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Smart Identification and Notification of Drugs in Medical Pharmacy using IoT

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ABSTRACT

We did not realize as human beings that the devices around us can communicate with us and communicate with them this is called the Internet of Things (IoT). The IoT is multiple physical objects that communicate using the internet, allowing sending and receiving of data.

IoT has its uses that expand to all areas of life, right from waking a person from sleep to putting them back to sleep. IoT has a lot of uses in the field of medicine. Every manufactured medicine is effective only for a particular duration that is already mentioned while we purchase. Medicine that a patient uses becomes fatal when consumed after the date of expiry.

The pharmacist often needs more time to make sure that each package of the medication is effective and not expired. Mistakes may occur because of improper storage of the drugs, not checking the expiration date of the medicine, which leads to the distribution of expired medicines to consumers, which leads to many problems. The chemical composition of the drug may change instead of being lifesaving, turn into a deadly poison.

Our study aim is to create an IoT device that contributes to identifying the dispensing of expired medicines by showing notices that alert the pharmacist that the medicine is ineffective, and thus may increase the verification in a short time for the pharmacist and will contribute to improving the reputation of the pharmacy.

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1. Introduction

Recently, universal healthcare systems have developed faster than ever before.

Devices, system components, and networks have become autonomous, and interconnected. This phenomenon is called the "Internet of Things" (Eng. IoT). The concept of smart pharmacies" refers to a technology that includes Internet of Things (IoT) components that ensure the functional activities of pharmacies. For these reasons, branching healthcare systems need a high degree of regulation and an incredible degree of security. Otherwise, the patient's life and information may be at risk.

There are pharmacies in hospitals and public and private clinics scattered in cities and villages, which calls for the need to work with the latest technology in the field of pharmacies, especially the Internet of Things, because of its practical applications that benefit pharmacies and pharmacists with many advantages in their field. First, the safe provision of all pharmacy data, categorization, analysis, treatment, and presentation according to the pharmacist's desire and need. Secondly, control of lighting, ventilation, and temperatures is required for each type of pharmacy content.

Thirdly, managing the preparation of orders according to medical prescriptions and electronically verifying the preparation of medicines, and this contributes to ensuring the correct medication is dispensed, tracking delivery, and full documentation of what is dispensed.

Electronic prescription and dispensing monitoring software can help prevent the misuse of hazardous and special substances by not only finding errors but also controlling uncontrolled patterns of prescription use.

1.1 Statement of the Problem:

Because the problem of drug expiration and bad storage is a serious problem for individuals and society because the effectiveness of the drug changes over time and the decomposition of the drug produces toxic substances that may affect the person and the chemical composition of the drug may change, we have decided to create an IoT device that detects expired drugs in the pharmacy.

1.2 Conceptual Framework:

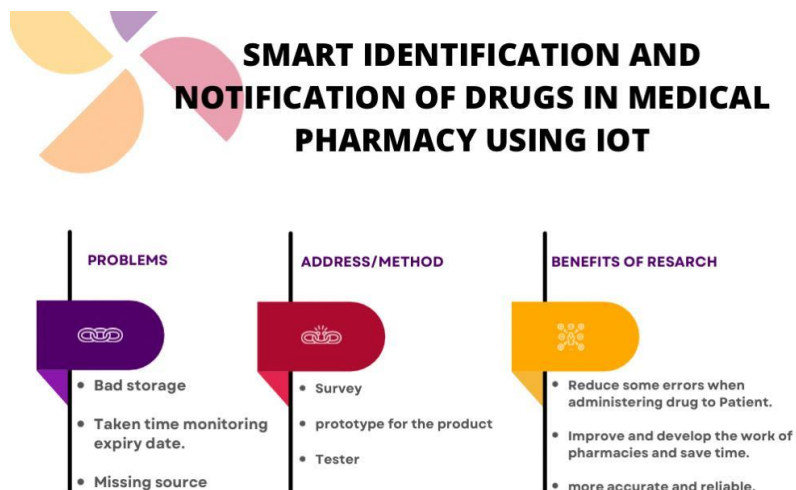


Fig 1.1 Overview of the Research

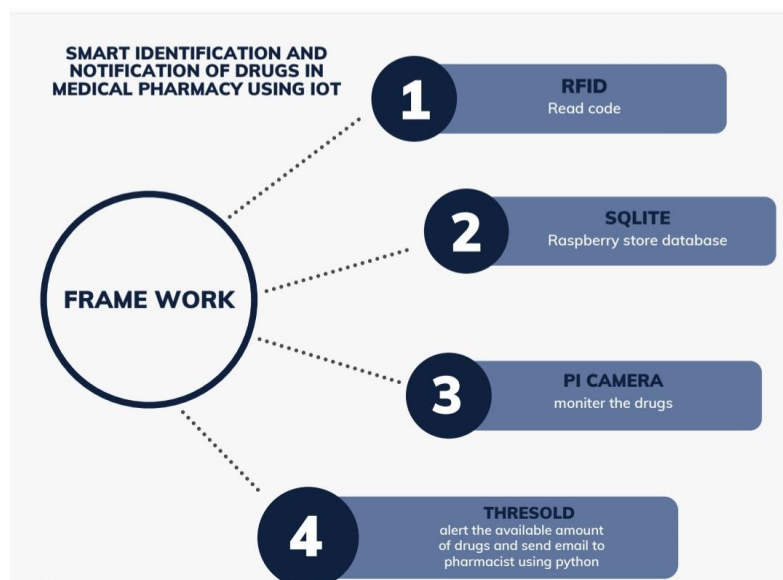


Fig 1.2 Research framework

1.3 Assumptions:

The use of smart identification and drug notification in medical pharmacies with IoT is very important as it will help the pharmacist know the expiry date of the drug faster and more accurately. Instead of looking at every drug and looking at the expiry date, it will contribute to raising the value of the pharmacy and protecting the consumer from ineffective medicines.

1.4 Hypotheses:

We use smart identification and drug notification in medical pharmacies with IoT for several uses in pharmacy, to significantly reduce prescription errors.

Moreover, we can develop health care services provided to patients and expand the provision of health services and make them keep pace with modern electronic technologies through:

Building an electronic environment that adopts Internet of Things (IoT) technology (smart identification and notification of drugs in medical pharmacy using Internet of Things technology, includes medicines, medical services, and other goods used in Diagnostics and treatment of diseases and injuries. Or in the maintenance of health includes health products contain medicines and medical devices that are subject to official approval by related bodies and other products are subject to this type of official control.

If the Internet of Things based control system is installed in these pharmacies, we will be able to contribute to ensuring patient safety, reduce errors resulting from dispensing non-drinkable drugs, and reduce risks resulting from failure to follow up on drug notification and validity by official supervision with the pharmacist.

Pharmacy automation and IoT technology will shift the focus of tomorrow's pharmacists. Instead of counting the contents of a bottle and filling it according to the prescriptions, they will be able to get out from behind the counter that will be electronic, thus helping patients and informing them about the ways and timings of taking medications

Our device works first by reading the code of each medicine then storing it in an SQLite database our device will be connected by a pi camera that can inform the pharmacist about the state of the medicine is expired or not if the medicine will be expired soon will send an email to pharmacist immediately

1.5 Significance of the Study:

Due to the challenges faced by the pharmacy department in some hospitals, this study aims to:

- To reduce some errors when administering the drug to the patient
- To improve and develop the work of the pharmacist and save time
- more accurate and reliable
- Reducing the effort expended
- To keep pace with the most rapid developments in the field of Internet of Things

1.6 Scope and Limitation:

The general goal of our project is to activate the use of the Internet of Things in the health field, especially the pharmacy, to reduce errors and increase accuracy in work, the target sample of the pharmacist and the patient, in the period 2021-2022. We will do our project in the Sultanate of Oman. This research needs a high cost to implement and install and is unable to use qualitative information and more studies are required.

1.7 Definition terms:

Healthcare: Maintaining health through diagnosis and treatment.

Date of expiry: pre-set data from the manufacturer and should not be used after the specific date.

Chemical composition of the drug: Affects the composition of drug molecules properties, and further determinates its absorption, distribution, metabolism.

Sensors: it is used to detect quantifiable physical and convert readable single into an electrical signal.

2. Literature Review

As medicine is very essential for wellbeing, the quality of medicine must also be given importance. One of the greatest challenges this industry is facing is dealing with expired medicines. Many researchers all over the world have made an intense investigation. A few that are more appropriate to this research are presented.

According to [1] has proposed a system that warns users about the drugs expiration dates using additional details via wireless communication, and also uses this system to help pharmacists and notify them about a drug that will expire soon. . The system works in both Hindi and English. Drug manufacturers must provide information about each drug as well as the expiration date and this app will scan the barcode of all the drugs. All medications purchased by the consumer are kept in the database (SQLite) and are well monitored to check the expiration date. A message is sent to the consumer through the Twilio API that the drug will expire soon and more details about the drug are used using Python, a consumer web app that can update chemists' Google Sheets. Researchers have proposed two algorithms to solve this problem very easily for pharmaceutical companies and consumers.

According to [2] Medicines play an important role in our lives as they are used to treat various diseases and disorders. They are also sometimes not available in certain places and are often expensive. One of the most common problems that people face is that they tend to miss the expiration date of their medicines. Most of us tend to waste a lot of time when it comes to labeling and keeping track of our medicines. Although it is possible to organize our medications by using pens and notes, it is not very efficient. Unfortunately, there is no way to get notified about the expiration date of the various medications that are written in a notepad. Instead, many apps provide a feature that will remind you about the medicines that are being taken daily Most of the time, and an expiration tracking feature is also present in most apps. This paper aims to introduce an application that will allow its users to keep track of the expiration of their medications. The paper presents a novel mobile app that will allow users to organize and track their medicines. It will also allow them to receive reminder notifications. The app is designed for people who do not have any technical expertise and is easy to use. It eliminates the time spent on keeping track of various details of their medicines and provides them with an organized view of their medical information. The app will also notify users about the status of their medicines. It will also remind them about the same whenever appropriate. This app is designed to help users keep track of their medicines and prevent them from consuming them prematurely. The app's interface is simple and user-friendly, which helps minimize confusion among the users. Every screen has instructions related to the screen on which the app is being used. This ensures that the users are not confused about the usage instructions. Medicines inventory app that effectively tracks expiration of expired and about to expire medicines, Ease of use of the application on the mobile phone with minimum software and hardware requirements., Expired and about to expire medicines are distinguished in two different colors so that users can easily identify them in a large list of medicines, Records dosage information along with tracking of expiry of the drugs. The application is designed to work with zero background battery consumption and negative storage consumption.

According to [3] Not much is known about the amount of waste that pharmaceutical companies generate. However, it is widely believed that their waste has caused ethical and biological problems. As for the unused drugs that are produced, the amount of waste they generate is significant. According to a 2001 study, the US produces about 1 billion unused drugs each year. This study also highlighted the environmental impacts of the drugs. This project aims to develop a system that uses artificial intelligence to help in the proper disposal and recycling of unused and expired drugs. The project, which is referred to as Al-Dawna, is a humanitarian organization that distributes medicines to those in need. Through its website, the SFDA explains how to properly dispose of unused drugs. The organization also offers a chatbot called Sarah's Smart Help, which can help people with their drug questions. However, the programs are not connected to smart devices. Medication information was collected to create a knowledge base for the proper management of medication. The knowledge is demonstrated in flowcharts. The form of if then rules has also been used to represent knowledge. The web-based expert system has been developed to automate the recommendation and educate consumers about medication disposal. Using the website for managing the medications either disposing or donating. The chatbot was constructed to interact with consumers using the knowledge base. Finally, the prototype device was implemented to automatically verify and classify medications based on their type and validity using artificial intelligence methods. The system has two main components: software and hardware. The software includes a web-based expert system and chatbot. The hardware contains a classification model.

According to [4] There is a big loss of medicine in Rwanda because of less monitoring, the purpose of this research is to evaluate the factors which can occur the expired medicine. The study research was used 25 responders, they used close-ended questions and they were focusing on factors that can produce the expired data, they focus more on the pharmacist who is working in MPPD, the highest response for this research is 96% response rate. The questionnaire result has been analyzed by a pharmacist, a lecturer in bio-epidemiology, and a physician. Based on the final result, the researcher found that supply chain management is 90%, other factors are 73%, poor storage is 68%, and excessive drug supply is 67%.

Our IoT device makes it possible to quickly and accurately detect expired medicines and bad storage in a faster time.

3 Research Method:

A good research design helps in the successful progress of research. This research aims to help both the pharmacy staff and the patients.

The survey will be carried out to understand the awareness of common people in knowing the expiry of medicine and to explore their awareness of the consequences of the same. An Online Questionnaire will be designed and floated among people of different age groups. The questionnaire consists of 2 separate sections for ethnographic information and questions to find out the awareness among people. The Survey consists of 6 logical questions which are mandatory and 2 optional questions. Finally, the final data will be analyzed using the table, to know the effect of expired and poorly stored drugs on the patient.

4 Analysis and Interpretation

To conduct the study, a questionnaire was floated to many consumers which included general public, adolescents, adults, and the elderly. All their responses were collected electronically using online survey form. A total of 29 respondents submitted their review. Based on the data collected the following analysis is presented.

The survey started with most basic question to understand whether the consumers are aware and cautious about the *Expiry Date* of the medicines.



Figure 4.1 Are you careful about the expiry date while buying drugs from the store?

As the chart in Figure 4.1 shows 48% of the respondents said *Yes*, so they are aware and careful when they buy medicine and 21% of them said *No* and 31% responded as *My Be*

Next question was to know if the consumers are informed mandatorily about the expiry date of the medicines they buy by the pharmacist. Figure 4.2 shows the opinion of the respondents.

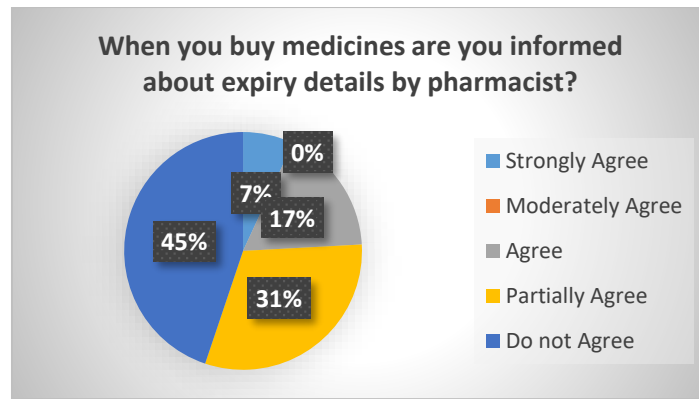


Figure 4.2 When you buy medicines are you informed about expiry details by the pharmacist?

Figure 4.2 show 45% respondents don't agree. they don't inform about the expired date of the medicine. Only 7% of them strongly agree that they are informed about the expiry date of the medicine.

We ask the respondents to give their opinion if some pharmacy sells the medicine that has near-to-expiry without informing about the same.

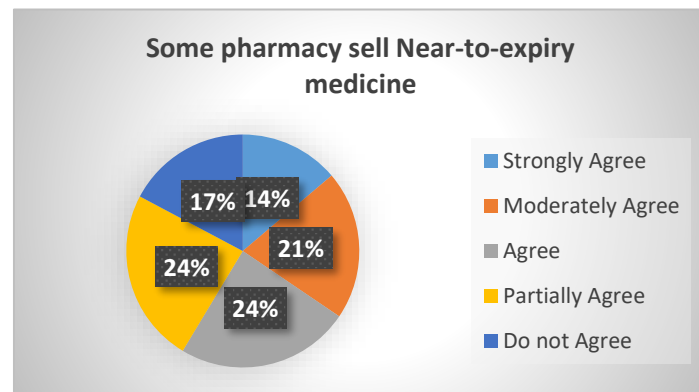


Figure 4.3 Some pharmacies sell Near-to-expiry medicine is the discount rate

The pie chart in figure 4.3 shows 24% of the respondents agree that some pharmacies sell the medicine when it is near to expire and 24% of them partially agree

The next question in the survey form was find the awareness of consumers about the dangers in consuming expiry medicines.

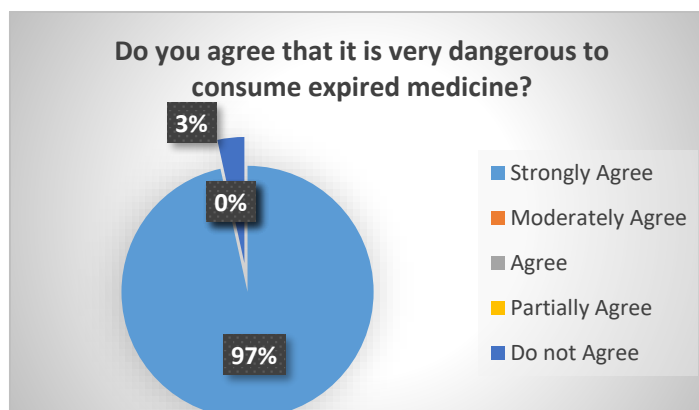


Figure 4.4 Do you agree that it is very dangerous to consume expired medicine?

Based on the data collected from respondents, 97% of them strongly agree that taking expired medication is very dangerous to a person's health. Still it was shocking to understand some 3% of the respondents are not aware the problems in consuming medicines whose expiry date is over.

Respondents' opinions about what are measures they are recommended to pharmacies regarding the expiration date of medicines in this question the respondent can choose two measures shown in figure 4.5

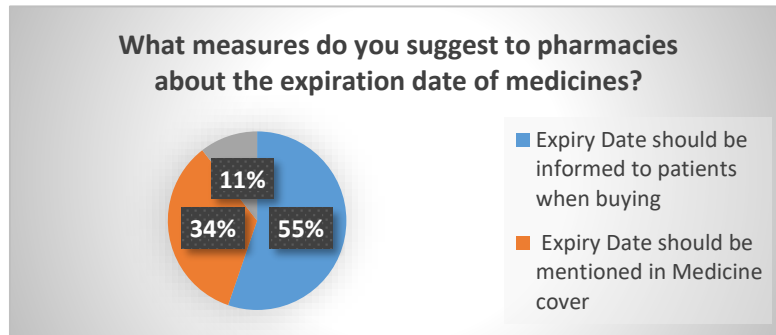


Figure 4.5 What measures do you suggest to pharmacies about the expiration date of medicines?

55% of the respondents prefer that the expired date should be informed to patients and 34% of them prefer that the expired date should be mentioned on the cover of the medicine

Respondent's opinion regarding that if the Customers in Oman are aware of the Consumer Law about selling expired products. The data we collected represent in table 4.6 and analysis figure 4.6

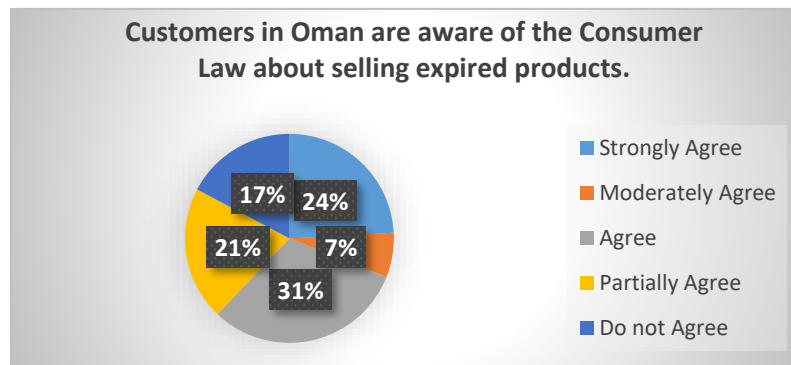


Figure 4.6 Customers in Oman are aware of the Consumer Law about selling expired products.

31% from them see that the customer in Oman are aware of the consumer law where is 17 % don't agree with that

Here, is the respondents' option from the problem we covered in our study if the respondents face one of the problems or not, it is clear in Table 4.7 below and analyzed in figure 7.4

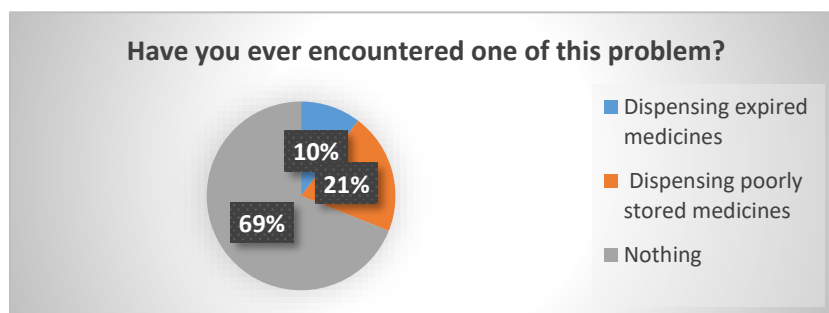


Figure 4.7 Have you ever encountered one of this problem?

As per Figure 4.7, 69% of respondents do not face any problem with medicine, however, 21% face problems with Dispensing poorly stored medicines

Later respondents' opinion if they agree that IoT sensors in auto-detecting expired medicines installed in pharmacies can help consumers in Oman, is shown in figure 4.8

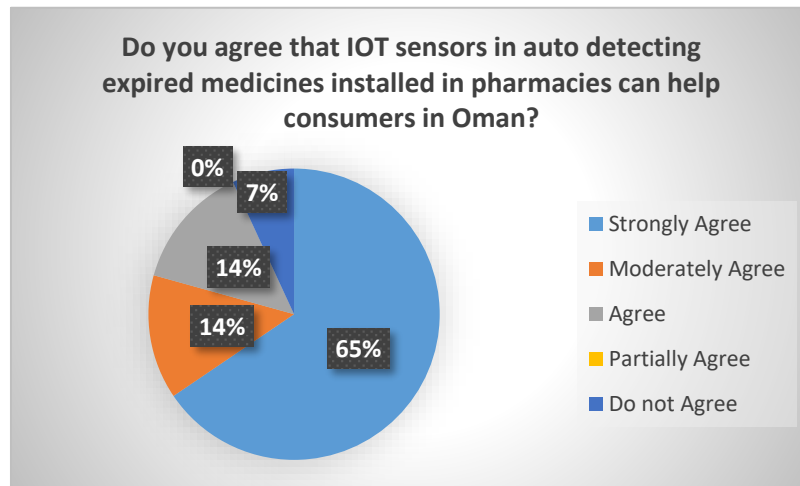


Figure 4.8 Do you agree IoT sensors in auto-detecting expired medicines installed in pharmacies can help consumers in Oman?

65% of respondents agree that IoT sensors in auto-detecting expired medicines installed in pharmacies can help consumers in Oman however 7% of respondents do not agree

5. Summary

Based on the results we obtained through the questionnaire, we found a small percentage that experienced some problems when dispensing the drug, including the poor storage of the drug. And many patients are not informed of the expiry date of the drug when dispensed. Most people support the idea of having a sensor that checks the expiration date of the drug or if it has any problems such as poor storage.

6. Conclusion

Smart identification and notification of drugs in medical pharmacies with IoT technology, people will avoid many dangers of expired drugs. Also increased focus on patient health. By developing health care services provided to patients and expanding the provision of health services

7. Recommendation

To save people's lives from the dangers of expired medicines must be developed health care services provided to patients by providing this device in all pharmacies because it will contribute to reducing the risks of expired medicines, increasing the accuracy, reliability, and reputation of pharmacies in the community, and developing the pharmacist's workplace.

References

- [1]. Tomar and B. Tomar (2021). A Smart Expiry Date Reminder System for Medicines, International Conference on Industrial Electronics Research and Applications (ICIERA), pp. 1-6, doi: 10.1109/ICIERA53202.2021.9726728.
- [2]. S. S. Bhat, K. Shraddha, A. S. Bhavana and S. S. Rao (2021). Digital Medicine Assistant-Health Application for Expiry Tracking, International Conference on Disruptive Technologies for Multi-Disciplinary Research and Applications (CENTCON), pp. 279-284, doi: 10.1109/CENTCON52345.2021.9687888.
- [3]. Banjar, Haneen, Rahaf Alrowithi, Sara Alhadrami, Esraa Magrabi, Reema Munshi, and Mayda Alrige. (2022). An Intelligent System for Proper Management and Disposal of Unused and Expired

- Medications, International Journal of Environmental Research and Public Health, 19(5), 2875. <https://doi.org/10.3390/ijerph19052875>
- [4]. Hakuzimana, T., Kayumba, P. C., Hahirwa, I., & Kabalisa, M. (2021). Assessment of factors contributing to medicine expiry in Rwanda: Case of the Medical Procurement and Production Division. Rwanda Journal of Medicine and Health Sciences, 4(2), 281–291. <https://doi.org/10.4314/rjmhs.v4i2.7>
- [5]. Amani Ahmed Al Shehhi, Rahma Fahad AL Mamari, Prasanna Ranjith. (2022). An Impact of Internet Technology on the Social Behavior Issues among Children in Al Batinah Governorate During 2020-2021. International Journal of Information Technology, Research and Applications, 1(1), PP. 25-32.