

Beyond Code: Tackling Limitations in Website Builders with Sketch-to-Code and Alternative Tools



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We can update existing **viewport-aware frontend user interfaces (UIs)** with a **partial design / wireframe** using **Vision Large Language Models (VLLMs)**.

1. Introduction & Motivation

Definition

Website builders are solutions that enable designing, publishing and managing websites **without having to use code**.



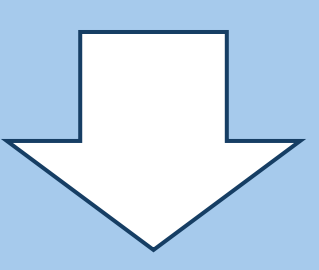
Drag-and-drop editor




UI generation with prompts / designs

Methodology

1 Identify Limitations




2 Verify Feasibility & Implement Solutions




User Survey

Collect novice and expert user input



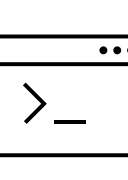
Case Study

Implement real-world business requirements in Wix



Experiments

Test feasibility of UI generation with partial design



Implementation

Implement solutions as a proof-of-concept (on top of GrapesJS)

2. Identified Limitations & Proposed Solutions

Difficulties in Customisation

- UI generation with designs
- Plugins-of-plugins system

Poor Documentation

- Auto generation of documentation
- Release source code (Open source)

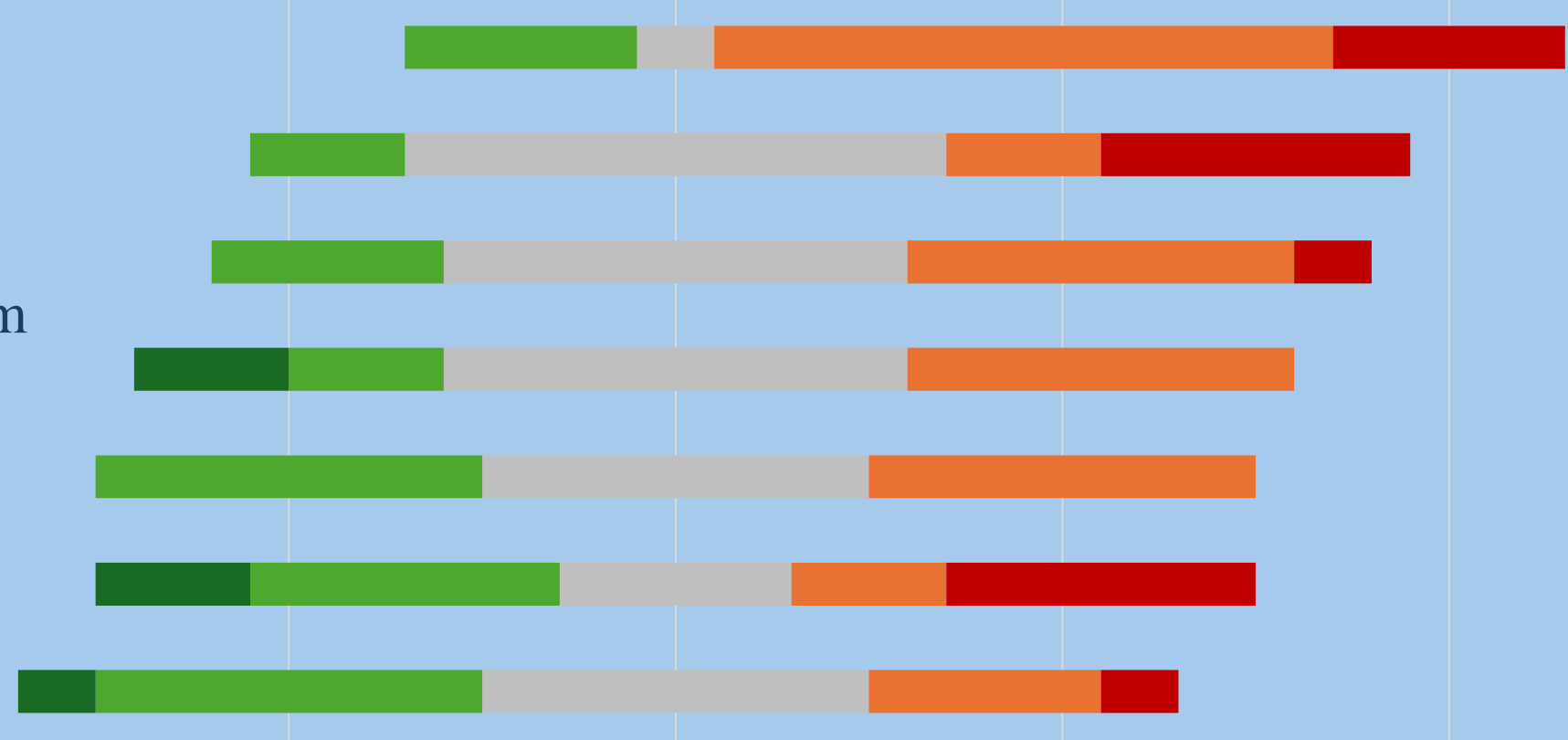
Lack of Versioning Tools

- Git integration
- Take snapshots of UIs and contents

Evidence


How significant or not significant are the following limitations in your experience with website builders?

- Not a Problem
- Minor Problem
- Moderate Problem
- Major Problem
- Critical Problem




Top 3 Requested Features:
Live Collaboration, Version Control, Sketch-to-Code

- Customisation
- Editing Experience
- History Tracking
- Documentation
- Tools Integration
- Vendor Lock
- Performances



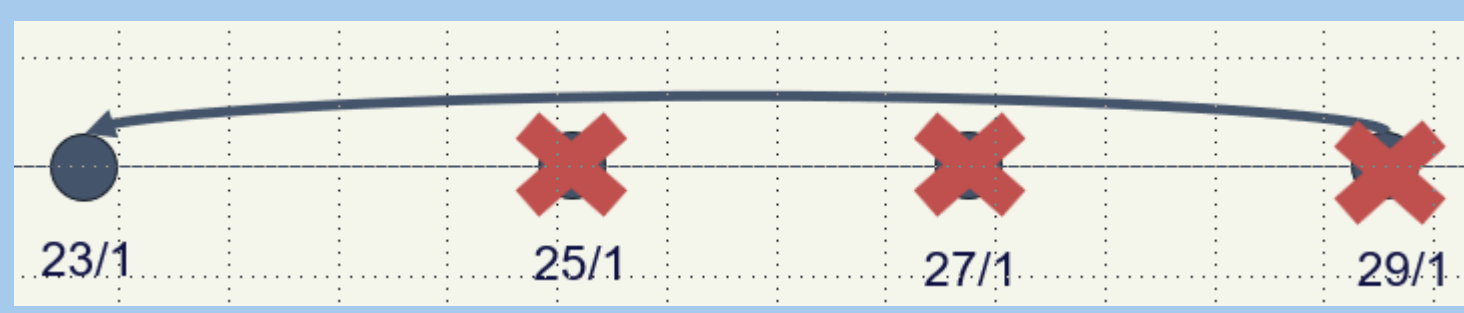
Unsupported scroll bar design



A versioning tool that track UI changes but not content in Content Management System (CMS)

```
variables: {...} json Table Copy JSON
values: Array(3) json Table Copy JSON
0: {...} json Table Copy JSON
  choices: Array(1) json Table Copy JSON
    0: "[Object]"
  price: {...} json Table Copy JSON
    value: "1125"
    currency: "SGD"
    _id: "4d88757b-95ba-4fb5-a38e-ef44dacc2d92"
```

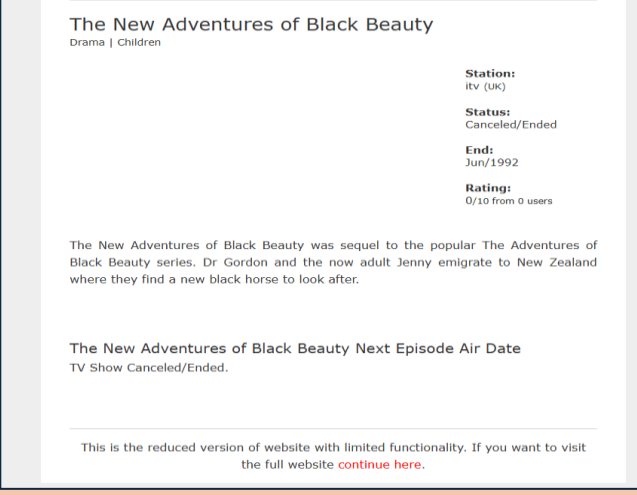
Erroneous API responses without documentation



Snapshots that are deleted after reverting

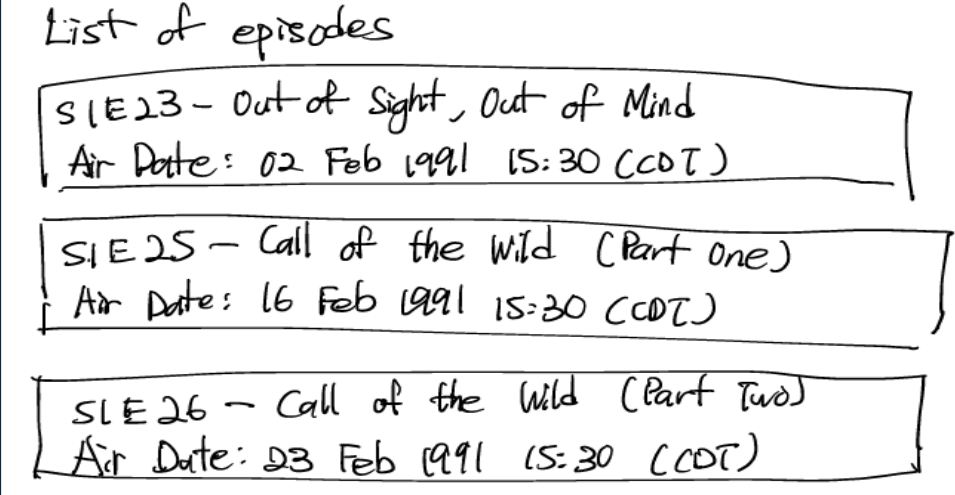
3. Experiments: UI Generation with Partial Design

- 1. Passing only the partial design / wireframe is a valid approach.
- 2. Commercial models outperform open-source models.
- 3. Generated UI remains responsive, given it is responsive before updates..



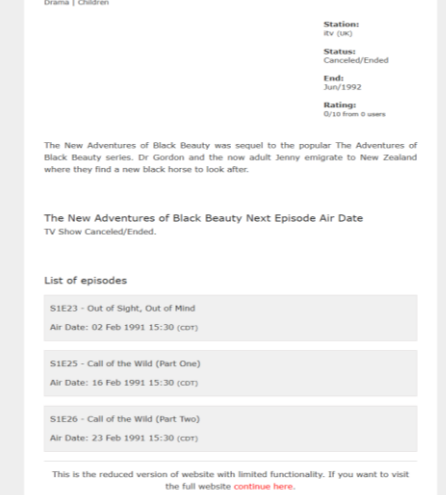
Initial UI

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Partial Design To Be Merged

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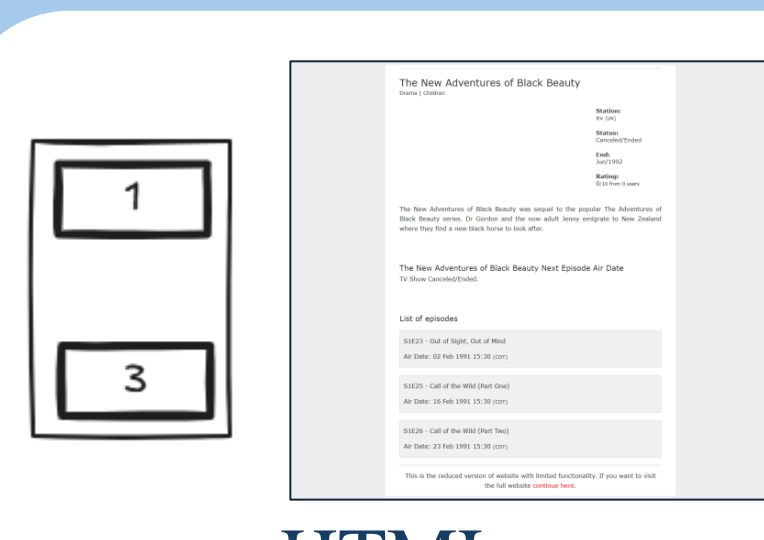
Updated UI

A. Data Preparation

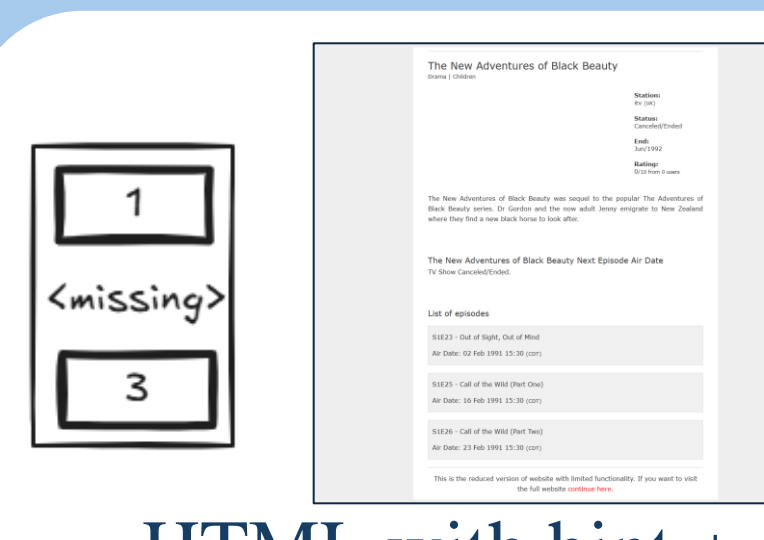
(1) Data Collection: WebCode2M Dataset, ≤ 2048 Tokens, x Illegal / Explicit Data

(2) Data Preparation: Take a screenshot, Extract, Screenshot of Original HTML, Screenshot of Removed Components, Remove unused CSS, Partial HTML


B. Prompting Methods




HTML + Entire design



HTML with hint + Entire design



HTML with hint + Partial design (in fixed size)



HTML with hint + Partial design (in varied sizes)

C. Evaluation & Results

Evaluation Metrics:

- High-level visual similarity
 - CLIP Embedding
- Low-level element matching
 - Block Similarity
 - Text Similarity
 - Position Similarity
 - Colours Similarity

Models	Prompting	Block	Text	Position	Colours	CLIP
Gemini2: 77b	Merging	0.534	0.887	0.731	0.803	0.868
	Merging with Hint	0.423	0.799	0.682	0.764	0.872
	Fixed-sized with Hint	0.522	0.871	0.756	0.8	0.873
	Varied-sized with Hint	0.45	0.808	0.669	0.745	0.873
Gemini3: 27b	Merging	0.649	0.926	0.761	0.757	0.87
	Merging with Hint	0.526	0.844	0.694	0.72	0.866
	Fixed-sized with Hint	0.491	0.842	0.698	0.726	0.868
	Varied-sized with Hint	0.49	0.861	0.727	0.768	0.864
Llama3.2-vision:11b	Merging	0.367	0.843	0.638	0.739	0.867
	Merging with Hint	0.326	0.776	0.618	0.649	0.849
	Fixed-sized with Hint	0.36	0.8	0.605	0.713	0.857
	Varied-sized with Hint	0.324	0.723	0.588	0.598	0.84
Llama3.2-vision:90b	Merging	0.345	0.837	0.617	0.673	0.838
	Merging with Hint	0.336	0.805	0.631	0.684	0.855
	Fixed-sized with Hint	0.305	0.829	0.647	0.701	0.854
	Varied-sized with Hint	0.299	0.702	0.515	0.596	0.852
GPT-4o	Merging	0.891	0.983	0.898	0.9	0.935
	Merging with Hint	0.897	0.984	0.881	0.95	0.935
	Fixed-sized with Hint	0.961	0.983	0.944	0.975	0.96
	Varied-sized with Hint	0.98	0.985	0.944	0.973	0.961
Gemini-2.0-flash	Merging	0.965	0.984	0.918	0.952	0.948
	Merging with Hint	0.967	0.983	0.92	0.961	0.952
	Fixed-sized with Hint	0.95	0.985	0.941	0.969	0.961
	Varied-sized with Hint	0.94	0.984	0.946	0.971	0.961
Grok-2-vision	Merging	0.842	0.976	0.86	0.886	0.914
	Merging with Hint	0.849	0.972	0.857	0.883	0.912
	Fixed-sized with Hint	0.91	0.973	0.933	0.967	0.957
	Varied-sized with Hint	0.964	0.983	0.936	0.953	0.954

4. Implementation

Implemented UI generation with full and partial design / wireframe, plugins-of-plugins system and auto generation of documentation.

Available @ boonhianlim.github.io/beyond-code/demo