

# Designing and Evaluating a Real-Time Heatmap Based Web Analytics Tool

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## Abstract

In the contemporary digital landscape, understanding user behavior on websites is crucial for businesses to optimize user experience and drive growth. Heatmaps have become an essential tool for visualizing user interactions, but existing tools are often limited in real-time capabilities and affordability for small to medium-sized enterprises. HeatGen addresses these gaps by providing an open-source platform with real-time analytics, scalability, and customizable features. The architecture combines a React SDK, Flask and Node.js servers, and a Next.js dashboard, enabling instantaneous insights into user behavior. Extensive testing has validated its efficiency, while user feedback highlights its practicality and potential. This paper explores HeatGen's development, implementation, and transformative impact on web analytics, paving the way for further innovations in real-time data visualization.

**Keywords:** Heatmap , Statistical analysis

## 1. Introduction

### Background:

Websites are essential for customer engagement. However, understanding user interactions is often a challenge due to expensive and limited analytics tools.

### Objectives:

1. Provide a real-time, open-source heatmap analytics tool.
2. Enhance decision-making through actionable insights.

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3. Offer scalability and flexibility for businesses of all sizes.

### **Problem Statement:**

Existing heatmap tools are either cost-prohibitive or lack real-time capabilities, making them inaccessible for small enterprises. HeatGen addresses these challenges.

## **2. . Literature Review**

Heatmap Technologies: Overview of visual data representation tools.

Real-Time Analytics: Use of technologies like WebSockets and in-memory computing for instant insights.

Open-Source Web Analytics: Comparison with tools like Matomo and Open Web Analytics.

Gaps Identified: Lack of real-time features and high costs in existing tools.

## **3. System Architecture**

Components:

1. React SDK: Captures user interactions such as clicks and scrolls.
2. Flask Server: Handles data preprocessing and statistical analysis.
3. Node.js Server: Manages backend data processing and scalability.
4. Next.js Dashboard: Displays real-time visualizations like heatmaps and user paths.

Workflow:

Data flows seamlessly from SDK to the Flask server, processed by Node.js, and visualized on the dashboard.

System Diagram: Includes user interaction data flow, data preprocessing, and visualization components.

## **4 . Methodology**

The system uses:

- React for SDK development.
- Flask and Pandas for statistical analysis.
- WebSockets for real-time data communication.
- Next.js for dashboard design.

#### 4. Results and Discussion

HeatGen demonstrated high performance:

- Data collection latency: ~50ms.
- Flask server processed 10,000 requests/second.
- Node.js handled 5,000 data points/second.

User feedback praised its ease of integration and real-time insights, while suggesting UI enhancements.

#### 5. Challenges and Limitations

Challenges included ensuring scalability and security. Limitations involved the absence of predictive analytics and a need for improved documentation.

#### 6. Future Work

Integrate predictive analytics for trend forecasting.

Enhance UI/UX for a more intuitive experience.

Expand scalability for enterprise-level traffic.

#### Conclusion

HeatGen is a transformative tool in web analytics, offering real-time heatmap visualization and actionable insights. Its open-source, scalable architecture makes it accessible for businesses of all sizes. With planned enhancements, HeatGen has the potential to set new benchmarks in web analytics.

#### References

1. **Smartlook**, "A guide to heat maps for website and mobile app analytics," [Online]. Available: <https://www.smartlook.com>. [Accessed: Oct. 23, 2024].
2. **Amplitude**, "What Are Heatmaps? 101 Guide," [Online]. Available: <https://www.amplitude.com>. [Accessed: Oct. 23, 2024].
3. **Splunk**, "Real-Time Analytics: Definition, Examples & Challenges," [Online]. Available: <https://www.splunk.com>. [Accessed: Oct. 23, 2024].
4. **Verfacto**, "What is Real-Time Data Analysis How It Works + Examples," [Online]. Available: <https://www.verfacto.com>. [Accessed: Oct. 23, 2024].

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5. **PostHog**, "The 12 best open source analytics tools you can self-host," [Online]. Available: <https://posthog.com>. [Accessed: Oct. 23, 2024].
6. **Opensource.com**, "Top 5 open source alternatives to Google Analytics," [Online]. Available: <https://opensource.com>. [Accessed: Oct. 23, 2024].
7. **Zoho PageSense's** Heatmap helps you understand how visitors interact with your website. You can track visitor clicks, how far down they scroll, and which parts of the website they spend the most time on.
8. **Mouseflow** tracks click mouse movement, forms, scrolls, and more. It shows an anonymized recording of the activity from each visitor on your site. This heatmap generator measures form errors, blank submissions, and more. You can integrate this tool with HTML, WordPress, Drupal, Joomla, Magento, Shopify, and more.
9. **Lucky Orange** is a heat map software that allows you to see how many people are on your website currently. You can compare historical statistics and see what keywords, languages, locations, mobile users, etc., are driving traffic on your website

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