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Digital Municipality: Deploying a Mobile Platform for Integrated Online Municipal Services in Nepal's Local Governments

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Abstract

The purpose of this study is to propose a mobile-first architecture that integrates vital municipal services within local governments in Nepal. While there is increased focus on digitizing services through the Government of Nepal's Digital Nepal Framework, most municipalities continue to rely on fragmented and paper-intensive procedures. This research involved conducting semi-structured interviews and surveys with the IT staff of seven local government organizations in Kanchanpur District (two rural municipalities and five municipalities). This research analyzed the findings using the Design Science Research approach and the SDLC model to identify the requirements and develop a viable architecture for the proposed information system. A relational database, micro service architecture, and security mechanisms like role-based access control and OAuth2/JWT are essential features that make this proposal possible. A few critical outcomes from the research suggest that such architectural designs help reduce costs, enhance transparency, and improve service delivery, particularly in disconnected regions by leveraging offline caching. This report is an informative resource for local governments wishing to implement effective e-governance systems centered on their citizenry. It demonstrates how municipalities can achieve digital transformation that is both scalable and sustainable along with the practical implementation of the Digital Nepal Framework.

Keywords: SDLC, architecture, design science, mobile governance, e-government, municipal services, Nepal

Introduction

The digitalization of services has occurred at the global level, but due to bureaucratic inertia and lack of infrastructure, sometimes, this has not been adopted uniformly, particularly in developing contexts (Heeks, 2002; Ndou, 2004). A vision of delivering

citizen-centric services via mobile devices in Nepal can be found in the framework known as Digital Nepal (Government of Nepal, 2019), as well as in the IT policy of Nepal (Ministry of Science, Technology and Environment, 2010). Local administrations continue to deliver services in silo fashion and in manual mode, despite these national-level aspirations. Routine tasks such as business licenses, payments of taxes, and births and deaths registration require physical presence at offices.

This study addresses this problem by designing a "Digital Municipality" architecture a unified mobile system that integrates multiple features into one application. This research highlights the inefficiencies caused by the current fragmented process and the absence of a unified mobile solution through the findings of IT professionals working in seven LGUs in the Kanchanpur district. Through the use of the SDLC, this study presents an architecture design that is scalable, secure, and accessible through Design Science Research methodology. There are two contributions made through this study: (a) the creation of an empirical modular design of a municipal mobile application, and (b) useful suggestions for LGUs to incorporate the country's digital policy in the local context.

Kanchanpur District consists of five municipalities and two rural municipalities, located within the Sudurpashchim Province of Nepal. The penetration of mobile phone use and internet connectivity has gradually improved, but the local population's usage of digital technologies is still quite limited. Municipal departments still rely on ad-hoc spreadsheet solutions, manual records, and disconnected web portals. This fragmented approach limits public access to efficient services, increases operational challenges, and reduces transparency.

"Digital Government" and "Digital Services" have been identified as significant areas under national initiatives such as the Digital Nepal Framework. But concrete technical designs, detailed workflow processes, and practical implementation approaches are necessary to translate these goals into practice within the municipal context. The purpose of this paper is to fulfill that need by proposing a replicable framework for mobile-based municipal services in Nepal.

Problem Statement and Objectives

In spite of the nationwide initiative towards digitization under the Digital Nepal Framework (2019), municipal governance in Nepal continues to be plagued by inefficient, fragmented, paper-heavy, and office-based processes. Routine processes such as obtaining company permits, making taxes, registering births and deaths, and submitting complaints remain manually performed and scattered across different systems in the Kanchanpur District. As the government struggles with issues like fragmentation of data, weak auditability, and the lack of analytical capability, the citizenry is burdened by repetitive visits, red tape, and long waits. Previous efforts in digitization have been rather disorganized and lacked adequate security and scalability.

The objective of this research is to develop a mobile-based platform that would help deliver improved municipal services within local governments in Nepal. To ensure convenient use for all the participants, such as local residents and administrative users, it is important to design an architecture that would focus on creating a mobile-first and modularity-based structure of municipal services. In addition to that, this study also puts a significant emphasis on identifying and analyzing the needs of all stakeholders involved in the development process of the mobile application in question, in order to transform them into relevant functional and non-functional requirements that will facilitate its efficiency, user-friendliness, and dependability. Moreover, it is critical to create comprehensive architectural and design solutions that would prove the feasibility and usability of the proposed system in practice.

Literature Review

Foundations of M Governance and E Governance

The concept of e-governance, which can be broadly characterized as the application of ICT to provide public services, foster stakeholder participation, and optimize administrative procedures, has undergone various levels of maturity (Ndou, 2004; West, 2004). Initially, there was an isolated digitization of services, and then came the

integration of such services within agencies and across life events (Layne & Lee, 2001; Andersen & Henriksen, 2006). All these approaches share two common elements, which have formed the foundation of our design: (a) service delivery must be citizen-centric and not agency-centric, and (b) interoperability at the back end is a necessary condition for front-end integration.

However, in low-resource environments, (Heeks, 2002) warns that many e-governance initiatives tend to falter due to an overestimation of institutional capacity or underestimation of the contextual realities, which he refers to as the "design-reality gap." In our current requirements analysis, this problem is tackled through the alignment of the recommended functionalities with actual staff practices, regulations, and network constraints involving seven LGUs. The expansion of e-governance to the mobile platform, which is often referred to as m-governance, allows for greater accessibility, especially when desktop computers are not available (Nhamo & Ndlela, 2018). Mobile phones can facilitate "always-on" micro-transactions, such as status updates and one-time password approvals, which are critical for Nepal's varied-connectivity environment.

User Contentment and Service Quality in Digital Public Services

Quality and trust are as relevant as accessibility in the adoption process of digital services. E service quality is measured by (Parasuraman et al. 2005) through the E S QUAL instrument that evaluates the quality of e services on the following dimensions: efficiency (ease of use), availability of the system (up-time and reliability of the service), fulfillment (timeliness of delivery), and privacy (data protection). The logic is further extended by Lee & Lin (2005) who find that in the realm of online communication, happiness and loyalty correlate directly with usability and trust. In the municipal environment these variables would imply such steps as making forms brief and avoiding clicks (efficiency), real-time status indicators (availability/fulfillment), and transparency in privacy policy and strong encryption (privacy).

Educations conducted in the public sector confirm these factors.

According to (Chen et al., 2018), citizens' tendency to reuse web-based tax portals depends greatly on their perceptions of security and timeliness. As such, timeliness criteria (such as automated alerts and SLA time counters) and security features (such as MFA requests and HTTPS status indicators) are included in our non-functional requirements. To conclude, it can be stated that quality attributes must be key considerations for electronic government applications.

Design science and the SDLC in public information systems

To solve problems of real life, Design Science Research involves the development and testing of artifacts, including software architecture (Hevner et al., 2004). Within the scope of E- Government systems, the implementation of such research methodology would involve iterative SDLC process with requirements gathering, modeling, prototyping and feedback incorporation (Janssen et al., 2015). However, comparative studies of SDLC models reveal that linear approaches have serious weaknesses in the face of change in policies, laws, or even stakeholders' expectations during the project (Balaji & Murugaiyan, 2012). That is why we give preference to front loading in analysis and design with subsequent implementation through pilot project – hybrid agility in practice.

By providing all necessary information, including descriptions of DFDs, use cases, ER diagrams and security models, we reduce risks for the developer and create testable artifacts for stakeholders (e.g. city council members) to evaluate before making investment decisions. Such methodology resembles that of Luna Reyes and Andersen who stressed importance of systematic qualitative data gathering for understanding of system dynamics from the stakeholder perspective.

Trust, Security, and Privacy

Mobile public services security is more than a technological challenge; rather, it involves questions of trust. The most common types of mobile security risks can be found in the list of Mobile Top 10 Threats (OWASP, 2023) among them there are

everything ranging from poor transport-layer security to insecure local data storage and weak authentication. Based on this information, our solution should provide for client-side secure storage (Keychain/Keystore), require TLS 1.2+ usage for all traffic and input validation. An ISMS (information security management system) that would involve risk assessment, incident response, and continuous improvement must be implemented within an organization following ISO/IEC 27001 standard (2018). This means software implementation of such measures as audit logs, role-based access control, and centralized secret management. Moreover, according to (Heeks & Bailur, 2007), accountability and visible security are the key components in ensuring public trust in technology. Consequently, I will give a lot of attention to transparent processes that could not be changed and allow demonstrating how users' requests and personal data are treated.

Nepal's Policy Environment

Both "Digital Government" and "Digital Services" have been identified as priority sectors within the DNF framework of Nepal, which also stipulates that interoperable systems should be provided so as to avoid any unnecessary repetition of the investment (Government of Nepal, 2019). This demand is clearly catered to by our microservice approach, which enables each town separately to make alterations to the services provided without having to change the entire system. The use of MFA, SSL/TLS, and secure databases is made possible through our compliance with IT policy, 2010 and the Payment Systems Act.

In addition, guidelines for the implementation of the framework at the municipal level are yet to be provided, even with the existence of high-level frameworks for national strategies. In the absence of empirical research in this area (beyond scattered case reports), our contribution is clearly pioneering because we provide a tangible, actionable framework for implementing national mandates at the ground level. & satisfaction of users of digital public services. To ensure sustainability, it is important to measure user

perceptions of quality and satisfaction. (Parasuraman et al., 2005) created the ESQUAL tool for assessing efficiency, availability, fulfillment, and privacy of online services. Similarly, (Lee & Lin, 2005) found happiness in relation to usefulness and trust. In the public sector, studies relating to the adoption of electronic tax filing (Chen et al., 2018) highlight timeliness and security as important determinants of reuse.

Research Gap

Earlier studies have either focused on the assessment of individual services (e.g., tax electronic filing) without considering the integration of multiple service modules in municipalities, or have provided a conceptual framework without any detailed mobile-enabled architectural support. To our best knowledge, no earlier work has considered the integration of all design components (DFDs, ER, Security Design Framework), along with an implementation roadmap, based on multiple modules required by municipalities in Nepal.

Significance of the Study

In this regard, this paper outlines an exhaustive guide to digital transformation in municipalities through the following points:

Enhanced Accessibility: End-to-end access of services to citizens through their mobile phones at any time.

Increased Efficiency: Through one dashboard control of processes, administrators can reduce errors and minimize the need for paperwork.

Data Integrity: In auditable log files and real-time monitoring of data enhance trust in the system.

Scalability and Compliance: The micro services approach makes implementation across districts easier while complying with the national ICT policy and Digital Nepal framework.

With this paper, local governments can implement mobile governance solutions that will help them deliver better public services in Nepal and other similar nations.

Methodology

This research relied upon the Systems Development Life Cycle (SDLC) in combination with the Design Science Research (DSR) approach. DSR is appropriate for this study as its aim is developing and evaluating the mobile-first architecture of municipal services based on real issues. The choice for using the SDLC among other approaches such as Agile, Spiral or DevOps can be explained by the need for a structured and sequential process with clear documentation, accountability, and traceability. These features are extremely important for government-based digital solutions due to their maintenance and longevity.

Study Area

The Kanchanpur District in the province of Sudurpashchim, Nepal, is composed of five municipalities and two rural municipalities, all of which form the seven LGUs selected for research. This selection was based on the rationale that they represent a current example of the existing digital divide at the municipal level.

Sampling Procedure

The purposive sampling technique was utilized in the study. Being the administrators and providers of digital services for the system, one IT officer per LGU was selected. Their insights played a critical role in identifying the needs and deficiencies of the system. The absence of ward personnel and ward citizens in the study can lead to biased results in favor of administrative perspectives. Further studies in the field are recognized.

Data Collection Tools

The two methods involved were:

1. Information in numeric terms regarding the e-services that already exist, the existing technical infrastructure and problems encountered were collected using an online survey.

2. Qualitative information concerning citizen needs, procedures and expectations in relation to the m-governance portal were obtained via semi-structured interviews.

Such methods were selected in order to find a balance between qualitative (perception-based issues) and quantitative approaches.

Data Use

Because this research project was aimed at providing recommendations on how to design the system and not testing hypotheses, the collected information from the IT specialists was not statistically analyzed but examined to find out the expectations from mobile application development along with issues that could appear during the process. A proposed design of the system was created based on the identified recurring themes turned into requirements.

Requirement Analysis

The online survey and semi-structured interviews with IT Officers from seven Local Government Units in the district of Kanchanpur comprising five municipalities and two rural municipalities were used to analyze the needs of stakeholders and requirements of the system. These challenges were found to be fragmented service delivery, lack of mobility, high costs due to administration, and heavy work for citizens.

Some of the functionalities were births and deaths record registration, permission, taxation, letter of recommendation, complaint of citizens, directory of ward, notice board, and AI Chatbot application. On the other hand, security (including encryption and access control), availability (with uptime guarantee and offline support), and accessibility (with multilingual support, mobile-friendly design, and WCAG compliance) were key non-functional requirements.

System Design

The first interface is the User Panel, which caters to users, while the second interface is the Admin Panel, intended for municipal employees. Not only does the User Panel provide real-time tracking, but the AI chatbot also allows the panel to cater to citizens in

need of essential services such as registering births and deaths, business licenses, paying taxes, recommendation letters, complaints, ward contacts, and other notifications. The Admin Panel assists in effective governance by offering staff members an easier method for role management, workflow monitoring, module configuration, and report generation. Designing for usability means that the layout is single column for smaller screen sizes, multistep forms with validation, file uploads with preview, and accessibility compliant with WCAG, such as high contrast mode, scaling, and language switching. Feedback mechanisms include progress indicators, notifications, and error handling, which increase public confidence. Offline-first design makes sure that functionality works even when Internet connectivity is not available.

The defense-in-depth framework takes an integrated security approach. Although authorization uses role-based access control with fine-grained permission models, authentication uses OAuth 2.0 with MFA for critical tasks. All traffic is encrypted using TLS 1.2+, and AES-256 encryption is applied to sensitive data at rest. Security measures include auditing critical activities, reducing vulnerabilities through OWASP-based hardening, and responding to incidents to monitor anomalies within the systems. Besides protecting information, such architecture provides multi-layered security measures and instills trust in local digital services.

The narrative is supported by a series of formal design artifacts that demonstrate feasibility and create scalable templates. The high-level block diagram in Figure 1 depicts communication flows between the user and admin panels and other backend services including data persistence services, microservices, and authentication services. The Level 0 DFD showing interactions between users, administrators, and repositories is illustrated in Figure 2. With service module decompositions of workflow and routing flows to the central service router, Figure 3 converts it to a Level 1 DFD. The use case diagram is illustrated in Figure 4 and helps to understand the administrative tasks (administration, processes monitoring, reporting) and citizens' interactions (user account management, services, and chatbot). The ER diagram conceptually illustrates various items including such items as User, Profile, Service, Document, Role, and Audit, all of

which are shown in Figure 5. Taken together, these artifacts prove that the system is secure, scalable, feasible, and structured, thus giving municipalities an applicable path toward mobile governance.

Figure 1

High-level block schematic of the mobile architecture for the Digital Municipality

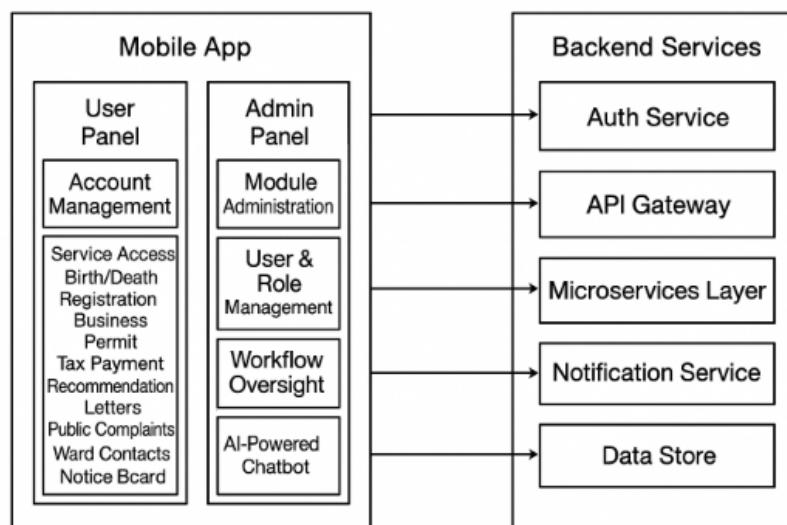


Figure 2

A Level 0 Data Flow Diagram (DFD) that illustrates the interactions and system context

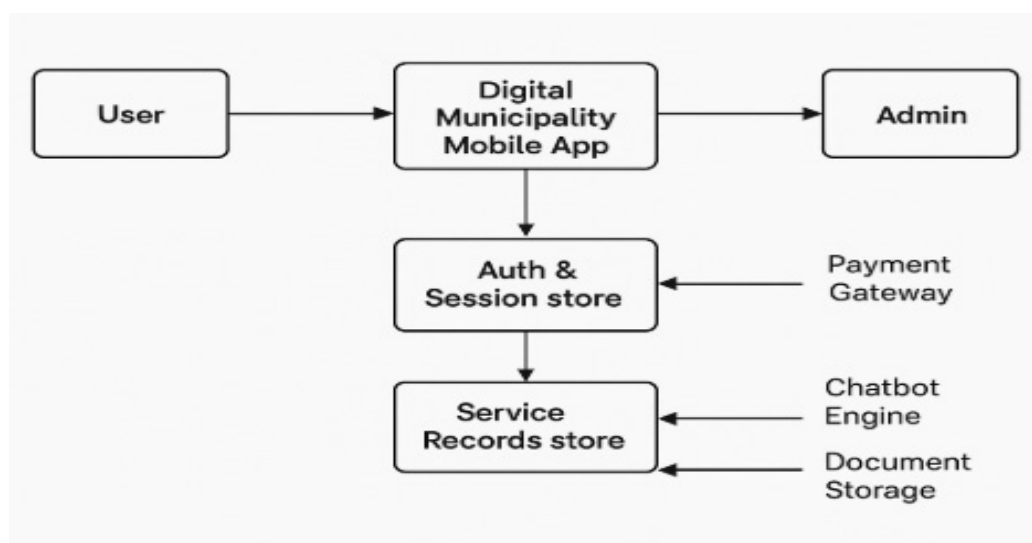


Figure 3

Core service modules and routing in a Level 1 DFD

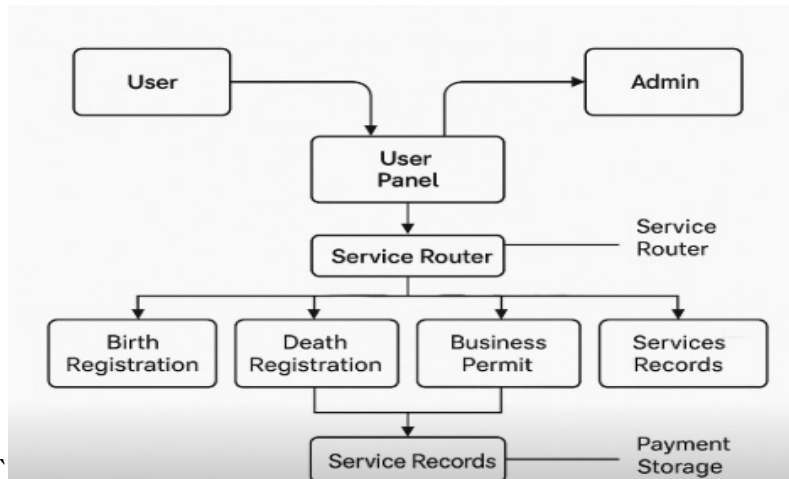


Figure 4

Two actors in a use case diagram of the Digital Municipality mobile system Administrators and Users

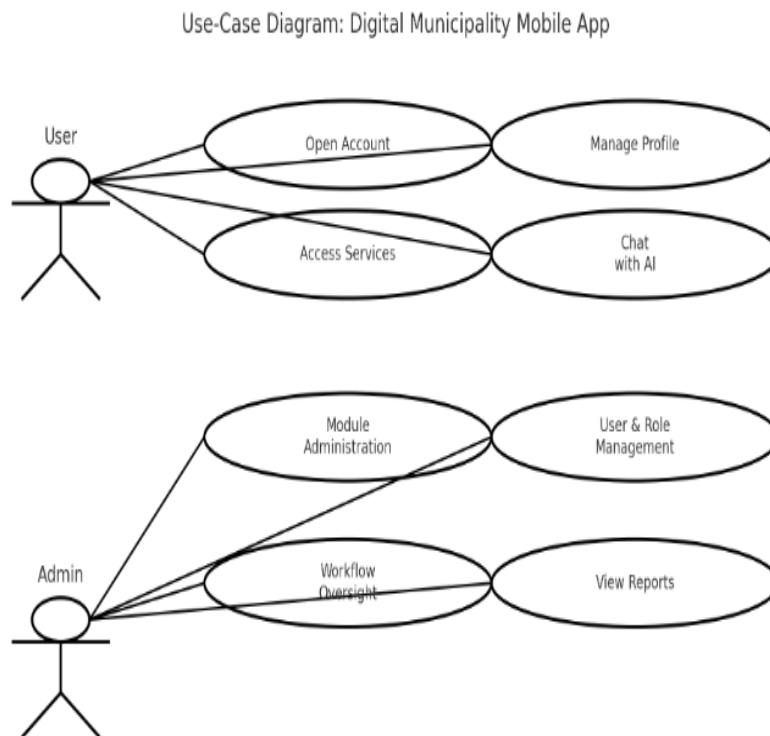
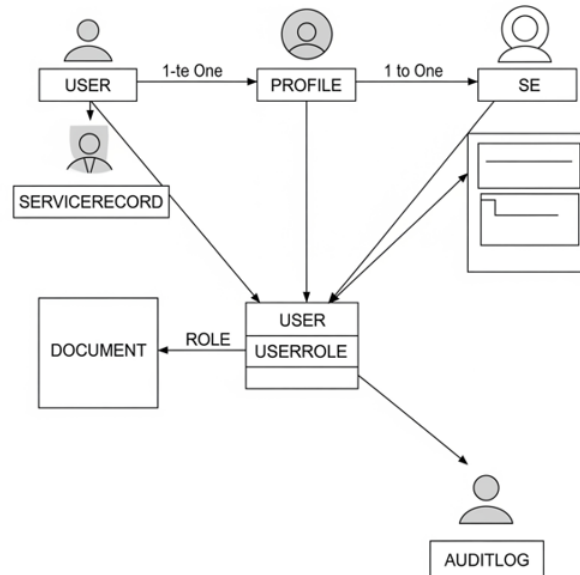


Figure 5*Conceptual ER model of the Digital Municipality database schema*

Implementation and Deployment Considerations

Implementation, testing, and deployment are also considered next phases in the development process after the design phase. Frameworks such as Flutter and React Native can be used for implementation purposes, while PostgreSQL will be used for the database. Testing methods that will ensure reliability and usability are unit testing, integration testing, and acceptance testing. Pilot testing will be employed during deployment, where the first municipality will be deployed before proceeding to other municipalities.

Results and Discussion

Births and deaths, corporate licenses, tax collection, recommendation requests, complaints, and official announcements could potentially all be brought together under one intuitive app that municipalities create based on the architecture described above. Through dividing up the functions into micro services and then using the user and admin interfaces to present the information, the architecture ensures constant availability, real-time status updates, and rapid approvals. The APIs being consistent

and shared across devices, along with progressive forms disclosure, and offline-first caches help minimize issues due to occasional loss of Internet connectivity. OAuth2/JWT-based authentication, role-based permissions, and full end-to-end encryption and audits bring security and privacy to the mix. It is clear from the aforementioned results that with a properly designed mobile solution, we can recreate or even improve upon what has traditionally been available in an office environment.

The challenges and demands raised by stakeholders during requirement analysis also emerge in the design results. IT officials across all towns often lamented the issues with manual paperwork, lack of integration, lack of awareness among citizens, and lack of security. The proposed design takes care of all these concerns through incorporation of digital self-service functionalities, seamless service processes, real time notifications, and built-in security measures. Thus, the study turns recurring stakeholder concerns into non-functional needs (availability, reliability, security, and accessibility) and functional requirements (digital registration, taxation, and permissions processes). Through such a discussion on the results, it becomes clear that not only does the proposed system align with the 'mobile first' approach prescribed by the Ministry of Federal Affairs and General Administration and the overall strategy of Nepal Digital Nation Framework but also offers a scalable way forward with respect to future expansions including integration with national databases, AI chat support, and analytics-based service improvements. Data flow diagrams, use case diagrams, and entity relationship diagrams have been provided to prove the feasibility of the design and ensure it is reproducible and assessable. Nevertheless, it is imperative to address the challenges related to managing the change in the area of personnel training, data transition, and reliability of networking at the level of local government to achieve a successful implementation. Thus, it becomes essential to conduct pilot projects, which will be accompanied by capacity building and performance evaluation.

Conclusion

The aim of this research was to develop an innovative mobile-first digital architecture that will facilitate the transition of critical municipal services through one unified

system. For this we first examined the repetitive problems encountered in operations, such as paper-based processes, disconnected workflows, bad integration between systems, low awareness among citizens, and security risks and converted them into both functional and non-functional requirements through inputs provided by IT officials from seven municipalities in Kanchanpur District. The architecture designed in this way with its clear separation between user and administrator interfaces ensures uninterrupted availability of services such as permit issuance, payment, registration, complaints, and notifications.

The proposed system integrates advanced security mechanisms, including OAuth2/JWT authentication, role-based access control, encryption, and auditing, along with the features of usability in terms of mobile-first and offline-first approaches and multilingual capabilities. Data-flow charts, use case diagrams, and entity-relationship schemas are some examples of formal designs that help provide a replicable design framework. This study is an effective path towards the digital transformation of governments since it adheres to the Digital Nepal framework and Mobile-First policy of Nepal. The proposed design will provide an approach focused on the citizens which can be implemented in many cases within the municipal governments.

Future Scope of the Study

Taking cue from the architectural framework thus created, the logical next step is to create a working prototype of this platform and test out the same within the chosen municipality. This will serve as a means of providing useful feedback regarding the development of better user interfaces, improved back end connections, and effective change management strategies that can be adopted within the context of local governments. Apart from these improvements, there may be other possibilities for future upgrades such as connecting this platform to national ID schemes and digital payment platforms to facilitate easier processes, while using AI-powered chatbots and analytics dashboards to enhance citizen participation.

References

- Andersen, K. V., & Henriksen, H. Z. (2006). E-government maturity models: Extension of the Layne and Lee model. *Government Information Quarterly*, 23(2), 236–248.
- Android Developers. (2023). *Build your first app*. Google.
- Apple. (2023). *Human interface guidelines*. Apple Inc.
- Balaji, S., & Murugaiyan, M. S. (2012). Waterfall vs. V-Model vs. Agile: A comparative study on SDLC. *International Journal of Information Technology and Business Management*, 2(1), 26–30.
- Bass, L., Weber, I., & Zhu, L. (2015). *DevOps: A software architect's perspective*. Addison-Wesley.
- Binder, R. V. (2000). *Testing object-oriented systems: Models, patterns, and tools*. Addison-Wesley.
- Chen, J. V., Jubilado, R. J. M., Capistrano, E. P. S., & Yen, D. C. (2018). Factors affecting online tax filing – An application of the IS success model and trust theory. *Computers in Human Behavior*, 86, 223–235.
- Elmasri, R., & Navathe, S. B. (2016). *Fundamentals of database systems* (7th ed.). Pearson.
- Facebook. (2015). *React Native* [Open-source framework].
- Fowler, M., & Foemmel, M. (2006). *Continuous integration*. ThoughtWorks.
- Government of Nepal. (2019). *Digital Nepal Framework*. Ministry of Communication and Information Technology.
- Grinberg, M. (2018). *Flask web development* (2nd ed.). O'Reilly.
- Heeks, R. (2002). Information systems and developing countries: Failure, success, and local improvisations. *The Information Society*, 18(2), 101–112.
- Heeks, R., & Bailur, S. (2007). Analyzing e-government research: Perspectives, philosophies, theories, methods, and practice. *Government Information Quarterly*, 24(2), 243–265.

- Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly*, 28(1), 75–105.
- Humble, J., & Farley, D. (2010). *Continuous delivery: Reliable software releases through build, test, and deployment automation*. Addison-Wesley.
- IEEE. (2008). *IEEE Standard for Software Test Documentation* (IEEE Std 829-2008). IEEE.
- ISO/IEC 27001. (2018). *Information security management systems—Requirements*. International Organization for Standardization.
- Janssen, M., van der Voort, H., & van Veenstra, A. F. (2015). Failure of large transformation projects: A comparison of successful and unsuccessful public sector projects. *Government Information Quarterly*, 32(1), 41–52.
- Johnson, R., Hoeller, J., Arendsen, A., Sampaleanu, C., & Thomas, R. (2016). *Spring framework reference documentation*. Pivotal Software.
- Kotter, J. P. (1996). *Leading change*. Harvard Business School Press.
- Layne, K., & Lee, J. (2001). Developing fully functional e-government: A four stage model. *Government Information Quarterly*, 18(2), 122–136. [https://doi.org/10.1016/S0740-624X\(01\)00066-1](https://doi.org/10.1016/S0740-624X(01)00066-1)
- Lee, G. G., & Lin, H. F. (2005). Customer perceptions of e-service quality in online shopping. *International Journal of Retail & Distribution Management*, 33(2), 161–176.
- Luna-Reyes, L. F., & Andersen, D. F. (2003). Collecting and analyzing qualitative data for system dynamics: Methods and models. *System Dynamics Review*, 19(4), 271–296.
- Meszaros, G. (2007). *xUnit test patterns: Refactoring test code*. Addison-Wesley.
- Ministry of Science, Technology and Environment. (2010). *Information Technology Policy*, Government of Nepal.
- Myers, G. J., Sandler, C., & Badgett, T. (2011). *The art of software testing* (3rd ed.). Wiley.

- Ndou, V. (2004). E-Government for developing countries: Opportunities and challenges. *The Electronic Journal of Information Systems in Developing Countries*, 18(1), 1–24.
- Nepal Telecommunications Authority. (2023). *Management Information System Report*. Author.
- Nhamo, G., & Ndlela, B. (2018). *Smart mobility, smart public services and m-governance in Africa*.
- In, G. Nhamo & N. Mjimba (Eds.), *Smart governance for sustainable cities* (pp. 125–146). Springer.
- Nielsen, J. (1993). *Usability engineering*. Academic Press.
- OWASP. (2023). *OWASP Mobile Top 10. Open Worldwide Application Security Project*.
- Parasuraman, A., Zeithaml, V. A., & Malhotra, A. (2005). E-S-QUAL: A multiple-item scale for assessing electronic service quality. *Journal of Service Research*, 7(3), 213–233.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
- Tidwell, J., Brewer, C., & Valencia, A. (2020). *Designing interfaces: Patterns for effective interaction design* (3rd ed.). O'Reilly.
- Tilkov, S., & Vinoski, S. (2010). Node.js: Using JavaScript to build high-performance network programs. *IEEE Internet Computing*, 14(6), 80–83.
- West, D. M. (2004). *E-government and the transformation of service delivery and citizen attitudes*. *Public Administration Review*, 64(1), 15–27.