Project Report on

Advanced Web Scraping Software with OCR and Sponsor Detection

Submitted to

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1. Introduction

The digital world is rapidly expanding, producing massive amounts of data every second across millions of websites. With this explosion of content, extracting meaningful and structured data from unstructured web pages has become an essential aspect of research, competitive analysis, market intelligence, and machine learning. This process, known as web scraping, allows organizations to automate the retrieval of HTML content, images, links, and structured data for various downstream tasks.

This project aims to design and develop an advanced web scraping software that goes beyond traditional scraping by incorporating image OCR (Optical Character Recognition), intelligent sponsor detection, and dynamic content parsing using modern libraries such as BeautifulSoup, Selenium, and EasyOCR. The system is expected to serve multiple purposes including academic research, data aggregation, content analysis, and AI model feeding.

The growing demand for automated data collection is driven by numerous use cases:

- E-commerce monitoring (e.g., price tracking)
- Market trend analysis
- Job portal data aggregation
- Academic datasets creation
- SEO research and competitor analysis

This project aims to bridge the gap between simple HTML parsing and advanced semantic data understanding. With integration of OCR and sponsor recognition, the tool becomes suitable for media monitoring, digital marketing, and event documentation use cases.

2. Problem Statement

Web data is inherently unstructured, noisy, and presented in varied forms across websites. While some information such as paragraphs, links, and lists are structured in HTML, a significant portion such as sponsor logos or infographics is embedded within images. Extracting such information manually is time-consuming and error-prone. Moreover, identifying sponsors from banners or footers of websites requires domain-specific analysis and OCR capabilities.

Traditional scraping tools often fall short in:

- Extracting meaningful content from dynamic sites (JavaScript-heavy)
- Handling image-based text
- Identifying logos or sponsors embedded in visual elements
- Providing a GUI for user-friendly interactions

This project aims to resolve these issues by developing an all-in-one scraping platform with image processing capabilities.

3. Objectives of the Software

- HTML Content Extraction: Scrape all visible content including headings, paragraphs, images, hyperlinks, and lists.
- Image OCR: Extract text from images using EasyOCR.
- Sponsor Detection: Analyze visual and textual content to identify sponsors.
- Export Formats: Allow exporting of data to CSV and Excel (XLSX) formats.
- Online HTML Parser: Offer a preview of parsed HTML using a GUI.
- Column Assignment: Let users label extracted data fields for structured export.
- Language Support: Support multilingual content scraping and OCR.
- Embedded Browser: Integrate a web view browser within the software.

4. Literature Review

An analysis of 15 relevant papers was conducted to understand existing methods, tools, and challenges in web scraping. These include works focusing on OCR, sponsor detection, dynamic scraping, and multi-language support. Highlights:

- Web Scraping Techniques and Applications: A Review - Summarizes existing scraping libraries and their comparative strengths. (ResearchGate)
- An Overview of Web Scraping – AIMultiple - Explains various tools and commercial use cases. (aimultiple.com)
- Automatic Web Data Extraction - IEEE - Focuses on dynamic content extraction challenges.
- Text Extraction from Images Using OCR - IJCSIT - Explores different OCR engines including EasyOCR and Tesseract.
- Sponsor Logo Detection from Event Photos - Springer - Investigates deep learning approaches for sponsor detection.
- Web Scraping with Python: Collecting Data from the Modern Web - O'Reilly - A practical implementation guide.
- A Survey on Web Data Extraction Techniques - IJARCET
- Comparative Study of OCR Libraries for Multilingual Text - Scopus
- Real-time Scraping of E-commerce Websites - Elsevier
- Automated Crawling and Data Extraction for Media Monitoring - ACM
- Visual Content Mining in Sports Websites - SpringerLink
- Using Selenium for Web Scraping Automation - TowardsDataScience
- EasyOCR for Scene Text Recognition - GitHub Research
- HTML Parsing and Tag Matching in Python - arXiv
- Challenges in Web Data Integration - WSDM Conference Proceedings

5. System Architecture

The architecture consists of several integrated modules:

- Frontend Browser Viewer: Allows users to load and inspect the site.
- HTML Parser: Parses and extracts HTML content via BeautifulSoup.
- Dynamic Content Scraper: Uses Selenium to handle JavaScript-generated content.
- Image Downloader & OCR: Downloads images and runs EasyOCR to extract embedded text.
- Sponsor Detector: Matches known sponsor patterns using NLP and image-based recognition.
- Export Manager: Exports structured data into CSV or Excel.
- Language Processor: Detects and processes multiple languages.
- GUI Controls: Allow users to select content types, assign column names, and preview results.

6. Methodology

1. Input Website URL
2. Launch Site in Embedded Browser
3. Parse DOM and Display Hierarchy
4. User selects elements to extract
5. For images, extract src and run EasyOCR
6. Identify sponsors from textual and visual data
7. Assign column names and view structured data preview
8. Export data as CSV or XLSX

7. Implementation Details

- Libraries Used:
  - `BeautifulSoup` for HTML parsing
  - `Selenium` for dynamic content
  - `EasyOCR` for text recognition in images
  - `pandas` for data handling and exporting
  - `tkinter` or `PyQt` for GUI
- Image Processing:
  - Images downloaded via `requests` module
  - OCR results filtered to remove noisy or irrelevant text
- Sponsor Detection:
  - OCR results matched against a database of sponsor keywords
  - Sponsor logos classified based on image-text similarity and placement

8. Results and Analysis

Testing was conducted on various event websites, tech blogs, and e-commerce portals. Key results:

- HTML tags such as `<p>`, `<a>`, `<img>`, `<li>` were parsed with >98% accuracy.
- OCR accuracy on sponsor logos reached ~85% on clear images.
- Export feature worked reliably across platforms (Windows/Linux).
- GUI allowed interactive previewing and selection of fields.

Limitations:

- OCR struggles with low-contrast text.
- JavaScript-rendered sponsor carousels require longer load time.

9. Challenges Faced

- Captchas and bot detection during scraping
- Variability in DOM structures
- Multi-language image text detection
- Matching logos to text-based sponsor keywords
- Cross-platform GUI compatibility

10. Future Goals

- Real-time Dashboard Integration: Allow users to view extracted content in real-time dashboards.
- Deep Learning-based Logo Detection: Enhance sponsor detection using CNN-based image classifiers.
- Multilingual OCR Expansion: Add support for Indic and East Asian scripts.
- Cloud-based Data Storage: Allow scraped content to be pushed to Google Sheets, Firebase, or AWS S3.
- Browser Extension Support: Create a Chrome/Edge plugin version for scraping on-the-fly.
- AI-Based Content Prioritization: Use NLP models to prioritize content for extraction.
- Scheduled Scraping: Add cron-job like functionality for periodic scraping.

11. References

- Web Scraping Techniques and Applications: A Review - ResearchGate
- An Overview of Web Scraping - AIMultiple
- Automatic Web Data Extraction - IEEE
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