



Research in Engineering Education Symposium (REES)
Regional Conference in Engineering Education (RCEE)
& Research in Higher Education (RHEd)
September 29 – October 3, 2025
Johor, Malaysia



Development of Website-Based Information System to Support the Implementation of Outcome Based Education at the Faculty of Engineering UNS

Sutrisno W. Ibrahim, Muhammad Syahputra, Faisal Rahutomo and Muhammad A. Naufal
Electrical Engineering Dept., Sebelas Maret University, Surakarta, Indonesia
Corresponding Author's Email: sutrisno@staff.uns.ac.id

ABSTRACT

BACKGROUND & CONTEXT

Outcome Based Education (OBE) is a student-centred educational framework that emphasizes the achievement of clearly defined learning outcomes. In higher education, effective OBE implementation requires robust systems for planning, delivering, and evaluating learning processes. The integration of information systems in managing OBE processes can offer improved transparency, consistency, and efficiency.

PURPOSE OR GOAL

This study was initiated to address the need for a systematic and efficient approach to managing OBE implementation at Universitas Sebelas Maret, particularly in the Faculty of Engineering. The primary goal was to develop a web-based information system to support outcome evaluation.

APPROACH OR METHODOLOGY

The research involved the design and development of a web-based OBE information system using PHP as the core programming language and the Yii2 framework, which applies the MVC (Model-View-Controller) architecture. The system was engineered to support functionalities such as management of graduate learning outcomes (CPL), curriculum mapping, and assessment based on OBE principles. Usability and functionality testing were conducted to evaluate system performance and user satisfaction, involving lecturers and academic staff as key users.

OUTCOMES

The developed system demonstrated improved efficiency in compiling and reporting learning outcomes, reducing manual workload, and increasing data accuracy. These outcomes suggest that digital support can significantly enhance the practical application of OBE frameworks.

CONCLUSIONS

The implementation of a web-based OBE information system has positively impacted the operational efficiency and data management processes for OBE implementation. These findings support the integration of technology in educational management as a practical means of reinforcing outcome-based practices in higher education.

KEYWORDS

Outcome Based Education, Information System, Yii Framework.

Introduction

Outcome-Based Education (OBE) has become a widely adopted paradigm in engineering education, focusing on measurable learning outcomes to ensure graduates possess relevant skills and competencies. This approach, endorsed by international frameworks such as the Washington Accord, requires systematic assessment and continuous quality improvement (CQI) processes (Washington Accord, 2022). However, many higher education institutions face challenges in managing course outcomes (COs), program learning outcomes (PLOs), and graduate attributes due to the lack of integrated and automated systems (Yusof et al., 2012).

At the Faculty of Engineering, Universitas Sebelas Maret, the implementation of OBE is hindered by decentralized data, manual assessment tracking, and inefficient documentation practices. This study seeks to answer the research question: How can a website-based information system support the implementation of OBE in engineering education? The objective is to develop a centralized platform that facilitates CO-PLO mapping, tracks student achievement, and supports accreditation preparation through accurate and real-time data management (Mahmood and Noor, 2019).

The system is grounded in the theoretical concept of constructive alignment, which promotes coherence between learning outcomes, instructional activities, and assessments (Biggs and Tang, 2011). It also incorporates CQI principles to ensure continuous data-driven improvements in curriculum and instructional design. By aligning educational theory with digital innovation, this research aims to enhance the effectiveness and sustainability of OBE practices.

Methods

Research Flow

In conducting research, of course there are several steps that must be taken. This research consists of several steps according to Figure 1. The image shows a flowchart about making and the steps of the software you want to build.

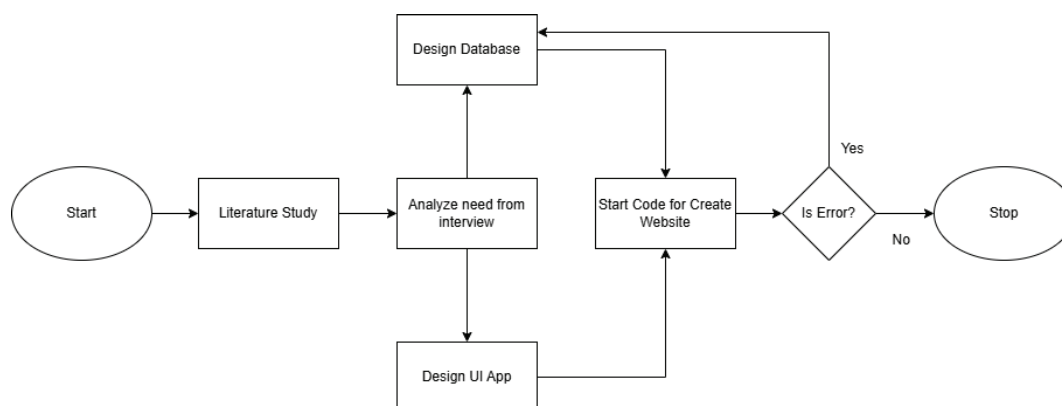


Figure 1: Research flow

The first step taken was to conduct a literature review of the research being conducted. This literature review aims to find out the source of information from the research you want to do in order to facilitate future research. The next step is to do an analysis of how the information system is needed. The purpose of this step is to find out how the client's needs and desires are for the information system you want to create.

The next step is to design the application design and design the database/storage system. Application design is generally carried out in the Figma application, which is an application that is used to carry out designs in either lo-fi or hi-fi form. However, in this research, the design will be made using an existing information system template to maximize the limited time. Next

is database design. This step can be done using the table on ms. Excel or directly using tables in mysql. This step is adjusted to the client's needs that have been determined in the previous step so that it can be according to what the client wants.

The final step in this research is the creation of code to implement the information system. Code generation is done using the Visual Studio Code application software. In making this software using the PHP language as a back-end and using the Yii2 framework. The use of this framework is to simplify and speed up the manufacturing process so that it can be done safely and quickly. In this process, of course, there will be many errors / problems. If there are errors, the right step is to find several forums that have the same source of problems and use these solutions. Some of these large forums include stack overflow and GitHub. If this step is complete, the creation of the information system has been completed and can be used by users.

Database Relations Design

The application and implementation of data in information systems is certainly inseparable from the structure of the database. Tables will be interconnected with one another to make data neat and easy to understand. Another goal of applying relations to the database is to streamline data retrieval and make it easier to display data. Each database relation has its own function. The following are some of the database relations that are implemented on the OBE website.

The first relationship is the relationship between the CPL list and the CPMK and CPL relations (see Figure 2). In the CPMK-CPL relation table there are two fields named id_ref_cpmk and id_ref_cpl. The id_ref_cpl field will be linked directly to the id field in the ref_cpl table.

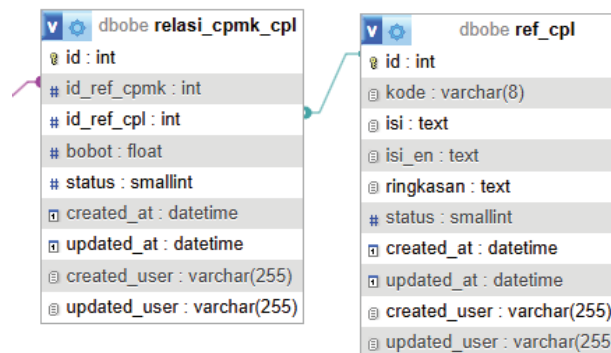


Figure 2: Relations CPMK and CPL

The next relationship as shown in Figure 3 is relation_cpmk_cpl with ref_cpmk. The fields that connect the two are the id_ref_cpmk field in the relation_cpmk_cpl table and the id field in the ref_cpmk table. In the student_achievement table there are two relations with the ref_cpmk table and ref_student. This table serves to provide a value per cpmk for each student.

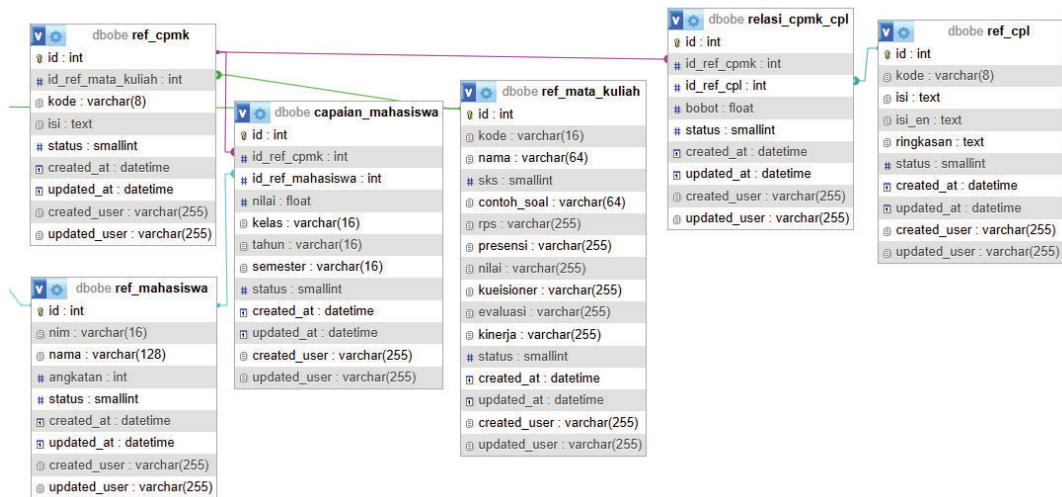


Figure 3: Student achievements

The subsequent relationship (see Figure 4) is the relationship in the displayed course table. This table has a relationship between several tables. The related fields include the table ref_lecturer, ref_class, ref_mata_kuliah, and id_ref_year_school.

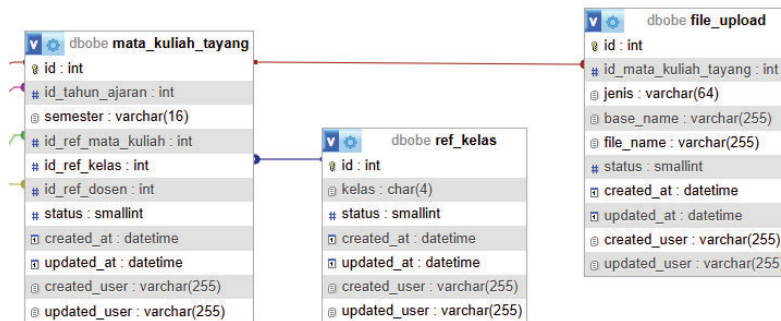


Figure 4: Broadcast course relations

Use Case Diagram

The next step is to create a use case diagram. This diagram aims to clarify the direction and purpose of making a website along with knowing the types of roles that are applied to the website and their features.

Based on Figure 5 it can be concluded that the website that will be created will consist of two main roles including administrators and lecturers. There is no significant difference seen between the differences between administrator and lecturer features. The features between the two will be more or less the same, namely being able to access data on the website such as broadcast course data, list of courses, list of CPMK, list of CPMK-CPL relations, list of students, list of lecturers, list of school years, list of classes and list of CPMK scores per student.

Administrators can have additional features and access where administrators can not only access these data, but can add, edit and delete these data through the website so there is no need to change directly through the database.

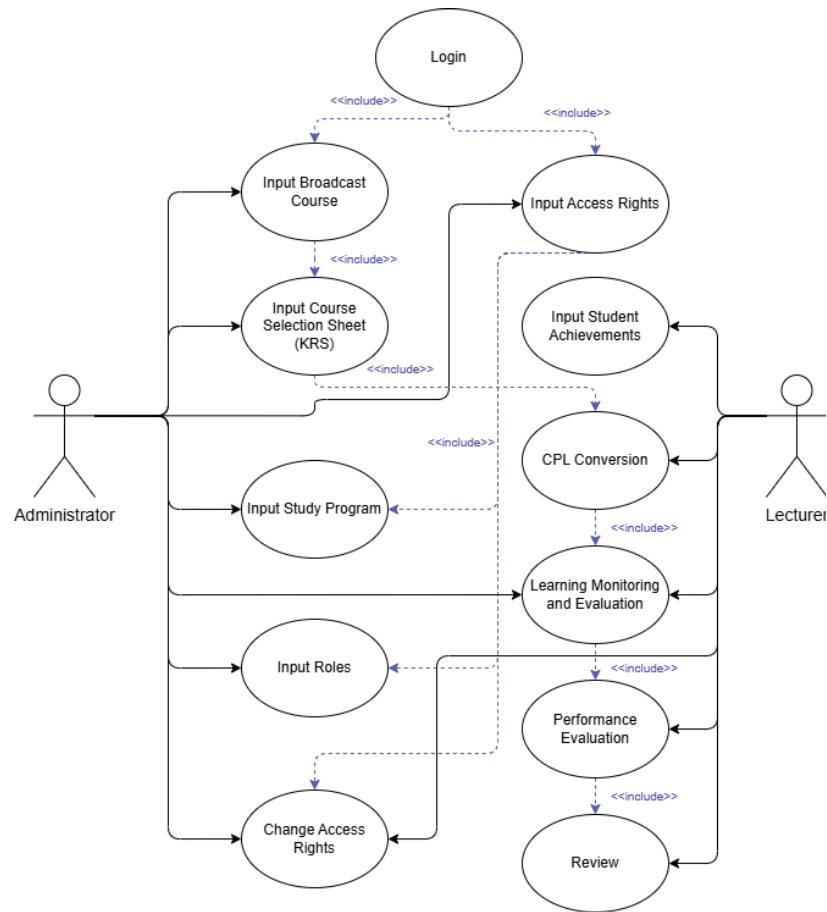


Figure 5: Use case diagram

The differences in the features of each study program are not too significant. Each study program has the same function as administrator or lecturer. Applicable features can be adjusted if there is a special feature that will only be implemented in that study program, but in general the features of each study program are the same.

How the Tool Works

In order for the software to work according to its original purpose, the next step is to design how the tool works. Here is a picture for the flowchart (see Figure 6) of the flow and how the tool works:

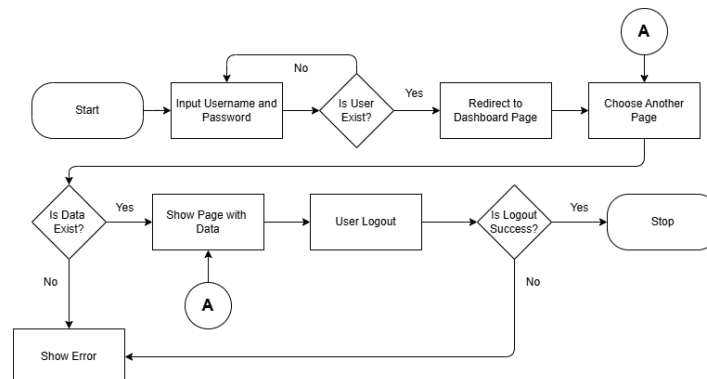


Figure 6: Software workflow flowchart

Based on Figure 6, it can be seen that the workflow of this software starts when the user logs in using a username and password. Furthermore, the algorithm of the software will detect and check in the database. If the data entered is in the database, then this software will store user data in the session so there is no need to log in again and then direct the user to the main page, namely the dashboard page.

Then the user can choose to enter another page. In this software there are several pages such as course pages, list of lecturers, list of grades, list of cpmk, list of cpl, list of students, list of school years and list of classes. After the user enters the page, then the software will check whether the data needed for the page is in accordance with the algorithm and whether the data is in the database.

The last step that can be done by the user is to logout. When the user chooses to log out, then the software will then check whether an error has occurred in the application.

Results and Discussion

PDCA System for Monitoring Learning

The learning monitoring system is a system that is used to document the data needed when carrying out PDCA (Plan, Do, Check, Act) so that a new repository is needed to store learning monitoring data for each course. The following is a database display for monitoring learning:

#	Name	Actions						
1	Religion	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
2	English	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
3	Physics 1	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
4	Calculus 1	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
5	Chemistry	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
6	Technical Drawing	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
7	Indonesian Language	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
8	Basic Social and Cultural Sciences	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
9	Ecology	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
10	Physics 2	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
11	Calculus 2	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance
12	Material Science	RPS	Presence	Example Question	Value	Attendance	Evaluation	Performance

Figure 7: Display of learning monitoring page

On the learning monitoring page there are 7 action buttons. These buttons include RPS, attendance, sample questions, grades, questionnaires, evaluation and performance. Each of these buttons will lead to a page containing a form to fill in according to the data required in that subject.

CPL and CPMK Monitoring and Evaluation System

A key technical component of the OBE (Outcome-Based Education) system is its robust monitoring and evaluation framework for both Course Program Learning Outcomes (CPL) and Course Learning Outcomes (CPMK). This system offers various visualization and assessment tools to monitor student performance and program effectiveness

Individual CPL Navigation Interface

The platform features an intuitive navigation interface designed for individualized CPL evaluation. Users can access a range of CPL assessments, including:

- Individual CPL
- Semester-based CPL
- Cohort-based CPL

- Alumni CPL

This structured approach enables comprehensive tracking of learning outcomes across different timeframes and organizational levels, supporting both formative and summative assessments.

Comprehensive CPL Achievement Visualization

The system incorporates advanced data visualization techniques to present CPL achievement data.



Figure 8: CPL achievement radar chart visualization

As shown in Figure 8, displays CPL achievement scores across a range of competency areas, including S1–S4 (Attitudes), K1–K6 (Knowledge), P1–P4 (Skills), and KK (Special Skills) for the 2018 academic year. This multi-dimensional representation enables educators and administrators to carry out the following:

- Identify strengths and weaknesses in specific competency areas
- Compare achievement levels across different learning outcome categories
- Make data-driven decisions for curriculum improvement
- Track progress over time for continuous quality improvement

The achievement scores range from 70-85 points across different competencies, indicating generally strong performance while highlighting areas for potential enhancement, particularly in S4 and K4 competencies which show relatively lower achievement levels.

Detailed CPL Performance Analysis

In addition to the radar chart, the system features a bar chart visualization that offers a more detailed breakdown of individual competency achievements as shown in Figure 9. This granular view presents:

- Specific achievement scores for each competency (S1-S4, K1-K6, P1-P4, KK)
- Comparative analysis across all measured learning outcomes
- Clear identification of high-performing areas (S1: 82, S3: 82, P3: 83) and areas requiring attention (S4: 71, K4: 72)

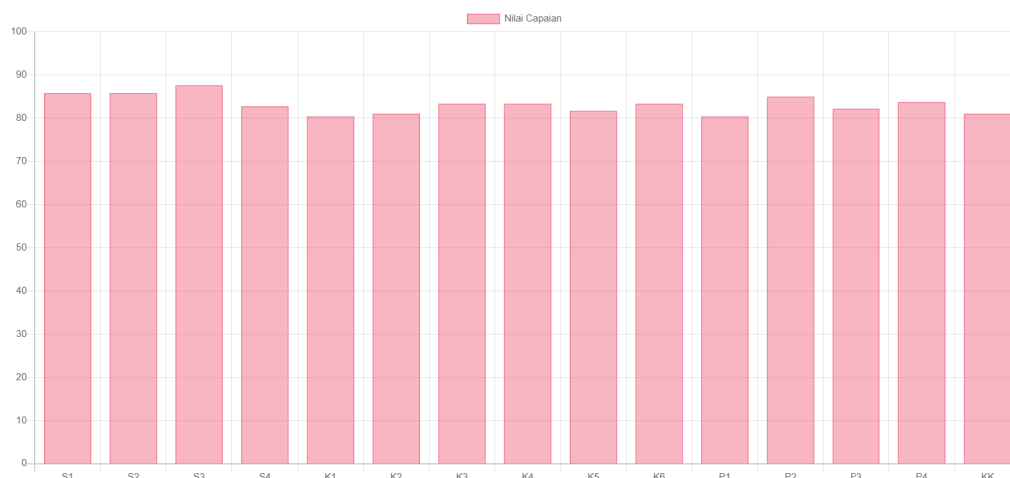


Figure 9: Detailed CPL performance bar chart analysis

By integrating both **radar and bar chart visualizations**, the system delivers a comprehensive analysis of student performance. This dual approach enables educators to gain both broad and focused insights, empowering them to make informed, evidence-based decisions for instructional improvement and curriculum development.

Value Evaluation on CPL

Value evaluation is one of the new features found in the OBE system. This feature functions to check the value data for each CPMK at each CPL. This update causes the creation of a new relationship in the student achievement table so that it can display data connected to that item. The value evaluation display can be found on the individual cpl monitoring and evaluation page. Here is the value evaluation display (see Table 1):

Table 1: Value evaluation table display

Grafik Radar			Grafik Bar		Evaluasi Nilai									
CPL 1	CPL 2	CPL 3	CPL 4	CPL 5	CPL 6	CPL 7	CPL 8	CPL 9	CPL 10	CPL 11	CPL 12	CPL 13	CPL 14	
CPL 15														
No	Nilai		Ref Cpmk			Mata Kuliah			Dosen					
1	85		Mampu menjelaskan tentang peribadatan yang benar sesuai dengan ajaran/syariat yang telah ditetapkan oleh agama			Agama-15			Abdul Malik S.S., M.Hum					
2	97		Mampu merinci hak dan kewajiban dalam hubungan bermasyarakat			Agama-15			Abdul Malik S.S., M.Hum					
3	80		Mampu menunjukkan kerja di laboratorium secara disiplin dan bertanggung jawab			Prak. Material Teknik-15			Prof. Dr. Joko Triyono S.T., M.T.					
4	80		Mampu mengikuti prosedur kerja dan standar kerja laboratorium serta menerapkan aspek K3			Prak. Proses Produksi 1-15			Fitrian Imaduddin S.T., M.Sc., Ph.D.					
5	79.5		Mampu mengolah dan menganalisis data sesuai dengan kaidah yang benar			Prak. Fisika-15			Dr. Bambang Kusharjanta S.T., M.T.					

The table consists of value data, CPMK, lecturers and courses taken by the student at CPL 1. When selecting another CPL, the value will automatically change according to the CPL selected by the user. The purpose of making this feature is to evaluate the student's grades, to check if there are any causes that make the student's CPL score decrease.

OBE System Performance Test

The finished OBE system certainly requires testing before being used. Therefore, the OBE system that has been hosted on the FT UNS server will check the performance of the website.

Website performance will be checked using Google PageSpeed and GTmetrix. Here is a display for the test results on google PageSpeed:

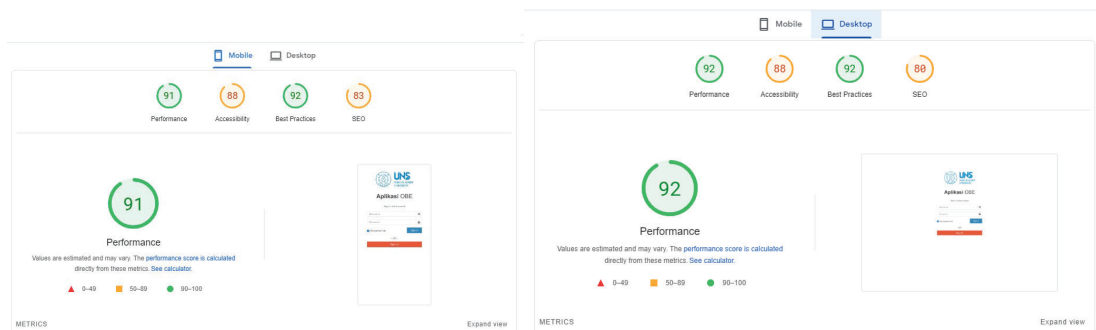


Figure 10: Performance checking results using Google PageSpeed

On Google PageSpeed, you can check performance when conditions are on the cellphone and conditions on the desktop. It can be seen that the performance for desktop displays is stronger and better than using mobile phones. This is because the OBE website uses an admin page template which is designed for computer screens so that if you open it on a mobile phone, you will experience a slight lag when downloading the required assets. Next is checking using GTmetrix, here are the results of checking using the GTmetrix website:

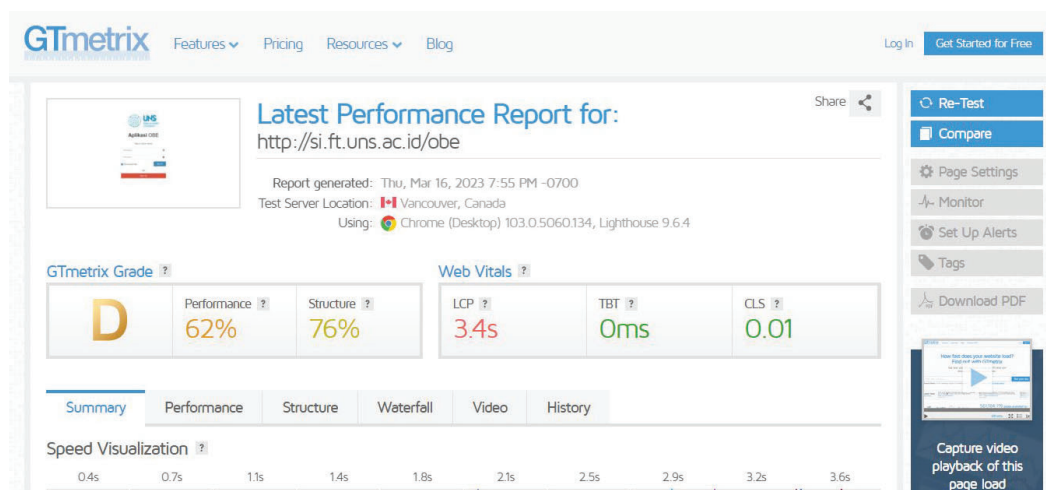


Figure 11: Performance checking results using GTmetrix

In the GTmetrix application, it can be seen that the performance on the OBE website reaches 62%. This is probably due to the large number of assets and JavaScript files that exist, as well as the data that is loaded on the page. Moreover, the server used is a Canadian server so there is a possibility that the website will run a little longer.

Conclusion

Based on the presentation of the material described in the previous sections, the following conclusions can be drawn: The OBE system has access rights features based on the position and study program of the user. The permissions feature is added to a new table and two new fields to the user's table. The management feature and change of access rights can function properly. Added sample question features for monitoring learning as a curriculum standard application. The system can display the value of each course in each student's achievements. Implementation of adaptations to several codes such as data display and to keep pages open

according to the access rights used. Based on Google PageSpeed and GTmetrix, the performance of the OBE website is running quite well.

References

- Agustino, R., Widodo, Y.B., Saputro, M.I. & Wiyatno, A., (2020). Sistem informasi data penduduk pada Desa Bogoharjo, Kecamatan Ngadirojo, Kabupaten Pacitan. *Jurnal Jaring SainTek*, vol. 2, 1-12.
- Biggs, J. and Tang, C., (2011). *Teaching for Quality Learning at University*. 4th Edition. Maidenhead: Open University Press.
- Candra, M.A.A. & Wulandari, I.A., (2021). Sistem informasi berprestasi berbasis web pada SMP Negeri 7 kota metro. *Jurnal Mahasiswa Ilmu Komputer (JMIK)*, vol. 1, 175-191.
- Dalis, S., (2017). Rancang bangun sistem informasi lembaga penelitian dan pengabdian masyarakat berbasis Web. *Paradigma*, vol. 19, 1-8.
- Ditjen Aptika, (2022). *Revolusi Industri 4.0. Kementerian Komunikasi dan Informatika (Kominfo)*. Accessed at <https://aptika.kominfo.go.id/2020/01/revolusi-industri-4-0/> on 19 September 2022.
- Firman, A., Hans, F. & Najoan, X. (2016). Sistem informasi perpustakaan Online berbasis Web. *Jurnal Teknik Elektro dan Komputer (JTEK)*, vol. 5, 29-36.
- Gillani, M., Niaz, H.A. & Ullah, A. (2022). Integration of software architecture in requirements elicitation for rapid software development. *IEEE Access*, vol. 10, 56158-56178. doi: 10.1109/ACCESS.2022.3177659.
- Helmut, E. (2021). Optimasi basis data Oracle menggunakan complex view studi kasus: PT. Berkas Optimis Sejahtera (PT.Bos), Pangkalpinang. *Jurnal Informanika*, vol. 7, 80-86.
- Mahmood, S.T. and Noor, M.N. (2019) 'An Outcome-Based education system to attain graduate attributes using continuous quality improvement cycle. *Education and Information Technologies*, 24, pp. 1579–1594.
- Nugroho, F.E. (2016). Perancangan sistem informasi penjualan online studi kasus tokoku. *Jurnal Teknik Mesin, Elektro dan Ilmu Komputer*, 7(2), 717-724.
- Prasetyo, B. & Trisyanti, U. (2018). Revolusi industri 4.0 dan tantangan perubahan sosial. *Prosiding SEMATEKSOS 3 "Strategi Pembangunan Nasional Menghadapi Revolusi Industri 4.0"*, (vol. 5, pp. 22-27).
- Priyanti, D & Iriani, S. (2013). Sistem informasi data penduduk pada Desa Bogoharjo, Kecamatan Ngadirojo, Kabupaten Pacitan. *Indonesian Journal on Networking and Security*, vol. 2, 55-62.
- Rifai, M. (2021). *Pengembangan Lanjut Sistem Informasi Outcome Based Education (OBE) di Universitas Sebelas Maret*. Surakarta, Indonesia: Universitas Sebelas Maret.
- Rosmala, M.D., Ichwan, M. & Gandalisha, I. (2011). Komparasi framework MVC (codeigniter dan cakephp) pada aplikasi berbasis web. *Jurnal Informatika Itenas*, vol. 2, 22-39.
- Safiudin, A., Sutrisno, Sulisty, M.E., Pramono, S. & Ramelan, A. (2020). The development of web-based Outcome Based Education information system. *Journal of Electrical, Electronic, Information, and Communication Technology (JEEICT)*, vol. 2 no. 2.
- Sitijak, D.D.J.T. & Suwita, J.M. (2020). Analisa dan perancangan sistem informasi administrasi kursus bahasa inggris pada intensive english course di Ciledug Tangerang. *Jurnal Ipsikom*, vol. 8, 1-19.
- Universitas Sebelas Maret. (2022). *Profil Universitas*. Accessed at <https://uns.ac.id/id/tentang-uns/profil-universitas> on 19 September 2022.
- Washington Accord (2022) *Graduate Attributes and Professional Competencies*. International Engineering Alliance.
- Yii Framework, (2022). *Panduan definitif Yii 1.1*. Accessed at <https://www.yiiframework.com/doc/guide/1.1/id/quickstart.what-is-yii> on 19 September 2022.
- Yolan & Mandusri, (2015). Sistem informasi pariwisata propinsi Nangroe Aceh Darussalam berbasis web. *JUPITER: Jurnal Penerapan Ilmu-ilmu Komputer*, vol. 1, 32-40.
- Yusof, K.M., Jamaludin, M.Z., Harun, N.F. & Hassan, S.A.H.S., (2012). Implementation of Outcome-Based Education in Malaysia: A review. *International Journal of Engineering and Technology (IJET)*, 2(1), 14–21.

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