Percussiano: a novel musical instrument that fuses sound and visuals

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***Abstract*—Percussiano is a unique musical instrument combining percussion and electronic interaction elements. Resembling a piano, it features four buttons, each activating a motor that spins an LED strip. The sound is produced by the LED strips hitting the floor, creating a rhythmic and visually captivating performance.**

I. Introduction / Background

Historically, the development of musical instruments has aimed at enhancing interactions and creating new sounds through the use of novel materials, technologies, and ergonomic features [1]. Additionally, creating new musical instruments can be driven by various motivations, including economic, social, and artistic factors, alongside the desire for creative expression [2]. Incorporating advanced technologies like 3D printing and LED strips can merge traditional designs with modern capabilities, allowing for improved aesthetics and personalisation [3], [4].

Moreover, constructing new musical instruments enables musicians and composers to explore new sound production methods, aligning with evolving artistic visions and the changing musical landscape [5]. By utilising innovative materials and manufacturing techniques, musicians can push the boundaries of instrument design and acoustics, creating unique instruments [6], [7].

A prototype of a new musical instrument designed to interact with its surroundings through sound and light is described here. Percussiano contains four moving luminous strips that hit the ground, therefore exploring how different materials, velocities and lengths of the strips influence sound dynamics and acoustic properties. This piano-inspired object also contributes to the field of experimental musical instruments by challenging traditional concepts of musical expression. Unconventionally combining light and sound opens new avenues for artistic exploration and creating novel music genres and performance styles.

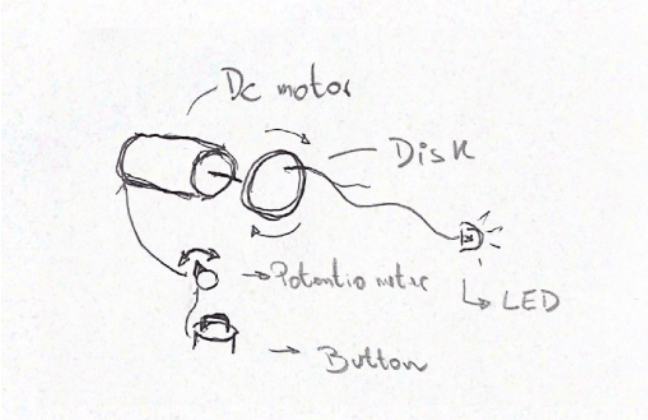
II. Related work

Musicology, particularly organology, has traditionally led the study of musical instrument design. This field focuses on the classification and science of musical instruments [8]. However, scholars from Science & Technology Studies (STS) have recently begun examining musical instruments as technological artefacts. They use technology dynamics and innovation theories to explore these instruments' development, transformation, and obsolescence. This interdisciplinary approach has introduced new perspectives on the evolution of musical instruments [8].

Practice-wise, the company Ableton showcased an array of inventors and their unique, tailor-made musical instruments [9]. The presentation provided an insightful look into the innovative and diverse range of instruments created by these inventors and how they could work—either connected to synthesisers or working analogically. Moreover, a significant inspiration for this device is Studio Zimoun, which specialises in creating architecturally minded platforms of sound using simple and functional components [10].

III. Imagined or existing prototype sketches/drawings/photos

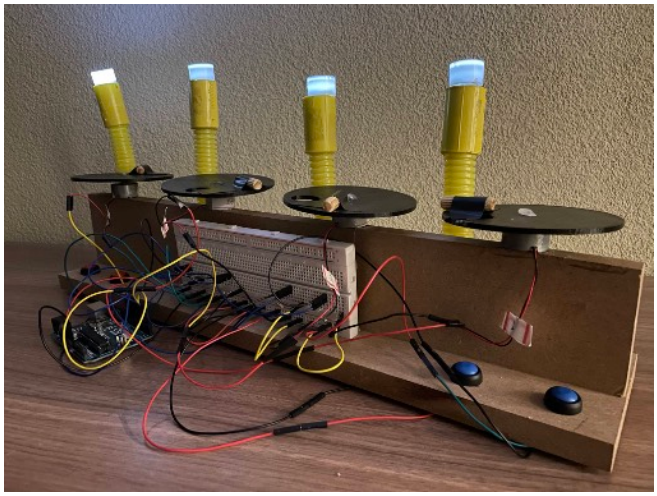
The figure below depicts a simplified diagram of how the system would work. Each button turns on a motor, making a disk spin. Attached to the disk is a piece of LED strip that also spins, making sounds by hitting the surface it is on. Potentiometers were thought to integrate the electric circuit so one could manage the motor speed.



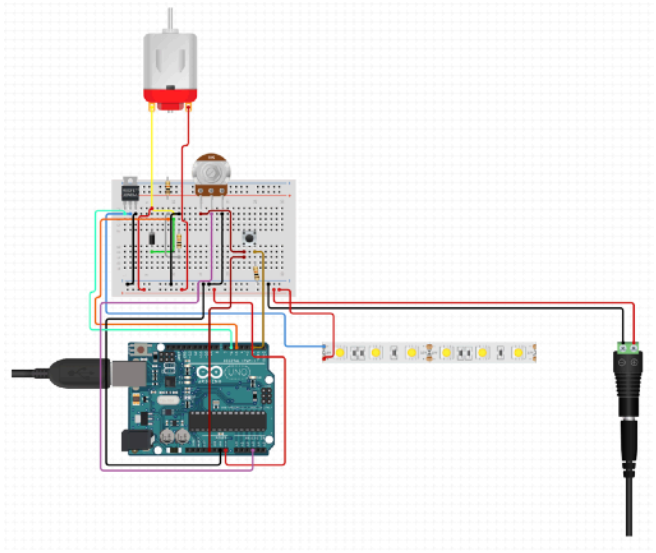
The first test of assembling the circuit, supported by a wooden stand, can be seen in the figure below. Please note that as no LED strips were available at that point, a plastic conduit was used instead, and on one end, there was a

single LED light. This test was unsuccessful since the motor was too weak to spin the entire structure.

The solution for this problem was detaching the conduit from the disk and using it as a stand piece. For this setup, the sound comes from the disks hitting the conduits, which were then filled with different materials. The figures below depict the object after these amends.



It is worth mentioning that at this stage, no potentiometer was used since the motor needed total power to hit the conduits without stopping. The figure below shows the diagram for the circuit, containing 10K Ohm resistors, a 1A 50V diode, an N-Channel MOSFET 60V 30A, a potentiometer 10K Ohm, a push button, a DC motor, an LED strip with external 12V power source and an Arduino Uno. These are the schematics for one component only and could be repeated to have more components assembled.



IV. Envisaged next prototype iteration

As mentioned before, the first prototype needs several improvements, such as integrating the LED strip, moving the setup to the horizontal position, and adding potentiometres. Moreover, it would be ideal to have the stand 3D-printed instead of wood.

V. Responsible innovation

This project aims to bring added value to society by providing a unique avenue for creative expression through a combination of sound and visuals. Its user-friendly design also makes it ideal for introducing children to the world of musical education. Notably, all the materials used in this project have been repurposed from scraps and spare parts

obtained from other projects, effectively promoting sustainability. Furthermore, the potential for 3D-printing the stand instead of wood offers an eco-friendly advantage, as the printing filaments are biodegradable, aligning with environmentally conscious practices.

VI. Author bio(s) / experiences

Graduated in Digital Design and having completed my master's degree in Interaction Design, I am a multidisciplinary artist who creates works to explore the intersections of culture, technology, and human experience. Drawing inspiration from my rich multicultural heritage, I seek to create immersive environments that invite viewers to engage with complex narratives and themes. In each of my works, I strive to create spaces that are not only visually captivating but also intellectually stimulating and emotionally resonant. Through my work, I invite audiences to join a journey of discovery, reflection, and connection.

My technical expertise includes web development, physical computing, interactive systems, game development, internet of things, and rapid prototyping. I have experience with electronics, and I have already designed and built my own circuits before.

VII. References

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