Mobile application for guidance and provision of toddler’s nutrition to support e-PKK

S Rochimah1, F Y Sianipar2 and R N E Anggraini3

Department of Informatics , Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

Email : 1siti@its-sby.edu, 2febryanyeremi@gmail.com and 3ratih_nea@if.its.ac.id

Abstract. Pembinaan Kesejahteraan Keluarga (PKK) is an Indonesian community with women as its member, especially housewife. It has many purposes, such as collaborating the knowledges among members, monitoring children’s health, supporting healthy life style in the family. This article is part of our research in building e-PKK, an integrated application to support many activities in PKK’s business processes. In this paper we build a module to guide and provide toddler’s nutrition to be used by mother. This application is very useful since baby’s growth phase is an important phase to be noticed by mother. Using this application, mother can easily obtain baby’s growth information whenever and wherever they are via their smartphone. This mobile device applications using backward chaining and forward chaining method. Backward chaining method is a method that uses a goal-based approach, while the forward chaining conducting a set of data for later inference process to find optimal conclusion. Moreover, this application provides recommendations of groceries, recipes, as well as the suitability of foodstuffs according to the age of early baby’s growth and the type of baby’s allergic. In addition, it also provide information about baby’s nutrition, growth benchmarks, and first aid. Besides, the application can be used to monthly baby growth record like Kartu Menuju Sehat (KMS) or Growth Monitoring Card, storing toddlers weighing, immunization and provision of vitamin A. An additional feature of this application is the complaints system, where other can ask directly to health care center about toddlers’ growth.

1. Introduction

Baby’s growth phase is an important phase to be noticed by every mother. Experts argued about golden period time, which is between 0-2 years, 0-3 years, 0-5 years or 0-8 years. But all of them agreed that early age of the baby’s growth is the golden period. In this period, baby’s brain ability to absorb every kind of information is very high, so parent’s role is needed in order to educate and optimize children intelligence intellectually, emotionally and spiritually. However, food allergies are common in this period than in adulthood due to incomplete baby’s digestive tract. Today’s technology developed very fast compared to previous decades. Along with it, mobile technology has indirectly become a part of people’s daily lives, for example smart phones. It is undeniable that more people used smartphones regardless of their status or age restrictions. We have had many applications on smartphone mobile device that is offering information about nutrition and development of the baby, so the baby’s mother can easily obtain every kind of information about the growth of the baby whenever and wherever they are via their smartphones devices. However, each of this application still have their shortcomings. For example, the application for baby food recipes are not given information about solutions to problems that often occur at the
time of feeding, while applications for baby’s growth are not given information about how to stimulate
the growth of the baby[1].
Therefore, this article demonstrates the development of an application using the PhoneGap platform
framework that can run on mobile devices. This application uses backward chaining and forward
chaining methods to provide recommendations of groceries, recipes, as well as the suitability of
foodstuffs according to the age of early baby’s growth and the types of baby’s allergy. In addition this
application also can provide information about baby’s nutrition, baby’s growth benchmarks, and
baby’s first aid. This application can also be used to record information like Kartu Menuju Sehat
(KMS) or Growth Monitoring Card used in some baby’s health care center, as recording information
about toddlers weighing, baby’s immunization and provision of vitamin A. An additional feature of
this application is given the complaints system, where mothers can ask directly to the health care
center about the growth of toddlers through this application.
With the making of this application, it is expected that this application will be able to help parents to
get useful information about baby’s nutrition, baby’s growth, and appropriate baby’s first aid in case
of accident in the baby or baby’s disease, and also help parents to monitor the baby’s growth.

2. Literature Study

2.1. Existing Application
Recently there are so many applications that can be used to help providing information about nutrition
as well as providing information about the baby’s growth. Some of the applications are as follows.
1. Baby Solid Food
   This mobile device application contains information about some kind of food that can be
   consumed by the baby aged 0-12 months. This application also provides recipes that can be made
   in accordance with the age of the baby[2].
2. Baby Development Track Growth
   This mobile device application contains information about the benchmarks of toddler’s growth
   divided into four parts, namely motor skills, cognitive development, language skills, and social
   and emotional skill[3].

2.2. Forward Chaining
The application of operators to those structures in the database that describe the task-domain situation
—to produce a modified situation—is often called reasoning forward. The object is to bring the situation,
or problem state, forward from its initial configuration to one satisfying a goal condition [4]. The
advantages of forward chaining method compared to backward chaining method is that a new data can
be inserted into the database table inference and there is a possibility to make changes to the rules of
inference.

2.3. Backward Chaining
Reasoning backward involves another type of operator than forward chaining, which is applied, not to
a current task-domain situation, but to the goal. The goal statement, or problem statement, is converted
to one or more subgoals that are (one hopes) easier to solve and whose solutions are sufficient to solve
the original problem. These subgoals may in turn be reduced to sub-subgoals, and so on, until each of
them is accepted to be a trivial problem or its subproblems have been solved[4].

2.4. Growth Monitoring Card
Growth Monitoring Card is a card contains the child’s normal growth curve based on the index of the
anthropometric weight in accordance to the baby’s age. By using the Growth Monitoring Card, the
growth disorders or the risk of excess nutrients can be known in advance, so preventive action can be
carried out more quickly and precisely before the problem become more severe[5].
2.5. **PhoneGap**
PhoneGap is an open source-based framework released by a company in America called Nitobi. PhoneGap framework allows everybody to develop a mobile device application using the expertise of HTML, CSS, and JavaScript. An application created by using the PhoneGap framework can be developed into a variety of different platforms[6].

2.6. **jQuery**
jQuery is a fast, small, and feature-rich JavaScript library. It makes things like HTML document traversal and manipulation, event handling, animation, and Ajax much simpler with an easy-to-use API that works across a multitude of browsers. With a combination of versatility and extensibility, jQuery has changed the way that millions of people write JavaScript[7].

2.7. **jQuery Mobile**
jQuery Mobile is a HTML5-based user interface system designed to make responsive web sites and apps that are accessible on all smartphone, tablet and desktop devices[8].

2.8. **jqPlot**
jqPlot is a plotting and charting plugin for the jQuery Javascript framework. jqPlot produces beautiful line, bar and pie charts[9].

3. **Analysis and Design**

3.1. **Requirement Specification**
System requirements is shown in use case diagram, showing relationship between actors and system. Based on use case diagram in Figure 1, user can see the recommendations for baby’s nutrients according to the age and the type of baby’s allergy, learning the baby’s growth benchmarks, as well as read first aid of common diseases that often affects the baby. Moreover, users can record information of baby’s growth just like the original KMS card, and can ask for the help of health care centre about the development of the baby.

3.2. **Recommendation Rules Design**
Some rules were built to recommend food for baby based on age and allergies. Age category along with the type of allergy can be seen in Table 1. This table is used in advanced methods of backward and forward chaining to obtain the rules of nutritional recommendations by category of age and the type of allergy.

| Age Category     | Intolerent Lactose | Allergy | Cow Milk Casein | Egg | Sea Fish |
|------------------|--------------------|---------|-----------------|-----|---------|
| 0-6 months       | ✓                  | ✓       |                 |     |         |
| 6 months         | ✓                  |         |                 |     |         |
| 7-9 months       | ✓                  | ✓       |                 |     |         |
| 9-12 months      | ✓                  |         |                 | ✓   |         |
| 12-18 months     | ✓                  | ✓       |                 | ✓   |         |
| 18-24 months     | ✓                  | ✓       |                 | ✓   | ✓       |
3.3. Database Design

The database used in this application is SQL and SQLite. The logic of this database is stored in the form of javascript and sql file. SQLite database can be accessed using Local Storage APIs provided by PhoneGap framework. As for the SQL database, it can be accessed using an application that has been stored in server.

4. Implementation

4.1. Interface Implementation

This section discusses the implementation of the user interface. This interface was developed using HTML5, CSS, JavaScript, and jQuery Mobile. All pages are included in the file named index.html.

4.1.1. Login Page.

This page provides a form that can be used to login. Users need to enter a phone number and password to log into the system. This page is shown in Figure 2.

![Figure 2. Login page.](image)

4.1.2. Main Menu Page.
This page showed six main menus used as a navigation to move to other pages, namely Nutrition page, Development page, First Aid page, Growth Monitoring Card page, History page, and Suggestion and Complaints page. The interface is shown in Figure 3.

4.1.3. Nutrition Page.
This page showing three submenu pages, namely Recommendation page, Allow page, and Information page. This page shown in Figure 4.

4.1.4. Development Page. This page showing a list of growth benchmarks information according to the age of the baby. This page shown in Figure 5.

4.1.5. First Aid Page. This page showing a list of diseases information and their treatment. This page shown in Figure 6.
4.1.6. Growth Monitoring Card Page.
On this page there are four submenu pages, namely Baby’s Data page, Graphic page, Immunization page, and Vitamin A page. This page shown in Figure 7.

4.1.7. History Page. On this page there are four submenu pages, namely Baby’s Data page, Graphic page, Immunization page, and Vitamin A page. This page shown in Figure 8.
4.1.8. Suggestion and Complaint Page. On this page there are two submenu pages, namely Complaints Replies page and Input Complaints page. This page shown in Figure 9.

![Figure 9. Suggestion and complaint page.](image)

4.2. Database Implementation

Implementation of the database is performed using SQLite Database as well as SQL Database which are shown in Figure 10 and Figure 11 below. SQLite database used to implement database in the mobile device, whilst SQL database used for web application.

![Figure 10. SQLite database implementation.](image)
5. Testing and Evaluation

5.1. Functionality Testing
The test which were conducted is functionality requirement testing. Functionality testing was using a black box testing method, wherein the method is carried out to ascertain the suitability of the output of the system. Testing the functionality of the system is done by setting up a number of scenarios to measure the success rate of the testing.

5.2. Evaluation of Functionality Testing Result
Based on functionality testing using the scenario that has been provided, obtained test results can be seen in Table 2.

| Testing Code | Testing Name                                                                 | Result  |
|--------------|-------------------------------------------------------------------------------|---------|
| UT-001-1     | Testing of login 1 feature                                                     | Success |
| UT-001-2     | Testing of login 2 feature                                                     | Success |
| UT-002       | Testing of logout feature                                                     | Success |
| UT-003-1     | Testing of see recommendarion 1 feature                                        | Success |
| UT-003-2     | Testing of see recommendarion 2 feature                                        | Success |
| UT-004-1     | Testing of see allow 1 feature                                                 | Success |
| UT-004-2     | Testing of see allow 2 feature                                                 | Success |
| UT-005-1     | Testing of see allergy and nutrition information 1 feature                    | Success |
| UT-005-2     | Testing of see allergy and nutrition information 2 feature                    | Success |
| UT-006-1     | Testing of see growth 1 feature                                                | Success |
| UT-006-2     | Testing of see growth 2 feature                                                | Success |
| UT-007       | Testing of see first aid feature                                               | Success |
| Testing Code | Testing Name | Result |
|--------------|--------------|--------|
| UT-008       | Testing of choose a baby feature | Success |
| UT-009       | Testing of see child data feature | Success |
| UT-010       | Testing of add new baby data feature | Success |
| UT-011       | Testing of change baby data feature | Success |
| UT-012       | Testing of see graphic feature feature | Success |
| UT-013       | Testing of fill growth monitoring card feature | Success |
| UT-014-1     | Testing of see growth monitoring card detail 1 feature | Success |
| UT-014-2     | Testing of see growth monitoring card detail 2 feature | Success |
| UT-014-3     | Testing of see growth monitoring card detail 3 feature | Success |
| UT-014-4     | Testing of see growth monitoring card detail 4 feature | Success |
| UT-015       | Testing of immunization record feature | Success |
| UT-016       | Testing of see immunization data feature | Success |
| UT-017       | Testing of vitamin record feature | Success |
| UT-018       | Testing of see vitamin data feature | Success |
| UT-019       | Testing of choose a baby history feature | Success |
| UT-020       | Testing of see baby data history feature | Success |
| UT-021       | Testing of see graphic history feature | Success |
| UT-022       | Testing of see growth monitoring card detail history feature | Success |
| UT-023       | Testing of see immunization data history feature | Success |
| UT-024       | Testing of see vitamin data history feature | Success |
| UT-025       | Testing of inputting suggestion feature | Success |
| UT-026       | Testing of see suggestion replies feature | Success |

6. Conclusion
Out of all processes that have been passed, – design process, implementation process, and testing process – can be concluded that it is possible to built an application that contains information about nutrition, growth, and treatment of diseases of babies aged 0-2 years old, it is possible to built an application for recording information about the baby's development aged 0-5 years old like a Growth Monitoring Card, and also it is possible to built an application to be used for communication with the health care center.Moreover, this application can provide the correct output results according to the purpose of the application shown by the test results which were success.

7. Future Work
Here are some future works for the development and improvement of the system in the future. Among them are the following.
1. Growth benchmark included with illustrations.
2. Complaints and suggestion feature can be given comments by the mother and the health care center (currently only frequently asked questions).
3. Applications can be run on a platform other than Android.

References
[1] Anggraini R N E, Rochimah S and Dalmi K D 2014 Mobile Nutrition Recommendation System For 0-2 Year Infant
[2] Google Play Store 2014 Baby Food Recipe
[3] Google Play Store 2014 Baby Development Track Growth
[4] Barr A and Feigenbaum E A 1981 The Handbook of Artificial Intelligence
[5] Kementrian Kesehatan Republik Indonesia 2010 Penggunaan Kartu Menuju Sehat (KMS) Bagi Balita
[6] Yudistira Y 2011 *Membuat Aplikasi iPhone Android & BlackBerry Itu Gampang*
[7] The jQuery Foundation 2014 *jQuery*
[8] The jQuery Foundation 2014 *jQuery Mobile*
[9] Leonello C 2009 *jqPlot*