ranked highly (mean = 4.72), indicating that it is necessary to ensure every record can be confirmed, authenticated, and audited in case of disputes or legal audits. This involves time-stamping transactions, having immutable records, and dispensing receipts that are compliant with national standards.

Further, stakeholders recognized the users' right to appeal or object to fines, a median score of 4.60. That is, the system should include a procedural interface for complaints, in line with administrative justice principles. Whether through on-line forms or linked judiciary portals, users should be able to ask for review when they believe a fine was issued unjustly. Lastly, the call for periodic audits and legal reviews (mean = 4.55) indicates the need that system evaluations must be embedded within organizational control. These audits not only ensure legal compliance but also allow the determination of weak points, inefficiencies, or evolving compliance risks. Interview responses highlighted the importance of compliance for legitimacy and stakeholder trust.

Table 8: Legal and Regulatory Compliance

Likert Statement	Mean	Std. Dev.	% ≥ 4
The system should comply with national laws such as the Electronic Transactions and Cybercrimes Acts.	4.80		98%
There should be clear documentation for how the system handles data in line with the Data Protection Act.	4.68	0.47	94%
All system-generated offenses and payments should be legally traceable.	4.72	0.45	96%
The system should allow users to challenge or appeal fines through a legal channel.	4.60	0.52	91%
Regular audits and legal reviews should be conducted on the system.	4.55		89%

4.1.7 API Documentation and Developer Support

Accurate API documentation and proper developer support are essential to the successful launch and sustainability of any online platform. In the case of Tanzania Traffic Police\\te-payment and notification system, properly documented information enables developers from governmental agencies, banks, mobile money service providers, or third-party services to easily integrate and keep their systems running with minimal resistance. Developer support processes also facilitate troubleshooting, updating, and continuous system enhancement, hence improving running stability and innovation.

Table 8 presents descriptive statistics of stakeholder responses to five Likert-scale items measuring perceived importance attached to documentation quality, ease of integration, and developer support availability. The findings show very strong agreement with extensive documentation, with the highest rated item, required technical documentation up-to-date, having a mean of 4.82 and 98% concurrence (responses $\geq$ 4). This highlights the expectation that the API will provide not just functional descriptions, but also comprehensive descriptions of endpoints, parameters, authentication methods, error codes, and anticipated responses. Lack of those materials will result in integration processes being delayed or unsuccessful due to miscommunication or construction.

The requirement for proper onboarding and integration procedures was the second-highest ranked item with a mean score of 4.75. Developers usually work under a tight schedule, so they require documentation that enables rapid deployment. This implies structured frameworks, graphical diagrams, minimal jargon, and step-by-step instructions that reduce the learning curve. Equally necessary are the inclusion of sample code snippets, FAQs, and usage manuals, which scored an average of 4.70. Such features allow developers to see the API in use and deploy it in real-world situations, especially in fields like fintech where platform and technology differences are common.

A test or sandbox environment is also considered crucial, with a mean of 4.68. A sandbox allows developers to test API calls, simulate transactions, and debug integration steps without affecting live systems or actual data. This capability not only reduces errors at release but also promotes secure and effective development practices. Finally, the importance of responsive support for developers, e.g., channels like helpdesks, forums, or ticketing, was appreciated with a mean of 4.60. While proper documentation reduces dependency on real-time support, having professional access ready is still valuable when developers aim to address platform-specific issues, policy changes, or emergency downtime.

Table 9: API Documentation and Developer Support

Likert Statement	Mean	Std. Dev.	% ≥ 4
The API should have detailed and up-to-date technical documentation.	4.82	0.39	98%
The documentation should include code examples, FAQs, and use-case guides.	4.70	0.47	95%
A sandbox/test environment should be provided for developers before live deployment.	4.68	0.51	93%
Developer support (e.g., helpdesk, ticketing system, or community forum) should be available.	4.60	0.56	91%
Integration instructions should be clear and allow for fast onboarding.	4.75	0.45	96%

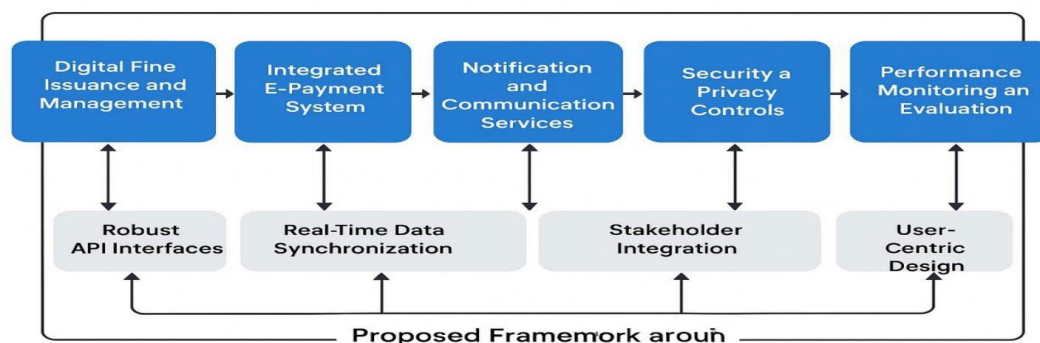## 4.2 Design and Development of Framework for an Integrated E-payment and Fines Notification System

To advance the proposed framework, the study initiated with the analysis of data collected from stakeholders by using a standardized questionnaire on a five-point Likert scale from "Strongly Disagree" (1) to "Strongly Agree" (5). This yielded quantitative responses concerning the perceived importance and effectiveness of varying system requirements, such as security, integration, usability, and automation. Information collected was then statistically calculated to determine priority characteristics and technical specifications that would maximize the performance of the system. Output of this calculation guided the architectural design, process workflows, and integration of building blocks of the framework to make it aligned with the realities of day-to-day work of the Tanzania Traffic Police in streamlining efficiency, transparency, and compliance issues in handling traffic offenses.

The recommended framework consists of five major functional pillars, which are: (1) Digital Fine Issuance and Management, (2) Integrated E-Payment System, (3) Notification and Communication Services, (4) Security and Privacy Controls, and (5) Performance Monitoring and Evaluation. These pillars are enabled by base-level enablers like strong API interfaces, real-time data synchronization, stakeholder integration, and user-centered design principles.

Table 10: Response on Key Functional Components of the Proposed Framework

Component	Mean	Percent
Digital Fine Issuance and Management	4.32	86.4%
Integrated E-Payment System	4.45	89.2%
Notification and Communication Services	4.18	83.0%
Security and Privacy Controls	4.51	90.8%
Performance Monitoring and Evaluation	4.27	85.6%

Figure 2: Proposed Framework

4.2.1 Digital Fine Issuance and Management

This module, rated at a mean of 4.32 on the five-point Likert scale and 86.4% of the participants in agreement or in strong agreement on its relevance, is the entry point of the framework. It provides traffic police officers with a web or mobile digital platform for issuing fines in real-time from the field. Each offence recorded is linked to a unique fine identification number (Fine ID), number plate, driver's license, GPS location, and date and time. The application integrates with the national traffic offence database for validation and prevention of duplication. The dropdown menu of pre-defined offence, corresponding legal codes, and fines ensures standardization and prevents discretionary abuse. By cutting down on paper issuance, this module saves processing time, prevents loss of data, and enhances traceability.

4.2.2 Integrated E-Payment System

With a mean score of 4.45 and interpreted by 89.2% of the respondents as the key driver of efficiency, this module integrates a number of digital payment platforms that facilitate the payment of fines via avenues such as M-Pesa, Airtel Money, Tigo Pesa, and commercial banks via open banking APIs. The payment gateway is user-friendly and multi-lingual to cater to rural and urban users. Upon a successful payment, an immediate confirmation message is received by both the offender and the central system. Payments are assigned to their respective Fine IDs to facilitate proper reconciliation and reduce manual audit requirements. Digital receipts are generated and can be downloaded or sent by SMS or email.

4.2.3 Notification and Communication Services

Module 4.2.3 scored an average of 4.18, supported by 83.0% of the participants who valued its role in increasing compliance. It includes a computer-based notification system that engages with offenders throughout the life cycle of the fine. SMS and email reminders are initiated at three points: when a fine is issued, a reminder close to the payment due date, and when a payment has been successfully received. Notifications carry critical information such as offence type, fine amount, due date, and payment information. Notices of escalation reminding of planned legal action against defaulters are also handled by the system. By doing away with human intervention, this module minimizes opportunities for corruption and keeps people informed and active.
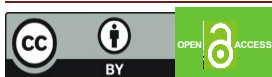
4.2.4 Security and Privacy Controls

Scoring the highest mean score of 4.51 with an agreement rate of 90.8%, this module emphasizes the critical need for robust data security. It employs security best practices like HTTPS/SSL encryption, OAuth2/token-based user authentication, and role-based access control (RBAC) to secure user data and system integrity. System actions like the imposition of fines, modifications to data, and confirmation of payments are all logged in tamper-proof audit logs. Access to personal information is stringently controlled to only authorised users, which supports public trust and internal abuse prevention.

4.2.5 Performance Monitoring and Evaluation

Scoring a mean of 4.27 and 85.6% support from the respondents, this module addresses real-time monitoring and measuring of system performance using dashboards and analytics. Such stakeholders as traffic police chiefs, local traffic command centers, and the Ministry of Home Affairs can view tailored reports of fines levied, levels of payment rates, average time to settle, money received, and officer action. They utilize the information for resource planning, help in identifying anomalies or abuse, and provide a foundation for continuous improvement. The framework also allows for periodic export of data to policy review and external audit.

4.2.6 Supporting Architecture

The architecture employs a RESTful API design to enable modularity, scalability, and seamless integration with external systems. These external systems involve the Tanzania Revenue Authority (TRA) for integration with tax tracking and revenue collection systems, the Traffic Management System

(TMS) for offence synchronization, and national ID databases for user authentication. Real-time sharing of data ensures that traffic offences are always up-to-date on all platforms, improving transparency and effectiveness of operations.

The framework has a user-focused design. Interfaces are made responsive so that they can work with mobile phones, tablets, and desktop browsers. Offline modes are also provided in areas where internet connectivity is weak and data is stored temporarily and then transferred when there is connectivity available. Feedback mechanisms are included so that user opinions are collected and ensured that the system adjusts as per user needs..With a high mean score of 4.45 and 89.2% of respondents recognizing it as a key driver of efficiency, this module integrates multiple digital payment platforms that allow users to pay fines through channels such as M-Pesa, Airtel Money, Tigo Pesa, and commercial banks via open banking APIs. The payment interface is designed to be intuitive and multilingual, ensuring accessibility for both urban and rural users. Once a fine is paid, a real-time confirmation message is sent to both the offender and the central system. Payments are tagged to their corresponding Fine IDs, ensuring accurate reconciliation and reducing the need for manual audits. Digital receipts are generated and can be downloaded or shared via SMS or email..

5.0   CONCLUSION

This study showed that the existing e-payment system used by the traffic police in Tanzania to collect traffic fines has shortcomings in meeting the operational requirements of the stakeholders. Inefficiencies, lack of user engagement, and lack of real-time confirmations about payments and traffic fines have resulted in failed transformation in e-government, as citizens lack confidence in the digital solutions offered by the government. A look at the proposed framework, which focuses on system integration, API interoperability, real-time notifications, and citizen engagement, clearly shows that the framework has technological and operational viability. This approach, through prototype validation, has been able to make payments easier, increase accountability, and increase transparency, meaning that digital

transformation in e-government transformation is more than just making things automated it must be designed to make things easier and beneficial. However, despite the results obtained, there are still some limitations in this study, such as an absence of field deployment based on perceptions from stakeholders, which might influence generalization to some extent. In the future, research work can emphasize pilot releases across different regions in relation to the performance of the system as well as the acceptance level by drivers, traffic officers, and administrative personnel to develop an understanding on facilitators and barriers to achieve comparative analysis from other projects within the context of e-government in Tanzania.

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