# AI-Musical Keyboard (Pro-Synth): A Web-Based Intelligent Digital Audio Workstation

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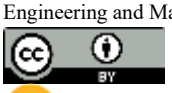

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## Abstract—

Artificial Intelligence and browser-based multimedia technologies are transforming digital music production and interactive entertainment. This paper presents AI-Musical Keyboard (Pro-Synth), a lightweight web-based intelligent musical keyboard developed using HTML5, CSS3, JavaScript ES6, Web Audio API, Canvas API, and MediaRecorder API. The proposed system enables real-time digital sound synthesis directly within modern web browsers without requiring dedicated hardware or external software installations. The platform supports multiple virtual instruments including Acoustic Grand Piano, Organ, Harmonium, and Indian Sanai using Frequency Modulation (FM) synthesis, waveform manipulation, harmonic layering, and Low-Frequency Oscillator (LFO) modulation. The system also supports polyphonic playback, live audio visualization, recording, and downloadable audio export. AI-inspired functionalities such as chord suggestion, harmonic assistance, adaptive note highlighting, and pattern analysis improve musical learning and interaction. Experimental analysis demonstrates low-latency audio generation with efficient browser compatibility and lightweight offline-capable performance.

The abstract must be written in a concise, objective, and reader-friendly manner so that it can stand alone as a complete overview of the paper. It should accurately reflect the core contribution and novelty of the research without including unnecessary background information or overly detailed explanations. Avoid the use of citations, references, figures, or tables in the abstract, and do not include undefined abbreviations or technical jargon that may limit readability for a broader academic audience.

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Keywords— Artificial Intelligence; Web Audio API; Digital Audio Workstation; FM Synthesis; Polyphonic Playback; Browser-Based Synthesizer


## I. INTRODUCTION

The evolution of music technology has transformed digital music production and interactive entertainment. Traditional Digital Audio Workstations required expensive hardware and software installations. Modern browser technologies now support real-time multimedia processing using browser-native APIs. The proposed AI-Musical Keyboard (Pro-Synth) integrates Web Audio API and AI-inspired functionalities to create a lightweight browser-based digital synthesizer capable of real-time sound generation, recording, and intelligent harmonic assistance.

## II. LITERATURE REVIEW

Several browser-based music production systems such as BandLab and Soundtrap provide online music creation platforms. However, these systems rely heavily on cloud infrastructure and internet connectivity. Research on the Web Audio API demonstrates that modern browsers are capable of performing advanced digital signal processing tasks with low latency. The proposed system differs by focusing on lightweight offline-capable client-side audio synthesis with AI-inspired interaction.

## III. METHODOLOGY

The proposed system was developed using HTML5, CSS3, JavaScript ES6, Web Audio API, Canvas API, and MediaRecorder API. The architecture follows an event-driven workflow. Keyboard events are captured through JavaScript, mapped to corresponding frequencies, and processed using OscillatorNodes and GainNodes. ADSR envelopes control amplitude behavior, while AnalyserNodes provide waveform visualization. The MediaRecorder API captures generated audio streams and exports them in downloadable formats.

## IV. RESULTS AND DISCUSSION

Experimental testing demonstrated successful real-time sound synthesis with low audio latency across modern browsers including Google Chrome, Microsoft Edge, Mozilla Firefox, and Safari. The system successfully supported polyphonic playback, audio visualization, live recording, and downloadable export functionality. FM synthesis generated realistic piano tones, while harmonic layering and LFO modulation improved overall sound quality. The lightweight JavaScript architecture reduced resource consumption while maintaining efficient responsiveness.

Table I: Example Table Title

| Column 1 | Column 2 | Column 3 |
|---|---|---|
| Data A | Data B | Data C |

## V. CONCLUSION

The AI-Musical Keyboard (Pro-Synth) successfully demonstrates the potential of modern browser technologies in building lightweight intelligent multimedia applications. The integration of Web Audio API and AI-inspired harmonic assistance enabled the development of an efficient browser-based digital synthesizer with real-time audio processing capabilities. Future improvements may include MIDI integration, advanced DSP effects, machine learning-based melody generation, and multi-track sequencing.

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