Design and Implementation of PIAK: A Personalized Internet Access System for Kids

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***Abstract*—Internet plays an important role to deliver information worldwide. But the available huge amounts of online information are not all appropriate for children. This paper presents the design and implementation of PIAK, a Personalized Internet Access system for Kids. It aims to assist and teach children about using the Internet in one single and safe environment. PIAK features four personalized components: cross-platform user interface, multilingual support, educative and assistive mediums, and web content filtering. Its design is based on the children's needs inferred from a survey finding. This will enable the Internet access to be more appealing to the children as they can explore the Internet in a controlled environment.**

***Index Terms*—Children; Internet Access; Personalization; Survey Finding.**

I. INTRODUCTION

With the keywords "internet access child", Google search engine finds 86,400,000 hits on 27 January 2017. On the same day, with the keywords "learn internet access child", the number of hits goes down to 23,500,000 hits, and even further down for the keywords "teach internet access child" with only 5,380,000 hits. These numbers indicate that the topic on Internet access for children is important, but not all online documents are focused on teaching or learning that access. It is known that Internet is as good as bad for children. In addition, many children lack access to the Internet or do not have the sufficient knowledge to use the Internet technology due to the digital divide between the urban and rural areas [1].

Furthermore, parents without higher education background might not be able to maximize the benefits and minimize the risks of their children going online [2]. Presently, there is no perfect solution that can be referred to control the Internet environment for the children, although many commercial parental control software and websites dedicated to children exist. This paper presents the design and implementation of a personalized Internet access for kids called PIAK, which has been developed in Sarawak, where the dominant ethnic group is Iban. It happens that the word PIAK sounds like 'Biak', which means "young people or kids" in Iban language.

The main contributions of the work presented in this paper can be summarized as follows:

- PIAK is the first system that integrates the personalization concept in the context of Internet access education for children;
- PIAK development process follows a user-centered design approach to fulfill the needs of indigenous children in Sarawak, Malaysia with regard to their Internet usage, safety and convenience when they are online.

The rest of the paper is organized as follows. Section II provides an overview of personalization techniques and applications. Section III describes the proposed methodology in designing PIAK. Section IV discusses the implementation of PIAK. Section V provides pre-finding of the evaluation with uses. Section VI discusses the implication of the system and Section VII concludes the paper.

II. RELATED WORK

A. Digital Divide in Internet Access

Research into information, communication and technology (ICT) and indigenous around the world has a long history. Furthermore, the rural area communities are facing lack access to the Internet or do not have the expertise to train them in ICTs. The deficiency to access the computers and Internet continues to be a major form of social and economic exclusion for them, including difficulty in accessing the technology due to cost, isolation, poor telecommunications infrastructure and low computer skills [3].

Survey on digital inclusion among indigenous people in Perak has clear insight of indigenous problems with the ICT. The researcher has verified a high percentage of indigenous people did not know how to use email, word processing software or even naming the computer parts [4]. Their findings have confirmed the existence of digital divide due to socio-economically disadvantaged. Surprisingly, another survey in rural area of Sarawak found that more than half of the respondents have access to the Internet at home or their workplace [5]. Although the Internet connectivity issues may have been resolved over the years but, still a lot to be done to understand current Internet access problems among the indigenous children.

B. Safe Internet Access

To date, various methods have been deployed to make the Internet a safe place for the children, such as SafeSearch feature and other commercial filtering software. Figure 1 shows the example when a child performs query searching on the Internet without any filtering system. The results might contain both good and bad web pages.

An alternative way to avoid bad web pages is by referring to a human-edited Internet directory, namely DMOZ Open Directory (http://dmoz.org). The directory is an open content distribution which can be referred by the Internet users. The information from such database is much more assured to be represented to the children, even though it has limited listings of web pages compared to the Google listing. Although this is not fully automated and requires extra steps to the Internet

users, the proposed integration of whitelisted Internet directory and the Internet content filtering should be able to provide a controlled and safe online environment.

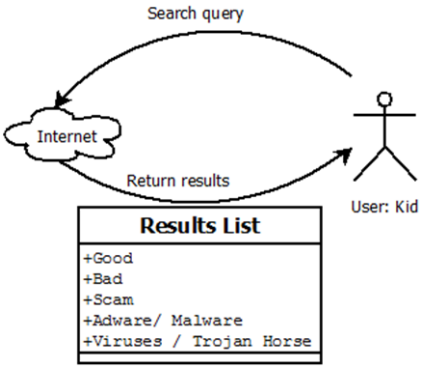

Figure 1: Internet access without filter

C. Personalization Techniques and Applications

Diverse definitions can be found in the literature for the term "personalization". This paper adopts the definition given by Mulvenna and colleagues: the goal of personalization is to provide a user with what he or she needs without requiring it explicitly [6].

Personalization techniques derived from recommendation techniques, which can be broadly divided into three approaches: collaborative filtering, content-based filtering, and hybrid techniques [7]. Collaborative filtering recommends to a user items that have been liked by other similar users. Content-based filtering recommends to a user items similar to those that the same user has selected or liked before. Hybrid recommendation techniques combined both content-based and collaborative filtering approaches.

Personalization can be found in different applications such as e-commerce, digital library, and e-learning. Each application has a different perspective of personalization. Amazon.com, the most popular e-commerce website, provides a user-friendly interface and adopted personalization to provide the right products at the right time and relevant to the customer needs. This is done by assimilating millions of customers and vast number of products in the electronic catalogue [8]. Digital libraries play an important role in narrowing the gap between the massive amount of available information and the specific needs of both students and researchers. A hybrid recommender solution using collaborative and content-based filtering is implemented to enhance the library recommendation for relevant research paper [9]. The innovation of personalized e-learning does not end in the formal education only. A specialized web browser is created to enhance the independent Facebook access towards the individual with intellectual disabilities. This is done by considering all requirements from the unique needs of each user before developing the system features [10]. Personalization can become an added value to market the lifelong learning scheme, by giving the students to choose their flexible curriculum design, effective teaching and assessment of their learning [11]. This learning model is getting effective when the involvement of student-teacher relationship is also emphasized in the knowledge development [12].

III. Design of PIAK

A. Data Collection for Prototype Design

To design PIAK effectively, an initial survey was conducted. An online questionnaire using SurveyMonkey platform was created. The questions were divided along five main topics: information on the respondent's device used to access the Internet, respondent's daily language usage, respondent's parent's educational background, the actions taken by the respondent to confront difficulties upon accessing the Internet, and the respondent's exposure on the Internet contents.

The selected population was secondary school children aged 13 years, who lived in the Serian district of Sarawak. All participants were selected through a process of convenience sampling, mainly based on availability, fast, inexpensive and reachable.

The reason of choosing secondary school children in the sample of the study is that they are already exposed to the Internet and they lived in a rural area, which faces many difficulties upon accessing the Internet. A total number of 237 respondents answered the self-administered questionnaires. The majority of respondents are female (70.5%). Table 1 summarizes the findings.

Table 1
Summary of the Survey Results

	Questions	Respondents' answers
1	Device usage for accessing Internet	Smartphone (90.6%) Laptop (37.9%) Computer desktop (12.8%)
2	Daily language	
	At school	Malay (87.71%)
	At home	Native languages (68.4%) Malay (22.8%) Mandarin (5.9%) English (2.1%)
3	Parent's background	Secondary school (67.1%) College/University degree (18.1%) Primary school (10.1%)
4	Solution to difficulties faced when accessing Internet	Asking someone with Internet knowledge (75.6%) Finding tutorial video (8.1%) Submitting question to web search engine Doing nothing (6.8%) Using built-in pop-up message or animated icon with sound (1.7%)
5	Internet content exposure	Viewing sexual images when surfing thru pop-ups or side ads (59%) Viewing sexual images posted in chat rooms or social messaging applications (48.2%)

Based on these new findings, a proposed solution to the children's Internet access in rural area is made: to combine in one environment, learning Internet and personalized learning for the children. The mapping of the survey results to the personalization features is shown in Table 2.

Cross-platform user interface – The most electronic device used by respondents is smartphone (90.6%). Therefore, it is normal that PIAK supports cross-platform user interface (UI) to expand the system usage.

Table 2
Mapping Survey Results to Personalization Features

Collected Data		Proposed System Features
Device utilized	➔	Cross-platform user interface
Daily language usage	➔	Multilingual support
Parent's education, difficulties on the Internet	➔	Educative and assistive mediums
Internet content exposures	➔	Internet content filtering

Educative and assistive mediums – Not all respondent's parents had obtained a formal education (67.1% of secondary school; 10.1% of primary school; 18.1% had a college / university degree and the remaining 4.6% did not have any education background or did not know, i.e., they don't live with their parents). This illustrates that parental monitoring and supervision on the children's Internet usage can be very minimal. Currently, technology for digital learning has expanded quickly to serve the learners. However, the Internet educational videos obtained from the video sharing website is not personalized for everyone. The language barrier and the information findings can be very challenging. It is expected that the respondents will ask someone to help them when difficulties arise. Apparently, 75.6% of the respondents will ask somebody who has knowledge about the Internet to help them. Besides that, respondents seek for a tutorial video (8.1%) or type the questions in the search engine box to find the information (7.7%). An old fashion to get help or hint is by using built-in pop-up message or animated icon with sound (1.7%) which no Internet connection is needed but least people are using it. Some Internet users will do nothing and keep on surfing the Internet when a problem occur (6.8%), perhaps they did not have any idea to refer to. Thus, PIAK will provide online aiding and selected support documents to give help and information about the Internet as concise as possible. Additional educational videos and documents can be added later.

Internet content filtering – Most of the respondents have seen sexual images delivered by pop-ups or side advertisement when surfing the Internet (59%). Respondents also reported that such images are also posted in the chat rooms or social messaging applications (48.2%). Both sources of the images are beyond the respondent's ability to control. Therefore, Internet users are often slid to the bad web pages when surfing the Internet. They are not automatically protected from the bad advertisements which redirect them to the bad web pages. Thus, a verified source of information and a web content filtering system is necessary for the proposed system.

There are two types of Internet content filtering applied to the system. One is to eliminate unwanted web pages from reaching PIAK webpage by integrating the blacklisted URLs database and naïve Bayes algorithm [13]. The other one is using hybrid collaborative filtering and content-based filtering to recommend the web pages. The DMOZ Kids and Teens Directory which is the safest source of web pages will be the main source of web pages to provide a healthy Internet environment. Therefore, none of the PIAK user is redirected to the unwanted websites.

B. PIAK Personalization Components

The survey results are the basis of the design of PIAK, which requires two main components: the user interface (UI) component and the search engine component. A block diagram of PIAK processing pipeline is depicted in Figure 2.

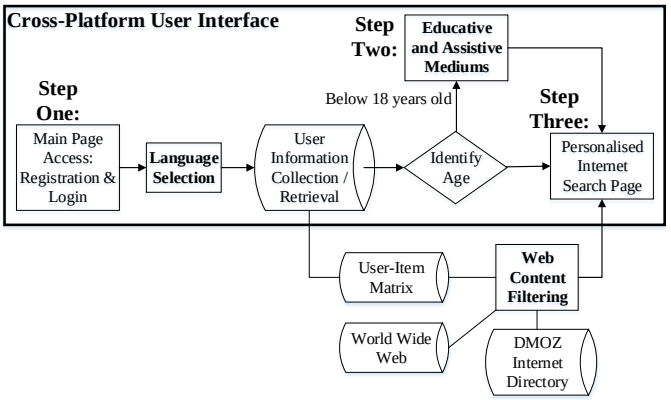

Figure 2: The block diagram of PIAK pipeline

The working mechanism of PIAK is divided into three main steps as explained in the following paragraphs.

Step one: A UI mockup of PIAK main page is shown in Figure 3. A new user needs to register once before entering PIAK system. Active users need to log in by using their username and password. To ensure that PIAK can be accessed by different background of the user, a multilingual option is provided. The language selection will affect the whole system language. This includes the on-screen text and the subtitle of educative and assistive medium.

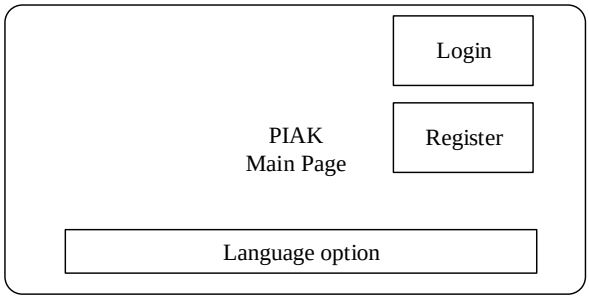

Figure 3: PIAK main page design

Step two: A new user is directed to the educative and assistive medium page to receive an early Internet education after registration. New users need to select their parent's education level and see the provided educational media before entering PIAK search page. The user interface mockup for educative page is illustrated in Figure 4.

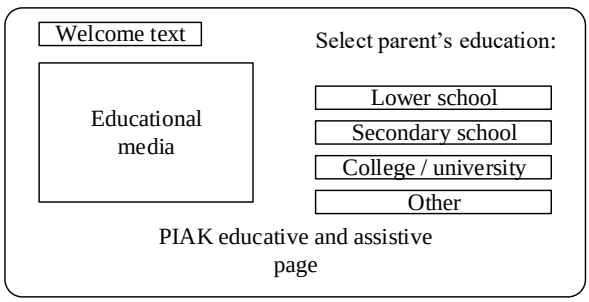

Figure 4: PIAK educative page design

Step three: Active user who has taken the early Internet lesson is directed to the PIAK search page as illustrated in Figure 5. A greeting text is personalized to the user by greeting user's first name in the user's preferred language. Furthermore, the greeting text will be considering the local

time. It means that if a user X logs in in the morning, the greeting text will be "Welcome X, good morning!". However, if X logs in in the afternoon, the greeting text will be changed into "Welcome X, good afternoon!". A tutorial link is provided for the user to get back to the educative and assistive medium. A profile update link is available for users to update their personal information as well as the log out link. A search bar located below is useful for users to find specific information or keywords when users cannot find any interest in the recommended web pages listing. The user is also able to browse many web pages based on the category listing on the left sidebar. Furthermore, a carousel banner is placed below the search bar to attract PIAK user to see some highlighted information. This could be on the Internet security subject or infographic relevant for the children.

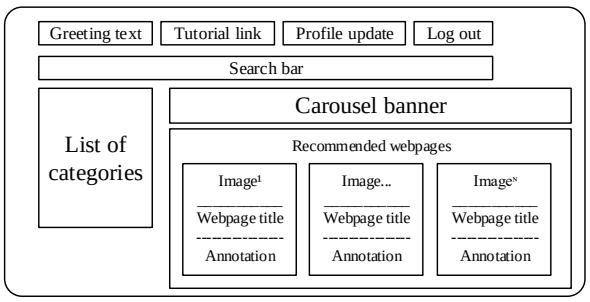

Figure 5: PIAK search page design

The searching feature is not designed to leave the current view of the webpage when returning search results. The search result is appeared in a box on top of the screen once the user performs keyword(s) searching. If the user clicked on any link, a new window will pop up and appear in front of the screen. The PIAK search result box is remaining open until the user clicked on the X mark on the upper right to close it. Figure 6 illustrates the mockup of possible occurrence to the current window once the user performs a searching.

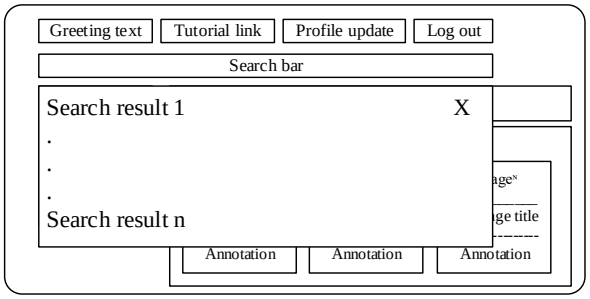

Figure 6: PIAK search engine design

IV. Implementation of PIAK

A. Software Requirements

Several requirements are needed before implementing the system. PIAK is developed using PHP 5, Python and JavaScript programming language. The integrated development environment (IDE) to develop the website is using Adobe Dreamweaver CS4 and Notepad++.

The execution of PIAK is done using the Apache HTTP Server, an open source Web server application developed by the Apache Software Foundation. It is also a component to support the combination of MySQL database and PHP scripting language. Several advantages of using Apache HTTP Server are low development cost due to no software licensing fee, flexible open source programming language and has a higher reputation in security option than the Microsoft's IIS. The prototype system is developed and tested at localhost before it is uploaded to a web hosting.

B. Sources of Media and Web Categories

The media for educational and assistive medium were selected from YouTube videos. A basic Internet tutorial video is designated to provide early Internet education for the kid. The video URL is embedded into PIAK and extra subtitles are provided in different languages.

The human-verified directory of the web namely DMOZ Open Directory (http://dmoz.org) is utilized to provide web categories. The accuracy of the information from the database is the key to the system, although DMOZ has limited listings of web pages compared to the Google listings. Table 3 summarizes the comparison.

Table 3
DMOZ open directory vs. Google

	DMOZ Open Directory	Google
1	Human verifies web pages	Human does not verify web pages
2	Listed web pages are safe for children	Search listing is not safe for children. Requires extra steps to filter out bad web pages.
3	Has categories	Has no categories
4	Limited listing	Huge listing

C. User Interface Implementation

PIAK main page – This page is adapted from Facebook login UI. A bootstrap template for Facebook is downloaded and remade to meet the PIAK system requirements. Figure 7 illustrates the UI for the desktop version, while Figure 8 shows the UI for mobile version of new user registration (left) and active user login (right). The user interface is designed to appear smoothly in any device. This will increase the system usage through different platform. Language selection is available below the screen.

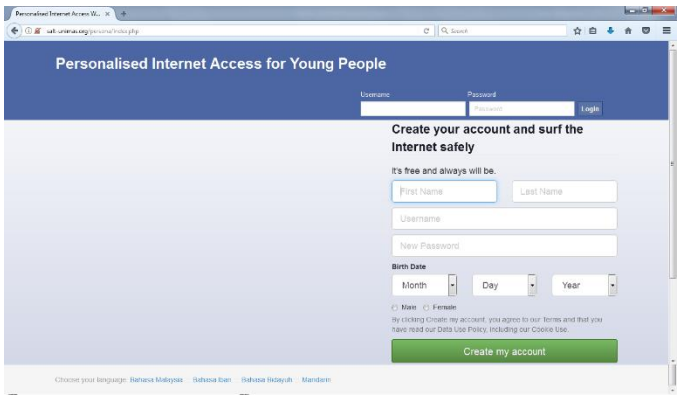

Figure 7: PIAK main page UI (desktop version)

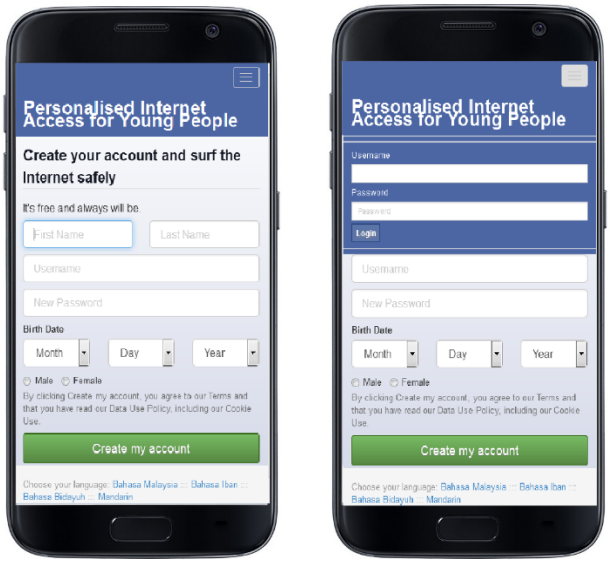

Figure 8: PIAK main page UI (mobile version)

PIAK educative and assistive page – The lesson is provided in English but personalized with the subtitle in the user's preferred language. This initiative has been made compulsory for new users below 18-years-old and having parents who did not graduate from college or university. To ensure that these users have a sufficient understanding on the use of the Internet, they must finish the lesson before being able to enter the search page. For the other users, the lesson is facultative, but at any time the lesson is accessible by clicking on the Tutorial Page link provided. Figure 9 illustrates the UI for desktop version while Figure 10 illustrates the UI for mobile version.

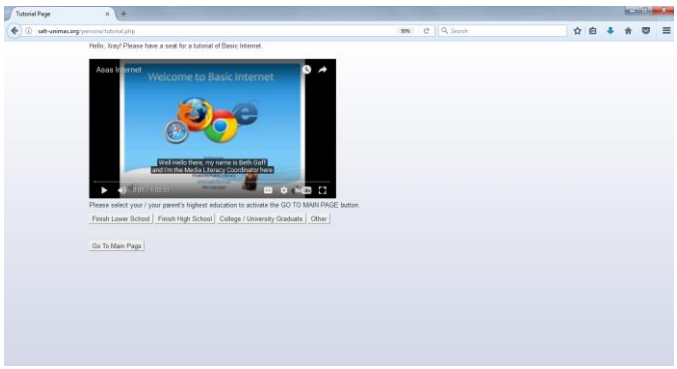

Figure 9: Educative and assistive UI (desktop version)

Figure 10: Educative and assistive UI (mobile version)

PIAK search page – A bootstrap theme of YouTube webpage is downloaded and altered to provide such UI based on the mockup. Instead of video, the system represents web pages in a box with an image and annotation of it. All contents were added with enough white space to make a clear look of the content. There is no fancy design which distracts the user from their main motive on the website at the same time will slow down the page loading. The picture of the recommended webpage is set to be simple, meaningful and distinguishable. Figure 11 illustrates the UI for PIAK search page which is easy to understand. However, when the UI is compressed for the mobile version, the contents are displayed in parallel.

Figure 11: PIAK search page UI (desktop version)

The links above the search bar in desktop version are placed inside the top right button. The carousel banner is resized fit to the mobile screen while each recommended webpages is shown in a single box as illustrated in Figure 12.

Figure 12: PIAK search page UI (mobile version)

PIAK search engine – Google Custom Search Engine (CSE) is utilized to create a basic search engine to do searches in the DMOZ Kids and Teens Directory. Users are also able to perform searches for everything but the return results are still in a controlled environment. Google CSE provides custom ranking which can be used to personalize the search based on keywords, weighted labels and scores. Besides that, an autocomplete feature is also available to help user to spell word correctly. This will help them to obtain results instantly by displaying useful queries as soon as they start typing in the search box.

Figure 13 illustrates the search results for keyword "computer". There are about 552 results from DMOZ database compared to 2,360,000,000 results from the Google search engine for the keyword on 3rd February 2017. However, this should be sufficient for the early Internet exposure to the children.

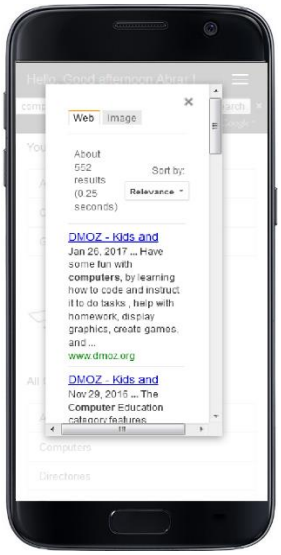

Figure 13: PIAK search result UI (mobile version)

D. Database

MySQL is deployed to provide a database solution for PIAK. All data can be directly retrieved, updated and stored in the database tables by using SQL query. The MySQL database is connected using mysql_connect() function. This function represents a connection string to a data source. The role is an intermediate object located between the client and server. In other words, it is a link to string the database to the requested site. Three tables in the database (Figure 14) are utilized in the system to add, retrieve or update data, namely the user_information, item_DMOZ and user_item.

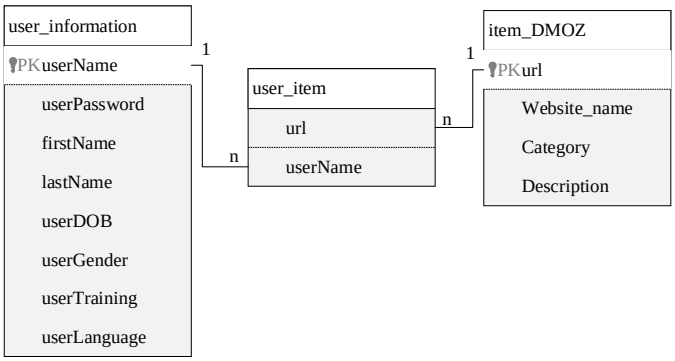

Figure 14: Database schema for the system

User personal information is stored in the *user_information* table with the Primary Key (PK) assigned to the *userName*. The *userName* is also used during the login to the system as well as the *userPassword*. Users are required to provide their information during registration for the purpose as shown in Table 4. DMOZ database contains a *url*, *website_name*, *category* and *description*. The *url* is assigned as PK because each website has a unique web address.

Furthermore, the *user_item* table is used to store visited web *url* and *userName* which later be used by the hybrid collaborative filtering and content-based filtering to outcome with the list of recommended web pages.

Table 4
Purpose of user information

Information	Purpose
Name (first name)	Welcome text
Name (last name)	System maintenance
Username	Login, User-item matrix
Password	Login
Birthdate	Educative medium
Gender	System maintenance
Training	Educative medium
Language (English, Bahasa Malaysia, Iban, etc.)	Welcome text, Educative medium

V. User Acceptance Testing and Evaluation

A permission is obtained from the school principal of *Sekolah Menengah Kebangsaan Serian* to perform user testing on PIAK. The testing is conducted on 15th November 2016 at the computer lab with the help of ICT teacher. Thirty respondents age 13 years old from class 1E were volunteered to assess PIAK. Briefings were given to the respondents before performing the tasks as illustrated in Figure 15. They are allowed to perform the task as many times as they want. Then, online questionnaire was administered to get feedback on PIAK's usability.

User No.:_____
Gender: Male / Female **Ethnicity:** _____ **Age:** _____
Task Scenario:
Task One –

Choose your preferred language, register your account, and look at the first-time system user video.

Task Two -

Have a look on the recommended web pages at the main system page and explore the content.

Task Three -

Perform a searching using your own query/ keywords and see the results. (e.g.: GAMES)

Figure 15: Task sheet

The purpose of the questionnaire after performing the task is to measure the usability of PIAK website and to ascertain whether the system features are successful in meeting user's needs. In this part, seven items of the system are measured as illustrated in Table 5:

Table 5
PIAK's system evaluation

#	Usability of PIAK
1	Overall reaction to the system
2	Registration interface
3	Educative video on basic Internet
4	Recommended web pages displayed
5	Reading characters on the screen
6	Organization of information
7	Search engine result

A five point Likert-type scale was used in the questionnaire from (1) ''terrible'' to (5) ''very useful''. Thus, number three will be neutral. The scale ranged from the negative output (no. 1) to a positive output (no. 5). Questionnaire administration is done by the researcher observed the users' testing and answering all the questions to ensure no misunderstanding will happen. They are guided only when they asked for help.

Table 6 displays basic information about the students who participated to perform the system testing. It is found that the respondent's gender is 50% female and 50% male with the total of 43.4% indigenous respondents (Bidayuhs, Ibans and Kadayan).

Table 6
Socio-demographic profiles of the respondents (n=30)

	Characteristic	N	%
1	Gender		
	Male	15	50
	Female	15	50
2	Age		
	13-years-old	30	100
3	Ethnic Group		
	Bidayuh	11	36.7
	Iban	1	3.3
	Kadayan	1	3.3
	Malay	13	43.4
	Chinese	1	3.3
	Others	3	10

The independent-samples t-test is utilized to compare the means between the indigenous and non-indigenous respondents on the same continuous, dependent variable which are their rating on the system features. This is important to identify any differences in their acceptance rate between both communities as the system is developed based on the indigenous communities' Internet requirements. Seven items listed as mentioned in Table 5 were tested using Levene's test and T-test. Levene's test determines that the assumption of equal variances has not been violated. The results are listed below:

(1) There was not a significant difference in the scores of non-indigenous (M = 3.65, SD = 0.931) and indigenous respondents (M = 4.15, SD = 0.801), conditions; t (28) = -1.567, p = 0.128 towards the overall reaction to the system. The results suggest that the system can be operated easily by both groups.

(2) There was not a significant difference in the scores of non-indigenous (M = 3.76, SD = 1.091) and indigenous respondents (M = 4.31, SD = 0.751), conditions; t (28) = -1.534, p = 0.136 on the acceptance of registration interface. The results suggest that the interface layout is familiar by both groups.

(3) There was not a significant difference in the scores of non-indigenous (M = 3.29, SD = 1.047) and indigenous respondents (M = 4.00, SD = 0.707), conditions; t (28) = -2.09, p = 0.46 towards the educational video of basic Internet. It is found that the level of acceptance on the provided educational medium are same for both groups.

(4) There was a significant difference in the scores of non-indigenous (M = 3.35, SD = 0.862) and indigenous respondents (M = 4.23, SD = 0.725), conditions; t (28) = -2.956, p = 0.006 towards the recommended web pages displayed. Specifically, non-indigenous respondents did not satisfy with the recommended web pages as the indigenous group.

(5) There was not a significant difference in the scores for non-indigenous (M = 3.71, SD = 0.985) and indigenous respondents (M = 4.23, SD = 0.725) conditions; t (28) = -1.613, p = 0.118 when reading the characters on the screen. Both groups reported that they can read the characters on the screen easily.

(6) There was a significant difference in the scores of non-indigenous (M = 3.18, SD = 0.728) and indigenous respondents (M = 3.92, SD = 0.760), conditions; t (28) = -2.733, p = 0.011 on the acceptance of information organization. Specifically, the non-indigenous respondents found the organization of the information is quite confusing compared to the indigenous respondents.

(7) There was a significant difference in the scores of non-indigenous (M = 3.41, SD = 0.712) and indigenous respondents (M = 4.38, SD = 0.506), conditions; t (28) = -4.176, p = 0.00 on the search engine result. Precisely, the non-indigenous respondents found that the search engine result is quite unhelpful to them but helpful to the indigenous respondents.

VI. DISCUSSION

This section discusses the issues related to PIAK's implementation and user acceptance. PIAK is developed and implemented to store and make use of data. In pursuit to offer a full experience on personalized Internet access, the user is required to provide their true information upon registering to the system. The user will be assisted systematically based on the information provided. This issue is also faced by major online systems which they cannot have control of people cheating on such information. PIAK does not collect sensitive personal information from the registration form. PIAK has no featuring to enforce the user to put accurate information in the system. If the user did not enter the actual information, they will not get the full experience on the educational resources personalized for them. However, they still can access the educational medium via the link provided whenever they

want.

The user acceptance analysis is performed to compare the level of acceptance between the indigenous and non-indigenous respondents. Thus, as the second objective of the paper is to fulfill the Internet needs of indigenous children in Sarawak, it is compulsory to verify whether they are accepting or rejecting the proposed system.

Based on the system's evaluation results, there are some statistically significant differences found in the system acceptance between the indigenous and non-indigenous respondents. The differences relate to the recommended web pages displayed, the organization of the information and the search engine result, which is found less likely accepted by the non-indigenous respondents.

The recommended web pages did not satisfy the non-indigenous respondents' desires. They need to perform extra searching to find something interesting. Although the system interface is adapted from YouTube interface, the contents offered are web pages and not video clips. Thus, the system might not up to their prior expectation. Compared to the indigenous respondents, they see the recommended web pages as a truly something new to them. The information provided is worth for them to look and explore. Their appreciation for the system is very high because they are not widely exposed to the Internet contents.

The non-indigenous respondents tend to rate low on the organization of information due to the information arrangement might be confusing to them. Furthermore, PIAK has a scarce user-item database in the early implementation which might not be able to recommend web pages efficiently and thus, discourage the non-indigenous respondents. While the indigenous respondents are not yet exposed with the varieties of the online system, they have to depend on such system to find useful information. Currently, they are easy to explore the Internet with PIAK.

Moreover, with many restrictions applied to the search engine feature, the personalized search results did not satisfy the non-indigenous respondents. They found that the Google search engine includes varieties of results with a wide range of topics compared to PIAK. Much information is also available in the national language too. Although the information retrieved from Google often not related to what they need, they are able to find it with the help of their parents. Unfortunately, the indigenous respondents did not fluent in the national language. They found difficulties to filter the retrieved information. Thus, they are merely depending on the personalized search engine to find what they need. Therefore, the process of verifying that the solution (PIAK) works for the target users, which is the indigenous communities can be ensured as a success.

The differences in user acceptance can also be perceived in socio-demographic perspective. The non-indigenous respondents are living in semi-urban area which the Internet connectivity is available through a wireless or fixed line. They also own a smartphone and accessing the Internet can be done all the time. They are able to use many applications which contribute to their learning and productivity. They often seek information from the Internet to finish their school works and this improves their skills in finding true and reliable information.

Meanwhile, the indigenous respondents are mostly living in the rural area. They face many restrictions to access the Internet, whether through the wireless or fixed line. This unfavorable situation creates an obstacle for them to participate actively in any organization where most organizations are now using the Internet to promote their activities. Furthermore, they cannot demonstrate their abilities in many domains such as music, film, photography or writing, although they have talents on that.

Some skills are developed when exploring the Internet and it cannot be built in isolation. The Internet users need to recognize and manage risk, to learn to judge and evaluate information, and to deal effectively with a virtual world that can sometimes be dangerous or hostile. Thus, PIAK is important for the less fortunate children to obtain such knowledge and stay safe in this new environment.

VII. Conclusion and Future Work

The paper presented the basic design and architecture of PIAK based on the system requirements obtained from a survey finding. The problems faced by the children in accessing the Internet were identified. The solutions to these problems were translated to be the components of PIAK, which consists of four personalization features: cross-platform user interface, multilingual support, educative and assistive mediums, and Internet content filtering. The PIAK prototype system is accessible at http://salt-unimas.org/persona. A system like PIAK is needed to avoid digital divide and ignorance of Internet risk since it is designed to provide early Internet education to the children. The pre-finding of system acceptance with uses is found positive by the children.

Future work directions include the enhancement of PIAK by adding more indigenous languages and more educative mediums.

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