Prefece

The **International Journal of Mobile Computing and Multimedia Communications (IJMCMC)** publishes original research papers, state of the art reviews, technical notes, case studies, innovative projects, and book reviews on topics leveraging all aspects of mobile and multimedia computing: from underlying technologies to applications, theory to practice, and servers to networks to devices.The coverage of this journal ranges from innovative topics to research findings to trends analysis on mobile multimedia and related theories, technologies, methods, applications, and services from all engineering, business and organizational perspectives.

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Topics Covered

- Active multimedia network
- Advances in MAN
- Augmented Reality
- Billing and security for mobile multimedia services
- Coding, equalization, and modulation
- Consumer applications
- Content distribution architectures
- Content distribution internetworking
- Cooperation in mobile multimedia
- Database for mobile systems
- Digital rights managements
- Economics of mobile multimedia
- Effect of mobility on computing
- Emerging access networks
- Enabling infrastructures for mobile computing and multimedia
- Ergonomics and health issues
- Home networking
- Industrial Applications
- IP video, streaming, and interactive video services
- Location- & context-aware dependent computing
- Low power networking
- Marketing Strategies
- Measurement and modeling of network operation
- Medical Applications
- Middleware support for mobile multimedia
- Military applications
- Mobile and multimedia markets and business models
- Mobile aware applications
- Mobile CSCW (computer-supported cooperative work)
- Mobile multimedia interfaces
- Mobile multimedia network traffic engineering
- Mobile multimedia platforms
- Mobile multimedia software architectures
- Mobile operating systems
- Multimedia and integrated services
- Multimedia traffic management
- Multi-point, multicast services
- Network models and architectures
- Network programming for mobile multimedia services
- New mobile and multimedia applications and services
- People with disabilities
- Personal area networks
- Personalization, privacy, and security issues
- Portable computers with wireless access
- Portable devices and smart sensors

Mission

The primary goal of the **International Journal of Mobile Computing and Multimedia Communications (IJMCMC)** is to provide researchers and academic communities around the world with the highest quality articles while reporting the state-of-the-art research results and scientific findings allowing students, developers, engineers, innovators, research strategists, and IT-managers in this field to gain greater insight into mobile multimedia as they relate to applications, management, and opportunities within any given construct. This journal publishes original research papers, state of the art reviews, technical notes, case studies, innovative projects, and books reviews on topics leveraging all aspects of mobile computing and multimedia communications: from

underlying technologies to applications, from theory to practices, and from servers to networks to devices.

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The Novel Method of Adaptive Multiplayer Games for Mobile Application using Neural Networks

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ABSTRACT

The rapid development of the games industry and its development goals were not just for entertainment, but also used for educational of students interactively. Unfortunately the development of adaptive educational games on mobile platforms in Indonesian language that interesting and entertaining for learning process is very limited. This paper shows the research of development of novel adaptive multiplayer games for students who can adjust the difficulty level of games based on the ability of the user, so that it can motivate students to continue to play these games. The authors propose a method where these games can adjust the level of difficulty, based on the assessment of the results of previous problems using neural networks with three inputs in the form of percentage correct, the speed of answer and interest mode of games (animation / lessons) to produce 1 output. The experimental results are presented and show the adaptive multiplayer games are running well on mobile devices based on BlackBerry platform.

Keywords: Adaptive Game, Blackberry, Education Games, Games Industry, Mobile Platforms, Multiplayer, Neural Networks

INTRODUCTION

Nowadays, the application of games on mobile devices is growing rapidly and in great demand by students for entertainment or just increase their knowledge. Drastic increase occurred in the use of games for a fun and educational tool for students and effective discussion about the use of adaptive games to enhance interested learning and entertaining to various aspects of education (Nikola, 2011). The Net Generation (Tapscott, 1998) has already arrived at university and college. They differ completely from the people in charge of their education (their teachers and parents) in the role that ubiquitous technologies have played in their everyday lives.

Today, students have grown up using devices like computers, mobile phones, and video consoles for almost every activity, from studying and work to entertainment and communication. This has probably altered the way they perceive and interact with the environment, both physically and socially (Prensky, 2001b). To meet the different cognitive requirements of the new generation, the educational community is considering new ways of learning. In particular, there is a wide interest in trying to engage students with the appealing features of videogames and Internet tools (Prensky, 2001a). Computer games are an incredibly successful genre that captivates children as well as adults and that instantly mirrors the spirit of a time and the state-of-the-art in computer technology. Computer games combine art and technology in a fascinatingly natural and convincing way. The games' success is reflected in enormous sales figures, economic growth, and numbers of users (Kickmeier-Rust, Mattheiss, Steiner, & Albert, 2000). The motivational potential along with the high level of interactivity and the large degrees of freedom in computer games for educational purposes may open entirely new horizons for educational technology (de Freitas, 2006). Playing games, in general, is not only one of the most natural forms of human activity but also one of the most natural forms of learning.

User adaptation in e-learning can be characterized as the ability of a system to personalize the learning experience to different individual condition over time. In general, the adaptation process includes three stages (Brusilovsky & Maybury, 2002): gathering information about the user; processing this information to initialize and update a user model; and using that model to provide the adaptive behavior. One of the students' features that can be considered in this paper is their learning styles.

Adaptive games-based learning style aims to support and encourage the learner considering his needs, strengths and weaknesses (Spring-Keller, Schauer, 2006). The best known of the games-based learning is to increases the motivation of learners (Ming Chun, 2005;

Shelton, Satwicz, & Caswell, 2011) and the relationship between games and constructivist theory (Gluskhova, 2008) because the games are well made can have pedagogical value of learning to produce a satisfactory outcome, because the student can cope with issues, work / play together and learn from previous experience. Technological pedagogical content knowledge is described as complex interaction of content, pedagogy and technology. The ways knowledge about tools and their pedagogical affordances, pedagogy, content, learners, and context are synthesized into an understanding of how particular topics that are difficult to be understood by learners, or difficult to be represented by teachers, can be transformed and taught more effectively with ICT, in ways that signify the added value of technology (Timur & Tasar, 2011).

A crucial factor for adaptivity is challenge. It can result from adapting the level of difficulty of the tasks to the learners' ability level so that a constant challenge is felt. Not only the level of difficulty of the tasks is adjusted to the learners' ability level, but also the system reacts to personal learning styles and preferences (Spring-Keller, Schauer, 2006). The entertaining videogame industry has grown and it is a mature industry that caters for all ages and genders. Driven by a commercial pressure to entertain different player profiles, successful games have developed sophisticated adaptation mechanism. Most games adapt their behavior to suit different levels of proficiency, adjusting the difficulty of the game (Torrente, Moreno-Ger, Fernandez-Manjon, 2008).

Developing adaptive educational games software for the BlackBerry device is an exciting area of development. Although it can be relatively simple, the task can also be daunting depend on the requirements, logical thinking, technical talents, resources and mindset. A difficulty many people encounter is in visualizing how to create a useful and adaptive educational game for a smart phone device. With desktop-based solutions reigning supreme for so long, it's often hard to visualize creating something

useful for a device with a tiny screen, limited memory, and a relatively slow pipe to the outside world.

There have been many studies on the development of education-based games for mobile applications such as (Thomas, 1999). But in the study, there is no comprehensive mechanism of how to identify the ability of users (students) who have a genuine interest in games or games that comes with a lessons and quizzes, as well as not using a Neural Network-based intelligence to input the percentage of correct answers, speed of answer and interest mode of games (animation / lessons). In addition, research on the development and use of adaptive educational games on mobile platforms in Indonesian language for students has not been touched at all.

One of the well-known providers of mobile games applications that are used in Indonesia is BlackBerry devices from Research in Motion (RIM). However, the application of adaptive educational games using Indonesian language is not a lot, this is a new challenge in the development of mobile games in Indonesia. BlackBerry Operating System enables the developers to develop open source Java-based applications that can be easily commercialized (Kao, 2010; Hamer, 2010). Advantage in developing applications of mobile games based on BlackBerry platform is still the lack of games for the application that is widely used in Indonesia, because given applications of BlackBerry tend to be focused on business. This is an important point for our research in developing games at low cost and reliable.

The state of the art of this research is that we propose a novel method for adaptive educational games on mobile application where the system will be able to identify the level of ability and interests of user (students) on one of his/her favorite games using Neural Networks. So based on such identification, information obtained from student's interest and the ability level and the mode are to make an adaptive game, so that students do not feel bored. The proposed adaptive system using the method of identifying the profile and level of understanding of the material field of interest

from the user contributes to a new method for adaptive games. Where the proposed model of educational games in the form of pure animation games and mathematics lessons/quiz based on artificial intelligence using Neural Network with 3 inputs and 1 output. The final result of this research is a framework of adaptive multiplayer game using neural network.

BLACKBERRY PLATFORM

BlackBerry is a mobile device that has the ability to push email, phone, messaging service, browsing the internet, messenger (BlackBerry Messenger / BBM), and various other wireless capabilities. BlackBerry was first introduced in 1997 by the Canadian company, Research In Motion (RIM).

BlackBerry was first introduced in Indonesia in mid-December 2004 by operator Indosat and Starhub company which is the main partner BlackBerry. BlackBerry market then enlivened by two other major operators in the country namely Exelcom and Telkomsel. Due to the demands of the government of Indonesia, the BlackBerry finally opened a representative office in Indonesia in November 2010.

BlackBerry became famous and popular in the market because the push email features from this product. We can call push email because all of new emails, contact lists, and schedule information (calendar) displayed directly into the BlackBerry automatically. With push email all incoming emails can be forwarded directly to the phone. Email also has undergone a process of compression and scan on a BlackBerry server so it is safe from the virus. Attachment data such as Microsoft Office and PDF documents can be opened easily. Users do not need to access the internet first and opened one by one incoming email, or checking for new email. This is possible because the user will be connected continuously with the virtual world through mobile phone networks are available. Storage tool also allows users to access data until when outside wireless coverage services. Once the user connects again, the BlackBerry

Enterprise Server will deliver the latest data entered. Another benefit using BlackBerry that can accommodate up to tens of thousands email without any risk of hangs, as long as there is memory left.

RIM provides a multi-tasking operating system for BlackBerry that allows the use of an intense than a tool. Operating System (OS) provides support for the Mobile Information Device Profile (MIDP) 1.0 and Wireless Application Protocol (WAP) 1.2. Previous versions allowed wireless synchronization via e-mail and calendar, Microsoft Exchange Server, Lotus Domino and other messages. While the latest OS 4 is a complement of MIDP 2.0, and allows complete wireless activation and synchronization with email, calendar, and many more. BlackBerry provides a variety of software that can be tailored to the needs of the operation.

BlackBerry Enterprise Server (BES)

BlackBerry handheld device is integrated in an organized email system through a software package called BES. BES can be used by network-based e-mail Microsoft Exchange, Lotus Domino, and Novell GroupWise. Special to individual users, they can use wireless email services provided by the provider without having to install BES. Individual users can use the BlackBerry Internet Solution without having to install BES on their smartphones. BES is intended for corporate customers with a range of big business. This software integrates all BlackBerry smartphones on an organization with existing enterprise systems. The advantage gained is extending wireless communications and corporate data to the active users in a secure manner.

BlackBerry Professional Software (BPS)

BPS is a wireless communications and collaboration solutions for small and medium enterprises. He presents a variety of features that are required of employees, in a package that is easy to install and cheaper prices.

BlackBerry Internet Service (BIS)

The software is designed for personal users allows you to integrate smartphones with 10 email accounts based on Post Office Protocol (POP3) and Internet Message Access Protocol (IMAP), send and receive instant messages, and surf the internet. With BIS, we can also open additional data (attachment) in the form of excel, word, powerpoint, pdf, zip, jpg, gif with the high data compression rate.

BlackBerry Mobile Data System (BlackBerry MDS)

An optimization application development framework for the BlackBerry Enterprise Solution, provides you a development tool to build, distribute, and manage interactions between BlackBerry smartphones and enterprise applications.

BlackBerry smartphones are built as a Java-based devices. All applications on the smartphone is built from Java ® ME. All BlackBerry smartphone supports at least MIDP 1.0 and Connected Limited Device Configuration (CLDC) 1.0, and smartphones using BlackBerry Device Software v4.0 or higher 2.0/CLDC1.1 MIDP.

Java Application Programming Interface (API) on BlackBerry smartphones allows to develop client applications that provide:

- Features customize the user interface;
- Local data storage on device;
- Event listening and system interfaces;
- Secure wireless transport over HTTP and TCP;
- Network coverage and support seamless roaming.

Research In Motion (RIM) has developed a world-class development tools to aid the development of BlackBerry applications with ease. Tools for developers at no charge and are constantly updated to include the latest features. One of the tools provided by RIM is the BlackBerry JDE Plug-in for Eclipse that

allows developers to build Java applications on BlackBerry using Eclipse. Application Programming Interface (API) is a set of rules and specifications that software programs can communicate with each other. API serves as an interface between different software programs and facilitates their interaction, similar to the way the user interface facilitates interaction between humans and computers. API can be created for applications, libraries, operating systems, etc., as a way to define their vocabulary and a way to ask for resources (eg function-calling conventions). API may also be included in the specifications for routines, data structures, object classes, and protocols used to communicate between the consumer and the program implementers API.

The BlackBerry wireless device was first introduced as a mean for instant, secure, mobile access to email. Today, it is becoming an integral tool of many business users and consumers. Not only can it be used as a cellular phone, it also provides organizer functionalities and is capable of executing applications based on Java ME (Java Platform, Micro Edition). More recent models are even equipped with built-in digital cameras, media plungers, Bluetooth and Wi-Fi. With so many features, it is not surprising to see the BlackBerry as one of the most popular mobile devices today. The blackberry is continually evolving with more innovative models released every year. And while RIM has thousands of third party vendors developing applications for this device, with this growth and expansion of subscribers more developers will be needed to create the applications for this platform. Learning about mobile devices in today's classrooms will be beneficial to the students as well as industry. RIM provides tools that software developers may use to program for the BlackBerry (D. Gavalas,2011).

The majority of these tools are provided free of charge to encourage development on the BlackBerry. Of these tools, perhaps the most popular one would be the BlackBerry Java Development Environment (JDE) which is an integrated development environment (IDE) for the BlackBerry platform. This IDE is also

equipped with a device simulator that can be used to load and test programs written for the BlackBerry. Other popular tools include the BlackBerry Email and MDS Services Simulator Package, which can emulate certain aspects of the BlackBerry Enterprise Server. When used in conjunction with a BlackBerry Device Simulator, users can simulate browsing Web content, sending and receiving email messages or application data traffic. RIM also provides plug-ins for developers who are comfortable with their existing tools such as Eclipse and Microsoft Visual Studio' a list of all the tools available can be seen at RIM's BlackBerry Tools. Along with the development of technology and the growing needs of the community in getting information without being limited by space and time, the Internet becomes a tool to meet the needs of the information can be accessed anytime and anywhere. Ease of access to information becomes a requirement in everyday life and in the business world. The business world and the internet can not be separated again, as companies large and small began to try to run the business through the internet as an alternative marketing and business transactions to face tight business competition (Syer, Adams, Zou, & Hassan, 2011)

The technology of wireless devices (wireless) has grown and become a trend among the people, one of the technology is the mobile application. Mobile application is an application that is run by using a mobile device like a smartphone device that is connected to the Internet to transmit and receive information. With the advantages of Internet technology and mobile technology application, then both can be used as a tool to facilitate communication, means of information, and promotional media (Gasimov, 2010). The growing use of smartphones, especially on the BlackBerry to be one significant factor in the level of need of the internet, where the BlackBerry can respond to customer needs in accessing the Internet anytime and anywhere. If seen from the development of the number of customers in Indonesia today, the BlackBerry service to gain a positive result with an increase in customers from multiple operators is about

100 thousand to 500 thousand during the third quarter of this year. Estimate the number of BlackBerry subscribers globally by 70 million users and BlackBerry Indonesia is the largest market in Southeast Asia (Utama, 2011). In 2010 the number of BlackBerry subscribers in Indonesia reached 2.63 million, and in 2011 is expected to reach 4 million, especially aided by launched new BlackBerry products at the end and beginning of the year. On the other hand it seems this is a good market for mobile application developers in Indonesia. Especially that directs the target to corporate and high end.

NEURAL NETWORKS FOR ADAPTIVE EDUCATIONAL GAMES

As mobile games become more complex and consumers demand more sophisticated remote controlled opponents, game developers are required to place a greater emphasis on the artificial intelligence and multiplayer aspects of their games. Neural Networks are computational algorithms that mimic the way nerve cells work. All of the incoming signal is multiplied by the weights on each input, the neuron cells, all the signals are summed and then multiplied by the weight plus a bias. The sum is entered into a function (activation function) produces the output of the neuron (here used a linear activation function). During the learning process, the weights and bias are always updated using a learning algorithm if there are errors in the output. Network function is determined by the connections between elements. We can train a neural network to perform a particular function by adjusting the value of connections between elements.

There are many different types of Neural Networks, each of which has different strengths particular to their applications. The abilities of different networks can be related to their structure, dynamics and learning methods. Neural Networks offer improved performance over conventional technologies in areas which in-

cludes: Machine Vision, Robust Pattern Detection, Signal Filtering, Virtual Reality, Data Segmentation, Data Compression, Data Mining, Text Mining, Artificial Life, Adaptive Control, games and more. Once modeling an artificial functional model from the biological neuron, we must take into account three basic components. First off, the synapses of the biological neuron are modeled as weights. Let's remember that the synapse of the biological neuron is the one which interconnects the neural network and gives the strength of the connection. For an artificial neuron, the weight is a number, and represents the synapse. Network is adjusted based on the comparison between the output and that output objectives in accordance with the target network. For the identification process, the weights are the direct weighing are called the input as a search parameter, as shown in Figure 1, the parameter is the price you are looking for w_1, w_2, w_3 and w_4. We use back propagation algorithm used for training the networks (Haykin, 2008).

Based on Figure 1, every input unit (x_i, $i = 1,..., n$) receive the signal input x_i and forward it to all units in hidden layer. Each hidden unit (Z_j, $j = 1,..., p$) summing the weighted input signal:
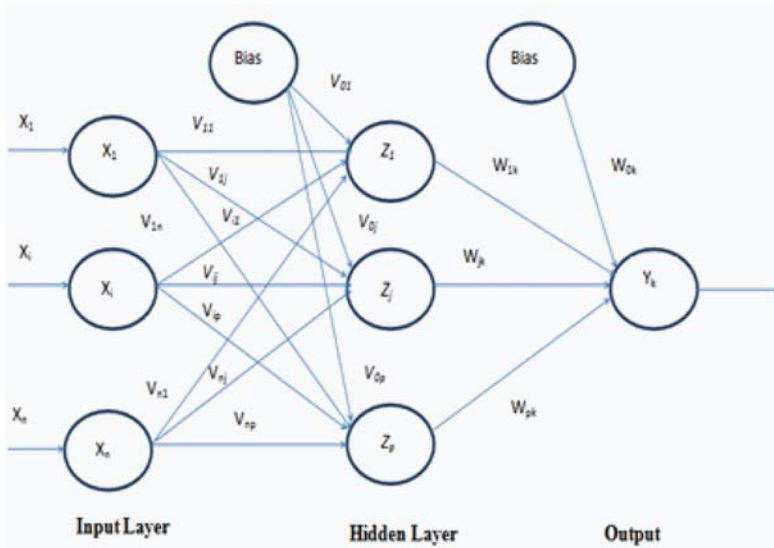
$$Z\_in_j = V_{0j} + \sum_{i=1}^{n} X_i V_{ij} \qquad (1)$$

Then we use the activation function to calculate the signal output, where the activation function is using binary sigmoid generally by the following formula:

$$f\left(z_{in_j}\right) = \frac{1}{1 + e^{-z\_in_j}} \qquad (2)$$

Every output unit (Y_k, $k = 1,..., m$) calculate signal inputs:

Figure 1. Neural network with 3 inputs and 1 output

$$Z\_in_j = V_{0j} + \sum_{i=1}^{n} X_i V_{ij} \qquad (3)$$

Then using activation function to calculate the signal output:

$$Y_k = f(Y\_in_k) \qquad (4)$$

PROPOSED METHOD

The Framework

Creating applications for mobile smart phone devices can be complicated by the following factors (Nielsen, 2009):

• Screen size

Rich graphic elements and the information that can be viewed and managed at once are limited by small screens, requiring users to rely on short-term memory to build an understanding of an online information space. Only essential information should be displayed for this reason. Also, optimize necessary graphic elements to reduce file sizes and load times.

• Input

Text entries may be slow and susceptible to errors. Operating graphical user interface widgets (e.g., menus, hypertext links, buttons, scrolling, etc.) can be awkward. User control and efficiency can be enhanced by simple input and navigation schemes and by highlighting selected items.

• Wireless Data-rate

Wireless network connectivity on mobile devices may be limited in availability and bandwidth, which imposes significant restrictions on the amount and speed of interactions and rich media in networked applications. Moving to the next screen is often slower than dial-up Internet access. Mobile wireless systems, however, are achieving higher data rates to support internet

and other data related applications. Soon fourth-generation systems will offer significantly higher data rates.

• Design

Web-based and client/server applications designed for desktop PC screens usually do not render well on mobile device screens. Create Web-based and client/service applications just for mobiles devices to ensure page layouts are mobile-friendly. Middleware solutions can be utilized for automatically generating a display or new user interface based on the application and the associated device screen size and type. The interface design must support the limited attention of users often distracted by people, events, activities, or objects. Mobile user interfaces should not have complex menus. Simple and descriptive pages and an ability to connect on-screen information with the physical world is desirable (Kurkovsky & Harihar, 2005).

The process of designing the framework using a workflow of Software Development Life Cycle has been studied (Pressman, 2010). Development IDE used is Eclipse Helios in it supports the BlackBerry Java Plugin 1.5 for

BlackBerry mobile application development and the BlackBerry Simulator. Gaming application utilizes maximum processor power capabilities, and maximum utilization of heap. Sometimes the application requires memory beyond the heap size, at that time there is possibility of application crashing i.e. app crashed in Blackberry, then you've tried restarting your phone and making sure that all settings are allowed. So we have to solve these problems where application which has to be developed should be able to run without crashing on minimal configuration smart phone. The connection to the BlackBerry device using BlackBerry Desktop Manager software. Figure 2 is our general framework shown using use case diagram that describe the actor and the important action in the games such as input name of the user, view high score, set the sound/voice, and playing with one/multiplayer.

Theoretically, the building blocks for mobile games multiplayer framework consists of a non-visible game client component, a game server running on App Engine and utility classes in App Engine which perform web service calls and convert data between App Engine types and a format that is understandable

Figure 2. Usecase diagram for adaptive games
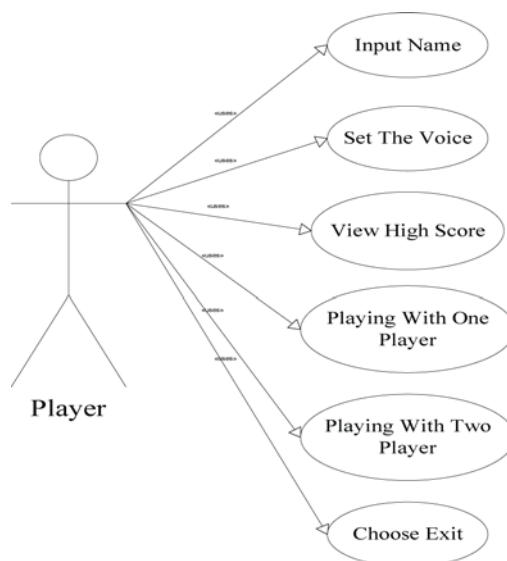
to a server. Every application that uses the game server must include a game client component and use the method call blocks to make server requests.

The basic architecture of multiplayer mobile games is shown in Figure 3. The game client includes built-in method call blocks which make requests to perform actions such as joining game instances, inviting new members, sending messages to other players and executing custom server commands. The game server defines a request handler for each of these actions which accept POST requests from the game client containing the result of executing the server command. When the server reply is received, the game client processes it and triggers events based on the result of the request, and in response to any changes to the game state on the server.

Figure 4 show the sequence diagram for multiplayer games using Bluetooth connection that consists of 3 entities (Player 1, Device Blackberry and Player 2). Bluetooth® technology is a standard for short-range wireless technology. It enables two devices to communicate using radio waves that operate at 2.4 GHz. A BlackBerry® device that uses Bluetooth technology can open a wireless connection with other Bluetooth enabled devices, such as hands-free car kits or headsets that are within a 10 m range.

Figure 5 shows the proposed class diagram for the adaptive multiplayer games. To store the data used by user, we use SQLite. SQLite is a software library that implements a self-contained, serverless, zero-configuration, transactional SQL database engine with very fast games. SQLite is the most widely deployed SQL database engine for mobile games. In Figure 5, the Player, Device Blackberry and Database are the important entities in our system.

Neural Network Implementation

The model of our neural network is designed for classification of the ability of users. The design of neural network is shown in Figure 6 with 3 inputs X_1, X_2, X_3 and output Y. Supervised learning is used in our model where the network is trained by providing it with input and matching output patterns.

Explanation of input and output in Figure 6:

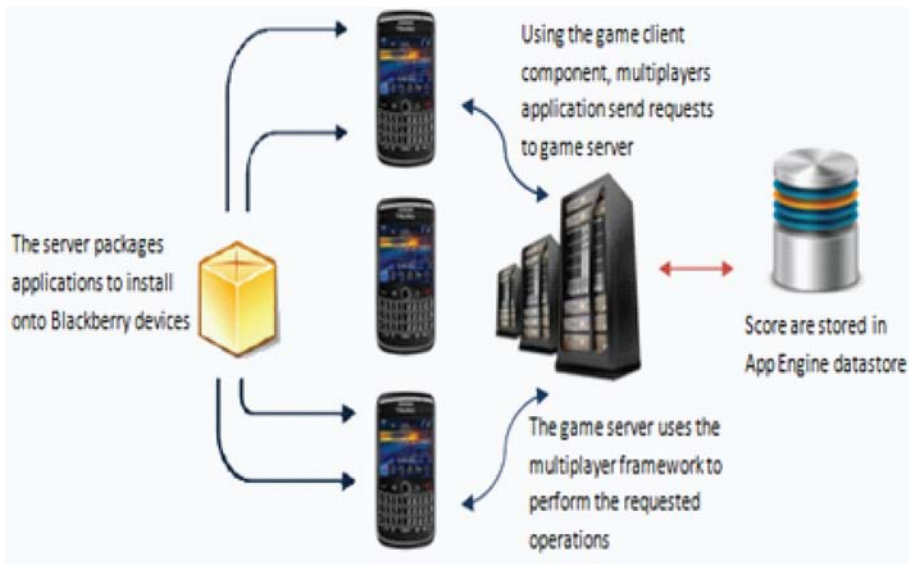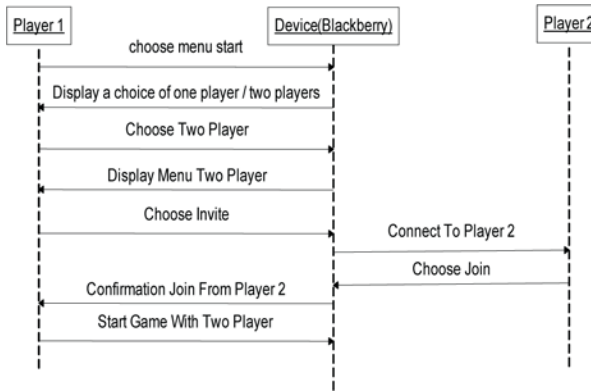*Figure 3. The basic architecture of multiplayer mobile games*

Figure 4. Sequence diagram for multiplayer games

X_1 : The time it takes the user to resolve questions.

X_2 : Comparison between the frequency of correct answers and wrong.

X_3 : Comparison of the frequency of the type of game played by the user (animation/math games).

Y: Adjustment of the level of difficulty based on the input.

For testing the Neural network system, we use 8 training data and output. For example, if the user could not answer all of the questions in <=80 percent time allowed, then x_1 is 0, if the correct answer <=80 percent, then x_2 is 0. The output 0 denotes the next group of questions more easily, and if the output is 1 it indicates that the next game should be more difficult. (Table 1)

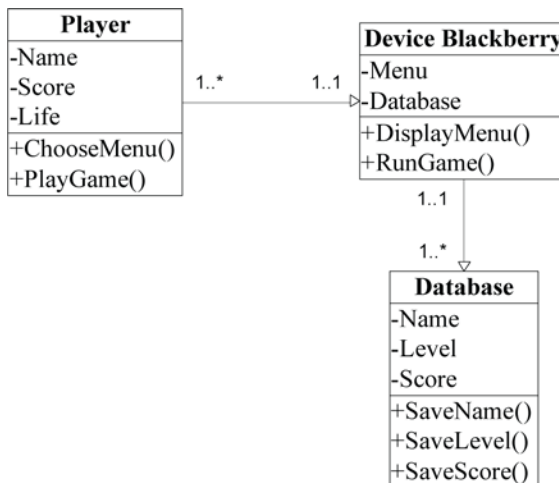*Figure 5. Class diagram of the adaptive games*

Figure 6. Neural Networks with output for classification for adaptive games (Budiharto, 2012)
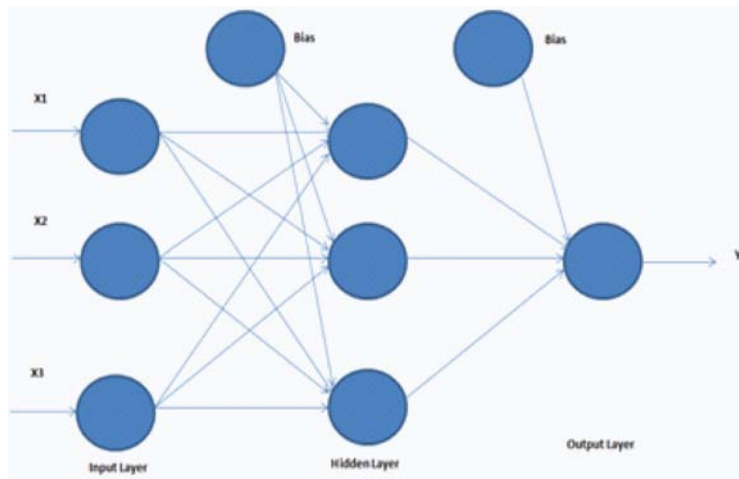

Table 1. Training and output data used in this research

Input			Output
X_1	X_2	X_3	
0	0	0	0
1	0	0	0
0	1	0	0
0	0	1	0
1	1	0	1
1	0	1	1
0	1	1	1
1	1	1	1

EXPERIMENTAL RESULT

Experiments performed on the Simulator and the real device BlackBerry Bold with OS 7.0 without lag and the results shown in Figure 7. We have some mathematics questions for elementary until junior high school level, and some animation games such as "simple moving ball" and "Collecting bananas to basket" games to be choose by the user. For the mathematics and animation games, we set that the user/student said to be master if the correct result >=80 percent from 10 questions and time needed <=80% from the maximum time allowed. And if the user always chooses mathematics games for 3 times, then the default mode is set to the mathematics games mode.

The training process does not require a long time, with the number of epoch determines the minimum error is obtained. Animation program created by the sound also can be run quickly. It should be noted that the handset is used must comply with the support of the OS used on the Development IDE used. Figure 8 shows the MSE vs Epoch in our experiment.

Figure 7. Result of simulation using BlackBerry Simulator, Main form for starting and choosing games animation/mathematics(a), question in mathematics games (b) and example of ball games(c) and the best scorer stored in SQLite (d)

Figure 9 shows the results of the required time at various values of hidden unit/nodes:

The training process does not require a long time, with the number of epoch determine the minimum error is obtained. Animation program created by the sound also can be run quickly. It should be noted that the handset is used must comply with the support of the OS used on the Development IDE used. In the epoch value of 10 is possible because the error falls off faster but it needs a longer time because the time needed per epoch longer because there are 10 hidden unit/nodes as shown in Figure 10.

CONCLUSION

This research has developed a novel method for adaptive multiplayer games using the back propagation algorithm in neural network with 3 inputs and 1 output. The proposed adaptive
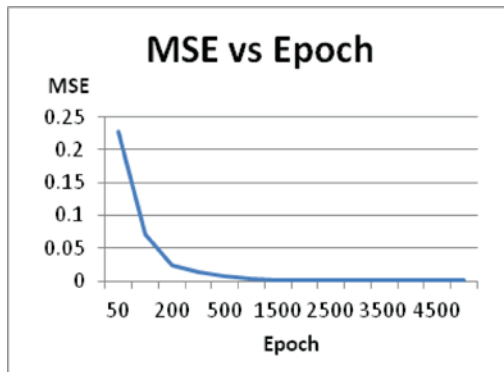
Figure 8. Result of MSE vs Epoch
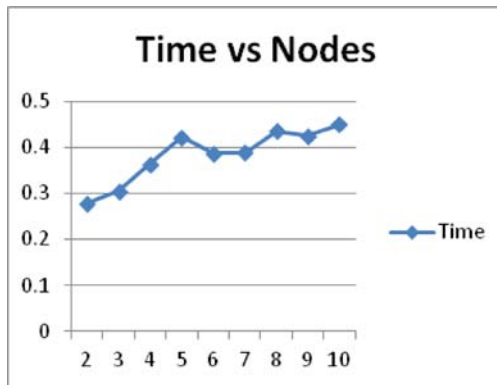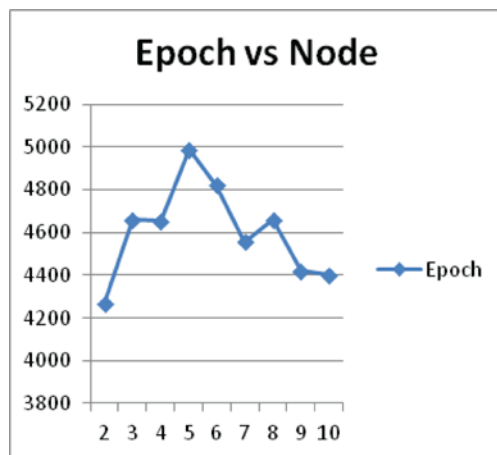

Figure 9. Result of time vs. hidden nodes

Figure 10. Result of epoch vs number of nodes

system using the method of identifying the profile and level of understanding of the material field of interest from the user contributes to a new method for adaptive games. In addition, the training algorithm does not take much time so the time needed to start loading this game is quite fast. With a little training data, using the back propagation algorithm can handle noisy data and still be able to predict the correct output. In the epoch value of 10 is possible because the error falls off faster but it needs a longer time because the time needed per epoch longer because there are 10 nodes in the hidden units. On the other hand, the system trained neural network can also make decisions accurately and quickly.

Our adaptive games successfully achieve the goals to be played with multiplayer mode and able to identify the level of the user and adjust the difficulty level of the next animations / questions. For future work, the model will be proposed adaptive educational games that can be run based on Internet connection.

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