Implementation of a Public Service Delivery Platform to Improve the Service Delivery of Indigent Registers in South African Municipalities

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Abstract—**Poverty alleviation and the rendering of basic services to households who cannot afford to pay for essential services are rated highly on the priority lists of the South African government. Municipalities are required to play an important role in ensuring that the poor and indigent communities have a decent standard of living and access to Free Basic Services (FBS). To this end, indigent registers have been seen as means through which to identify and target those unable to provide for their own basic needs for receipt of certain allocations of FBS, as well as for other targeted interventions. For many years, South African municipalities have been doing this process manually resulting to poor service delivery as they cannot verify eligible indigent beneficiaries. In this paper we report on a system that was developed to automate indigent management processes and to empower the indigents. The aim of this system is assist municipalities in the implementation of robust administration of indigent population and improve service delivery. This system has been already deployed in one of the major municipalities in South Africa and is planned to be deployed and replicated in other municipalities of the country in its aim to improve the service delivery of the indigent registers.**

Keywords—**Municipality; South Africa; indigent, public service delivery; service improvement**

I. INTRODUCTION

Since 1994, the South African government has introduced numerous laws, policies, and strategies to improve the socio-economic conditions of poor households in the country [1]. At the national level, there is a social security assistance program in the form of cash grants that is provided by the South African Social Security Agency (SASSA) which targets different groups such as children, people with disabilities, pensioners, war veterans, and the unemployed. These social grants have been very successful, contributing in large part to combating absolute poverty in the country [2]. There is also another system that operates at the local government level, relating to the provision of benefits in respect of basic municipal services such as water, sanitation, electricity, and refuse removal.

However, while the distribution of social assistance grants at national level to qualifying individuals has been relatively successful, the municipal roll-out of subsidised basic services – referred to as Free Basic Services (FBS) - to poor households has been disappointing [1]. The provision of FBS via the local implementation of municipal indigent policies has been undermined by problems around deciding which benefits should go to which beneficiaries and how to target the correct beneficiaries.

A number of studies have been conducted in this regard, including a case study conducted at City of Tshwane municipality titled "The implementation of the indigent policy in the City of Tshwane: Challenges and options" [3]. Mashapha, reports that indigent policy is implemented through the identification process, which is the criterion the municipality uses in order to register the indigents on the municipal database. An indigent is an individual residing in South Africa who cannot afford to pay basic services rendered by their respective municipality [4]. The municipality is offering a social package as part of the free basic services. The funding of the programme, which is critical for sustainability, and the exit programme that seeks to transform the poor into economically independent residents who will afford basic municipal services. She then recommends that there is a need to improve the implementation of the indigent policy in municipalities to assist the most disadvantaged group in the community, the poor. Furthermore, it is also emphasised that these challenges would render the indigent policy inefficient and would require more improvement to avoid wasteful expenditure.

The manual administration of indigents by their municipalities to determine indigents that need help with access of free basic services is inefficient. This paper reports on a system that we developed in this regard to address the challenges hindering successful delivery of services to indigents.

Software development methodology was used to develop the system. ICONIX [1] software development process was used to gather and analyse requirements, design, implementation and deploying the indigent registration service delivery platform.

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[1] A reliable method that gets project from use cases to source code as soon as possible.

This system is made of four subsystems: (1) kiosk application which is available 24 hours - 7 days a week for applicants to pre-register (supply limited personal identifiable information such as ID number and names without submitting supporting documents) to be on the indigent's registry. (2) Desktop application used by authorized municipal user to enrol new applicants or modify existing indigent's details, municipal users to share and request information from subject matter experts. (3) a web application used by verified indigents to submit complaints or compliments about the services rendered by their respective municipalities, also to engage and share information with indigents in a form of news/announcements. (4) Handheld application used to identify and verify indigents at their homes as they cannot go to their municipalities due to disability or old age.

This paper is structured as follows: Section II sets the objectives of the paper. Section III elaborates on the methodology used to develop the system. Section IV conceptualizes and elaborates implementation plan of the system. Section V formulates system considerations. Section VI identifies the issues and challenges associated with the development. Section VII describes features and benefits associated with this system. Section VIII specifies the contribution and enhancements brought by the system. Section gives a summary and future work of this paper.

II. OBJECTVES

The main objective of this paper is to develop a system by leveraging Software Engineering artefacts, innovative technologies such as smart card, biometric enabled kiosk and desktop terminals to automate and enhance indigent identification, authentication as well as free basic service management.

Key outcomes that are expected from this system are as follows:

- To assist municipalities in the implementation of a robust administration of the indigent population through the elaboration of effective solutions to know, manage and empower the poor.

- To increase the efficiency of service delivery at municipalities by facilitating communication between stakeholders and government departments.

- To provide platform that strengthens the idea of inter-government collaboration and coordination as outlined in the National Development Plan of South Africa.

- Implementation of innovative ways to ensure that the services are improved and reach the people most in need of them without burdening municipalities with too many extra responsibilities.

- Provision of efficient and cost effective solutions that will assist municipalities in identifying and authenticating indigents in an effort to combat and reduce fraud.

III. METHODOLOGY

Software development is a very complex process [5], [6]. In many cases, software is developed with lack of planning and informed decision which may lead to many challenges projects not being finished on time or within budget. There are various methodologies for software design and development, such as waterfall model, incremental mode, open source, ICONIX, agile and prototyping which if used correctly can help avoid such challenges. Description for each of these models can be found in [7-11].

Based on the problem that this paper is trying to solve, ICONIX Software Development Process (SDP) was considered. ICONIX SDP is a use case driven methodology that is suitable for medium projects. Rosenberg, Collins-Cope, and Stephens [9], describe ICONIX SDP as "a plan-driven and feedback-driven, small-increment, short-iteration development". The flow of ICONIX SDP is depicted as in Fig. 1.
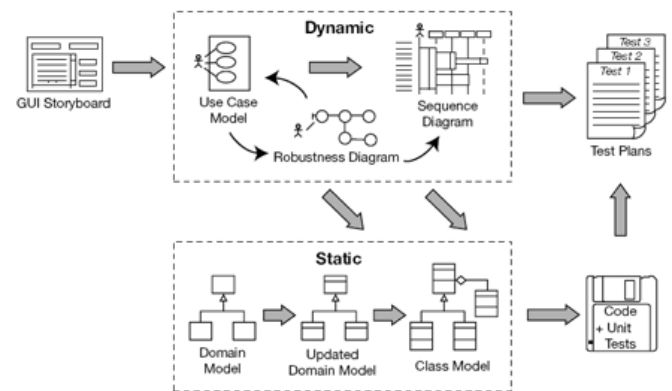

Fig. 1. ICONIX SDP workflow [12]

The ICONIX SDP is divided into dynamic and static workflows. The dynamic workflow is iterative and use cases are being done in small batches until being implemented rather than doing all the use cases before starting to write code. Whereas a static workflow updates classes and objects required to solve the problem.

ICONIX SDP is made of four milestones; at each stage the work for the previous milestone is reviewed and updated. The ICONIX SDP artefacts were followed in order to complete the project deliverables on time.

A. Milestone 1: Requirements Review

System requirements were defined with the involvement of the client and other stakeholders, the objects were also identified. These objects contain or describe the problem. The following is an overview of the system requirements gathered:

- *Kiosk:* The kiosk will complement the manual user registration process and serve as an automated self-service interface capable of registering indigent into the system on 24/7 availability. The kiosk will have biometrics and smart card reader capabilities, connection to government departments for information verification.

- *Desktop application:* A desktop is a paperless system that allows for all information about an individual (indigent) to be traced from a single point through an identity number and fingerprints that are connected to systems at municipal, provincial, and national levels.

- *Web application*: Indigents will check their application progress using their identity number, also they can submit feedback regarding services rendered and the municipality will share information (news or announcements and jobs or training) with indigents.

- *Handheld device:* The handheld device will serve as a mobile indigent authentication and identification system used onsite or when visiting the indigent settlements.

B. Milestone 2: Preliminary Design Review

From the requirements and a domain model draft the robustness diagrams showing steps of the use case [12] were derived. Robustness diagram describes behavior of the objects, corrects disambiguate between domain model and the use case. This activity ensures that we have an updated domain model.

C. Milestone 3: Detailed Design Review

Sequence diagrams showing a low-level design details were drawn. A sequence diagram illustrates interactions of the objects and messages sent amongst them. A class model also known as class diagram was created from the domain model and the use case text was used to draw sequence diagrams. At this point a class diagram is a static structure diagram describing the structure of the system's classes, their attributes, methods, and the relationships among objects [13].

D. Milestone 4: Deployment

The code was written with the guidance of the class and sequence diagrams; additionally the unit tests were written to verify if the implemented system matches the requirements and the detailed design. The User Acceptance Test (UAT) was also done to test if the implemented system was able to support day-to-day business operations prior to the system been released. The system was then deployed to one of the South African municipalities.

IV. TECHNOLOGY DESCRIPTION

The system overview is depicted as in Fig. 2. The system is composed of a multi-interface portal that is made up of four subsystems: a desktop application that is used for indigent management and exchange of information between municipal users at different municipalities; a handheld application for on-site verification of indigent's identity; a kiosk application for indigent pre-registration and sharing of information between municipalities and indigents; and a web application for information sharing between municipalities and indigents. The developed system shall be able to connect to other external entities such as Department of Home Affairs (DHA), South African Revenue Service (SARS), Unemployment Insurance Fund (UIF), South African Social Security Agency (SASSA), and Deeds office for the purpose of verifying information provided during indigent registration processes.

All the subsystems (kiosk, desktop, handheld, and web applications) of the system are independent of each other and self-contained. The relationship between the subsystems and external systems shall be through the use of web services. The information to be verified by the external system includes the indigent South African Identity (SA ID) number, name, surname, income, and fingerprints. The subsystems must also be capable of retrieving information from external system for display and storage.
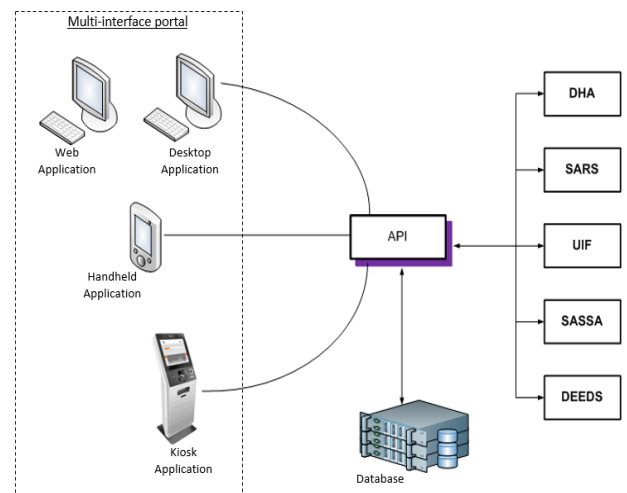
Fig. 2. System overview diagram

V. DEVELOPMENTS

The diagram illustrated by Fig. 3 below shows the high-level software architecture and the major technology choices and tools used in the development of the actual system. The developments of the system were broken down into two development components, a web development component and a native development component (the kiosk, desktop and handheld devices).

The native application embeds the web application using WebKit which is a browser engine to render web pages. This type of design was chosen because there were some features that could not be implemented using the web development. These features include fingerprint capturing. Most Software Development Kits (SDKs) that come with the peripherals for capturing biometrics are written in languages that support native developments and there are currently no browser Application Programming Interfaces (APIs) for interfacing hardware.
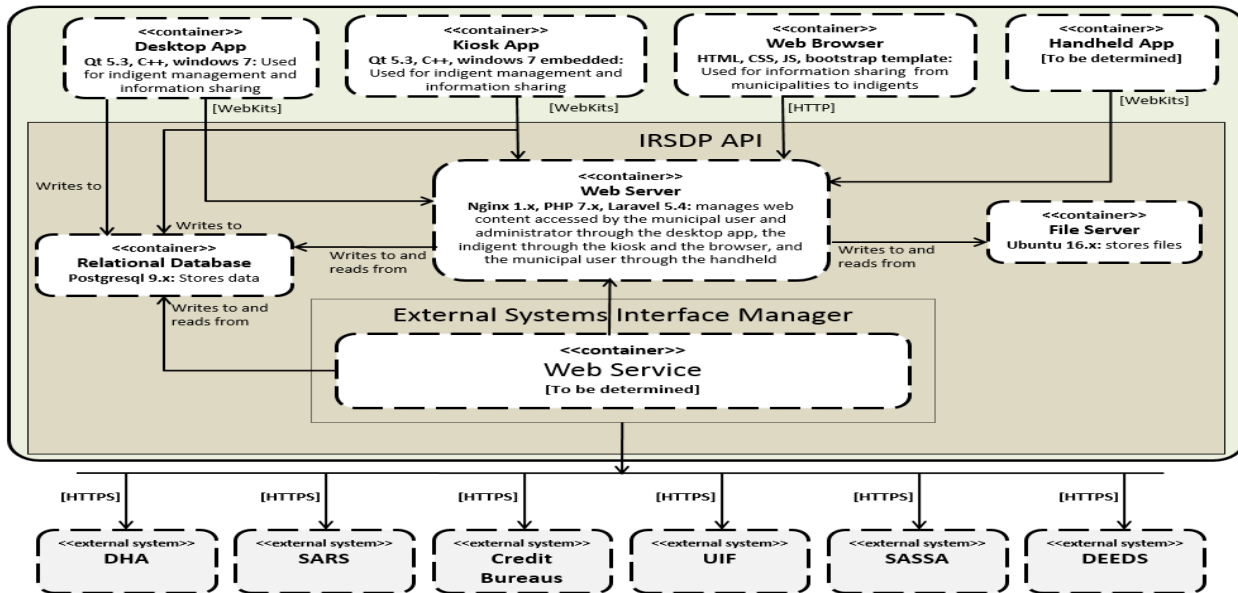
Fig. 3. Architectural container diagram

VI. CHALLENGES

During the requirement analysis phase, it was assumed that connection to external government entities such as SARS, SASSA were made available for the information verification purposes. Due to unavailable online connections the verification by external government entities is not implemented at this stage.

VII. FEATURES AND BENEFITS OF THE SYSTEM

This section describes the features and benefits that are offered by the system.

Forum

Forum allows the municipal users to share a particular topic either within the municipality or across various municipalities. Municipal users can comment and like a post.

This can be experience gained over the years by a municipality and deemed necessary to be shared or instances where municipalities require information from users or subject matter experts. Forum is made of the following:

- *Posts*
  A post is created and uploaded by a municipal user who has access to the system. A post's home page displays the most commented and liked posts.

- *Documents*
  This feature extends a post; the only difference is that the user has to select municipalities registered into the system to have access to the document. The uploaded document can be viewed online and also be downloaded. An authenticated municipal user can view the documents uploaded by others and can edit only those uploaded by them.

Survey

This is a public participation platform to enhance engagement between municipality stakeholders and the indigents. Surveys uploaded by the municipal user for verified indigents to rate and comment on the quality and quantity of the services provided by their respective municipalities; and possibly suggest ways to improve poor public service delivery. Verified indigents are those who have been approved to be on the indigent's registry. Surveys are made of multiple choice questions with radio button, which allows the indigent to select one option per question.

Jobs and training

The municipal user posts a job or training and this information is accessible to those who are in the municipal indigent registry. The objective of this feature is to address high unemployment rate by sharing the advertised vacancies internal and external to the municipality. Verified indigents can access this information online or using kiosk placed in any public area.

Indigent management

This feature allows municipal user to enrol applicants who want to be on the indigent registry. Their biographical, occupants and dependents data, portrait and income are captured as well as documents supporting data captured. An applicant can always come later to modify information captured during enrolment phase. Applicant can provide municipal user ID number to view their application status.

Indigent Feedback

Verified indigents can submit complaints and compliments regarding the services rendered by their municipalities. This allows the municipal user to address and escalate complaints submitted in order to improve public service delivery.

VIII. VALUE-ADDS, INNOVATIONS, AND CONTRIBUTIONS

The value-adds, innovations and contributions of the implemented system are as follows:

- The implementation and use of biometrics (fingerprints and portraits) to identify and verify the legitimacy of indigent beneficiaries to ensure that only qualified beneficiaries get access to free basic services. This has the positive effect of assisting with cost cutting as well as reducing fraud.

- The implementation of a mobile platform in the form of a handheld device composed of fingerprint readers, 2D barcode reader, smart card connector and GSM/GPRS (Global System for Mobile communications/General Packet Radio Service) to allow municipal employees to remotely enrol beneficiaries who cannot get themselves to enrolment stations due to disabilities or sickness thereby significantly improving service delivery and satisfied clients.

- The implementation of an e-platform (internet based) that allows municipalities within the country to share experiences in real-time, challenges and lessons learned. This has the potential of significantly strengthening inter-departmental coordination.

- The implementation of an automated self-service platform in the form of a Kiosk to help reduce congestion at municipal offices. This self-service kiosk will also serve as an enrolment or personal information update medium that indigents can use on a 24 hours basis.

IX. Conclusion

The manual administration of indigent hinders the municipality to give free basic service to eligible indigents. With the current manual process, it is very hard to review those who for instance no longer alive, who are employed and can now afford to pay for services, or those who stay in the same house hold to avoid doubling their free basic services. If the system users are well equipped to use the system, it can said that it will contribute towards addressing the key problem of the public delivery service for indigents. The developed system gives those who cannot to go the municipality a platform to apply (at their own time) and also reduces queues at the offices. It can be argued that the municipalities will now be able to render free basic services to those who qualify and this will help cut down the expenditures. Also, dissemination of jobs and training opportunities is enhanced as indigents have access to external and internal vacancies and can apply.

For future work an interface connecting to the external government entities to verify applicant's and indigent's data such as fingerprints and employer details will be implemented. There is also a need to capture indigent's biometrics (fingerprint and portrait) to authenticate indigents on the kiosk subsystem. Implementation of the handheld subsystem will also be done so that it can extend availability of the system services to those who cannot go to the municipality due to disabilities or old age. Conduction of qualitative study exploring if the system has enhanced indigent administration and empowerment at the municipalities using the deployed system will also be studied.

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