

# Virtual Job Fair Information System Based on Augmented Reality and Virtual Reality

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**Abstract:** Organizing a job fair is one of the steps to bridge the needs of companies in finding workers and the needs of job seekers to find work. Creative Media State Polytechnic as a vocational college provides support to alumni to get decent jobs and according to their fields of expertise. In accordance with one of the Main Performance Indicators of higher education, namely graduates get decent jobs. Currently, Polimedia does not have a system that supports the implementation of the job fair, or is still done manually. Research with the theme of developing virtual job fair information systems based on augmented reality and virtual reality has two objectives. The first objective is to develop an information system that assists the process of posting job vacancies and allows users to register for available vacancies. Then the second is to facilitate virtual job fairs. Because apart from the impact of the coronavirus pandemic, holding a virtual job fair can be a distinct advantage for alumni who are looking for work because they can significantly save transportation and accommodation costs. The system development methodology used is the System Development Life Cycle with the waterfall method. The waterfall method is divided into five stages, namely the analysis, design, implementation, testing and support stages. The design phase uses the Unified Modeling Language, namely use case diagrams and entity relationship diagrams, while the implementation phase of augmented reality uses 3D modeling, markers, and interface adjustments. In addition, the design of augmented reality and virtual reality applications uses the A-Frame framework.

**Keywords:** Virtual Job Fair, Job Fair, Information System, Interactive Website, Augmented Reality, Virtual Reality

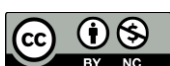
## INTRODUCTION

The COVID-19 pandemic has an impact not only on public health but also affects the condition of the national economy. From an economic perspective, the pandemic has had an impact on increasing unemployment (Fahri., 2019). Data from the Central Statistics Agency, in February 2020 the Open Unemployment Rate (TPT) was 3.69 percent, an increase in February 2021 of 6.26 percent. Creative Media State Polytechnic (Polimedia) as a vocational college provides support to alumni to get decent jobs according to their fields of expertise (Kemdikbud, 2019). One of the efforts made is to organize a job fair that bridges the needs of companies seeking employment and alumni who are looking for work.

Virtual Job Fair is a job fair held online through a digital platform. Like the job fair, which is held offline, which is a meeting place for companies that are recruiting workers or promoting company brands to job seekers. The difference is in the virtual job fair, the activities are carried out virtually on an interactive website platform. The advantage of a virtual job fair from the company side is that it reduces the cost of the venue, catering, and accommodation. While the benefits from the participant's side, the virtual job fair can also be accessed from anywhere with the devices they have to overcome the constraints of accommodation and transportation costs that must be incurred by job seekers. The problems contained in this research are how is software engineering used in the design and development of job fair virtual information systems. Also, how to make a visualization that is close to the work market environment that is close to reality in the virtual job fair information system that is easy to use (user friendly) and has an attractive design.

There are several studies related to job market information systems and the development of Augmented Reality/Virtual Reality (AR/VR) on web systems. For example, Pratama (2019) developed a web-based job fair application for the social service agency for manpower and transmigration in South Kalimantan. Christopher *et al.*, (2019) conducted research on Job Search Website Development for Pelita Harapan University Career Center which built a website-based information system to facilitate companies in posting job vacancies and enabling alumni to register for available vacancies. Also, Senoaji *et al.* (2020) examined the application of the Hajj and

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Umrah service information system that was integrated with AR/VR. The novelty in this research is the integration of web AR and VR with the A-Frame framework.

## LITERATURE REVIEW

### Website Technology

The development of information technology (web) is getting faster in various fields ranging from government and other institutions (Baiti, et al., 2019). With technology, all activities can be done easily, quickly, and efficiently. One job fair service that uses web technology is Jobstreet.com. Jobstreet.com is the number 1 web application in Indonesia for providing job vacancies for job seekers (CNN Indonesia, 2020). Website is a technology that can be accessed through a browser using a URL page (Wijaya, 2018). The Internet is an important part of accessing web pages. Websites can access information without having to install applications on the user's device. One of the most widely used programming languages in developing web applications is PHP (Hills et al., 2013). PHP is a lightweight and open-source programming language (Hills et al., 2013). In the process of designing web applications, a framework is needed to make them faster (Xiaosong, 2020). Many PHP frameworks are used to develop web applications such as Laravel, CakePHP, and CodeIgniter. According to Clare (2005) there are general criteria frameworks used in developing the web such as architecture, documentation, community support, flexibility, and a list of features. In the process, these criteria lack implementation details and are not specific. So there is another method for evaluating the PHP MVC framework by using lines of code as a comparative metric. and can define differences in building the basic components of web applications. The PHP framework can improve the performance of the application (Fayyaz and Munir, 2014).

The framework consists of a Model, View, and Controller. There are several generic classes, functionality, and plugins to speed up the runtime. Opinion conveys related research by comparing and analyzing the impact of the data abstraction layer (ORM) on the performance of the CodeIgniter and CakePHP frameworks (Clare, 2005). According to Fayyaz and Manar (2014) the results do not have much difference, according to performance, and with respect to response times on live servers. So the result is CodeIgniter has better performance with throughput on the server directly. The results of research conducted by the author, it is related to the development of the SIMJOF application using the Codeigniter framework.

### Virtual Reality

Virtual reality is a technology that displays the virtual world at the same time as the real environment (Halfond and Orso, 2005). Several studies related to the application of virtual reality technology include increasing motivation, experience, and understanding (Skaryz and Seredinsky, 2017). One of the technologies used in this research is the development of VR on the web. Web VR does not require special devices because it can be accessed via a web browser using the internet (Valeur et al., 2005). VR web application development using the A-FRAME framework. This framework can be easily embedded in the jobs fair information system (SIMJOF). Web Virtual Reality can be patented in a web environment and can interact with queries so as to produce a more dynamic web (Valeur et al., 2005). In this study, Virtual Reality is used to describe the state of the jobs fair in the virtual hall of Polymedia. Users will be invited around to visit the boot of each company. In addition, users can access information related to company profiles and job listings. 3D animation created using Blender software.

### Augmented Reality

Augmented reality is a technology that represents the real world and adds virtual objects to it. According to the Klopfer (2008) 's opinion Augmented reality is showing the real world then virtual objects are added to the top position. In contrast to Virtual Reality technology which cannot represent the real environment in it. The development of Augmented Reality technology has had an impact on various fields. One of them is applied to the SIMJOF application (Jobs Fair Information System). This technology provides a new experience for users to see the virtual hall object of the Polymedia Job Fair as a whole. Users can see virtual objects in more detail by zooming in and out of the object. Devices used by users to access Augmented reality technology such as computers, laptops, and mobiles have cameras as virtual object detectors (Yuen et al, 2011).

Website-based AR application design requires the AR.js library. This library is open source and easy to access using github. The author uses the AR.js library because it supports PHP program code in accordance with the development carried out on the information system. There are no additional applications for creating Augmented Reality applications using AR.js (Community, 2022). The resulting marker is as desired because it can be customized in the AR.js library (Etienne, 2017). Types of marker detection techniques in AR include Image tracking and Natural Feature Tracking. Image tracking is a type of image marker detection using natural images. In tracking image markers, there is usually a frame to detect AR objects (Siltanen, 2018). Natural

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Feature Tracking (NFT) is a technique of tracking and detecting using image-based tracking. Parts were found to detect markers such as angles, lines on edges, and others (Cukovic, 2015).

### Security Sistem.

Every web application that is created has important information and data. Client data is one of the important data owned by the application. So there need to be responsible for organizations and companies in providing security to their systems. Hacker attacks that usually occur in web applications, attack the query, URL, and interface. One of the most dangerous attacks on web applications is Structured Query Language Injection (SQLI). However, SQL Injection has security-related issues involving unauthorized access to the database (Halfond and Orgo, 2005). This attack usually occurs at the database layer by using HTTP requests at the time of sending by executing without prior validation. A malicious attack that targets web applications is Structured Query Language Injection (SQLI). Related to these attacks, some scientists use several approaches to deal with SQL injection problems. Most of these solutions feel uncomfortable because of the inability to adapt to changing attack patterns quickly. So the CRB reasoning mechanism is applied by combining a multilayer perceptron neural network. The final solution is to use the CRB system (Skaryz and Seredinsky, 2017). Next for web security added a Secure Socket Layer on the CodeIgniter Framework. One method (Kosuga et al., 2005) is in the form of protocol 0. which is at the top of the Transmission Control Protocol/Internet Protocol (TCP/IP). The function of this method (Valuer et al., 2005) can manage transmission security, security in the process of sending data, security in browsing the web, and security when obtaining information via the internet.

### METHOD

The system development methodology used is the System Development Life Cycle (SDLC) with the waterfall method. This method has five stages, namely the analysis, design, implementation/coding and support stages. The waterfall method in this study can be described by the flow chart in Figure 1 below:

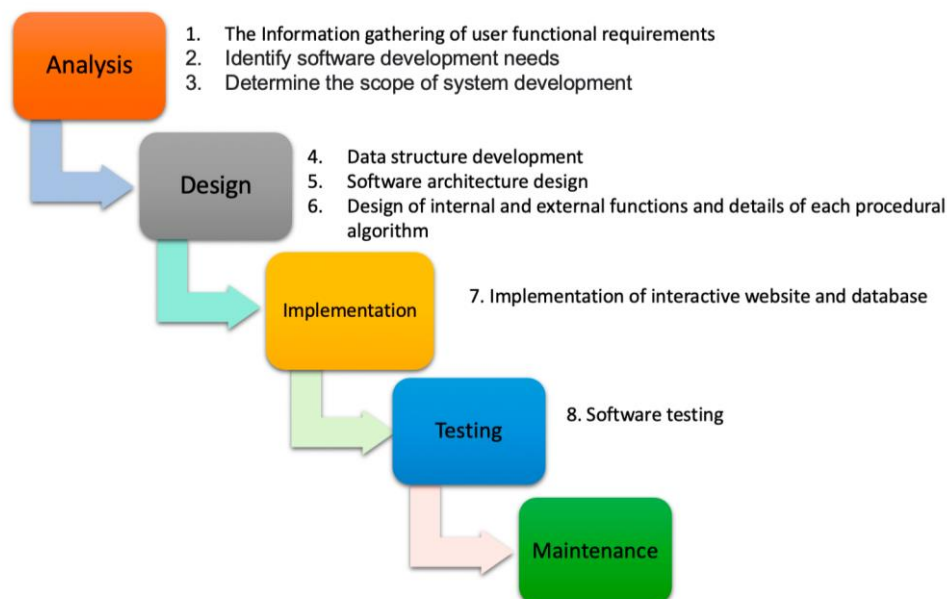


Figure 1. Research Method Diagram

The explanation of the various stages is as follows:

#### a. Analysis

The analysis stage is the initial stage of the process and is very important because it affects the subsequent stages and the entire development process. The main tasks at the analysis stage are:

1. Gathering of information what are the functional requirements of the user/user. Information on functional requirements from users is obtained by interviewing 3 potential users, namely universities, companies and job seekers.
2. Identify system development needs. Software/system development needs include the need for software, hardware, and other supporting applications.
3. Determine the scope of system development. The scope of system development is obtained from literature/library studies.

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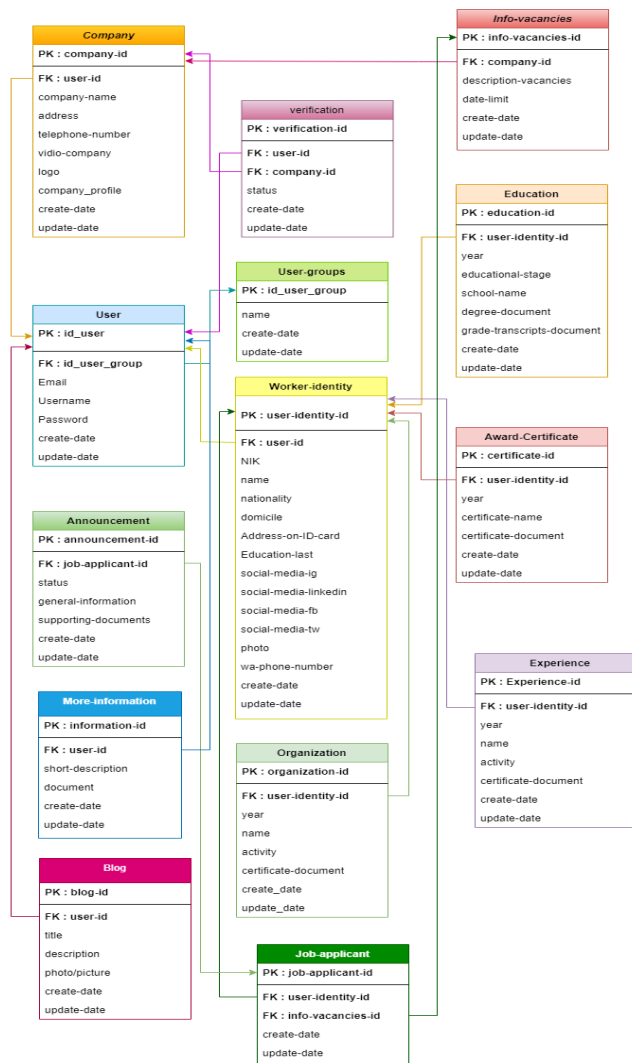


**b. Design**

At this stage, the authors design to build a virtual jobs fair information system. Here are the steps to take:

*1. Entity Relation Diagram (ERD)*

At this stage the author designs the ERD database according to the needs of Jobs Fair both from companies and job seekers. The following is the ERD design in Figure 2 below:



**Figure 2.** ERD SIMJOF

In the figure 2 above the company registration process (user table, user-group table, company table, verification table) while jobs seeker registration (user table, user-group table, worker-identity table). Job seekers fill in application data and upload documents (Education table, award-certificate table, Experience table, organization table). In order to make it easier for job seekers to choose the right company, the company must complete detailed company profile data and application info (company table, company info table). After completing the application data, the job seeker determines the company's choice to include the application letter (Job-applicant table). Next, the company selects Jobs seekers and announces them (Announcement table, More-information table). Admin selects the company by verifying (table verification). In addition, the admin is also in charge of managing the blog jobs fair (blog table).

*2. System Requirements Specification*

In this study, the author uses website technology because access to information is easy and does not require an installation process. The programming language used in developing web applications in PHP. PHP is an open source, stable, and flexible programming language. In addition, a framework is needed to

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accelerate the work of developers in building Jobs Fair Information System (SIMJOF) applications. The framework chosen for the PHP programming language is CodeIgniter because it has a very good classification based on the ITU-T standard (Valeur et al, 2005). Display User Interface Design (UID) on applications using Bootstrap 5 because it is faster and responsive. So that the resulting website application is more interactive, the author uses several libraries such as javascript, ajax and jquery. Data storage in the application uses a MySQL database. MySQL is an open source database, the table structure tends to be flexible and the security system is guaranteed because it has good performance. As for the 3D virtual display jobs fair using virtual reality web technology and augmented reality web. This technology was developed using HMTL 5 and the A-Frame framework. The author chose to use the A-Frame framework because it uses the same programming language, namely PHP. In addition, the author also adds security to the website application. Security (security) is used to anticipate the system against bad things happening such as application break-ins, data loss and other hacker crimes (Huang., et al, 2003). The CodeIgniter framework has its own security settings using technology that can prevent the occurrence of CSRF (Cross-site Request Forgery). CSRF is a type of website attack by sending a request or getting something according to the hacker's wish. After that in the codeigniter configuration the author adds security by activating SSL (Secure Socket Layer) (Aamodt et al., 1997) . In addition, every get and post URL that sends an id or session must be changed to the Encrypt algorithm. While the Decrypt algorithm is used in the internal program to access the id or session that is sent via the URL. The last is related to security in the process of storing data, the author uses SQL injection in the queries made (Another and Mohammed, 2014).

### 3. System Architecture

The Jobs Fair Information System (SIMJOF) application is designed using the CodeIgniter framework for its information system and the A-Frame framework for virtual reality and augmented reality technology. then the database uses mysql. The application project is planted on a cloud server and accessed via the internet by three users, namely admin, company and jobs seeker. The user accesses the SIMJOF application using a link in the browser. Users can use mobile devices, computers and laptops because the application is designed to be user friendly. Each user user can exchange data information with one another. The following is the SIMJOF architecture in Figure 3 below:

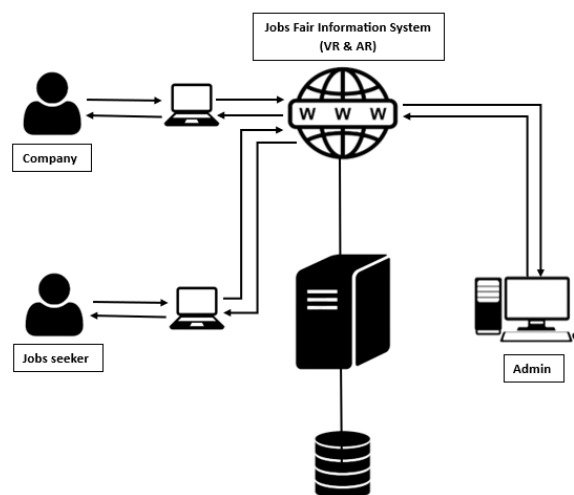


Figure 3. SIMJOF architecture (source : researcher property).

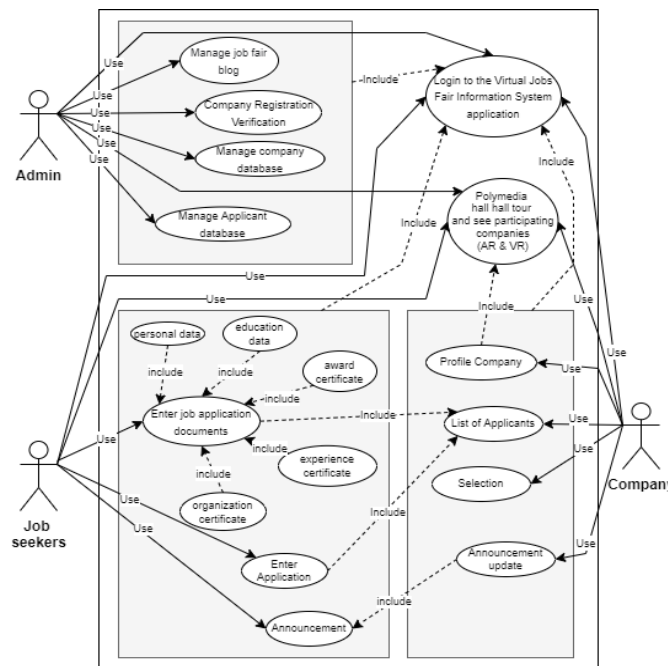
### Usecase Diagram

In this application, employers and job seekers have full access. Job seekers will be given convenience starting from finding companies, applying for jobs, the selection process and getting announcement info. All activities and information can be done online, so you don't have to come directly to the career fair or career expo. In addition, application documents completed by the user can be stored properly and can be reused if you want to apply for work in other places. Then from the company side, it is easier to find candidates who excel in higher education. Furthermore, the company is facilitated in conducting the selection process and providing announcement information. In addition, the role of the admin is also very important in selecting companies that want to collaborate. Update information about career fairs or career expos on blogs and also manage company databases and applicant databases. There is a virtual room tour career fair using Virtual Reality and Augmented Reality technology. This technology allows users to experience real career fair activities as they do in general at

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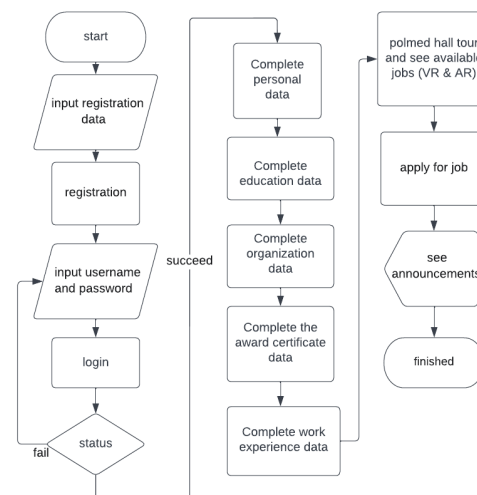
the location. All actors can access this service. The following is the flow of interaction between actors in Figure 4 below:



**Figure 4.** Usecase SIMJOF (source : researcher property)

**User’s Scenario**

After analyzing the system requirements, scenarios are needed to determine the objectives of the Jobs Fair Information System (SIMJOF). The purpose of this scenario is to make it easier for job seekers and companies to communicate well at Jobs Fair activities provided by the SIMJOF Application. In this study, the authors create 2 user scenarios, namely the user as a job seeker and as a company. The first scenario is that applicants register and login to the SIMJOF application. Then follow the application documents in the form of personal data, education data, award data, experience data and organizational data. Next, participate in virtual jobs fair activities to see participating companies and submit applications. The following is the applying job scenario in Figure 5 below:



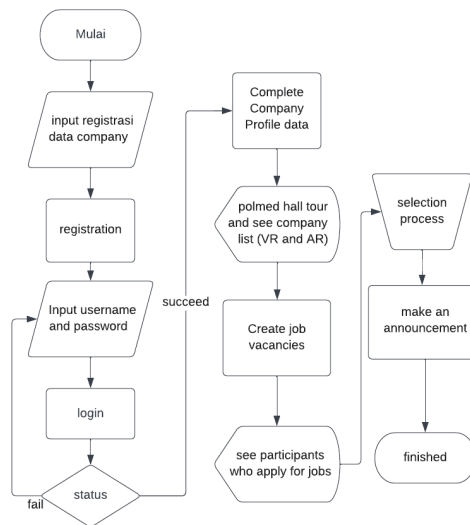
**Figure 5.** Applying Job Scenario

At the virtual jobs fair, 3D animation (virtual reality) and augmented reality are made as real in general, just like when users come directly to the polymedia jobs fair hall. After that, the user can determine the company's choice, by clicking on one of the available lockers to enter a cover letter. Then wait for the announcement information from the company for the next stage to the final stage. The second scenario flow on

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figure 6, the company registers and then logs in to the SIMJOF application. Waiting for admin verification to proceed to the next stage.

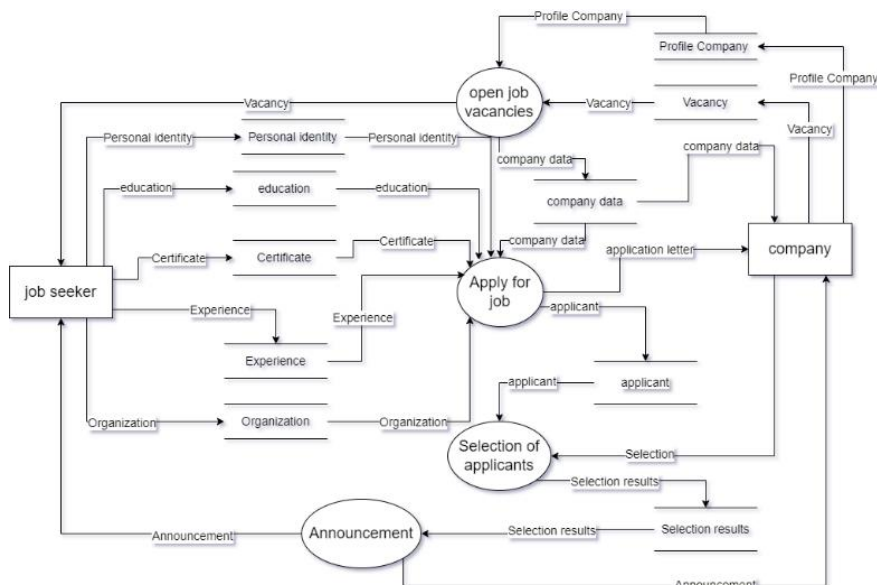


**Figure 6.** User’s scenario

After going through verification, the user can complete the company profile data. Then look at the company's boot locker on the polymedia 3D hall physical menu. Next see the list of applications that come in. Then carry out the selection process offline and update the announcement on the application until the final stage.

**SIMJOF’s communication flow**

At this stage, it describes the interaction flow between the job seeker and the company. The company creates job vacancies by updating vacancies data and company profiles. Then job seekers can see available vacancies at the company, then apply for jobs by completing application documents such as identity, education, certificates, experience and organization. The company obtains a list of incoming job seekers and then conducts a selection process. The selection process produces a list of job seeker participants who pass and fail and then update the announcement. The results of updating the announcement data from the company can be seen by job seekers and companies. The following communication flow is illustrated in the Data flow diagram in Figure 7:



**Figure 7.** SIMJOF’s communication flow

**Implementation**

After the design requirements for system functions have been determined, the next step is to implement the design into a program in the application. Implementation or coding is made by programmers to translate the

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results of the design / design into a particular programming language. In this research the making of website program code uses PHP and HTML5 programming languages, while database processing uses MySQL, for web browser scripts using Javascript. The application in this study was built with several designs, including database design using Entity Relationship Diagram (ERD), program structure design using Navigation Structure, and system design using Unified Modeling Language (UML). The design stage will produce output in the form of a document called System Requirements or also called Software Design Document (DPPL) which will become the basis for programmers in the programming implementation stage.

Implementation of augmented reality using markers and Vuforia Software Development Kit (SDK) (Yuen et al., 2011). The use of markers in physical form such as cards or paper makes the implementation of AR more noticed by the user. 3D Modeling Objects using Blender 2.78 for and Adobe Photoshop CC 2015 for making markers and user interfaces. Just like augmented reality, virtual reality development uses 3D modeling and the same framework uses A-FRAME.

**Test**

After the implementation of the program code has been completed, the next step is to ensure that the application functions can run properly and that there are no more program errors. The program testing method will use the white box testing method. The white box test is a test carried out for test and analyze program code when there is an error or not mentioned with white box testing (Sita, 2021). The following is a general white box testing on the function method of one of the menus in the SIMJOF application in Table 1 below:

Fungsi	Pengujian
Create, Update. Select, Delete,	<p><b>Controller:</b></p> <p><b>SELECT</b> -select-function () \$data = \$this-&gt; model-class-&gt;select () if (! empty(\$data))     return json_encode(data, status="berhasil") then if     throw PageNotFoundException::forPageNotFound(); end</p> <hr/> <p><b>CREATE</b> - create-function () \$data = \$this-&gt;validasi(data-input) if(\$data)     \$status = \$this-&gt;model-class-&gt;create(\$data)     if (status == 1)         return json_encode(data, status="berhasil")     then if         return json_encode(data, status="gagal")     end then if     return view(page) end</p> <hr/> <p><b>UPDATE</b> -select-data-byid-function (\$id)  \$data = \$this-&gt;model-class-&gt;select-by-id(\$id) if (! empty(\$data))     return json_encode(data, status="berhasil") then if     throw PageNotFoundException::forPageNotFound(); end</p> <p>-update-data-byid-function () <b>\$data = validasi(\$data)</b> if(\$data)     \$status = \$this-&gt;model-class-&gt;update(\$data)     if (status == 1)         return json_encode(data, status="berhasil")     then if         return json_encode(array(\$data=null), status="gagal")     end then if</p>

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	<pre> return view(page) end  <b>DELETE</b> -delete-data-byid-function (\$id)  \$status = \$this-&gt;model-class-&gt;delete(\$id) if (status == 1)     return json_encode(data, status="berhasil") then if     return json_encode(array(\$data=null), status="gagal") end         </pre>
login	<pre> -login-function ()  \$data-login = validasi(\$input_login) if(\$data-login)     \$status = \$this-&gt;login-model-&gt;cek-login(\$data-login)     if (status == 1)         return view (home)     then if         return view (login)     end then if     return view (login) end         </pre>

**Tabel 1.** White box testing SIMJOF

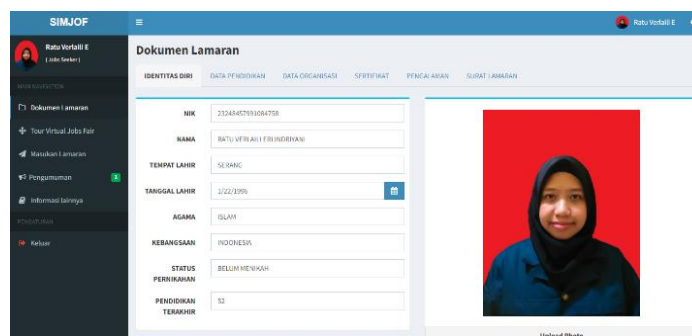
**Support stage.**

In the development of an application, changes can occur, be it addition, subtraction, or modification of the application's functions or menus. This can happen due to errors that are not detected in the test or changes in user requirements. The support or maintenance phase can be in the form of a development process from analysis to implementation and testing, but not to re-creating a new application.

**RESULT**

**Interface Sistem Information Jobs Fair (SIMJOF)**

After logging in, job seekers complete application documents in the form of personal data, education data, organizational data, award certificates, and experience. Identity data that must be completed by the job seeker includes nick, name, place of birth, date of birth, religion, nationality, marital status, latest education, address, social media and photo. After completing the identity data, then inputting Education data such as year of education, name of university, level of education and cumulative achievement index. Then upload the Education certificate according to the level that has been inputted.



**Figure 8.** application page (job seeker)

Next, input organizational data such as year, organization name, position, activities and upload organization certificate. Finally, job seekers complete work experience data such as work period, company agency name, position, activity and upload work experience letters. Completed application documents can be viewed in full on the application letter tab. Then job seekers can follow the expo career online by accessing the

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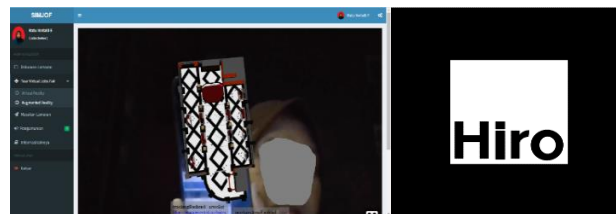


virtual reality and augmented reality tab menu. Virtual reality and augmented reality technology can provide the same experience for job seekers as participating in live activities.



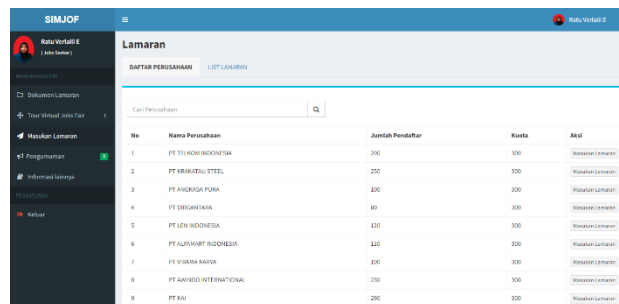
**Figure 9.** VR job fair tour (job seeker)

Seeker job's activity can control navigation to get around the company boot view. In addition, job seekers can also see more detailed presentations of the visited companies. Company presentations using videos and brief descriptions. Furthermore, a different experience is also felt by job seekers when using augmented reality technology. Where users can see more details from the top side of the polymedia jobs fair hall architecture. Users can do this by scanning the markers that are highlighted on the camera. The marker used is the Hiro marker.



**Figure 10.** AR jobs fair **Figure 11.** AR Marker

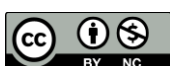
After looking in more detail at the company's needs and a brief presentation, finally the job seeker can determine the choice of the company to be applied for. Then proceed to the application input menu by searching for a company and then clicking the application input button.

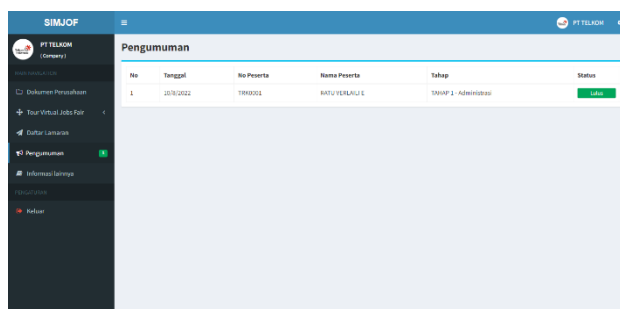


**Figure 12.** Application list view (job seeker)

After that the user will be taken to the detail page of the company's requirements specifications. If the specifications of the company's needs match the qualifications of the skills possessed by the job seeker, then you can proceed to the next stage by clicking the submit button. The process will automatically send application documents to the company. Then the company looks at the list of applicants along with the application documents. The company checks the submitted application documents in the form of personal data, education data, award data, experience data and organizational data. if the data submitted by the applicant is complete and in accordance with the needs of the company, the administrative process is declared passed. Then the company makes announcements to participants directly on the SIMJOF application.

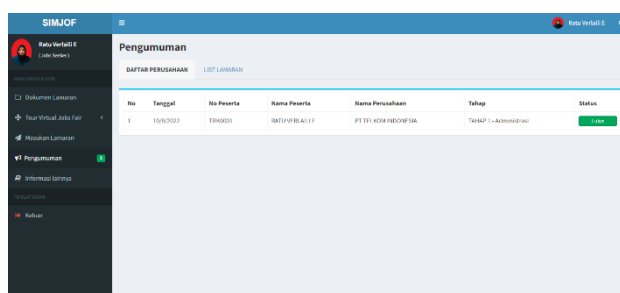
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**Figure 13.** Announcement (company)

The company updates the participants who pass in the status table by clicking the button from not passing to passing. Each button on the first reload will have a failed status before being changed by the company admin. Then the data that has been updated by the company will be seen by applicants on the announcement menu.



**Figure 14.** Announcemnet page (job seeker)

If the applicant's status is passed, the status button displays "passed" with a green button, while the button with the description "not passed" is red and cannot be clicked.

### White Box Testing Results Sistem Information Jobs Fair (SIMJOF)

The stages in this test, there are several stages such as the source code mapping stage, making flow graphs, and test scenarios according to what has been determined. The test shows that the flow and source code of web programming in the library system are logical so that the system can produce the functional requirements needed by the system in serving users.

### CONCLUSIONS

This study discusses the design of a virtual jobs fair information system based on VR and AR. This application is abbreviated as SIMJOF (Jobs Fair Information System). The function of this application is to connect companies and job seekers in online jobs fair activities. In this application, applicants are facilitated in finding vacancies, entering applications, the selection process and announcement information. In addition, the company is also given the convenience of finding the right career candidates from universities, conducting the selection process and providing announcement information. Furthermore, in this application there is a virtual tour hall jobs fair facility for polymedia using Virtual Reality and Augmented Reality technology. Virtual tours can provide users with the same experience as when they come directly to jobs fair activities at Polimedia. Virtual tour facilities can be accessed by companies and job seekers. Furthermore, for the SIMJOF application design process using the waterfall methodology. This methodology has the advantage of minimizing the occurrence of errors during testing. The framework used in designing the Jobs Fair information system uses CodeIgniter, while the framework used in the Jobs Fair virtual tour animation uses A-FRAME. The process of storing data in the SIMJOF application uses a MySQL database. Furthermore, to make the SIMJOF application more interactive. using several libraries such as jQuery, Ajax and Javascript Then testing the application using the white box testing method. This test is carried out on the internal SIMJOF application program. In addition, a security system is added to the application using security facilities owned by the CodeIgniter framework and the database uses SQL injection in queries.

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