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Decision Support System for Relapse Prediction among Drug Addicts

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Abstract: Automated computer technologies are essential to develop modern living environment in current community. Software engineering, as one of engineering disciplines that implements a systematic application, technological knowledge and methods to economically obtain software that is reliable and works efficiently on real machines. In Relapse Prediction System for Drug Addicts (RePSDA) project, a new model of prediction system among drug addicts was developed. This system was developed to predict retake or relapse tendency among drug addicts in rehabilitation centre. The prediction system is able to foresee relapse by individual once the related data was fed into the system automatically. In order to automate the prediction, a data mining algorithm was implemented and being tested as proof that the prediction result in the model could be trusted and reliable. This paper presents the development of a decision support system for relapse, including technology used, a framework that works in PHP language. There are modules such as user management, patient management and relapse prediction that can help management of rehabilitation centre makes prediction. The use of codeIgniter as a framework in the RePSDA model development is able to help the development process.

Key words: Decision support system · Relapse Prediction · System Development · Codeigniter

INTRODUCTION

Decision support system also called as DSS is one of information system with the objective to enhance the decision processes efficiency and eventually help human in operating daily business [1]. RePSDA project applies DSS concept to help human in handling drug addicts issue by developing a new model of prediction system.

Drug addicts is not a new issue in Malaysia and becomes more serious issue, due to almost half of the prisoner in Malaysian is prosecuted under drug abuse guilt [2]. It shows that drug abuse is an expanding issue in Malaysian community. What is the definition of drug addict generally? As defined in 1961 UN Single Convention on Narcotic Drugs, drug addiction is "a serious evil for the individual" and "a social and economic danger to humankind" [3]. Meanwhile the term addiction refers to a chronic neurobiological disease state showed by a pattern of behaviour of craving of drug usage even the harmful and bad effects result in well known. This behaviour continues to persist even there is no longer drug use [4]. Regarding the behaviour of the drug addicts, a common legislation is applied in many countries; drug addicts or abusers may have a major obstacle in getting a good healthcare, housing, citizen advantages, occupation, loans and the right to vote. Apparently, the damage and effects of the drug abuse are long lasting not only for the individual, but also to the society and community [5]. By looking towards drug addiction issue, a critical problem in the rehabilitating drug addicts and abusers is drug use after a while of clean and drug-free [6]. This scenario is called relapse. As defined in [3] relapse is a big tantrum feeling that cleans drug addicts have when a drug craving happened. In reality, r elapse becomes more important in healthcare and research problem, but still does not define it operationally [7].

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In Malaysia, National Anti-Drug Agency (NADA) had declared that a number of new drug abuse cases in 2015 are 20,289 cases, meanwhile a number of relapse cases in the same year is 6,379 cases. It shows that on average a number of 1,691 new cases reported in a day and 532 relapse cases reported [8]. Realizing and acknowledging the drug addicts and relapse become more critical, Malaysia government did structure a brand new strategy to overcome the addiction and relapse problem in Malaysia society. One of the strategies is by introducing a rehabilitation with open-concept approach for the addicts. This step is applied since year 2010 by NADA. Open-concept approach is an approach more flexible to the addicts where they able to directly undergo rehabilitation and treatment voluntarily at community service centres nearby with no formal judging process. One new thing about this unique approach is that, it focus on relapse addicts, the addicts that have been free-drug previously to get the treatment without effected their daily life and career [2].

From year to year many strategies have been taken to reduce the drug addicts. Beside open-concept approach, there is another approach for rehabilitating drug addicts and relapse addicts that quite suitable to be applied in Malaysia. Since Malaysia is one of Islamic country with a long history of Muslim rule and Muslim culture, an idea with Islamic-based approach was produced. As referring to statistic announced by NADA, in 2015 the new drug addicts by ethnicity shows that Malay is the highest addicts with 16,354 new cases compare to Chinese, India, Local Sabah, Local Sarawak and other ethnic. Similarly for relapse column, Malay ethnic records the highest offenders with 4.981 relapse cases compare to other ethnic [8]. Other than that, as cited in [9], [10] proved that there is a significant relationship between spiritual with drug addiction or relapse. The research evaluates drug abusers who able to complete religious activities outpatient program in eight (8) weeks. Therefore, an Islamic-based approach was recognized by NADA, is a body that provides rehabilitation and supervision specifically to the drug addicts. This Islamic-based approach is called *Inabah* [11].

Inabah is a special programme held to provide rehabilitation and treatment to drug abusers and the focuses are on spiritual aspects. It was first established in September 1905 at Suralaya, West Java, Indonesia by Syaikh Abdullah Mubarok bin Nur Muhammad. For information, the branches outside Indonesia is up to 4 branches which are located at Kedah, Sabah, Kuala Terengganu and Singapore. A research was held at Kuala Terengganu branch to prove that *Inabah* able to recover the drug addicts and the result shows that recovered patients is 83.91%. [12] [11]. That number is very motivated. How *Inabah* can become such an effective program in addiction field. Curiosity to discover what the content of this programme is exactly exists when looking at the recovered patients' percentage. *Inabah's* activities are full with back-to-Islamic activities such as prayer, reciting the Quran, zikr, religious class and etc. Malaysian *Inabah* programme was conducted with continues religious activities such as repent shower, zikr, qiyam al-lail, fasting, compulsory and not-compulsory prayers. Besides that, the program inculcate good attitude inside the patients' spiritual [11].

While addiction and relapse become more serious issue, government and non-government bodies are trying hard to ensure this issue could be resolved. Or the number of new addiction cases and relapse cases is decrease from year to year. Looking towards this loop, there exists an urgent need to develop novel strategy in the field of computer technology. The emerging technology is very fast and could help in creating or producing brand new system that able to reduce the addiction case. The need for better prevention strategies underlying relapse or retake drug for non-medical purpose is becoming more important. This prevention step could minimize treatment effort and cost funded by government, as well as rehabilitation centre.

Therefore, this paper proposes a new system, that capable of analysing and discovers patterns and trends in drug addicts' dataset. The patterns and trends may be used to produce a useful and understandable knowledge that able to prevent relapse. This model is one of the effort could be done in the computer technology field as a prevention step because the model able to classify the patients into two (2) groups; Relapse and Not Relapse group. The appropriate prediction algorithm does the classification. The existence of the model that capable of making prediction is hoped to affects the rehabilitation management centre to become more alert and firm in the treatment course provided.

The article deals with the explanation of developing a system in predicting relapse among drug abusers by using software engineering steps. Software engineering predictive model involves development of models, with the help of Knowledge Discovery Database concept, for predicting corresponding attributes [13].

MATERIALS AND METHODS

Process Flow of RePSDA: Technically, the system is developed from PHP language and will be using a few facilities that work in PHP environment. The model will apply Codeigniter web frameworks with MVC concept. On the user side, the system is expected to provide a user friendly interface that able to successfully run basic flow as below:

Add New User (System User): This flow enables System Administrator to add new user as a new system user. Basically new user in this project is the user at the rehabilitation centre. Once the user is successfully added, the new user is able to login into the system by using the valid login id given by the System Administrator. Basic functions such as edit and delete user are provided. Details flow is illustrated as Figure 1.

Add New Patient (Drug Addicts): This flow enables System Administrator or Centre Administrator to add new patient into the system. For Centre Administrator user, he/she is allowed to add new patient's data into the system for his/her centre only. In other hand, System Administrator user is able to add new patients for any centre. In short, Centre Administrator may manage the patients under his/her centre only. Basic functions such as edit and delete patient are provided. Details flow is illustrated as Figure 2.

Run Relapse Prediction: This flow applies Knowledge Discovery Database (KDD) and data mining concept whereby the prediction result is generated. In order to run the prediction algorithm which is embedded in WEKA tools, RePSDA (as mentioned before is developed using PHP) need to communicate with Java language. The back-end process of prediction is illustrated as Figure 3.

To complete the prediction flow, the system is loaded with the information and data (variables contribute most to the relapse), then the back-end process will determine whether the person is possible to relapse or not. The process flow to run the prediction by individual through RePSDA is illustrated as Figure 4.

View Demographic Report: This flow enables System Administrator or Centre Administrator to view demographic report as per input. Hence, it is important for the user to enter patients' information correctly and precisely. This is due to the wrong report generated if the wrong information is entered. Basic functions such as converting the report into PDF format are provided. The report generated is useful for future work. Relapse report also included. Details flow is illustrated as Figure 5.

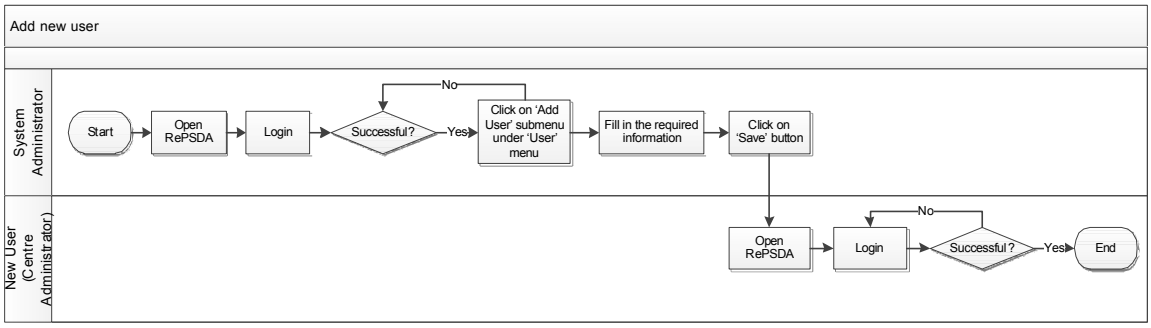

Fig. 1: Add New User process flow

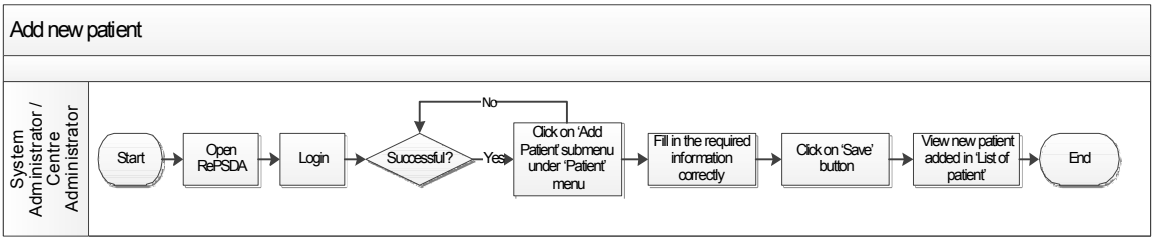

Fig. 2: Add New Patient process flow

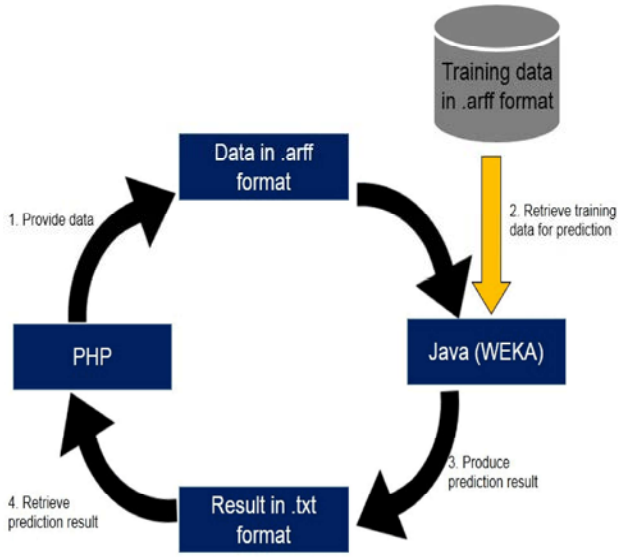

Fig. 3: Generating Predictive Result

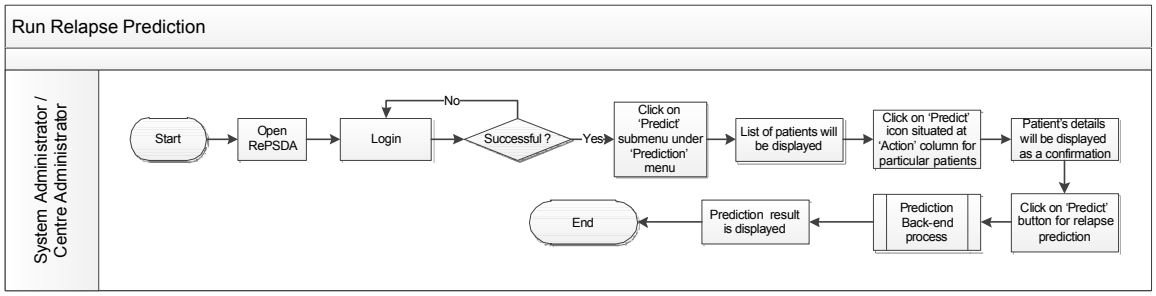

Fig. 4: Run Relapse Prediction process flow

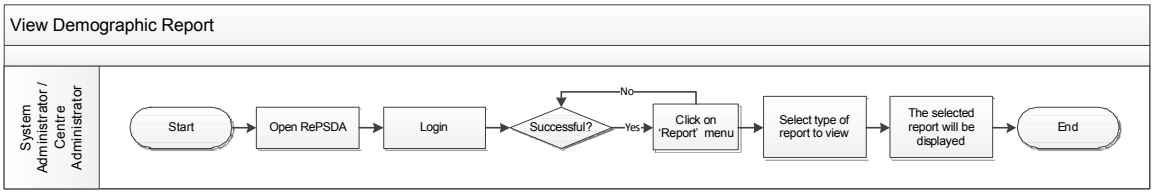

Fig. 5: View Demographic Report process flow

In addition, the system applies data integrity, which means, the data is private and secure. Without an appropriate access, user is not allowed to access into the system. Since the system is a web-based application, the respond time is depending on the network but the respond result is real-time. Besides that, the system can be accessed anywhere with the legal domain and login id as along as the device is connected to the Internet.

RESULTS AND DISCUSSIONS

From our study, an efficient model proposed with prediction accuracy 85.7% was Artificial Neural Network (ANN). The result proves that the model can be trusted and can be applied as one of prevention step of relapse. Therefore, a decision support system ReSPDA was developed with the integration of ANN model.

RePSDA is a web-based system that allows any rehabilitation centre to perform the tendency of relapse prediction by individual. This step is one of prevention steps to avoid relapse. RePSDA have four (4) separate modules from two (2) types of access level. The modules are; 1) Add New User, 2) Add New Patient, 3) Run Relapse Prediction, 4) View Demographic Report. While the access levels are; 1) System Administrator and 2) Centre Administrator.

Fig. 6: RePSDA Main Page and Login Page

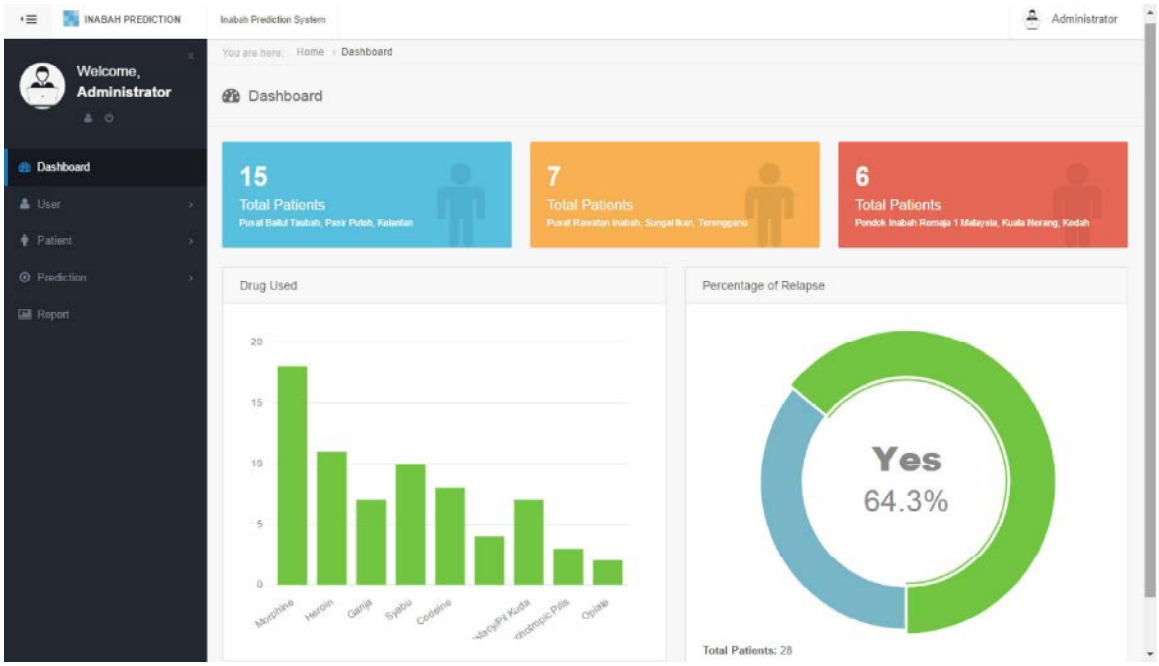

Fig. 7: RePSDA Homepage

In order to develop a user-friendly interface, RePSDA is developed by using Codeigniter template. Figure 6 shows Main Page and Login Page of the RePSDA.

Once the login id and password are entered, the system will check either the user is a valid user or not. If the user is a valid user, the system will let the user accesses the system and Homepage of the system will be displayed as Figure 7.

User will get the access of the RePSDA according to the access level. For example, if the user is a user at the Centre A, the homepage of Centre A will be displayed and the user can only manage the data in the Centre A.

Before prediction can be run, a registered user is required to input patients' details completely and correctly. This step is essential in order to gain an accurate prediction result. The information required consists of demographic data together with other information (data contribute most to the relapse) as illustrated in Figure 8.

Once the required information is completely saved, relapse prediction is allowed. To run the prediction, the user needs to view list of patients and select which patient to be predicted as Figure 9.

Relapse prediction can be run by clicking on the yellow Predict button under Action column for any patient required. The result of the prediction is displayed through a pop-up message box as Figure 10.

RePSDA also provides reports for demographic data that allow user to view a few reports that can be generated from RePSDA. A few reports available in RePSDA is described as Figure 11.

The reports generated can be viewed in PDF format by clicking on 'Patients List' icon beside the graph.

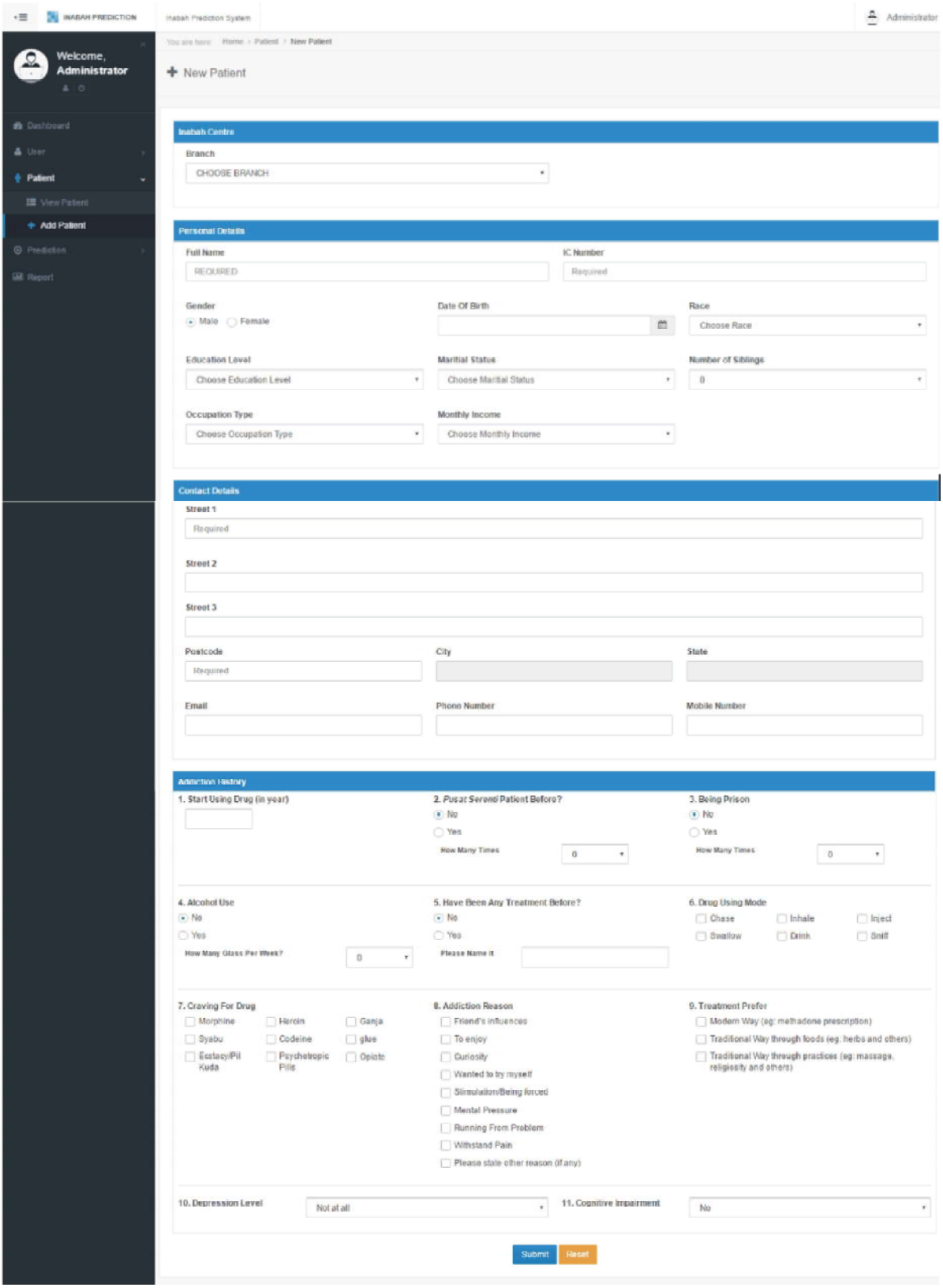

Fig. 8: Patients information interface

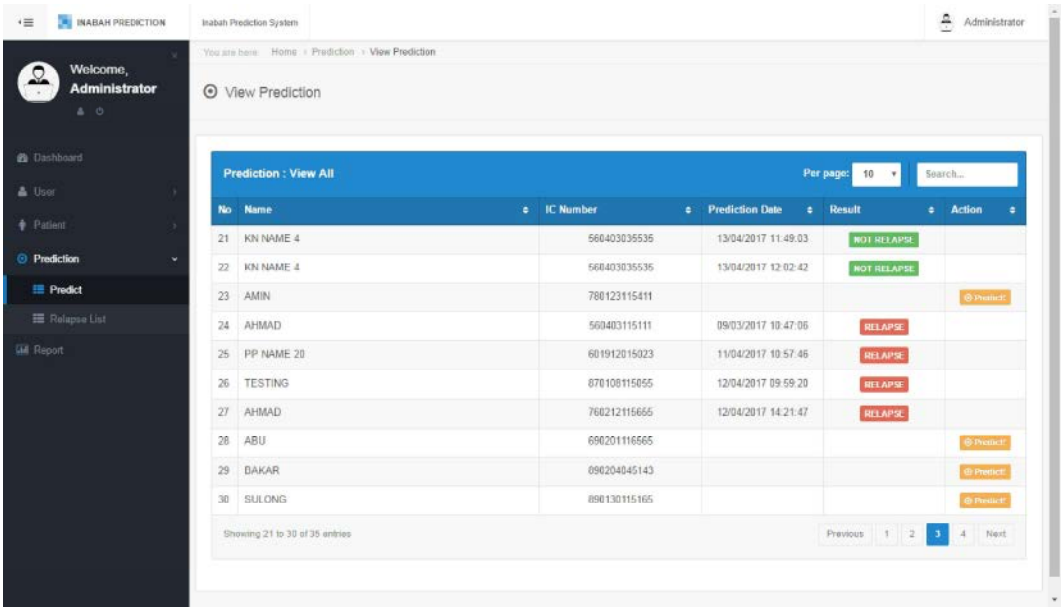

Fig. 9: List of Patients to be predicted

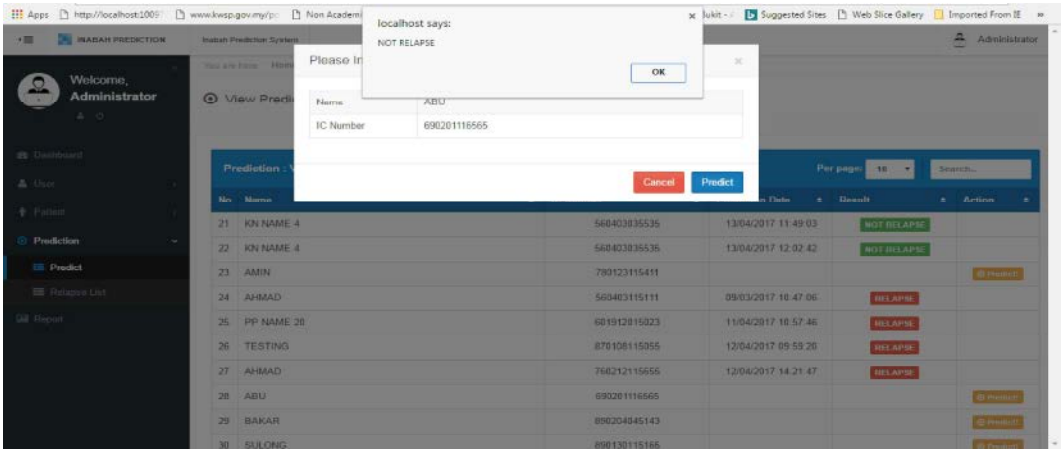

Fig. 10: Pop-up message box to display prediction result

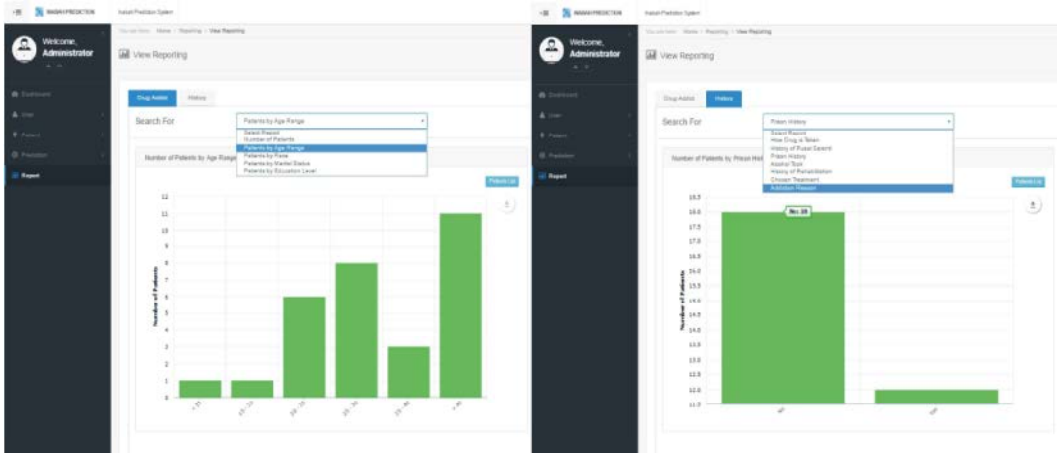

Fig. 11: List of Reports

CONCLUSION

Decision support system is important in human's life in helping daily routine. In this paper, the scope is to prevent relapse cases among drug addicts. The development of RePSDA is hoped to reduce relapse cases reported year by year. RePSDA did integrate with the ANN model and the prediction result proves that accuracy produced is able to be applied in any rehabilitation centre.

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