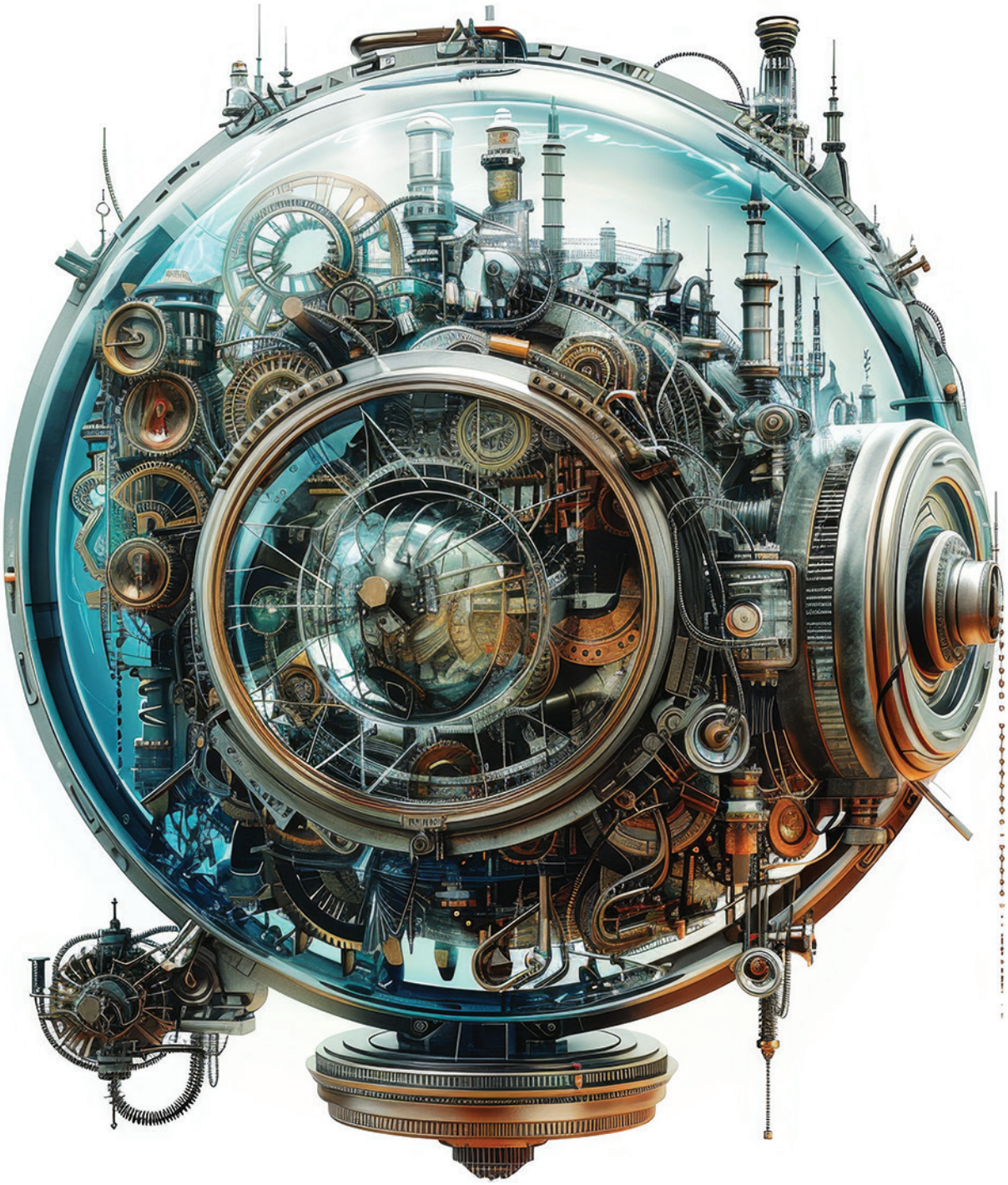
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Poster Sunum Türkiye:	00	**Yurt Dışı Ülke Dağılımı**	12 Farklı Ülke
Türkiye Toplam Bildiri Sunumu:	45	**Toplam Yurt Dışı Bildiri Sunumu**	53

Kongremize toplam gelen bildiri sayısı 98 adettir. 12 farklı dünya ülkesinden 53 adet bildiri sunulmuş olup tamamı sözel sunumdur. Bu sayı kongre toplam katılımın %54'ü yabancı katılımcıdan oluşmaktadır. Türkiye'den katılım ise 45 sözel bildiridir. Türkiye dışı katılımcıların ülke dağılımları kitabın ikinci bölümünde yer alan özetlere ait bilgilerin içerisinde yer almaktadır.

Kongremiz iki gün sürmüş olup, ülke içi ve ülke dışından toplam dinleyici dahil katılımcı sayısı ülke dışından 76 kişi Türkiye'den ise 62 kişidir.

Kongremizde kabul edilen bildirilerinin tamamı kongre başkanı, düzenleme kurulu başkanı ve oturum başkanlarının yönetimi ile idaresi doğrultusunda yukarıdaki tablolarda beyan edildiği şekilde sunumu yapılmıştır.

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Prof. Dr. Emine Selcen DARÇIN
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Assist. Prof. Dr. Ulvi BAŞPINAR	**Türkiye**
Dr. Kaan Yüksel OYULMAZ	**Scotland**

13 invited speakers participated in our congress. 6 of these participants are from different countries of the world, and their distribution is 6 different countries. All of the invited speakers attended our congress and presented their speeches under the chairmanship of the congress chair.

Presentation And Distributions Türkiye		**Presentations And Distributions Abroad**	
Oral Presentations Türkiye	45	**Abroad Oral Presentations**	53
Poster Presentations Türkiye	00	**Abroad Country Distribution**	12 Different Country
Total Presentations Türkiye	45	**Total Abroad Presentations**	53

The total number of papers submitted to our congress is 98. 53 papers from 12 different world countries were presented and all of them were oral presentations. This number consists of foreign participants, 54% of the total participation in the congress. Participation from Türkiye is 45 oral papers. Türkiye distribution of out-of-country participants is included in the information on the abstracts in the second part of the book.

Our congress lasted for two days and the total number of participants, including the listeners, from the country and abroad is 76 participants from abroad and 62 participants from Türkiye.

All of the papers accepted at our congress were presented as stated in the tables above, in line with the management and administration of the congress chair, the organizing committee chair and the session chair.

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As the organizing committee and the congress chair, we acknowledge and confirm the accuracy of the above-declared information and present our respects.

Prof. Dr. Carlos Rolando RIOS-SOBERANIS
Congress Co-Chair

Prof. Dr. Emine Selcen DARÇIN
Congress Chair

EVALUATION OF EARTHQUAKE READINESS OF EXISTING BUILDINGS: A CASE STUDY OF ERZİNCAN PROVINCE[1]

Taha Yasin CEMALOĞLU[1], Atila KUMBASAROĞLU[1], Hakan YALÇINER[1], Ahmet İhsan TURAN[1]

[1]Erzincan Binali Yıldırım University, Faculty of Engineering and Architecture, Erzincan / Türkiye

Abstract: The aim of this study is to evaluate the earthquake preparedness level of existing buildings in the city center of Erzincan using modern data processing approaches. Erzincan is located on one of Turkey's most active seismic belts, and assessing the safety of its building stock is of great importance for disaster risk management. For this purpose, two different street survey methods have been integrated into a software system developed within the study. The first method is a questionnaire-based street survey prepared by the ITU Alumni Association Bursa Branch, while the second is the visual street survey developed by Erdem Erdoğan for buildings in Ankara. In addition to these methods, an artificial intelligence-supported module, developed with Python-based machine learning algorithms, was used to analyze photographs of buildings taken from four directions and predict their structural safety. The system was developed using open-source Python libraries, integrating both visual recognition and data classification functions. The analysis results revealed that the predictions made by the AI model were highly consistent (approximately 90%) with the other two methods. These findings suggest that AI-assisted street survey applications can provide faster, more systematic, and reliable evaluations compared to traditional fieldwork. Furthermore, with its user-friendly interface and data analysis modules, the system has the potential to serve as a widely applicable decision support tool in engineering applications. In conclusion, the developed system could significantly contribute to urban-scale building inventory creation, disaster risk management, and urban transformation planning.

Keywords: Earthquake, Erzincan, Python, Street Survey, Software

INTRODUCTION

Urban areas in Turkey consist of numerous reinforced concrete and masonry buildings, constructed in different periods and under various supervision conditions. Particularly in cities like Erzincan, which are highly prone to seismic risks, the evaluation and analysis of the existing building stock is of great importance for urban planning and disaster risk reduction efforts. One of the traditional field-based assessment methods, street surveys, has been used for a long time to collect information about the age of buildings, their usage status, types of materials used, and visible structural characteristics (Kumbasaroğlu et al., 2021; Dalıeh et al., 2023; Ayaz et al., 2022). However, these methods are time-consuming, labor-intensive, and prone to human error during the evaluation process.

In recent years, advancements in artificial intelligence have provided new and wide-ranging possibilities for the automatic visual analysis of building conditions. The integration of street survey methods with AI can help in collecting data more quickly, consistently, and on a larger scale. Although various survey-based tools have been developed by universities and engineering associations to assess building risks, the integration of these tools with AI-supported evaluation systems is still limited.

In this study, two different street survey methods have been integrated into a specially developed software system. The first method is the traditional human-based survey approach used by the ITU Alumni Association Bursa Branch (Ünal & Yurtcu, 2006). The second method is the visual street survey developed by Erdem Erdoğan (2007), which was used in his master's thesis (Seismicity of Existing Buildings in Ankara). In this method, buildings are observed and scored

[1] This paper is derived from the unpublished master's thesis titled 'Evaluation of Earthquake Readiness of Existing Buildings: A Case Study of Erzincan Province,' prepared by the first author, Taha Yasin CEMALOĞLU, at Erzincan Binali Yıldırım University, Institute of Science. ORCID NO: 0009-0009-6489-7084

according to predefined criteria. In the final phase, an AI module capable of processing and analyzing photographs of buildings taken from four different directions was developed and integrated into the software. Thus, the evaluation was carried out with three different methods, and the results were compared. This study aims to demonstrate the speed, objectivity, and reliability of AI-assisted street survey systems in structural assessment processes.

The results of this study are expected to serve as an example in the field of civil engineering, showcasing how modern AI technologies can be efficiently utilized and accelerate the evaluation of building conditions in earthquake-prone regions.

METHOD AND FINDINGS

The software system developed in this study is designed to assess the earthquake risk of existing buildings through three different methods:

1. AI-Based Visual Analysis
2. Survey Method Developed by the ITU Alumni Association Bursa Branch
3. Erdem Erdoğan's Street Survey Method

The software is designed as an integrated platform that allows users to upload building photographs and simultaneously run these three methods. This platform enables parallel evaluation of all three methods and provides a comparative analysis of the results.

Software Infrastructure

The software has been developed on the Emergent platform and consists of both front-end and back-end components. FastAPI-based Python service is used as the back-end, while the front-end is implemented using the React.js framework to ensure integration. MongoDB is used as the database, where the analysis results are stored.

The software connects to artificial intelligence services using the emergentintegrations library to perform image analysis. For image analysis, the OpenAI GPT-4 Vision model and, as an alternative, the Google Gemini Pro Vision model are integrated into the software. These models perform visual analysis using photographs taken from four different perspectives (front, back, left, and right) of the buildings.

Additionally, the software utilizes the Pillow (PIL) library to process and prepare images for analysis. The ReportLab library is used to generate a PDF report enriched with images, containing the results of the analysis and AI-generated recommendations. The report is created separately for each method and is provided to users in a downloadable format.

Data and Image Collection Process

The existing buildings identified in the city center of Erzincan were examined and analyzed using two different street survey methods. In the first phase, a human-based field survey was conducted; the structural, geometric, and usage characteristics of the buildings were examined and observed on-site. In the second phase, the same buildings were evaluated and analyzed on-site using the criteria of the other street survey method. After the completion of these two assessments, high-resolution photographs of the buildings taken from four different perspectives (front, back, left, and right) were uploaded to the software. These photographs were processed using artificial intelligence analysis modules, thereby creating a third evaluation method.

Three Different Analytical Systems

The developed software provides an integrated interface that allows the three mentioned methods to run in parallel and compares their results:

Method 1 - AI-Based Visual Analysis

In this phase, the GPT-4 Vision and Google Gemini Pro Vision models examine high-resolution photographs taken from four perspectives of the building, evaluating the following parameters:

- Structural features (number of floors, material types, balconies, projections, etc.)
- Visible damages and cracks
- Safety issues and structural defects
- General condition assessment in terms of earthquake resistance

As a result of the analysis, the software assigns a risk score between 0 and 100, determines the risk category (high, medium, low), and generates technical recommendations.

Method 2 - ITU Alumni Association Bursa Branch Survey

This method is the software-integrated version of the 12-question survey used in human-based street survey studies. The software makes predictions for each question based on the photos and calculates the risk score of the building. Buildings are categorized according to their risk score (high, medium, low). This method has been compared with real field data and shows a high consistency rate (over 90%).

Method 3 - Erdem Erdoğan's Street Survey Method

In this approach, structural features are observed and scored based on parameters. The presence of a basement, types of projections, short column formations, building alignment, and soft-story conditions are detected and analyzed through photographs. This method has also been compared with real field data and shows a high consistency rate (over 80%).

Software Workflow Phases

In the first phase, the software greets the user with its interface and requests the upload of high-resolution photographs taken from four perspectives of the building, as shown in Figure 1.

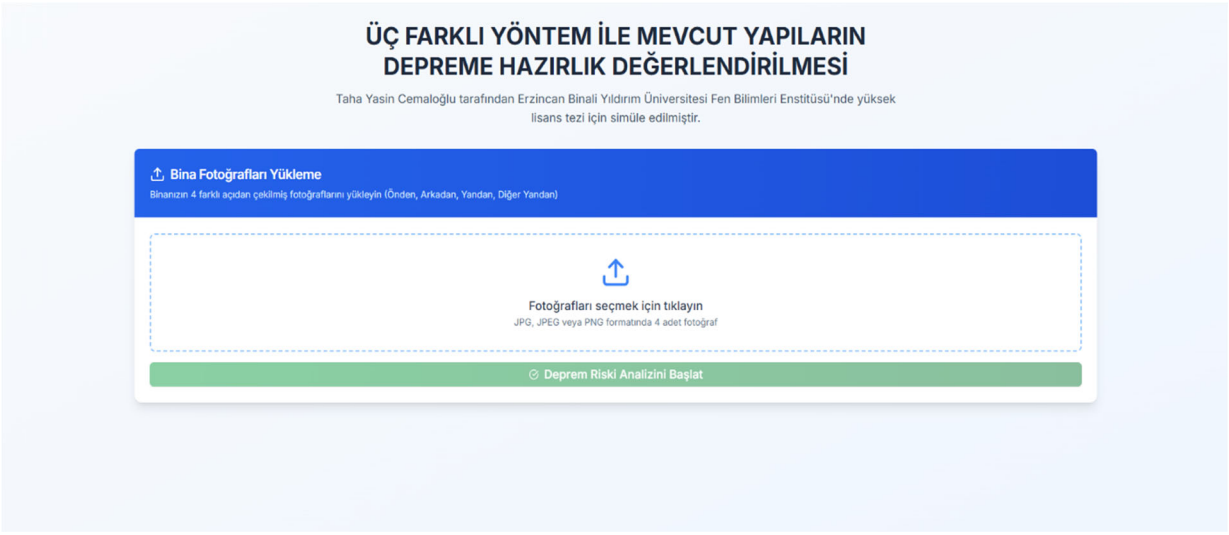


Figure 1. The Software Interface

In the second phase, the photographs of the building taken from four perspectives are uploaded to the system, as shown in Figure 2.

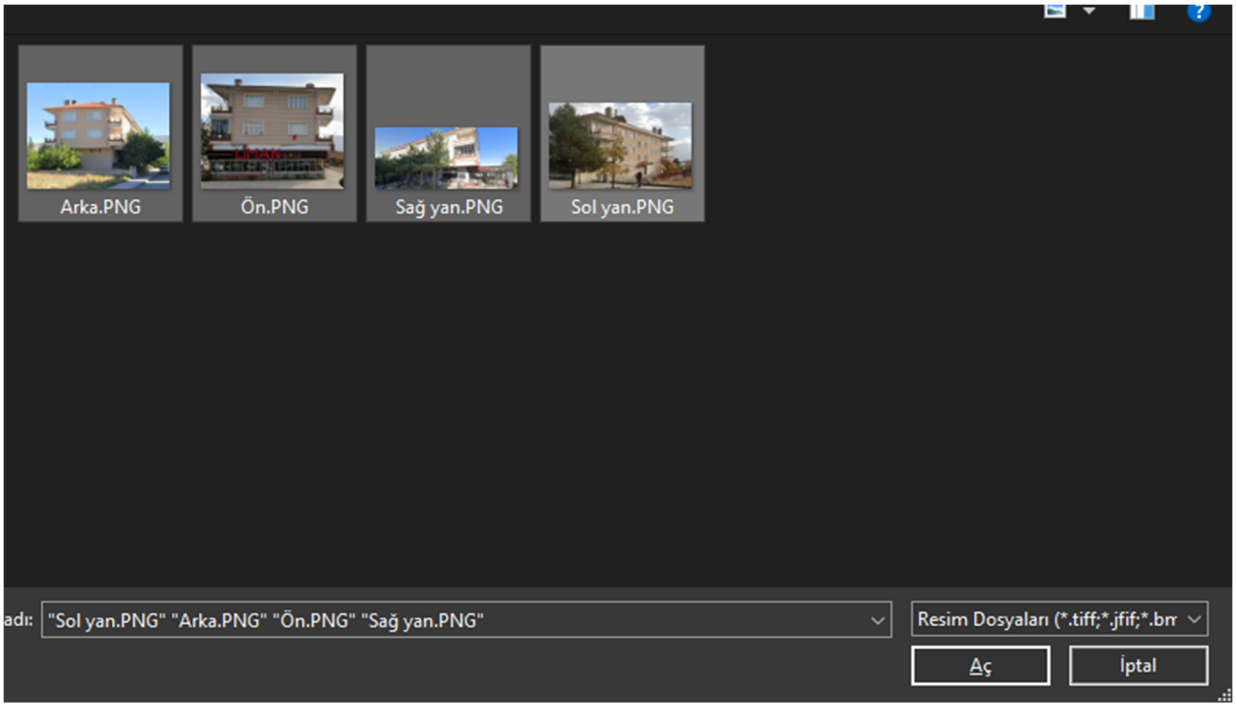


Figure 2. Uploading Building Photographs to the System

In the third phase, the "Start Earthquake Risk Analysis" option, which is inactive before uploading the photographs, becomes active and starts glowing green, as seen in Figure 3.

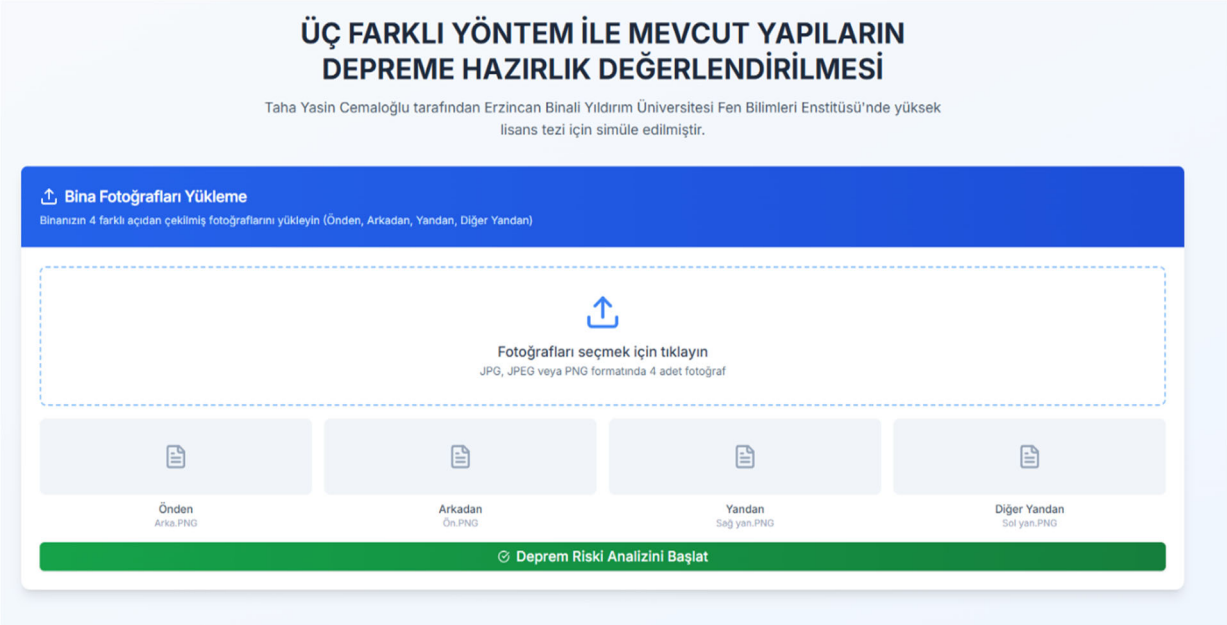


Figure 3. The System Ready for Analysis

In the fourth phase, the "Start Earthquake Risk Analysis" option, now activated, is clicked, and the analysis is initiated, as shown in Figure 4.

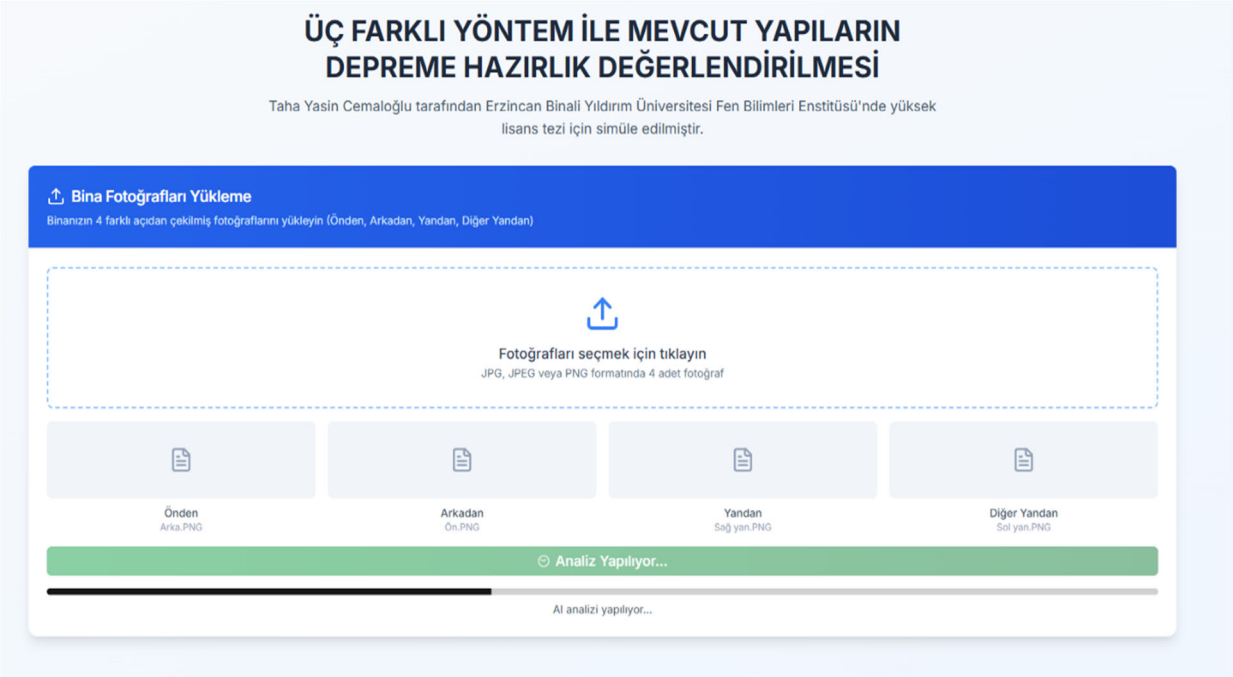


Figure 4. The Analysis Phase

In the fifth phase, the system prepares the analysis results obtained through three different methods, displayed in Figure 5, in separate tabs.

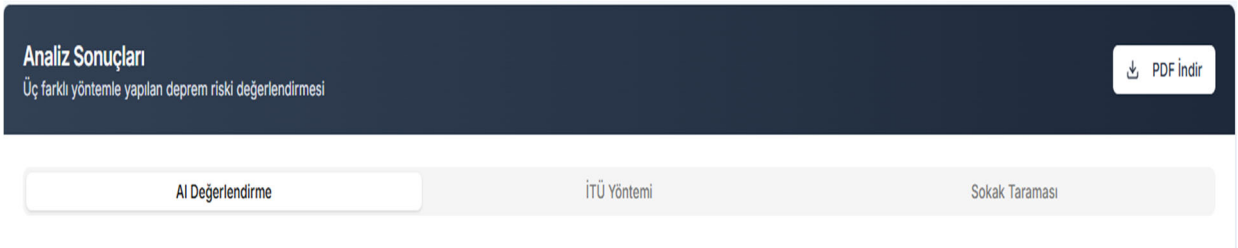


Figure 5. The Tabbed View of the Analyses

Each tab is labeled with the name of the analysis method. When clicking the AI Evaluation tab, as shown in Figure 6, the report of this analysis method is displayed. The AI Evaluation tab shows the report containing results of artificial intelligence-assisted visual analysis. This report presents the risk levels identified based on visual analysis of buildings in detail, according to the structural features. Additionally, the evaluation based on photographs is accompanied by insights and recommendations on building safety.

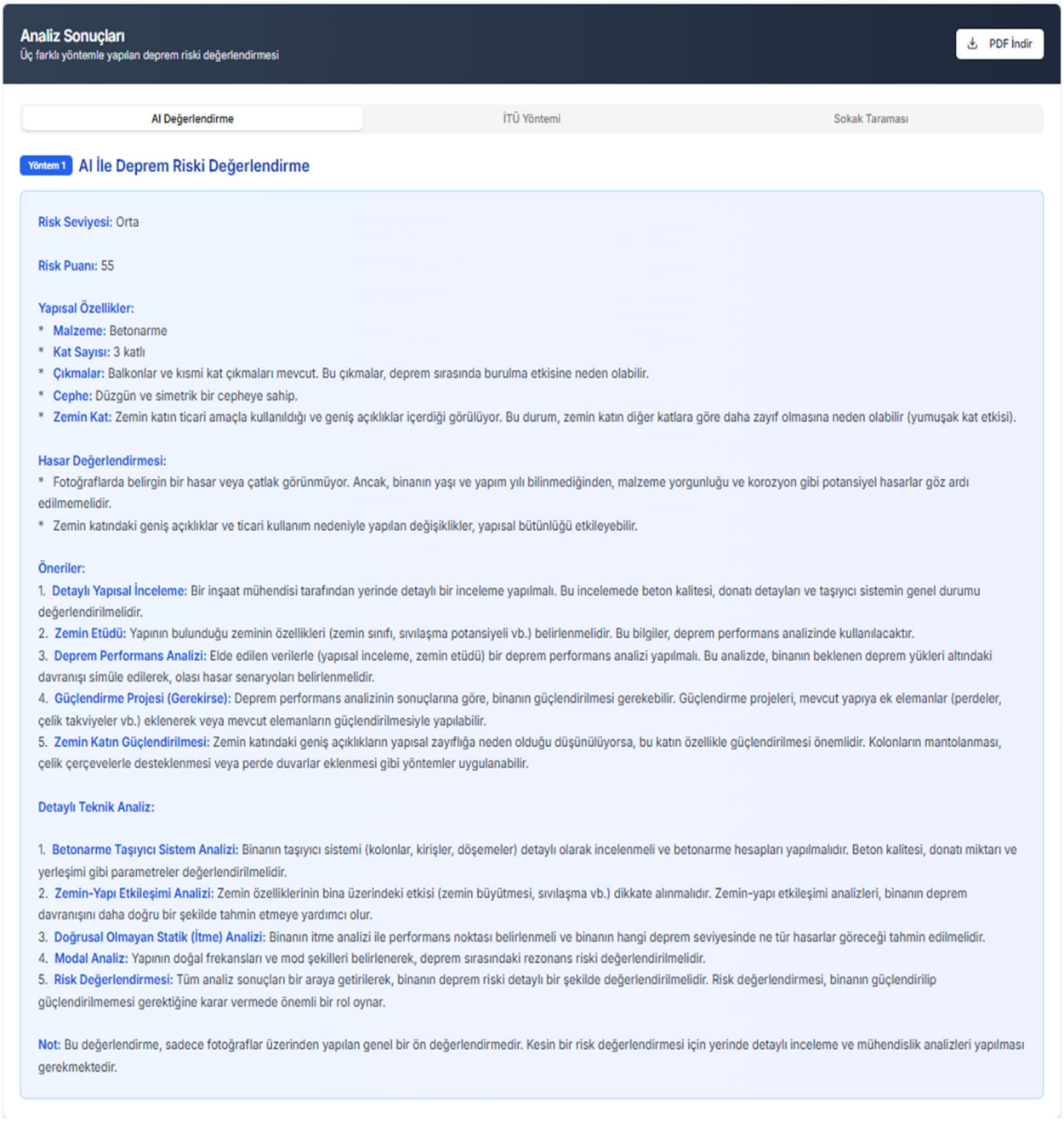


Figure 6. The AI Evaluation Method's Analysis Report

When clicking the ITU Method tab, as shown in Figure 7, the report of this analysis technique is displayed.

This analysis is based on a 12-question survey system developed by the ITU Alumni Association Bursa Branch.

The AI module correlates each survey question with the visual data extracted from the building photographs, performing automatic scoring and risk classification.

Each question covers critical parameters such as building age, number of floors, material type, basement presence, balcony projections, ground usage, and environmental conditions.

The total score determines the risk category (high, medium, or low), and accordingly, expert recommendations are automatically generated by the system.

Through this process, the system digitizes human-based field survey data, transforming it into an automated evaluation procedure and thus enabling the digital transformation of traditional street survey methodologies.

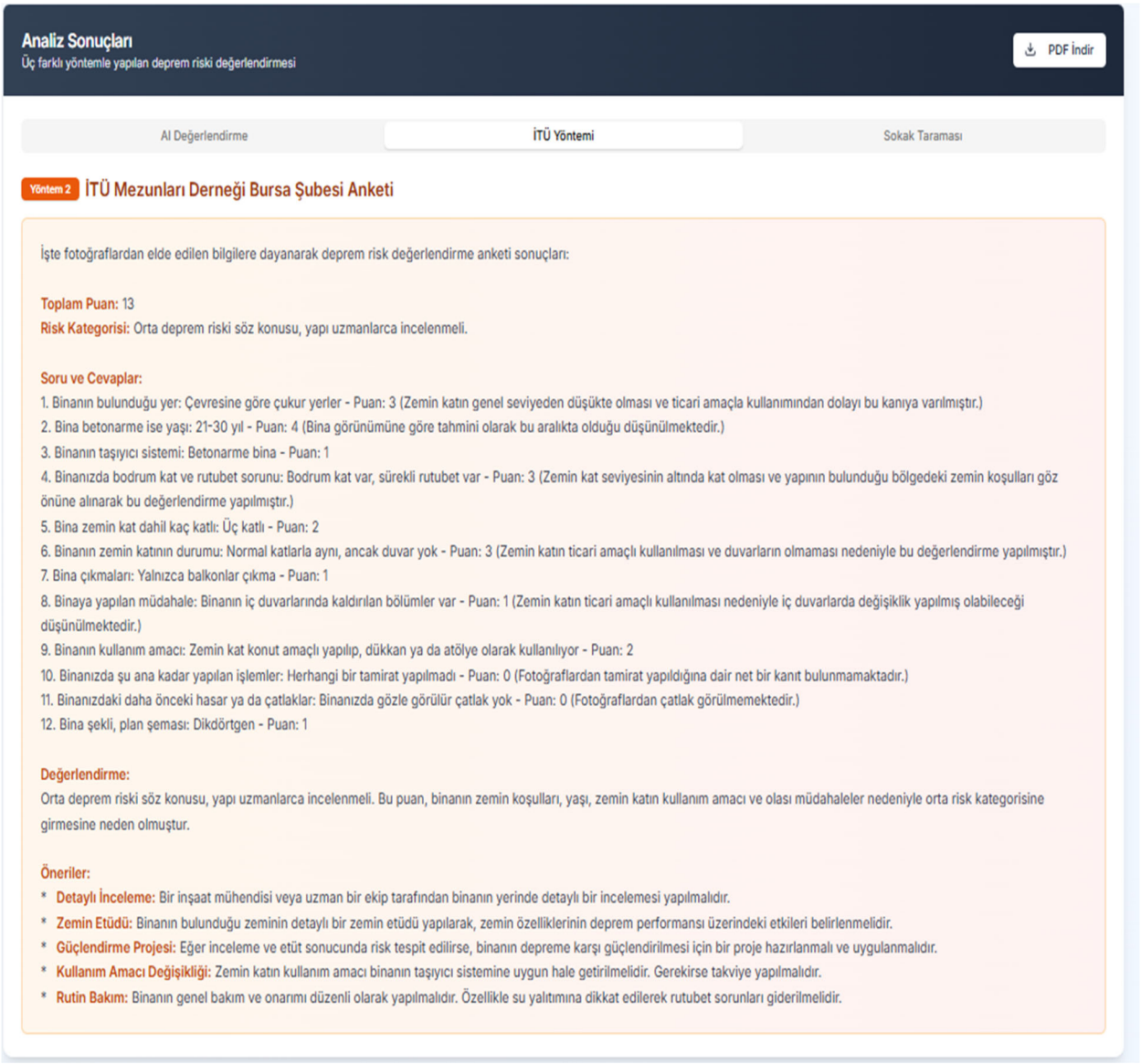


Figure 7. The ITU Method's Analysis Report

Erdoğan method is displayed, as shown in Figure 8.

This method is entirely based on visual and structural observations, using a scoring system that evaluates parameters such as basement presence, projection types, short column formation, building alignment, soft-story effects, and exterior quality.

For each parameter, the software uses photographic data to perform automatic scoring, and the final total risk score is calculated. The resulting value is classified (e.g., "moderate risk") and further interpreted in the structural assessment and recommendations section.

The outputs provide preliminary guidance for field engineers while also illustrating how soft-story behavior or unilateral projections can increase the overall risk score.

This analysis highlights the system's capability to digitally interpret visual field observations and support engineering decision-making in seismic risk assessment.

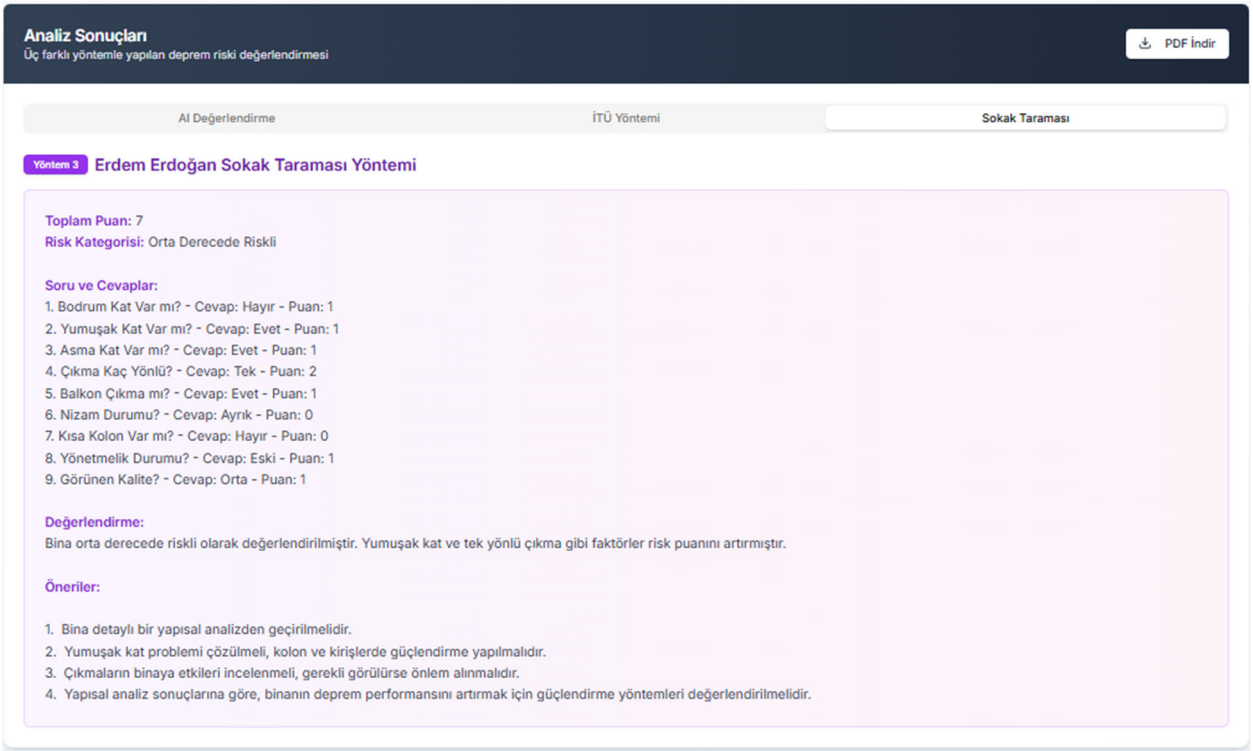


Figure 8. The Erdem Erdoğan Method's Analysis Report

CONCLUSION

Within the scope of this study, the developed software has introduced a new method and approach for field assessments by integrating both traditional and artificial intelligence–assisted techniques for evaluating the earthquake risk of existing buildings. Based on the analyses conducted on selected buildings in the city center of Erzincan, the developed system demonstrated successful performance in terms of speed, accuracy, and consistency.

The visual analyses performed through artificial intelligence exhibited a similarity ratio between 80% and 90% compared to human-based traditional street survey methods. This level of consistency indicates that the AI's visual processing and analytical capabilities can accurately identify building characteristics and produce results that closely align with conventional methods. The software's error margin, ranging between 5% and 15%, was found to be within an acceptable range, especially considering the human-induced errors present in traditional approaches, further supporting the reliability of the system.

A noteworthy advantage of the developed software system is its significant time efficiency. While the evaluation of ten buildings through traditional methods takes several hours on average, the proposed software can analyze the same number of structures in approximately ten minutes, provided that the photographs are available. This finding demonstrates that the system can provide valuable support in rapid preliminary assessments of large-scale urban areas.

The results indicate that integrating this AI-assisted software system with traditional street survey methods can substantially reduce the dependence on manual labor and accelerate the entire evaluation process. Consequently, building inventory updates, earthquake risk analyses, and pre-disaster planning activities can be conducted much faster than under conventional conditions.

In conclusion, this study presents a concrete example of the practical applications of software and artificial intelligence in civil engineering. The developed system shows potential for effective use in future studies involving building classification, damage detection, and regional seismic risk mapping.

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