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WEB-BASED MANAGEMENT INFORMATION SYSTEM (WB-MIS): A VITAL SOLUTION TO RCC'S INFORMATION MANAGEMENT

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Abstract

Web-based Management Information Systems (WB-MIS) has been integrated in Organizations in many developed and developing countries, but the use of WB-MIS in Residential Care Centres (RCCs) in Tanzania is miserable. Most of RCCs have no even personal computers hence ICT illiterate, whilst the few who owns rely on using them for secretarial services. The RCCs' management information system in Tanzania has to undergo a substantial transformation, while emphasizing the rapid growing application of new information and communication technology (ICT).

This paper presents the survey results on the status of the available MIS at Residential Care Centres in Tanzania. The paper has discussed the current status of the available MIS within RCCs in Tanzania specifically looking at the forms and categories together with its effectiveness in managing RCCs information. It further discusses the available challenges along with the proposed possible solutions for the better management of the organization. The paper also presents a web-based management information system (WB-MIS) designing idea for RCCs in Tanzania from which the primary goal of this application will be to offer a suitable interface to its users in order to support and improve collection, dissemination, and the utilization of information for decision making in the RCCs.

Introduction

Information in any organization is crucial to planning and management activities. Problems associated with information includes [3]: how to determine information needed for the purpose at hand; how to get hold of it if it exists or how to collect it if it does not; how to store it so that it can easily be accessible and how to interpret them and resolve underlying questions for instance quality, contradictions, incompleteness and hence an appropriate and timely decision making.

In the second half of last century, radical changes took place in favour of performance improvement in the information systems management tools, information technology, and ways of decision-making performance measurements within organizations [4]. According to Shelly and Rosenblatt. [6], information system development satisfies functional and non-functional requirements, internal and external constraints, and other requirements for usability, compatibility, portability, reusability, and documentation. Such requirements reflect social and organizational expectations of how, where, when, and why an Information system may be used. Nowadays the focus relies on the need of having a centralized Information System (IS) to effective manage large amount of data and information which are previously in a paper form.

For effective residential care services, one critical factor is the existence of MIS, which may be an online system where anyone connected to the internet can have access to it. The system is needed to perform complex tasks such as generating reports for decision makers, provision of individual RCCs' information, and all other tasks which require fast data encoding and more technologically advanced systems.

Residential Care Centres Survey

Survey was conducted in order to determine the status of the available Management Information Systems for RCCs in Tanzania. Fourteen RCCs were chosen as pilot study areas, where by ten of them were from Dar es Salaam and four were from Morogoro. The selection was based on vicinity and availability from each other as the researcher had limited time and fund resources. The methods employed in the collection of data involved onsite visits and observations, Interviews, Questionnaire and Literature survey. The research conducted consisted of a literature review of published papers, books, website visits as well as deployed web-based Information Systems and program reports. A brief review of studies done by previous researchers was done.

In the study made to assess MIS status in RCCs, different forms, categories and usage of MIS in different application areas and management activities were observed. The results show that majority of respondents (33.7% and 22.5%) explained that Paper-based Information Systems are commonly

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and most commonly used while 37.1% revealed that database information systems are not commonly used in RCCs in Tanzania. On the other hand the majority of the respondents have proved the importance of having web-based information system within RCCs in Tanzania, since 20.2% and 55.6% said the system is not commonly used and rarely used respectively (see figure 1).

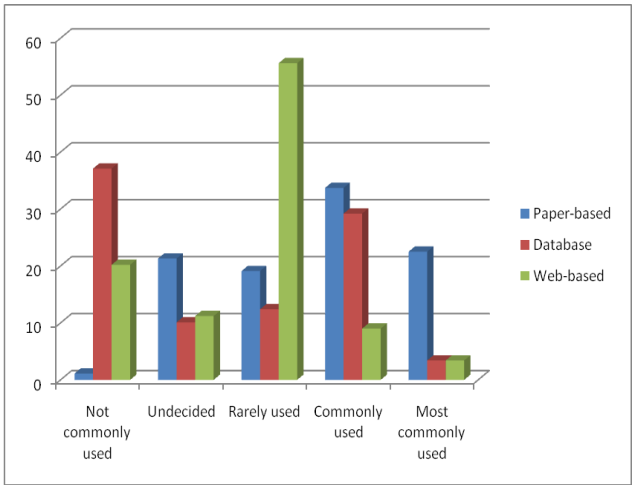

Figure 1: Forms of MIS and its usage

On the other hand survey results have revealed that majority of the respondents (65.2 per cent) reported that Decision-taking information systems were not used in RCCs in Tanzania, followed by 57.3 per cent and 53.9 per cent who respond on Predictive and Decision-making information system respectively being rarely used. Despite the fact most of the categories seems not useful, 39.7 per cent revealed that Data-bank information are being used and 33.7 per cent are mostly being used. Table 1 and Figure 2 shows a summary state of different categories of MIS, and its usage for the 14 Residential Care Centres that were surveyed in Dar es Salaam and Morogoro regions in Tanzania.

Table 1: Categories of MIS

Categories	Not used	Undecided	Rarely used	Used	Mostly used
Data-bank	6.7	1.1	19.1	39.3	33.7
Predictive	6.7	9.0	57.3	22.5	4.5
Decision-making	11.2	15.7	53.9	19.1	0
Decision-taking	65.2	15.7	16.9	2.2	0

Source: *Researcher's Findings, 2012*

The survey further revealed that the available MIS is used as a Databank since 39.3% and 33.7% responded on being used and mostly used respectively. Databank systems are merely used to observe, classify, and store any item of data which might be potentially useful to the decision maker. 57.3% and 53.9% said predictive and decision-making systems IS category are rarely used. It was also observed that the decision-taking category was almost not used since only 2.2% responded on being used (See figure 2)

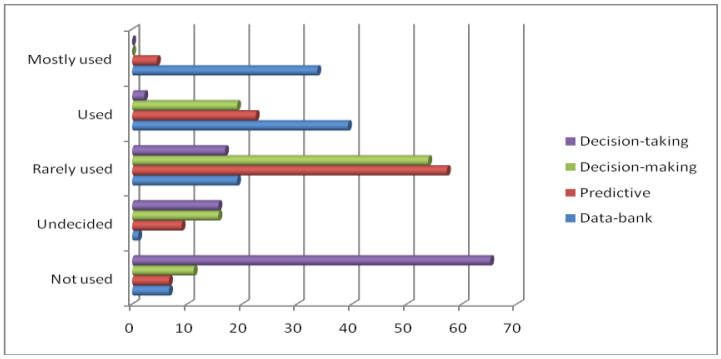

Figure 2: Categories of MIS and its usage in Tanzania

The findings of this study reflect the need for further investigation on the use of MIS within RCCs and how can they be utilized to improve information sharing. Majority of respondents agreed that to large extent the use of ICT in quest of RCCs information processing and sharing is of great importance. When examining the responses, it appears that the implementation of computer based information system (CBIS) has not been done in most of these RCCs. The fact that most of the respondents indicated that they know little about the existence of MIS in their organizations, confirms that these RCCs do not use MIS on their daily operations. It was shown that many RCCs do not keep electronic records of their information, which means that they do not have databases. Most of the interviewed staffs keep only manual records of the OVCs details and other organizational information. Manual records are difficult to analyze, especially when there are a lot of records. Those few records that are captured on the computer are isolated from the rest of the data in the manual record, so it is difficult to put them together to form a knowledge base. Despite the few RCCs with a database, the information is not exploited in any way that could highlight opportunities for stakeholders to support these centres. The concepts of data warehousing, data mining, business intelligence or customer hubs do not exist in the RCC environment.

As the survey results depicted, paper-based (paper filling) information system is the one which has been used since ever. Adebayo's [4] article entitled "*Management Information Systems for Managers*" touches the fact that MIS for most of RCCs in Tanzania are still in paper-based. This is supported by Patel et al. [15] and Machuve [8] whose results on their researches were the same. However Nielinger [14] on his research "ICT utilization by Non-Governmental Organizations (NGOs)" found that more than 50 per cent of these

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NGOs were using email and www. Web-based information systems are rarely used and the available MIS is being used mostly as Databank to store Orphans and Vulnerable Children (OVC) bio-data or used for automation activities like identification of OVC in the centre, and admission of OVC information. Storing data is very important but will not result in any benefit or competitive advantage unless the RCC takes out that data, starts analyzing it and studying patterns in it, and uses it to draw up organizational strategies. So apart from the database, the RCCs need to invest in or outsource analytical tools and skills in order to explore the information for potential benefits. For instance the use of web-based MIS is inevitable, RCCs should push their way to the information and communication technology era hence this again reflects the need for knowledge and skills related to ICT.

As far as the challenges users face when accessing and retrieving information from the current MIS, it was found that Organizations are confronted with many information management problems and issues. In this study respondents were required to rate the challenges of the available MIS users face when accessing Information. Majority of the respondents saw Information overload, increased data entry, storage and retrieval costs (65.2 per cent) as really a big problem by system users. This was followed by the lack of access to current and relevant information (52.8 per cent), increased updating errors and reduced consistency (41.6 per cent), not easy to access information at a time (43.8 per cent). Inadequate information searching skills and computer skills (50.6 per cent) was also highly cited as real a big problem as shown in Figure 3

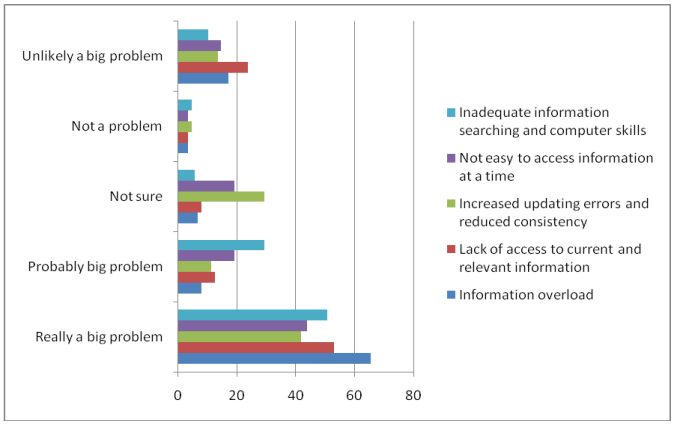

Figure 3: Challenges/Problems users face when accessing and retrieving information from the MIS

Despite the mentioned challenges, generally improving ICT infrastructure was seen as the best solution to improve the situation. Later respondents were required to identify what they were thinking is the best solutions to the above mentioned challenges. Majority of the respondents were proposing developing an online MIS to be the Very possible solution (61.8 per cent), followed by developing a database system (44.9 per cent) will be a possible solution (See table 2 and figure 4 below).

Table 2: Possible Solutions for the challenges users face when accessing and retrieving information from the MIS

Possible Solution	Very possible	Possible	Probably possible	Impossible	Very impossible
Developing an online MIS will be the possible solution	61.8	10.1	11.2	14.6	2.2
Developing a database system will be a possible solution	10.1	44.9	27.0	14.6	3.4
Strengthening the ICT infrastructure including internet will be the possible solution	37.1	22.5	29.2	6.7	4.5
Training system users about information searching and computer skills will be the possible solution	43.8	22.5	30.3		3.4

Source: *Researcher's Findings, 2012*

Respondents also pointed out that training system users about information searching and computer skills is very important as 43.8 per cent reply as the very possible solution and finally, Strengthening the ICT infrastructure including internet (37.1 per cent). Thus generally Computer-Based MIS is highly needed to overcome the above mentioned challenges.

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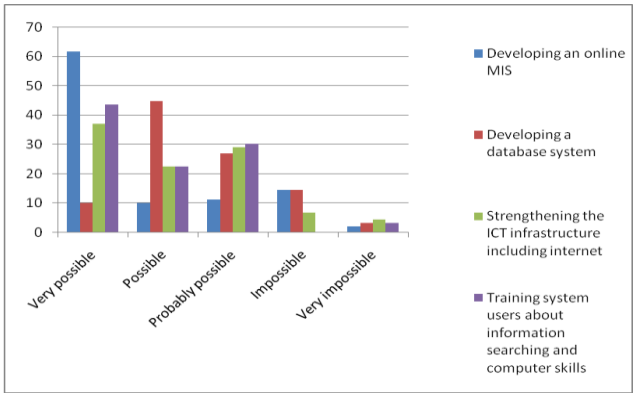

Figure 5: Possible Solutions for the challenges users face when accessing and retrieving information from the MIS

Methodology for Web-Based RCC-MIS Development

A number of methodologies can be combined in order to comply with the system requirements as well as time and costs constraints. Software Development Life-Cycle (SDLC) methodologies applicable in system development can be employed where by the actual development of web-based RCC-MIS can rely on Rapid Application Development (RAD) approach while also incorporating incremental prototyping in order to speed up the process. Microsoft Windows platform and Web based technologies like HTML markup language, Java Scripting languages, Cascading Style Sheets (CSS), PHP server side scripting language, MySQL database management system, and Apache web server can be used. Understanding of database management systems (DBMS) and data modeling is very critical.

While developing the system, the initial segments are suggested to be developed first and the system will later be refined and modified as per new user requirements. According to Shelly and Rosenblatt [6], in each segment the system concepts are tested and this provides an opportunity to examine input, output and user interfaces before final decisions are made. This iterative method is usually followed till the system is accepted by the client [10]. The importance of considering users in developing computer systems in general has been recognized since the 1970s [4]. As a primary source of information the approach in developing RCC-MIS can involve the participation of users from the analysis stage to implementation. Questionnaires, physical observation and discussion with system users, administrators and managers are very useful in collecting the clients' system requirements. Most of the managers, administrators and other system users are not aware of the ICT technology, though some are in contact with at least computers. With this respect, gathering user-requirement for a platform has to take an approach based on the user requirements on broader fundamentals, that is, secondary source of data. This can include other researches' reports, recommendations from an analysis of current articles, journals, published and unpublished papers, as well as the investigation on the existing MIS models.

Development of RCC-MIS

Web technology is an attentive concept, subject to wide variation in practice, which has become a common mode of information system development worldwide. Abels et. al [2] elaborates this by stating that the extreme case is the use of the web technology to facilitate the whole cycle of information sharing from initial dissemination to final decision making. With web technology, a range of operations will be available in between, with no or little physical interaction among system users. Hence, the World-Wide-Web (www) opened a new dimension to computer based system where users can interact from anywhere, anytime with possibilities for huge cost savings. Online information sharing has created new dimension to opportunities for collaboration among RCCs stakeholders and beyond.

The need for web-based RCC-MIS being developed is underlined by Ramrattan [11] who argues that organizations, which includes different groups of people and knowledge requirements, needs effective manageable system to monitor their daily operation activities, and provide reports on management efficiency. Hence, constant tracking of the system user actions and online information sharing can be done. RCC-MIS will provide a technological, parameter driven framework to allow RCC staff deliver OVC information contents, and to interact with other stakeholders to facilitate open discussion. Advancing RCC-MIS will support a range of administrative functions relating to office automation and administration to enable content delivery, performance tracking, and management of OVC.

Requirement Analysis

An understanding of the current RCC-MIS capability is required to begin to understand the relevant RCC-MIS requirements. Stakeholders need to be identified and several interviews need to be conducted regarding the current information management system, use of IT and potential improvements. The development of web based RCC-MIS has to consider both functional and non-functional requirements specifications.

Functional Requirements refer to very important system requirements in a software engineering process such as technical specifications, system design parameters and guidelines, data manipulation, data processing, and calculation modules etc. The key goal of determining functional requirements in a software product design and implementation is to capture the required behaviour of a software system in

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terms of functionality and the technology implementation of the business processes. From the requirements analysis, RCC-MIS functional requirements based on top level were basically at least to support orphans' details registration, school registration, fee payments, religion and denomination identification, health records monitoring, contact person's details, orphan leaving RCC records as well as approval from the respective ward executive officer. The system also accepts RCC basic information, allows RCC staff basic records registration and processes and outputs various reports.

Non-functional requirements describe what qualities the system should have. In the first quest of CB-MIS is concerned, the aspects of usability, performance, security, privacy and maintainability should be considered. For the RCC-MIS proposed, the user interfaces should be intuitive and simple as well as consistent with the business process supported. The system should be designed to reduce the time required to enter OVC information as well as reducing errors in entry. The system must have consistent performance at all times for all users and maintains performance when supporting multiple users. The system should also be designed in such a way that non system users are not allowed to access some of children's account information of the system. Only management team and system operators have the right to access this information. The list of authorized users needs to be reviewed and password protected. The component based architecture can be used in the system to simplify maintenance and allow for its expansion at later stages. The system should also be technically easy and fast to access on web. Even the users with limited technical skills and interests can easily access the system. In addition to that the system need to be interactive in the manner that after receiving the input attributes from the user; it automatically creates the view for that input at run-time and gives the results appropriately.

The system must contain methods of searching and fast updating the data to ensure an efficient and up-to-date dissemination of information from the sources to the end-users. The system should also contains all the features to accommodate relevant data and can generate reports required for a general uses as well as the information required for making the projections and taking decisions by the RCC managers.

RCC System Design

The choices of tools and technologies to be used to develop RCC-MIS need to meet the functional and non-functional requirements are discussed in detail above. In this regard, the system specification can be an open source browser-based database-centric system with MySQL as the back end data store. The front-end, or the user interface, can be designed using a variety of technologies including PHP, MVC, MySQL, JavaScript, CSS, HTML, and Apache. Today, PHP (hypertext preprocessor), is one of the widely used open source, server-side, HTML embedded scripting language used to develop web-based applications ranging from simple websites to complex applications. Thousands of applications are using PHP as their core language and support from both its developers and community is massive worldwide. Technically, PHP is almost a platform independent language running on a variety of operating systems [15] and supports a number of database management systems and web servers hence making PHP-based applications highly portable with minimal or no modification at all. So, the choice of PHP from other languages to implement RCC-MIS will be considering these major factors among others.

In its simplest definition, MVC is a design pattern. A design pattern is a code structure that allows for common coding frameworks to be replicated quickly. MVC was originally described in terms of a design pattern for use with Smalltalk by Trygve Reenskaug in 1979. His paper was published under the title "*Applications Programming in Smalltalk-80: How to use Model-View-Controller*", and paved the groundwork for most future MVC implementations. Since then, a number of frameworks for various programming languages have been developed. Today, PHP itself has dozens of MVC frameworks being used worldwide.

The basic theory behind MVC is to have three different pieces that work in unison to form a complex application. And is the most used pattern for today's world web applications aimed to separate the three major application components, namely: the data access logic, the application logic, and the presentation logic. The benefits of this approach are to ensure system maintainability, scalability, and portability, among others. RCC-MIS was designed using CodeIgniter (CI) – a PHP MVC framework designed by EllisLab, Inc.1 which adheres strictly to OOP rules.

The design of database can use MySQL database. This is the world's most popular open source database. With over 65,000 downloads per day, MySQL continues to be the choice for a broad range of database developers, administrators, and IT managers who want a high performance database that is reliable, affordable, and easy to use. MySQL is a central component of the widely used LAMP open source web application software stack. LAMP is an acronym for "Linux, Apache, MySQL, Perl/PHP/Python". Research has shown that MySQL is being used by many companies including frequently visited websites on the internet like Flickr, Nokia.com, YouTube, Wikipedia, Google, Facebook, and Twitter[2].

[1] http://ellislab.com

[2] http://en.wikipedia.org/wiki/MySQL

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MySQL works on many different system platforms, including AIX, BSDi, FreeBSD, HP-UX, eComStation, i5/OS, IRIX, Linux, Mac OS X, Microsoft Windows, NetBSD, Novell NetWare, OpenBSD, OpenSolaris, OS/2 Warp, QNX, Solaris, Symbian, SunOS, SCO OpenServer, SCO UnixWare, Sanos and Tru64. This fact makes MySQL the perfect choice when designing an application without assurance of the environment on which the application will be running. So, the choice of MySQL as a supporting database for RCC-MIS will consider those factors with portability and sustainability in mind. The design of RCC-MIS can follow the 3-tier architecture as depicted in Figure 6, where the tasks of the system can be divided into three distributed tiers [12][7]

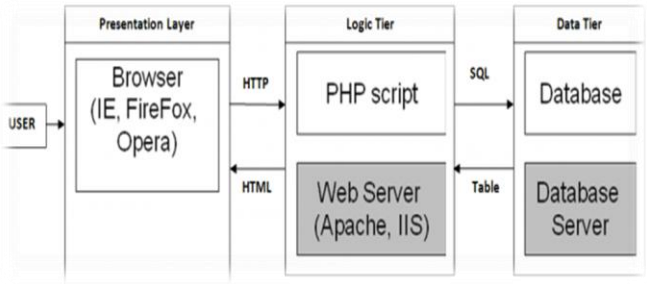

Figure 6: Three-Tier model of system architecture

The Presentation tier is the topmost level of the application which provides the application's user interface (UI). It communicates with other tiers by outputting results to the browser/client tier and all other tiers in the network. Various web-based technologies can be used to design the RCC-MIS user interface.

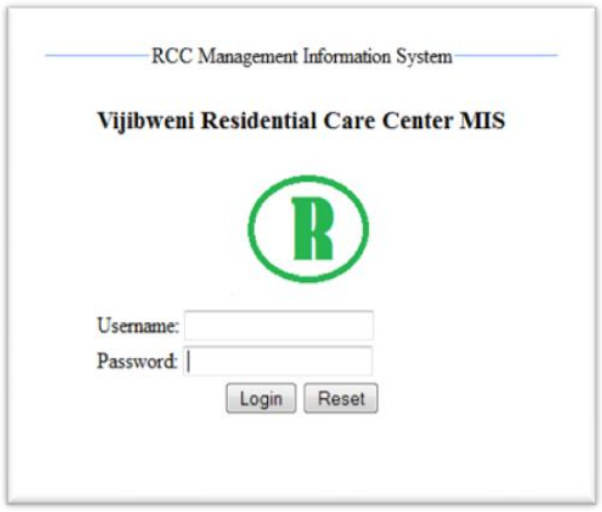

Figure 7: Log in interface

The data access tier is responsible for controlling an application's functionality by performing detailed processing. It is where mission-critical business problems are solved. The components that make up this layer usually exist on the server machine to assist in resource sharing and load balancing originating from the client requests to the database management system or the data store. Some of security features are also implemented in this tier. The data tier consists of database servers; it is the actual DBMS access layer. It can be accessed through the business services layer and on occasion by the user services layer. Here information is stored and retrieved. This tier keeps data neutral and independent from application servers or business logic. Giving data its own tier also improves scalability and performance. This layer consists of data access components (rather than raw DBMS connections) to aid in resource sharing and to allow clients to be configured without installing the DBMS libraries and ODBC drivers on each client.

client.

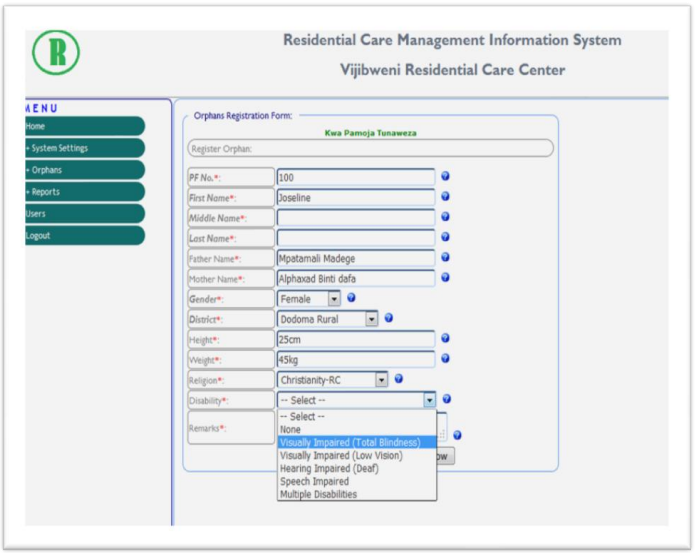

Figure 8: Registration form

Implementation and Testing

The system can be implemented according to the logical architecture described in figure 3 as the 3-Tier architecture can be designed to adapt system development. Presentation tier interacts with users and display RCC information from the system to users. This tier will be presented in HTML layouts generated by JavaScripts. The application tier will handle the request from users and responses the information to users. The presentation tier can be in component-based architecture and implemented as JavaBeans. It acts as a bridge between application tier and database tier. Lastly, database tier can be implemented by MySQL Server. After development the system need to be locally deployed, tested, and evaluated by system users and consequently be validated by other three staff who had never used RCC-MIS software before, with respect to user satisfaction of the developed package.

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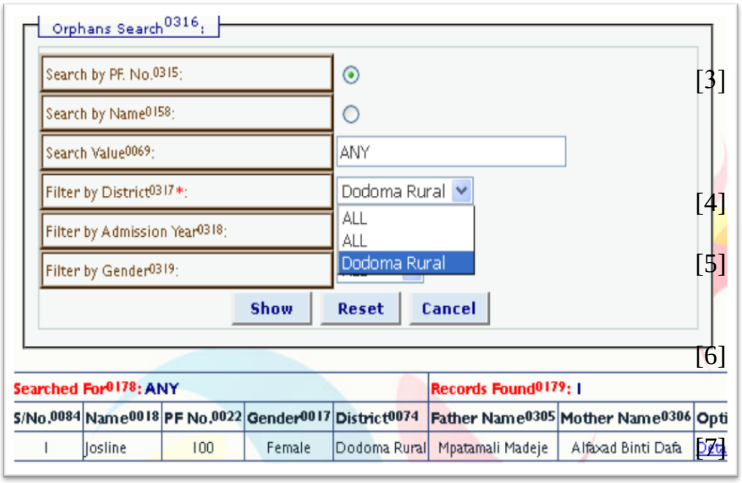

Figure 9: Information search page

Conclusion

The use of ICT provides innovative ways to complement the traditional paper based information system worldwide to optimize resource usage, sharing and collaboration. This study has revealed that generally the information sharing between RCCs and other stakeholders in Tanzania is not satisfactory. This is due to the fact that the available MIS are totally outdated hence not competitive enough in providing easy access of the information and supporting organization's management activities.

Therefore, the development of on-line facilities for RCCs of Tanzania should have high national priorities and hence relevant in achieving its objectives. A web-based management information system for RCCs is necessary and must address the peculiarities of local conditions of these centres so that ICT resources can be used to improve management functions for better decision making. The RCC-MIS to be developed will allow creation, storage, re-use and delivery of digital information. To influence the RCC-MIS usage, internet connectivity has to be established soonest to these RCCs. Connectivity of other services such as e-healthy, e-commerce, and e-learning can be introduced in the surrounding areas.

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