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**Evaluasi Akurasi Hasil Pemindaian Scan-to-BIM Terhadap Kondisi Aktual Gedung Daruslan Menggunakan
Integrasi Building Information Modelling dan Augmented Reality**
Alfath Qornain Isnan Yuliadi, Ir. Ika Rahmawati Suyanto, S.T., M.Eng.
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ABSTRAK

Industri konstruksi mengalami transformasi digital melalui pemanfaatan teknologi seperti *laser scanning*, *Building Information Modelling* (BIM), dan *Augmented Reality* (AR) untuk meningkatkan efisiensi dokumentasi dan inspeksi bangunan. Dalam dokumentasi bangunan eksisting, *Terrestrial Laser Scanner* (TLS) memungkinkan pembentukan model *scan-to*-BIM yang mampu merepresentasikan geometri bangunan secara akurat. Namun, evaluasi kesesuaian model hasil pemindaian terhadap kondisi aktual umumnya masih dilakukan pada lingkungan digital sehingga memiliki keterbatasan dalam verifikasi visual di lapangan. Oleh karena itu, penelitian ini bertujuan mengevaluasi akurasi hasil *scan-to*-BIM terhadap kondisi aktual Gedung Daruslan melalui integrasi BIM dan AR.

Penelitian ini menggunakan metode kuantitatif dengan data sekunder berupa model 3D Gedung Daruslan hasil *scan-to*-BIM berbasis data pemindaian TLS serta data pengukuran dimensi elemen eksisting. Data primer berupa model 3D yang dibuat secara manual berdasarkan gambar perencanaan 2D Gedung Daruslan. Proses penelitian dilakukan melalui integrasi model BIM menggunakan Autodesk Revit, Autodesk Construction Cloud, dan GAMMA AR, kemudian dievaluasi menggunakan parameter *Root Mean Square Error* (RMSE) dan klasifikasi *Level of Accuracy* (LOA).

Hasil penelitian menunjukkan bahwa integrasi BIM dan AR dapat diterapkan secara sistematis untuk mendukung evaluasi hasil *scan-to-BIM*. Nilai RMSE model *scan-to*-BIM sebesar 20,53 mm, model berbasis gambar rencana sebesar 57,34 mm, dan pengukuran berbasis AR sebesar 19,24 mm. Berdasarkan klasifikasi LOA, model *scan-to*-BIM dan hasil pengukuran AR termasuk kategori LOA20, sedangkan model berbasis gambar rencana termasuk LOA10. Selisih pengukuran antara GAMMA AR dan Autodesk Revit sebesar 2,7 cm menunjukkan bahwa AR konsisten sebagai alat bantu evaluasi, meskipun masih terdapat kendala teknis seperti distorsi model dan keterbatasan visualisasi elevasi.

Kata kunci: *Scan-to*-BIM*, Building Information Modeling* (BIM), *Augmented Reality* (AR)*,* Evaluasi Akurasi*, Root Mean Square Error* (RMSE)

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ABSTRACT

The construction industry is undergoing a digital transformation through the implementation of technologies such as laser scanning, Building Information Modelling (BIM), and Augmented Reality (AR) to improve the efficiency of building documentation and inspection. In existing building documentation, Terrestrial Laser Scanner (TLS) enables the creation of scan-to-BIM models that can accurately represent building geometry. However, the evaluation of scanned models against actual conditions is generally still conducted in digital environments, which limits direct visual verification in the field. Therefore, this study aims to evaluate the accuracy of scan-to-BIM results against the actual condition of Daruslan Building through the integration of BIM and AR.

This study employed a quantitative method using secondary and primary data. Secondary data consisted of the 3D model of Daruslan Building generated from the scan-to-BIM process based on TLS scanning data, along with dimensional measurement data of existing building elements. Primary data consisted of a manually created 3D model based on the 2D design drawings of Daruslan Building. The research process involved integrating the BIM model using Autodesk Revit, Autodesk Construction Cloud, and GAMMA AR, followed by accuracy evaluation using the Root Mean Square Error (RMSE) parameter and Level of Accuracy (LOA) classification.

The results show that the integration of BIM and AR can be systematically implemented to support scan-to-BIM evaluation. The RMSE values for the scan-to-BIM model, design-based model, and AR-based measurement were 20.53 mm, 57.34 mm, and 19.24 mm, respectively. Based on LOA classification, the scan-to-BIM model and AR-based measurements were categorized as LOA20, while the design-based model was categorized as LOA10. The measurement difference between GAMMA AR and Autodesk Revit was only 2.7 cm, indicating that AR provides consistent support for evaluation. However, several technical limitations remain, including model distortion, reference point calibration, and dependence on internet connectivity.

Keywords: *Scan-to-BIM, Building Information Modeling (BIM), Augmented Reality (AR), Evaluasi Akurasi, Root Mean Square Error (RMSE)*