

Online System on Monitoring and Feedback for Education

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Abstract – This study reported the staging of process on developing a mobile application for real-time data management information system on monitoring and feedback in early childhood education, it can help tracking child development and education and assist teacher in monitoring and feedback on child services. A formative study was carried out to gather necessary information through data mapping, in-depth interviews with key stakeholders, document reviews, application development, deployment the application, field assessments, usability testing and integrated analytics that involving 253 respondents. To obtain a full picture on early childhood education, data on child growth and education shall be mapped and linked in one mobile application. The monitoring and feedback of mobile app were conducted by tracking of performance using Meraki software include connectivity, battery charge, disc usage, last online time, and location. Tracking of data entry onto the application by the users through reporting dashboard installed. Analysis from the daily tracking data presented to the users through coaching activity to monitor their performance indicators are on-time submission was 89.38%, completeness percentage data quality were 93.38%. Using a tablet PC or mobile phone, data could be easily entered at any time by the person. Due to still poor infrastructure at the grass root level, the system also allows a safety store offline that could automatically link to server when network connection is available. Based on the study this application is applicable for online monitoring and feedback on early child development and education. Results suggest the use of real time rapid analysis of these routine assessments of provider performance and the application usability enables a dynamic process of continuous quality improvement.

Keywords – *Online System, Monitoring, Feedback, Education*

I. INTRODUCTION

Many field workers who rely on paper record-keeping complain that manually compiling monthly and yearly reports for their supervisors takes more time than it should. Moreover, supervisors complain that reports they receive from workers are incomplete or poorly compiled [1]. One of the benefits of switching to a paperless record-keeping system is the ability to automate and standardize reporting at all levels in the field system [2]. Data entered could be automatically synced with the reporting module, so workers can access and compile their reports at any time [17]. They can easily track their progress during the month or year without having to manually compile data. Supervisors and reporting authorities can rest assured that the data being reported is accurate and reflects real service provision and health events on the ground. They can easily detect anomalies with digitized reporting and significantly reduce the time to respond to an emergency, such as a disease outbreak, when it occurs [2].

In rural areas, or anywhere field workers might be spread out and hard to reach, having an online web portal and dashboard for daily monitoring is an efficient and smart way to ensure workers are regularly providing timely care to their clients [3]. The smart registry web portal allows end user login for monitoring client data and printing paper reports of their data if required for submission [18]. Supervisors at higher levels can login to monitor their education workers and view their service provision in real time along with aggregate data across all workers at a particular field level. The web portal can also archive data, in case a education worker needs to review older records which are no longer stored on the application [4].

Paper registers present strategic challenges for tabulation and access to real-time data for decision-making, monitoring Frontline Education Workers (FEW) performance at district or national level, and providing a reasonable level of accountability for authentic and complete individual data records. The burden of paper-based reporting takes valuable time away from service provision, often results in the duplication of information across multiple registers, and requires manual tabulation of the data for summary reporting [20]. Paper-based data also does not facilitate continuity of care between visits or across providers. Tracking services provided to a client requires scrutiny of multiple documents, which are often not organized by client name. Consequently, clients who have missed services or appointments are not identified in a timely fashion, leading to a missed window of opportunity for intervention. Developing aggregate monthly or quarterly reports from this paper-based data is error-prone and time consuming, a task that is repeated at several levels of supervision before a compiled report reaches the senior management layer. By the time data reaches the decision maker, the opportunity to use the data for real-time strategic decisions has passed [20].

The ubiquity of mobile technology, such as phones and tablets, and their increasing penetration among even the most remote and marginalized populations has provided a platform for innovators to creatively target pervasive education system challenges. Even in the absence of structured mobile interventions, education system actors have used mobile devices to improve communications across the developing world, and as such provide an opportunity to strengthen education system [21].

Monitoring following an application notably to oversee the compliance of the application usage by the front



education workers. This will also allow us to understand how each user utilizes the application in daily basis. Furthermore, any issue either regarding the application/device or the utilization itself can be early detected through this research.

There is a clear and urgent need for an integrated education information system to generate quality data, reduce the workload of frontline education workers, and provide data in realtime for supervisor and policy makers to guide strategy and improve education outcomes.

II. RESEARCH METHODOLOGY

A formative study was carried out to gather necessary information through data mapping, in-depth interviews with key stakeholders, document reviews, application development, deployment the application, field assessments, usability testing and integrated analytics that involving 253 respondents. The methodology used in developing the application as follow:

2.1 Literature Study

Collecting data from books, literatures, or objects related to the topic of Child care including module of Community Development Workers was published by World Bank and Partners in 2013. Anthropometry calculation algorithm with Z Score. for the classification, we using the table calculation from "Anthropometry book 2010" from Indonesia Ministry of Health and for weight indicator, we using standard of red borderline¹⁹.

2.2 Hardware and Software Requirements

Child care application consists of two application system that is Application Server which keeps overall data from Client Application which only contains data based on coverage area of community development in field. The server is responsible for requests for both existing and new data.

Tools Selection: tools used to build information systems based on Android mobile is Java and MySQL programming.

IDE: Android Studio is the official Integrated Development Environment (IDE) for Android app development, based on IntelliJ IDEA.

2.3 Hardware Specification

a. Server

Child care and education application was required server specifications as below: Product/Service Virtual Private Server - VPS Hazelnut Active, Backup Quota 10 x GB, OS Template is debian-8.0-x86_64, Platform Linux x86_64, OS Package Debian GNU/Linux 8.0 (for AMD64/Intel EM64T) OS EZ template, CPU Cores 4, CPU Limit 1600 MHz, Memory 4.00 GB, HDD 80.0 B.

b. Client

The specification of client as follow : Screen size 5", Brand Samsung Galaxy, OS Android 6.0, RAM 2 GB, Storage 16B.

c. Laptop

Laptop Specifications are Brand is Lenovo,

Type Legion Y520-N21D, Processor is Intel Core i7-7700HQ, RAM 16 GB DDR4; 2 x SODIMM Slot, HDD 1TB SATA SSD + 256GB, VGA using NVIDIA®GeForce®GTX 1050 Ti, DVD Writer, Screen 15.6", DOS

a. Webserver: Nginx

1. Programming Language Backend: PHP version 7 with Framework used is Laravel version 5.0.
2. Database: MySQL has several features among others
3. Portability: Supports various operating systems like Windows, Linux, FreeBSD, Mac OS X Server, Solaris, Amiga, and more.
4. Open Source : MySQL is distributed open source, under the GPL license so it can be used free of charge.
5. Multiuser: MySQL can be used by multiple users at the same time without any problems or conflicts.
6. Performance Tuning: MySQL has an amazing speed in handling simple queries, in other words it can process more SQL per unit of time.
7. Column Type: MySQL has a very complex column type, such as signed / unsigned integer, float, double, char, text, date, timestamp, and others.
8. Commands and Functions: MySQL has full operators and functions that support SELECT and WHERE commands in the query.
9. Security: MySQL has several layers of securities such as sub netmask level, hostname, and user permissions with a detailed licensing system as well as encrypted passwords.
10. Scalability and Restrictions: MySQL is capable of handling large-scale databases, with more than 50 million records and 60 thousand tables and 5 billion rows. In addition, the index limit that can fit up to 32 indexes in each table.

b. Procedures of Application Design

The design of the application was done by designing UI (User Interface) design, database like variables/fields, values, label, logical check, range check, calculation and function design in the application.

a. Logic

The use case staff described the interaction between the teacher and the system. Tutor/teacher are required to login in order to ensure access to data. Login using username and Password for each teacher. Username and Password will be sent to the server for validation. The server that receives data from the application detects every request based on the URL address it receives. Data from this URL address will determine the type of request the server must perform at the same time respond to requests with the appropriate data. If there is conformity with existing staff



data it will be replies in the form of basic data from Staff and data in the form of access rights code. The basic data that is sent back to the client is: Full name, NIK, Locations covering the names of sub-districts, districts and provinces After successfully logging in, the first thing to do is fill in the local database by requesting the server to send data based on the location of the work area of the staff officer. After the initial data is filled then the activity can be done to recording the data of visits to the Child care service. Data from this Server as the basic data used for Mother and Child Identity in Child care applications.

b. Activity

Activity describe activity in the system has been built, how each flow begins, the decisions that may occur, and how they end. Activity diagrams can also describe parallel processes that may occur in some executions. Activity diagram consists of staff login process, master data management process, process.

c. Class

Class described the state (attribute / property) of a system, all at once offer services to manipulate the situation (method / function). Class is a specification which, if instantiated, will produce an object and is the core of object-oriented development and design.

d. Database SQLite

The database design was a translation of the class diagram in the form of tables containing field names, field types, key types, and field actions. Database for data storage in This application, which is useful to accommodate the required data.

e. UIX

Based on Use case and flowcharts. Each element break into deliverable and lay down a strategy to go ahead with. Design part of (UI/UX) and prepare a design that delivers the best user experience. The UI prototype tested on different devices. We make sure that smooth navigation on the Mobile App that already created.

c. Coding

Perform database creation and mobile application development. This project used Model View Presenter (MVP) is the latest and greatest Android architecture pattern. This decouple business logic (Model) from view logic (Activity / Fragment) by utilizing an intermediate step called the Presenter.

a. View

The view was extremely limited in MVP, it's only works on display data and navigate to a new screen when the presenter tells it to. The View has no visibility of the Model, except for the POJOs / Entities. In regards to Android specifically, this would include my Activities, Fragments, Recycler View Adapters, and anything that extends the Android View class.

My personal preference is to only let the Activities & Fragments talk to the Presenters and leave the Views & Adapters to only display data and delegate events (On Click) back to the Activity or Fragment.

b. Presenter

The presenter lays between the View and the Model, and it acts to events passed from the view. For instance, when the Finish Button (to save data) is clicked inside the view, it would call presenter. Save (). Once this occurs, the presenter utilizes the Model to determine if all criteria are met (I.e. a valid email address) and, if so, we can safely save the data. The presenter would then either notify the view to display an error message, or notify the view to navigate.

c. Model

The Model includes business logic that was entirely decoupled from the UI / Platform specific logic. This encompasses my Entities, backend services / helpers (web, database, etc), and business logic. It will used wrapper class (either called Model or Interactor) that will talk directly to the backend services and hold business logic.

d. Z Score calculation

a. Data Source

we used growth chart indicator on daily basis that can be downloaded at <http://who.int/childgrowth/standards/> on file that contains the percentiles of z score. The file contains the coefficients of L, M and S that can be used to calculate Z Score.

b. Calculation

Flow process of calculation as follow, app would prepare all the indicator into 2-dimensional array with 4 column each, contains age, L, M and S value, user input the child visit date, weight and length/height data into app, app calculate the children's current age on day unit, by find the range between visit date and the child birth date. by using the age (calculation result on step b) as the index, app would get L, M and S data on that index and calculate Z Score using LMS formula below:

$$Z_{ind} = \frac{[y/M(t)]^{L(t)} - 1}{S(t)L(t)} \quad (1)$$

Anthropometry has a same calculation algorithm with Z Score. for the classification, we using the table calculation from anthropometry book from Indonesia Ministry of Health.

e. App design flow and Testing

This stage was done to test the functionality of applications that have been built (Figure. 1).



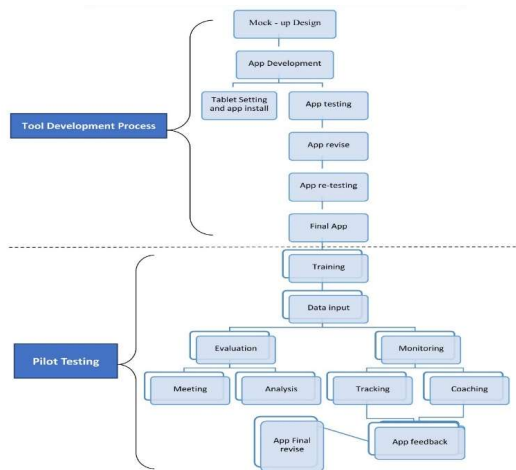


Figure 1. Design flow of application development

III. RESULTS AND DISCUSSION

To obtain a full picture on childhood development and education in early education, data on child growth and education shall be mapped and linked in one application. We introduced a mobile app to systematically compile the individual as well as group data (i.e. school profiles) across different aspects of child life, ranging from Child care and education [5]. Using a tablet PC or mobile phone, data could be easily entered at any time (real-time data) by the person (Figure 2).

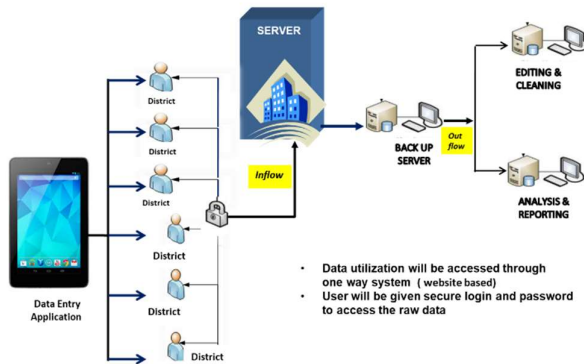


Figure 2. Data Management System

The monitoring and feedback were basically conducted every day through following several ways: Tracking of tablet or smartphone performance was using tracking software, Meraki (Figure 3.) installed in the device prior to deployment. The tablet or smartphone performance indicators include connectivity, battery charge, disc usage, last online time, and location.

#	Status	Name	Model	Tags	OS	Connected	Connectivity	Disk % used
1	●	user5	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	22%
2	●	user5	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	17%
3	●	user5	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	21%
4	●	user5	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	49%
5	●	user4	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	29%
6	●	User12@meraki	SGHPE21	android	Android 5.1.1	now	●	34%
7	●	user8	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	33%
8	●	user13	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	14%
9	●	user10	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	11%
10	●	user1	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	12%
11	●	user2	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	22%
12	●	User12@meraki	SGHPE21	android	Android 5.1.1	now	●	34%
13	●	User11	SAMSUNG-SM-T217A	android	Android 4.2.2	now	●	11%
14	●	user16	SAMSUNG-SM-T217A	android	Android 4.2.2	Dec 15 08:55	●	29%

Figure 3. Tracking result by Meraki Software

Tracking of data entry onto the application by the users through a Reporting Dashboard built for monitoring and evaluation use (Figure 4) and (Figure 5).



Figure 4. Reporting Dashboard

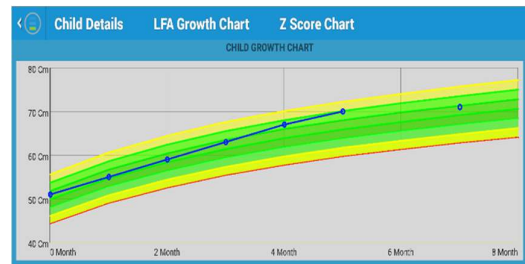


Figure 5. Z score report on child growth

All data log that were generated from the tracking device and Reporting Dashboard are collected and accumulated for later being analyzed. This analysis is used to understand the usage pattern as well as evaluate the users' performance.

Analysis from the daily tracking data was also presented to the users through coaching activity. The purpose is for the education workers to also be able to monitor their own performance. Other than above analysis, during coaching, it was also provided the users with analysis of other performance indicators driven from data entry, such as on-time submission (Figure 6.) and data quality (Figure 7). Through this data-driven coaching, we also encouraged and supported the education workers for a high compliance of the application usage.



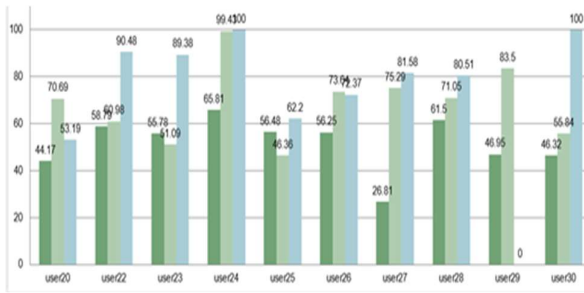


Figure 6. On-time submission data on child development

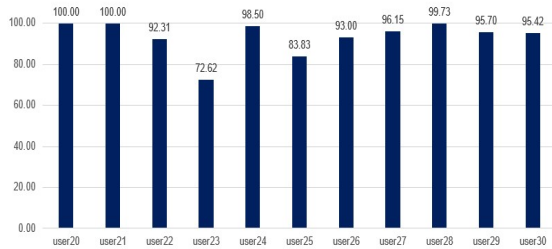


Figure 7. Data quality and completeness of child development

Due to still poor infrastructure at the grass root level, the system also allows a safety stored offline that could automatically link to server when network connection is available. The immediate data entry was provided real-time data report that could be accessed by any relevant stakeholders at any levels to response accordingly. However, to avoid misuse of data, the access has also been restricted with a secured login system [6].

Based on this study, these forms were launched simply within the smart register screens at the tap of a button, and allow offline data entry where network connection is not always available. Data has been safely stored offline until the device has a network connection again and the data is then submitted to the secured server [7]. There was been a backup server provided to keep the data updated if the main server gets into trouble. With this application, users can easily jump between questions, answering them in whichever order best matches their workflow. This application allows projects to include data entry validations and mandatory questions in their forms [8]. In addition, the application offers advanced features such as data entry calculations and cascade selects, which are useful in forms where the user must select their location from a long, expandable list. Smart registers make these once time-consuming tasks easy to accomplish. Smart register has a customizable array of sort and filter options to rearrange and filter down the list of clients to a new list that matches the user's immediate work needs. Each smart register is equipped with a smart search feature, obviating the need to scroll and scroll through the lists when trying to search for a single respondents. The search results were instant, meaning the results start appearing as soon as we start typing. The search feature was also customizable to whatever search term is needed, whether a name or an ID number [9]. The application allows data entry directly in the interface. Data was collected on the app with smart paper forms, which are built to resemble paper, but supports advanced skip/form logic including constraint checks. To reduce typing errors, the packages used a built-in data

check algorithm to check the consistency and validity of each entry. If there is error or inconsistency found then it will be fixed directly [10]. After all the data was entered into the server, then they have to be edited and cleaned before being analyzed.

Data was entered automatically synced with the reporting module, so teacher or child workers can access their reports at any time. They can easily track their progress without having to manually compile data each time. Supervisors and reporting authorities can rest assured that the data being reported is accurate and reflects real service provision and health events on the ground [11]. In rural areas, or anywhere health/community development workers might be spread out and hard to reach, having an online web portal and dashboard for daily monitoring is an efficient and smart way to ensure workers are regularly providing timely care. The smart registry web portal allows end user login for monitoring their own data and printing paper reports of their data if required for submission [16]. Supervisors at higher levels can login to monitor their child workers and view their service provision in real time along with aggregate data across all workers. The web portal can also store archived data, in case a child worker needs to review older records which are no longer stored on the app. Currently, it has comprises of a server backend and Android based mobile phone client [12].

The servers has kept in a high dedicated connectivity location, an undergraduate of computer was provided by university is responsible to maintain and daily backup the data in those servers [13]. The operator who has been selected have a capability and skills to monitor, manage and maintain the server or server management. That person has to monitor all the other data and then coach the couple and what to do. All the primary data source inflow and outflow should be from the bottom of the page and the other user access should be on the top. Data Utilization for all stakeholders or others can be accessed through one gate (website based) Through a secure login, users were able to access the display data for analysis and reporting [14]. Data in a database or in a statistical package has been restricted to those who have a password for access. In any reports or publications the confidentiality of all were retained. Data collected during project was a real-time data processing and directly transfer into the server. Only limited personnel have an access to the data concerned [15]. Data has been accessed by certain personnel under the study for purpose of data analyses and reporting process. checking the data that has been collected for validity and internal consistency by automated data processing scripts customized to the needs of the project data. The scripts is flag in real time inconsistencies and alert a supervisor of potential problems requiring correction. checking the validity and internal consistency check for all data that goes into the server database on daily basis.

IV. CONCLUSION

Based on the study, this application is easily applicable for real-time monitoring and evaluation on early childhood education. Results suggest the use of real time rapid analysis of these routine assessments of provider



performance and the application usability enables a dynamic process of continuous quality improvement. It has also been shown to increase frontline education workers performance and responsiveness to the uptake of application and identified key implementation challenges early on. Developing both rapid analysis processes and evaluation techniques that utilize the real time data made available by application is crucial for continuous quality improvement and sustainability of online education approaches

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