ISSN 2085-4552

Designing a QR Code Attendance System Using BYOD (Bring Your Own Device)

Ahmad Raihan Djamarullah[1], Ilyas Nuryasin[2], Hardianto Wibowo[3]
[1, 2, 3] Department of Informatics, Universitas Muhammadiyah Malang, Malang, Indonesia
[1]raihandj@webmail.umm.ac.id, [2]Ilyas@umm.ac.id, [3]ardi@umm.ac.id

Accepted 5 February 2024
Approved 19 April 2024

***Abstract*—Attendance is an activity of collecting attendance data from each individual who attends events, work, and learning. The current application of attendance in certain companies, schools, or universities is still done manually using paper so it is considered less efficient and effective. Digitizing attendance activities can provide many benefits, such as making managing large amounts of attendance data easier. This is usually used in companies or schools. To reduce additional costs, this can be done by using a personal device as a medium for taking attendance, this can be called BYOD or Bring Your Own Device. The attendance that will be designed will use the user's smartphone or mobile device as a medium for taking attendance by scanning the QR code. The results of tests carried out using black box testing on mobile and web applications, shows that all the features contained in both applications are running according to their function. The use of QR Codes and also the implementation of BYOD can make it easier for users to take attendance. Apart from this, it is also easier for admins to manage user attendance data.**

***Index Terms*— Attendance System; QR Code; Bring Your Own Device; BYOD**.

I. INTRODUCTION

Currently, information technology plays an essential role in society. With the rapid development of technology, many areas of life have become more manageable[1]. With current technology, the information obtained is managed quickly and accurately [2]. Utilizing this technology helps everyone create various kinds of tools and programs that can help make every activity easier so that it becomes more productive [3], [4].

Various activities are currently becoming increasingly complex and dense, so a high level of mobility is required [3]. One example of an activity that can be made easier by using technology is attendance. Attendance is an activity of collecting attendance data from each individual who attends events, work, and learning[5], [6]. Attendance is very important because it is one of the factors used in the assessment aspect of an agency[6], [7]. The current application of attendance in certain companies, schools, or universities is still done manually using paper so it is considered less efficient and effective [8], [9]. Using manual attendance still has several disadvantages, such as the information that has been collected must be managed manually, which can take a lot of time and is also prone to errors in data management[2], [8], [10]. Apart from that, by using manual attendance the process of archiving attendance data can also take a long time and there is a risk that the archive data will be lost[10], [11]. Therefore, the aim of this research is to create a digital attendance system.

Digitizing attendance activities can provide many benefits, such as making managing large amounts of attendance data easier. This is usually used in companies or schools[12], [13]. Implementing a digital attendance system can use several additional tools that can scan cards, faces, and fingerprints [14]. However, implementing this attendance system can be categorized as expensive because it requires costs to purchase additional equipment [14]. To reduce additional costs, this can be done by using a personal device as a medium for taking attendance, this can be called BYOD or Bring Your Own Device [15], [16], [17].

Therefore, the use of technology such as smartphone is very necessary. This is because nowadays almost everyone has a smartphone. In Indonesia alone, in 2018, it is estimated that the number of active smartphone users will be more than 100 million people [18]. Smartphone has features that are very useful in helping users' daily activities [14], [19]. Smartphone are highly portable due to their compact size and low power requirements [15]. Utilizing a digital attendance system based on BYOD can be cost-effective and efficient since users don't need to sign for attendance, reducing the accumulation of attendance data files[20].

Based on the background explanation above, the theme raised is designing a QR Code attendance system with the implementation of BYOD (Bring Your Own Device). The attendance that will be designed will use the user's smartphone or mobile device as a medium for taking attendance by scanning the QR code.

II. RESEARCH METHOD

A. Research Flow

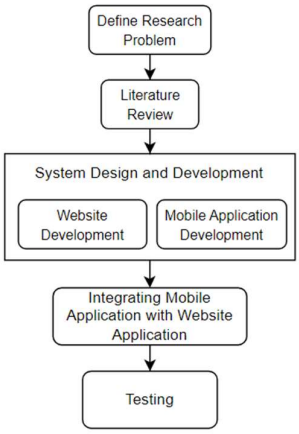

Fig. 1. Research Flow

The flow of the intended research is illustrated in Figure 1. The research will utilize the prototype model of software development to design an attendance system that will be accessible on both websites and mobile devices. The following stages will be involved in the research:

1. Website Development

The website-based attendance system will later be designed using the Laravel framework. The website will be used as a place for admins to manage user data, and attendance data from users and also as a medium for displaying attendance QR codes.

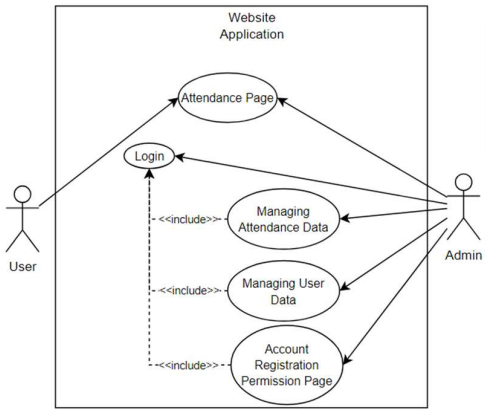

Fig. 2. Website Use Case Diagram

Figure 2 shows a picture of the Website Use Case Diagram. This website consists of several pages. The main page is the attendance page, which is accessible to all users. Additionally, there are two pages for managing attendance data and user data. These pages can only be accessed by admins and are designed for managing user data and attendance information. Finally, there is an account registration permission page, this page was created to prevent the creation of careless accounts.

2. Mobile Application Development

A mobile application will be designed using Flutter, which will have an API to send data to the website, where it will be managed by the admin. The purpose of the application is to allow users to take attendance by scanning the QR code displayed on the website.

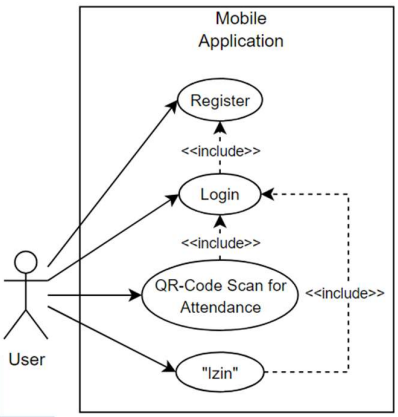

Fig. 3. Mobile Application Use Case Diagram

Figure 3 shows a picture of the Mobile Application Use Case Diagram. Users can interact with various pages, such as login, registration, and attendance. Users can register for an account, but their account will not be active immediately. They need permission from the admin to activate their account. The QR code scanning feature is available on the attendance page for users who wish to register their attendance. In addition, an "Izin" feature is available for users who are unable to attend.

3. Integrating Mobile with Website Application

During the website development, an API will be created and integrated with the mobile application. This API will include functions such as login, attendance, password change, and logout.

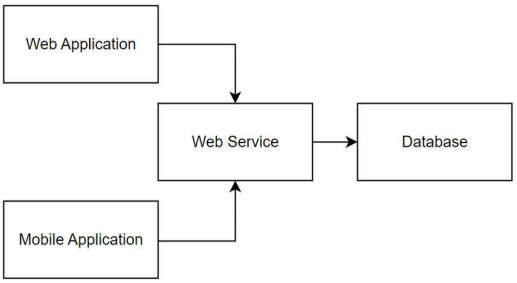

Fig. 4. System overview that has been integrated

Figure 4 shows a picture of the system after integration between the mobile application and website application. Users can mark their presence by scanning the QR code that appears on the website using the mobile application, which will transmit the data to the database via the API. The attendance information will

be displayed on the website, where the admin can access and manage it. The admin has the authority to oversee both attendance and user data for all system users.

4. Testing

After the prototype design and integration of two applications, the system will be tested using the Black Box Testing method to ensure its functionality and stability. The testing will be divided into two stages, the first on the website and the second on the mobile app.

B. Bring Your Own Device (BYOD)

Bring Your Own Device or BYOD is a concept that allows users to use their devices to connect, access data, or complete tasks from systems used in a company, institution, etc. [14], [15], [17]. BYOD is a growing trend since mobile device users started using personal devices to help with their work. According to Jeffrey in [21] Bring Your Own Device or BYOD is a strategy proposed by Malcolm Harkins, Intel's chief security and privacy officer, based on his observations which show that most employees bring personal mobile devices while working. This is why policy proposals take advantage of this trend to reduce costs and increase productivity[21].

Devices used in BYOD implementation can be laptops, tablets, and smartphones, but currently, smartphones are commonly used in BYOD implementation. Smartphones are considered easier to use because they are easy to carry due to their small size and can be connected to the internet network anywhere[16], [21].

BYOD can be applied not only in companies but also in the education sector, such as by helping students learn and develop skills by using these devices[17].

Implementing BYOD in the attendance system that will be designed can provide many benefits for users and companies. The benefits that can be obtained from implementation for companies include saving budget expenses and also not needing to prepare new devices for digital attendance tools. Apart from benefits for the Company, BYOD also provides benefits to users such as increased mobility and productivity because by using personal devices, users can work and access company data or materials wherever they are. Furthermore, it also provides convenience for users because it uses a device that is always used, making it easier to work[13], [15], [21].

III. RESULT AND DISCUSSION

In this section, we will explain the web application and mobile application for the QR code attendance system that will be developed as well as the test results using the black box testing method.

A. Web Application

The attendance system that will be run through the website will be designed using the Laravel framework. The designed website will be used to display QR Codes and manage attendance and account data for each user.

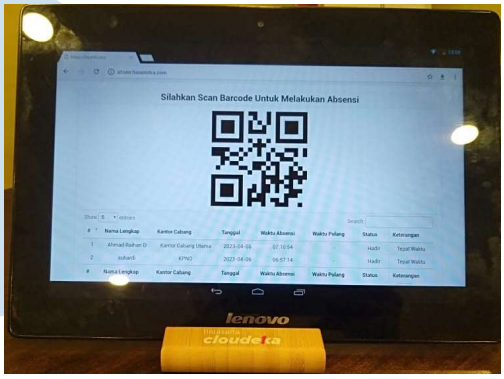

Fig. 5. Attendance Page

Figure 5 shows the main page or page used to display the QR Code which can be scanned by users when taking attendance. The QR Code on the attendance page changes every 5 seconds to prevent cheating. On this page, there is also a table to display a list of users who have missed arrivals and returns on that day.

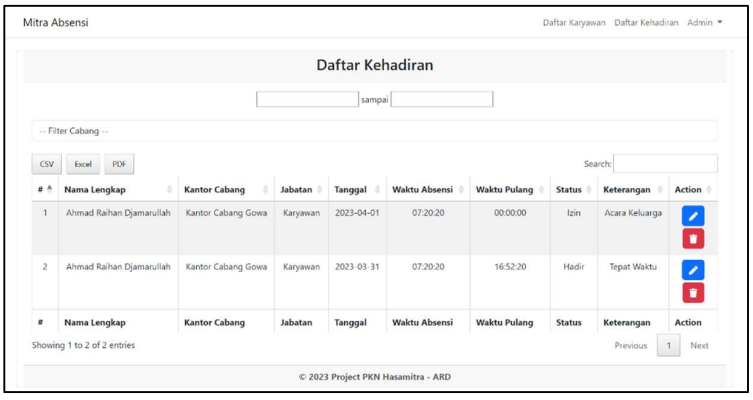

Fig. 6. Attendance Data Management Page

Figure 6 shows page that admins can use to manage attendance lists. The features presented include filters based on company branch, a search column to search for specific data, an attendance filter with a range of dates, months, and years to make the attendance recap process easier, and also a feature to export attendance data into CSV, Excel and PDF file formats for Facilitates the attendance recap process by admin.

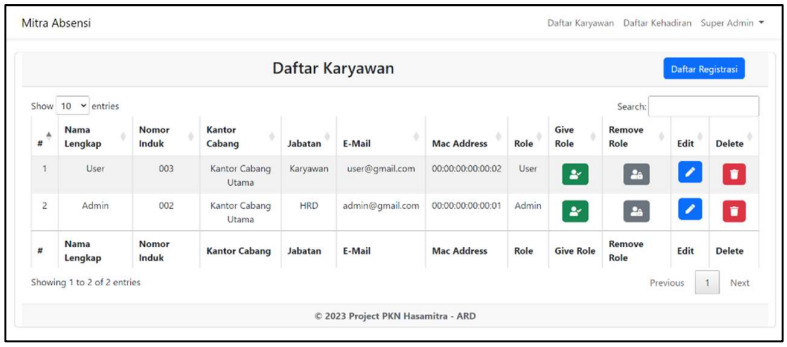

Fig. 7. User Data Management Page

Figure 7 shows page that can be used by admins to manage the user list and approve the user account registration process. Apart from that, admins can also assign and delete Admin roles when there is a change in position in the company.

B. *Mobile Application*

The attendance system that will be run via smartphone will be designed using Flutter and integrated into the website with an API that created from the website. The mobile attendance application will later be used by users who will take attendance into the system.

Fig. 8. Mobile Application Home Page

Figure 8 shows the main page of the mobile application. On this page there are features for absence, changing passwords, permissions, and also logging out. The attendance feature can be accessed by pressing the scan QR Code button and users can scan the QR Code on the website provided.

Then the permission feature can be accessed by selecting the permission menu which will then display a dialog alert to enter the type of permission, whether permission or sickness, and also information about absence. Next is the change password feature which users can use to change their old password to a new password. And the last one is the logout feature to delete running tokens and sessions.

C. *Black Box Testing*

At this stage, testing is carried out on the two applications using the black box testing method. This test is carried out to find out whether the features in the application function properly. Testing is divided into 2 parts, namely web application testing and mobile application testing.

In table 1 shows the test results of the web application using black box testing, testing is carried out on all features on the web. The results of this test show that all features are functioning according to their function.

Table 2 shows the test results of the mobile application using black box testing, testing is carried out on all the features contained in the mobile application. The results of this test show that all features are functioning according to their function.

TABLE I. WEB APPLICATION TESTING RESULTS

No	Testing	Validation	Input	Test Result	Status
1.	Login	Verify Username and Password	Username and Password are Correct	Login Success	Valid
			Username and Password are Incorrect	Login Failed	
2.	Updating User Data	Accessing the Web Application and Select the Update User Menu	New User Data	Update Success	Valid
3.	Deleting User Data	Accessing the Web Application and Select the Delete User Menu	Select User	Delete Success	Valid
4.	Giving Roles	Accessing the Web Application and Selecting the Give Admin Role Button	Select User	Role assignment was Successful	Valid
5.	Approve the Registration Request	Access the Web Application and Select the Registration List Menu	Select User	User Registration Successful	Valid
6.	Updating Attendance Data	Accessing the Web Application and Select the Update Attendance Menu	New Attendance Data	Update Success	Valid
7.	Deleting Attendance Data	Accessing the Web Application and Select the Attendance User Menu	Select Attendance Data	Delete Success	Valid
8.	Export Attendance Data	Accessing the Web Application and Selecting the Export Button	Select Attendance Data	Export Successful	Valid

TABLE II. MOBILE APPLICATION TESTING RESULTS

No	Testing	Validation	Input	Test Result	Status
1.	Login	Verify Username and Password	Username and Password are Correct	Login Success	Valid
			Username and Password are Incorrect	Login Failed	
2.	Register	Click on the 'Register' Button	User Data	Register Success	Valid
3.	Attendance with QR Code	Accessing the Mobile Application and Click on the QR Code Button	Scan QR Code in Web Application	Attendance was Successful	Valid
4.	Permission to be Absent	Accessing the Mobile Application and Click on the 'Izin' Button	Type of Permission to be Absent and Description of Absence	Permission to Absence Successful	Valid
5.	Change Password	Accessing the Mobile Application and Click on the 'Ganti Password' Button	Old Password and New Password	Changed Password Successfully	Valid

IV. CONCLUSION

From the research that has been carried out, the results obtained are that the design of the QR Code attendance system is well made. The use of QR Codes and also the implementation of BYOD can make it easier for users to take attendance. Apart from this, it is also easier for admins to manage user attendance data.

Applications are designed using web and mobile platforms. The web application can be used by admins to manage attendance data and also user data who can make attendance in the system. Then the mobile application can be used by users to take attendance or give permission not to attend.

The results of tests carried out using black box testing on mobile and web applications. It shows that all the features contained in both applications are running according to their function.

ACKNOWLEDGMENT

The Author would like to express his gratitude to the Universitas Muhammadiyah Malang and the

lecturers who helped and supported in preparing this research article.

REFERENCES

[1] T. Marlein Tamtelahitu, J. Sambono, and J. E. Unenor, "Designing a Smart Student Attendance System Using QR Code and Geolocation Techniques", "Perancangan Sistem Absensi Pintar Mahasiswa Menggunakan Teknik QR Code dan Geolocation," *JIPI (Jurnal Ilmiah Penelitian dan Pembelajaran Informatika)*, 2021. , in press

[2] N. L. Khairina and M. Dedi Irawan, "Application of QR Code in Employee Attendance Application Using Bootstrap", "Penerapan QR Code Pada Aplikasi Absensi Karyawan Menggunakan Bootstrap," *JOURNAL OF COMPUTER SCIENCE AND INFORMATICS ENGINEERING (CoSIE)*, vol. 01, no. 3, p. 2022, 2022. , in press

[3] M. Himyar, Mu. F. Mulya, and J. H. S. RIngo, "Android-based Employee Attendance Application with QR Code Implementation Accompanied by Personal Photo and Location as Case Study Validation: PT.Selindo Alpha", "Aplikasi Absensi Karyawan Berbasis Android Dengan Penerapan QR Code Disertai Foto Diri Dan Lokasi Sebagai Validasi Studi Kasus: PT.Selindo Alpha," *Jurnal Sistem Komputer dan Kecerdasan Buatan (SisKom-KB)*, 2021. , in press

[4] K. Sianturi and H. Wijoyo, "Megara Hotel Pekanbaru Employee Payroll and Attendance Web Based", "Penggajian Dan Absensi Karyawan Megara Hotel Pekanbaru Berbasis Web," *EKONAM: Jurnal Ekonomi Rancang Bangun System Informasi* , 2020. , in press

[5] N. Rubiati and S. Widya Harahap, "Student Attendance Application Using QR Code with PHP Programming Language at SMKIT Zunurain Aqila Zahra in Pelitung", "Aplikasi Absensi Siswa Menggunakan QR Code Dengan Bahasa Pemrograman PHP di SMKIT Zunurain Aqila Zahra di Pelitung," *Jurnal Informatika, Manajemen dan Komputer*, vol. 11, no. 1, 2019. , in press

[6] A. T. Faramita, S. Wiguna, and A. Fuadi, "Implementation of the Multi App V.1.0 Attendance Application Online in the Work Motivation of Islamic Religious Education Teachers at SMA Negeri 1 Wampu", "Implimentasi Aplikasi Absensi Multiapp V.1.0 Secara Online Dalam Motivasi Kerja Guru Pendidikan Agama Islam Di SMA Negeri 1 Wampu," *Khazanah : Journal of Islamic Studies* 2022. , in press

[7] W. Dinasari, A. Budiman, and D. Ayu Megawaty, "Mobile Based Teacher Attendance Management Information System (Case Study: SD Negeri 3 Tangkit Serdang)" , "Sistem Informasi Manajemen Absensi Guru Berbasis Mobile (Studi Kasus : SD Negeri 3 Tangkit Serdang)," *Jurnal Teknologi dan Sistem Informasi (JTSI)*, vol. 1, no. 2, pp. 50–57, 2020. , in press

[8] D. Prasetyo, I. Fitri, A. Rubhasy, and U. Nasional, "Web-Based Online Attendance System With QR Code in Real Time Using Vigenere Cipher Algorithm", "Sistem Absensi Online Berbasis Web Dengan QR Code Secara Real Time Menggunakan Algoritma Vigenere Cipher," *Journal of Information Technology and Computer Science (INTECOMS)*, vol. 4, no. 1, 2021. , in press

[9] M. Nandi Susila, K. Salam Ruzki, A. Dwi Praba, and E. Wulansari Fridayanthie, ""QR Code Based E-Attendance With Extreme Programming", "E-Absensi Berbasis QR Code Dengan Extreme Programming," *Jurnal Sistem Informasi (JSI) STMIK Antar Bangsa*, 2022. , in press

[10] F. K. Adam, A. F. O. Pasaribu, and A. D. Wahyudi, "Ditlantas Employee Attendance Monitoring Application Using GPS Technology (Case Study: Ditlantas Polda Lampung)", "Aplikasi Monitoring Absensi Karyawan Ditlantas Dengan Penerapan Teknologi GPS (Studi Kasus: Ditlantas Polda Lampung)," *Jurnal Informatika dan Rekayasa Perangkat Lunak*, vol. 4, no. 1, pp. 1–9, Mar. 2023, doi: 10.33365/jatika.v4i1.723. , in press

[11] R. Roosdianto, A. O. Sari, and A. Satriansyah, "Design and Build an Online Employee Attendance Information System Application", "Rancang Bangun Aplikasi Sistem Informasi Absensi Karyawan Online," *INTI Nusa Mandiri*, vol. 15, no. 2, pp. 135–142, Feb. 2021, doi: 10.33480/inti.v15i2.1932. , in press

[12] D. S. Pratomo and C. Budihartanti, "Design and Development of an Employee Attendance Application Using the Mobile-Based QR Code Method at PT Bayarna Teknologi Nusantara", "Rancang Bangun Aplikasi Absensi Karyawan Menggunakan Metode QR Code Berbasis Mobile di PT Bayarna Teknologi Nusantara," *Journal of Information System, Applied, Management, Accounting and Research*, vol. 6, no. 4, pp. 804–814, 2022, doi: 10.52362/jisamar.v6i4.921. , in press

[13] I. Dzikria and A. Rizal, "Design and Build a Restaurant Self-Ordering System Based on Progressive Web Apps", "Rancang Bangun Sistem Pemesanan Mandiri Restoran Berbasis Progressive Web Apps," *Jurnal Sistim Informasi dan Teknologi* , vol. 5, no. 1, 2023, doi: 10.37034/jsisfotek.v5i1.252. , in press

[14] I. G. N. D. Paramartha and I. W. A. Suranata, "Analysis and Design of an Attendance System Using QR Code and BYOD Method", "Analisis dan Perancangan Sistem Absensi Dengan Menggunakan QR Code dan Metode BYOD," *Jurnal Teknologi Informasi dan Komputer*, vol. 6, no. 2, Jan. 2020, doi: 10.36002/jutik.v6i2.1023. , in press

[15] M. Idris, "Selection of Bring Your Own Device (BYOD) Implementation Solutions Based on Security Controls", "Pemilihan Solusi Penerapan Bring Your Own Device (BYOD) Berdasarkan Kontrol Keamanan," *Jurnal Ilmiah MATRIK*, vol. 21, no. 3, 2019. , in press

[16] Y. Mega Puspita and M. Hasanudin, "Mobile Device Management for the Use of Bring Your Own Device (BYOD) as Company Data Security during the Covid-19 Pandemic," *International Journal of Information System & Technology Akreditasi*, vol. 6, no. 158, pp. 528–536, 2022. , in press

[17] A. H. Arif, S. W. Tho, and S. K. Ayop, "Development of a BYOD (Bring Your Own Device) Integrated STEM Learning Module for Physics Education in Matriculation Colleges: A Needs Analysis", "Development of a BYOD (Bring Your Own Device) Integrated STEM Learning Module for Physics Education in Matriculation Colleges: A Needs Analysis," *Practitioner Research*, vol. 3, pp. 171–190, Jul. 2021, doi: 10.32890/pr2021.3.9. , in press

[18] I. Rahmayani, "Kementerian Komunikasi dan Informatika." Accessed: Jan. 29, 2024. [Online]. Available: https://www.kominfo.go.id/content/detail/6095/indonesia-raksasa-teknologi-digital%20asia/0/sorotan_media

[19] U. Rahmalisa, Y. Irawan, and R. Wahyuni, "Android-Based Teacher Attendance Application for Schools with QR Code Security (Case Study: SMP Negeri 4 Batang Gansal)", "Aplikasi Absensi Guru Pada Sekolah Berbasis Android Dengan Keamanan QR Code (Studi Kasus : SMP Negeri 4 Batang Gansal)," *Riau Journal of Computer Science,* 2020. , in press

[20] A. Febriandirza, "Designing an Online Attendance Application Using the Kotlin Programming Language,", "Perancangan Aplikasi Absensi Online Dengan Menggunakan Bahasa Pemrograman Kotlin," *Jurnal Pseudocode*, 2020. , in press

[21] P. Hadi Nugroho and R. Achmad Darajatun, "Design of a Village Development Monitoring Information System Based on Bring Your Own Device", "Perancangan Sistem Informasi Monitoring Pembangunan Desa Berbasis Bring Your Own Device," *METIK JURNAL*, vol. 5, no. 2, pp. 10–18, Dec. 2021, doi: 10.47002/metik.v5i2.286. , in press