

## ICMR 2019 8<sup>th</sup> International Conference on Multidisciplinary Research

### MYTOXAPP: A MOBILE SYSTEM OF TOXICOLOGY EMERGENCIES THROUGH IMAGE PROCESSING

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#### *Abstract*

Most of us live with potentially dangerous chemicals which can be found in our home; kitchen cabinets, hallway closets, living rooms and bathrooms. If do not properly stored or used, these products could cause minor like illness to serious as death and even life-threatening health problems. Therefore, the National Poison Centre (NPC), located in Universiti Sains Malaysia (USM) has proposed an idea to develop an application of household chemical identification. The system is developed in two types of application which are web and mobile. Web application is mainly for admin like centre's officers to manage the household chemical database. Mobile application is used by public users and medical professions. The main objective of this system is to help and educate people on knowledge of toxic chemical in household products. Besides, this system can help NPC to gather the number of poison cases in Malaysia by receiving from users reporting toxic case. The reporting action can encourage users to contribute their data for NPC indirectly. This system acts as a household chemical identifier system for public users to search household chemical information easier. There are two ways of input receiver; user typing and the use of Optical Character Recognition (OCR) technology. OCR will analyse the scanned-in image, and then translate the character image into searchable data for better conveniences. With this system, the main expected result is to decrease the number of poison case to at least half compared to previous years.

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**Keywords:** Optical Character Recognition (OCR), toxicology, household chemical, poison.



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## 1. Introduction

The National Poison Centre (NPC) is a consultation centre for drug and poison information and poisoning management, located at Universiti Sains Malaysia (USM). The mission and vision of the centre are to promote health, reduce poisoning and prevent death through excellence, compassion, and innovation (About PRN, 2018). They found out that most people are living with a chemical in their daily life. Chemical is everywhere. For instance, people use detergent to wash clothes daily. Detergent is made up by a few different chemicals which they do not know its function or information of each of these chemicals. Thus, they will have no idea on the side effects may happen in the future. They will only figure out the detergent is harmful when they suffered from side effect brought by the toxic. By that time, their health condition might already in danger. To avoid themselves in toxic chemical and danger, they will have to check the ingredients of household product whether contain any harmful chemical or not before consuming the product.

To overcome this problem, Environmental Working Group (EWG)'s Healthy Living App has implemented product barcode scanning in the mobile application that has been developed for the users to get any information on toxic chemical instantly that will be captured by the mobile camera (EWG's Healthy Living App, 2018). However, this application is just a barcode scanner that can get products' rating and ingredients and will not have the latest updated products list as there is a lot of new households launched in the market every day. Moreover, majority of the listed products in the app are sold in United States. Thus, this app is not actually applicable within Malaysia.

As part of the NPC role is to reduce poisoning and advocate people health, the centre has proposed an idea on developing an application of household chemical identification for providing efficiency and convenience for household users to identify and understand more on chemical's information and its knowledge. This project will have a screen capturing method on searching information of product's ingredients with the integration of Optical Character Recognition (OCR) (Ruhaiyem, Mahalingam, & Syed-Mohamad, 2019). OCR is a mechanism or electronic conversion of images of printed or written text characters into machine-readable text data, such as ASCII. The mind of using OCR is it is an effective way and compatible in all devices to extract words from images or PDF files.

## 2. Problem Statement

In accordance with the World Health Organization (WHO) statistic, it has shown that about 100,000 people in worldwide die each year from unintentional poisoning (Poisoning Prevention and Management, 2016) Although in most instances the poison will not kill, poisoning can occur at any time and in any place, for example, your own home, while traveling, outing, visiting relatives and when guests are visiting. Recently, a sensation alcohol poisoning case happened in Malaysia which has 19 victims have died while 14 victims were in critical condition due to consuming alcohol containing methanol (Alcohol Poisoning Death Toll Rises 19, 2018). Methanol is a poisonous substance which can cause people stomach ache, nauseousness, vomiting, headache, and blurry eyesight, with some experiencing difficulty of breathing, cramp, and loss of consciousness. The above example has shown that many people do not know the side effect brought by the poisonous chemical can cause serious case happened.

Currently, NPC is the only centre that serves the entire population of Malaysia with regards to toxicology cases. All poisoning exposure calls received by the centre are entered into a standardized Poison Case Report Form (PCRF) manually. Majority of the calls are mainly from hospitals and clinics that consult information on poisoning management and treatment. Furthermore, NPC has different online platforms to access to toxicology resources (pesticide, household resources are limited). In addition, NPC also lack of proper platform to educate people on household chemical. As they discovered that many people are not very familiar with those fancy scientific terms listed on the back of the products. Besides, there are a lot of chemical names that are difficult to spell and pronounce also. A non-medical profession such as householder will definitely not recognize and know the chemical's function, information, and some side effect if consume it more.

The current existing applications such as *GoodGuide* and *EWG's healthy living app* are having a problem with their database updates time. Many users are complaining that they cannot get the latest household chemical information due to their databases not regularly updated. On top of that, existing approaches are using UPC barcode scanning to search for household product information. This approach is much more dependent on household product information updated which is lacking searching flexibility. Once the in-charge person did not update the database, users cannot find any information on the new household products.

### 3. Research Questions

Two research question were formed based on the research statement discussed above:

- 1) How can this research development of digital platform benefits different types of users; i.e. healthcare/pharmacist from NPC and public users?
- 2) How this digital platform improves its performance in facilitating NPC handles toxicology/poisoning cases of public users?

### 4. Purpose of the Study

The overall goal of this study is to explore the digitalization of the toxicological management in particular related to consumer products. Therefore, an initial system has been proposed as a platform for NPC pharmacists, officers and healthcare providers throughout Malaysia to get easy access to toxicology resources for the identification and management of toxicology emergencies. Three objectives are derived to support the goal: firstly, to provide a digital platform for Malaysian healthcare providers to effectively consult toxicology/poisoning cases with NPC pharmacists, secondly, to provide a digital platform for public users to access information resources in toxicology, and thirdly to facilitate NPC handling poisoning cases by gathering report from the medical officers while improving the existing solution to avoid the issue of incomplete data in NPC database by taking the contribution of household chemical information from public users and medical officers.

An OCR-based toxicology is a system with mobile- and web-based enabled. The main features of the system are toxic case reporting, multi-criteria search, toxicology product catalogue, OCR-based product scanner. Currently, the scope of toxicology is focused on household consumer and pesticide products. Both

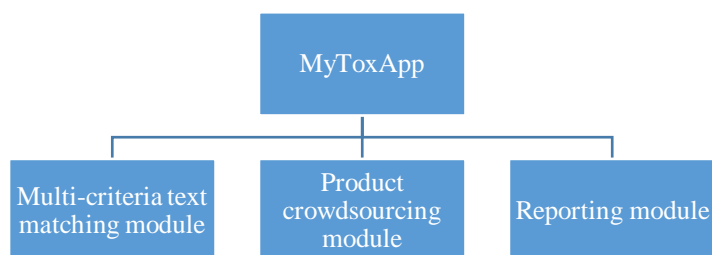
reporting features by healthcare providers and consumers will enable the collection of data related to toxicology for further analysis. At the same time, the system will also enable public users/consumers to search for household and pesticide chemical information resources. More details of the proposed system are discussed in the next section.

The mobile application is used by public users and medical professions. The main objective of this system is to help and educate people on knowledge of toxic chemical in the household and pesticide products. Besides, this system is designed to facilitate real-time toxicity reporting by Malaysian consumers. The reporting action can encourage users to contribute their data for NPC indirectly. This system act as a household and pesticide chemical identifier system for public users/consumers to search household and pesticide chemical information easier. There are two ways of input receiver; user typing and the use of OCR technology. OCR will analyse the scanned-in image, and then translate the character image into searchable data. With the used of OCR, it very convenience for users to search for things that they do not need to type word by word. With this system, the main expected result is the number of poison case by household chemical can decrease at least half compared to the previous year.

## 5. Research Methods

In this study, an initial attempt has been made to provide a digital platform to facilitate consultation and accessibility to information resources in toxicology. We adopt an agile software development approach in this study in which requirements and solutions evolve through the collaborative effort with the NPC pharmacists and researchers. A prototype is developed to demonstrate the main proposed solutions.

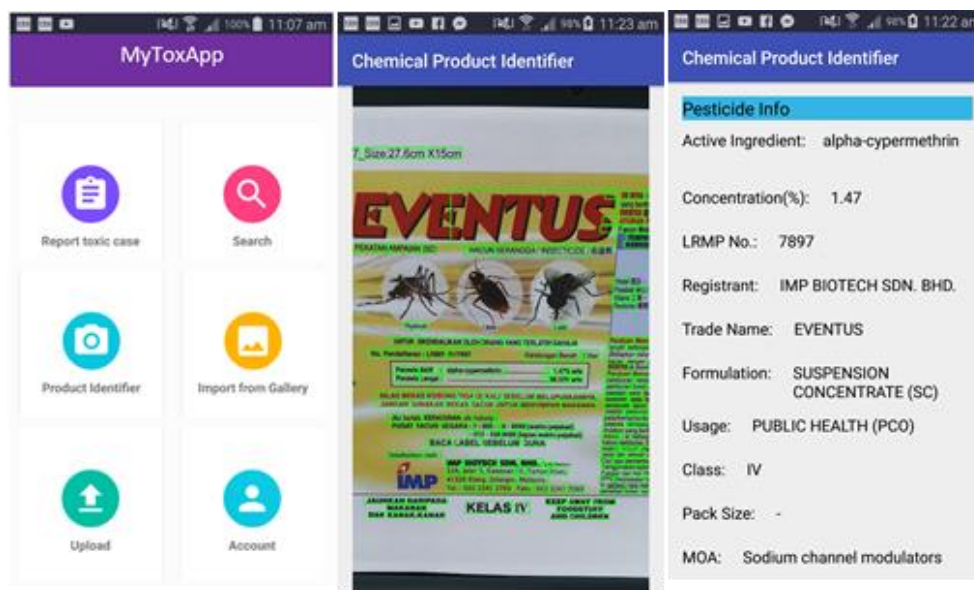
There are two platforms provided: a mobile platform is for both healthcare practitioners and NPC pharmacist to handle poisoning cases and also consumers to upload and access information in toxicology; and a web platform is for NPC's admin to manage and verify toxicology data contributed by consumers. A smart text-based search function allows the stakeholders to search for relevant information related to toxicology. There are two ways of input receiver; user typing and the use of OCR technology. The OCR function enables scanning of products' ingredient by live scanning image (Ruhaiyem et al., 2019). It will link to the built-in product and its chemical list database to match with the searching word. After matching word successful, it will display the information of the household product such as product name, active ingredients, and so on for scanned text. This application has also used crowdsourcing data collection method by providing public users like poison infected patient to upload a new household product information to the NPC toxic chemical database, but all the uploaded information must be verified and filtered by NPC officers. Figure 01 as below shows the overall module structure of the system.



**Figure 01.** The overall system modules

## 6. Findings

The main functionality of MyToxApp covers Toxic Case Reporting, Multi-Criteria Search, Toxicology Product Catalogue and OCR-Based Product Scanner. As shown in Figure 02 below, it scans a household product's label and provides relevant information for consumers to learn and for pharmacists to provide consultation. The OCR-based toxicology system has been user tested and a number of findings and potential new ideas derived for the next iteration.



**Figure 02.** Functionalities of MyToxApp

The system benefits society considering that chemical is everywhere in our life today. The greater demand for household users with always using household products justifies the need for life-changing toxic chemical alertness education method. Thus, public users that apply the application will be able to get educated with the chemical knowledge that links to their living better. Besides, the features of enabling public users and the medical profession to upload new data to the database is a new trend as crowdsourcing data collection today. This can solve the problem faces by existing application like Environmental Working Group which is does not have frequently updated database. The crowdsourcing data collection from public users and medical professions can make NPC's officer life become easier as they can get more valuable information as possible. The added information directly impacts the number of poisonous cases. Moreover, the users can search for product's information by manually typing or by using camera scanning (using OCR) is also convenience to all age groups.

### 6.1. Advantages and strength of the proposed system

There are numbers of advantages and strength of the proposed system. Firstly, this application can search chemical product content and knowledge in different angles such as type, scan using camera and import images. It also has appropriate processing time for retrieving data from database. This mobile application allowed medical officers to send reports of poisoning cases through any mobile platform

anytime. Public users are able to contribute chemical product data to the incomplete chemical product database. This system provides absolutely simple, easy to use and less time-consuming interface.

## **6.2. Limitation of the proposed system**

However, there are limitations found in the study. At the moment, the main limitation is the server of database is local; therefore, this system cannot go online. The users' camera quality must be good enough for processing the image into text and the camera position can be only in portrait mode (for OCR function).

In overall, the main benefits of MyToxApp are effective consultation and management of poisoning cases and digitalization of toxicology resources. It has a commercialization value to the relevant stakeholders such as the Ministry of Health Malaysia and the Ministry of Agriculture and Agro-based Industry Malaysia.

## **7. Conclusion**

As a conclusion, the proposed solution has the uniqueness that is this application enables the users to search things in different ways. The users able to scan many ingredient names by just using image capture tap and retrieve the information of the product in appropriate process time for all the text found inside the image at a time. In addition, this application is following the new trend of data collection that is collecting new data from public users and medical profession. This application allows users to report toxic case and automatically upload the information into database. The expected outcomes from this project are all users are able to know the dangers of consuming chemical product and get to know common poison chemical names, side effect, poisonous symptom, and first aid information. This application can also increase the user's awareness of the poisonous chemical. Besides, the expected result from this application is the number of unintentional poison cases in Malaysia can decrease. NPC can achieve their mission and vision from this project as their aim is to reduce poisoning and prevent death through excellence, compassion, and innovation.

However, this proposed system still can be further improved by implementing more advanced functions. One of the suggestions is sending notification of recent danger chemical product to user. This function requires the real-time server database to notify users at whenever user is online. Another suggestion is that a live chat bot between user and NPC's staff can also be included in the future work. This function can enable the user to get live poisoning consultation with NPC's staff whenever they face problem with chemical product problems or get poison. Apart from that, the user interface of the mobile application can be more attractive and appeal to the user.

## **Acknowledgments**

The authors would like to express gratitude to NPC staffs and pharmacists for their valuable inputs and knowledge sharing throughout the studies. The authors also wish to thank Universiti Sains Malaysia for the support it has extended in the completion of the present research through Bridging University Grant No.: 304/PKOMP/6316502.

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