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AI-Assisted Grid-Based Music Sequencing A Study Using Tenori-Off

ANISHASHARAN[1], Mrs. Tejaswini A[2]

[1] MCA Student, PES Institute of Technology and Management, Shivamogga, Karnataka, India.

[2] Asistant Professor, Dept of MCA, PES Institute of Technology and Management, Shivamogga, Karnataka, India.

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Abstract - This paper introduces an interactive AI-based music generation system built using the Tenori-Off project. Inspired by Yamaha's Tenori-On, this system allows users to create melodies and rhythms using a visual grid interface. Each grid cell represents a musical note or drum sound, and when activated, it plays automatically in sequence. This project helps beginners understand how sound, timing, and AI can combine to produce creative musical patterns in real time. Additionally, the system leverages machine learning algorithms to suggest harmonious note combinations and rhythmic variations. It serves as both an educational tool and a creative platform for exploring generative music through AI interaction.

Keywords: AI Music Generation, Machine Learning in Music, Melody and Rhythm Generation, Algorithmic Music Creation, Music Technology.

INTRODUCTION

Music has long been a powerful medium for creativity, and recent advances in artificial intelligence are reshaping how people compose and interact with sound. Auto Jam with AI introduces a browser-based system where users can create melodies and receive instant drum accompaniments generated through machine learning. The platform relies on a recurrent neural network trained on drum sequences. Its simple interface allows anyone—beginners or musicians—to experiment with ideas and build musical patterns. By observing the generated rhythms, users gain insight into how melody and percussion interact. The system demonstrates how AI can act as a creative collaborator rather than a passive tool. Ultimately, Tenori-Off showcases the potential of combining AI, music education, and accessible web technology.

LITERATURE SURVEY

- Roberts, A. (2021). Magenta.js: A JavaScript API for Augmenting Creativity with Deep Learning: Magenta.js demonstrates how deep learning models can run directly inside a browser using JavaScript. It explains tools for generating melodies, drums, and musical transformations in real time. From this work, I learned how browser-based machine learning can support interactive music creation without heavy dependencies.
- Thio, V. (2019). A Minimal Template for Interactive Web-based Drum Pattern Generation: The study presents a lightweight framework for generating drum patterns through web technologies. This helped me understand efficient ways to build responsive rhythm-generation tools for online platforms.
- Paqué, S. (2023). The Generation of Evolving Drum Sequences Using Artificial Intelligence: From this research, I learned techniques for designing AI systems that maintain musical flow while avoiding repetitive patterns.
- Yang, L. C., et al. (2017). MidiNet: A Convolutional GAN for Symbolic-Note Generation: This study taught me how adversarial learning can improve the quality and diversity of AI-generated music.
- Zhang, M., et al. (2025). Advancing Deep Learning for Expressive Music Composition: This work highlights the importance of capturing human nuances such as dynamics and phrasing. I learned how expressive modelling can elevate AI-generated music beyond simple rhythmic or melodic patterns.

METHODOLOGY

PROPOSED METHODOLOGY

1. User Input Capture: Users create or select a melody using the interactive grid interface.

   The system records note positions, timing, and duration in a structured format. This encoded input forms the basis for generating synchronized drum patterns.

2. Melody Preprocessing: The entered melody is quantized to a fixed time grid to ensure rhythmic accuracy. Pitch and timing are converted into numerical sequences suitable for model processing. This step standardizes the musical data before feeding it into the AI model.
3. Feature Extraction: Essential musical features such as intervals, note density, and rhythmic flow are extracted. These features help the model understand musical context beyond individual notes. By capturing structural patterns, the system produces more coherent drum outputs.

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4. RNN-Based Drum Generation: A recurrent neural network (RNN) predicts drum events based on the processed melody. The model uses learned temporal patterns to align drums with melodic emphasis points. Each time step generates kick, snare, or hi-hat events that match user input.
5. Post-Processing of Drum Output: Raw model predictions are mapped to instrument types and quantized for timing stability. Soft or low-confidence predictions are refined to avoid off-grid or irregular beats. The final sequence ensures musical consistency and clean rhythmic structure.
6. Audio Rendering: Tone.js and WebAudio API convert the melody and drum sequence into real-time audio. Drum hits and notes are assigned to sound samples that are triggered synchronously. This allows users to instantly hear the combined composition without delays.
7. User Interaction and Feedback Loop: Users can adjust melodies, tempo, or pattern length and immediately hear updated results. The system regenerates drum patterns with each change, enabling continuous refinement. This feedback loop encourages experimentation and enhances creative exploration.

DATA FLOW DIAGRAM

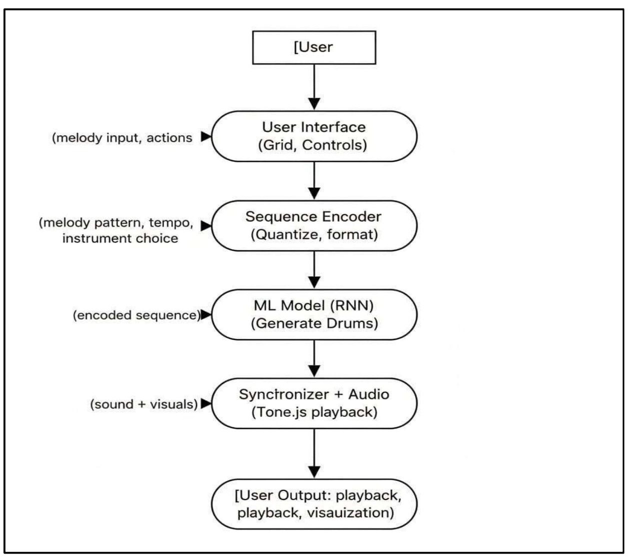

Fig 1. DFD Digram

Mathematical Formulation

The grid can be represented as a 2D matrix **G[m][n]**, where:

- **m** = number of notes (rows)
- **n** = number of beats (columns)

If **G[i][j] = 1**, the note at row *i* and beat *j* is active (played). Otherwise, **G[i][j] = 0** (silent).

The output sound at time *t* can be modeled as: $S(t) = \Sigma (G[i][j] \times A_i \times \sin(2\pi f_i t))$ where:

- **Ai** = amplitude of note *i*
- f_i = frequency of note *i*

 The sum runs over all active notes at time *t*.

This formula helps generate real-time sound waves for the selected notes.

1. Initialize grid G[m][n] with all cells set to 0.
2. Wait for user input — if a cell is clicked, set G[i][j] = 1.
3. Start the sequencer loop to play each column in sequence.
4. For each active note (G[i][j] = 1), play corresponding sound using Web Audio API.
5. AI module analyzes patterns and suggests variations.
6. Continue looping until the user stops playback.

EXPERIMENTAL RESULT

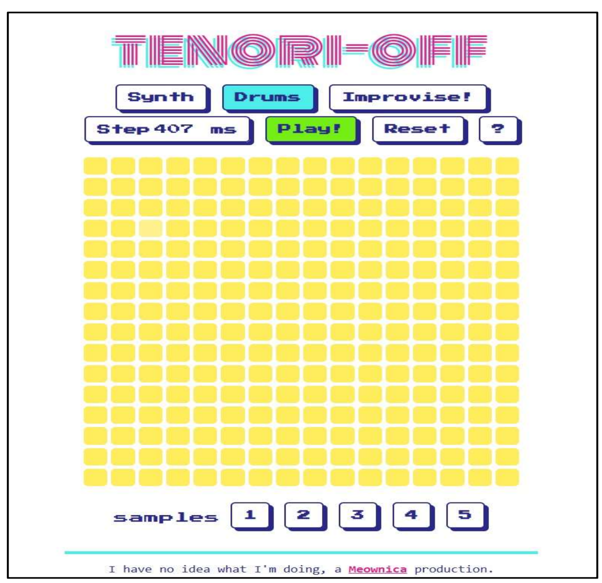

fig AI Music Grid

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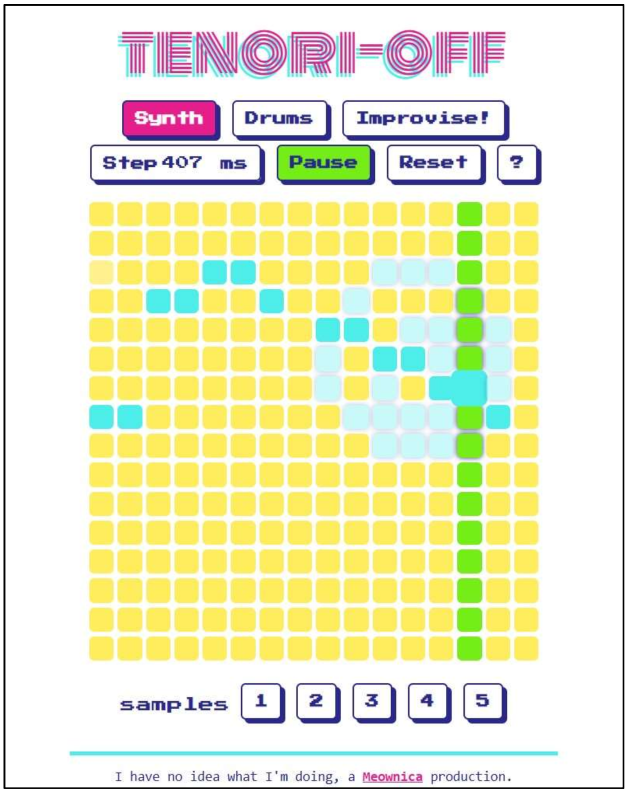

fig 3.Playing twinkle twinkle little star in synth

CONCLUSION

Auto Jam with AI represents a significant step forward in merging music education with artificial intelligence. By running entirely in the browser through Magenta.js, Tone.js, and WebAudio, it eliminates installation barriers and provides instant access to generative music tools. Its RNN-based drum model produces rhythm patterns that align with usercreated melodies, making musical exploration easier for beginners while offering creative freedom to advanced users. The platform demonstrates how collaborative human-AI interaction can support learning, creativity, and rapid experimentation. Overall, Tenori-Off makes rhythm creation more intuitive, accessible, and engaging for a wide audience.

FUTURE ENHANCEMENT

Future versions of Auto Jam with AI can expand its capabilities by supporting additional instruments such as piano, bass, and guitar. Integrating real-time MIDI input will allow musicians to connect external hardware directly to the system. Exporting music to WAV or MIDI formats can make the tool more useful for professional workflows. More advanced AI models—especially Transformers—can generate richer, more complex melodies and rhythms. Customization options like new sound packs, themes, and visual layouts will enhance user experience. Cloud saving and sharing features can encourage collaboration among musicians.

REFERENCES

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