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Design and construction of a Wireless lamellophone

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Abstract

Indigenous musical instruments have existed in Africa for centuries, many of which have not been updated to integrate with modern technology. One such instrument is the Lamellophone, commonly played among the Yoruba people of Nigeria, where it is known as the Akadigbo. This plucked idiophone is traditionally used to produce musical notes in local performances. The current design aims to integrate wireless technology with the Lamellophone, allowing it to function within wireless coverage areas and enabling greater mobility and versatility for performers. The design when tested shows promise.

Keywords: lamellophone, wireless fidelity, Music

INTRODUCTION

Traditional communication plays a crucial role in African societies, serving as a foundation for social cohesion, cultural identity, and sustainable development. It encompasses the transmission of messages through culturally relevant channels that connect people to their native languages and symbolic systems, enabling the effective sharing of information from one individual to another (Ushe, 2015).

In the field of music, technological advancements have significantly influenced how musicians express themselves and engage with audiences. Many musicians embrace modern technology for its potential to enhance personal expression and expand creative boundaries (Nwarukweh, C. 2015). Innovations such as sound amplification, electric pickups, and mobile computing have transformed performance dynamics by enabling novel sonic experiences and decoupling physical gestures from the resulting sound output (Osho, S. 2011). This is particularly evident in the evolution of electronic percussion, which has become a commercially successful sector in modern instrument design (Williams & Overholt, 2020).

Wireless communication, defined as the transmission and reception of data without physical cables, has emerged as a powerful tool in various technological applications, including music performance (Suresh et al., 2019). As digital transformation accelerates globally, the need for integrating modern communication systems into traditional practices becomes increasingly important (Kumbhalkar, 2016).

This paper explores the application of wireless transmission technology—similar to that used in electric acoustic guitars—to traditional African musical instruments (Vidal, A. 2012), specifically the lamellophone. The objective is to enable the instrument to transmit audio signals wirelessly, thus eliminating the need for external microphones. This innovation enhances the mobility and flexibility of performers, allowing them to play the instrument within a defined geographical space while maintaining high-quality sound transmission.

The Role of Music in Yoruba Culture

To the Yoruba people of Southwest Nigeria, music functions as a vital means of cultural communication and preservation. It plays an integral role throughout the various stages of life—birth, initiation, marriage, and death—serving as a medium through which the community's social and cultural values are passed down and maintained. Music is not merely entertainment; it is a linguistic and communicative tool deeply embedded in Yoruba tradition (Abubakre, 2008).

Music also serves as a traditional communication system, carrying embedded messages that reflect cultural norms and societal values (Omojola, 1989; Osho, 2011). According to Odoemelam et al. (2015), African communication systems possess inherent cultural preservative qualities. As Nwarukweh (2015) notes, the interpretation of words within these systems is often rooted in cultural contexts and meanings.

Yoruba music is particularly shaped by the tonal nature of the Yoruba language. As Olusoji (2008), Olaleye (2012), and Oludare (2015) explain, Yoruba music is word-bound, meaning that musical melodies are closely tied to the phonemic tones—low, mid, and high—of the language. These tonal inflections directly influence musical composition and delivery. Linguists such as Akinlabi (2004), Fajobi (2005), and Abubakre (2008) have analyzed this connection through the lens of phonology, defined by Webster (2015) as the systematic use of sound to encode meaning in any spoken language.

In vocal music, these phonemic tones are more readily employed, allowing musicians to express intelligible words through tonal speech. In contrast, instrumental music relies on tonal mimicry and cultural knowledge for interpretation. Instruments such as the *konkolo* rhythm carry textual implications, which listeners must decode based on an understanding of Yoruba phonology. While vocalists communicate messages directly through words, instrumentalists using melorhythmic instruments must adapt tonal patterns to convey meaning effectively.

Historical Development of Music in Yoruba Culture

Music has long held a central place in the cultural history of what is now Nigeria. Before the advent of European colonialism in the mid-19th century, music was already a core component of social, religious, and ritual life. It was rarely performed in isolation; instead, it was typically accompanied by dance, poetry, dramatic expression, and visual arts such as sculpture, costume, and painting.

One prominent example of traditional Yoruba instrumentation is the **Agidigbo**, a type of *lamellophone*—an instrument that produces sound via vibrating metal strips or tongues. When the free end of one of these strips is pressed and released, it vibrates to create sound. The Agidigbo belongs to the *plucked idiophone* category of instruments (also known as *prongaphones*), which are also found in other African cultures under names like Mbira, Sanza, and Kemba (Vidal, 2012; Echezona, 1981).

In Yoruba musical traditions, particularly *Apala* music, the Agidigbo plays a critical *melorhythmic* role. It performs a dual function: maintaining a steady rhythmic ostinato and providing melodic accompaniment and interludes. Originally, the Agidigbo was the central instrument of a genre known as *Agidigbo music*, which emerged in the 1920s. However, as this genre declined and more popular styles like Juju and Apala music rose in the 1930s, Agidigbo players began to integrate the instrument into these newer forms.

The Agidigbo found a lasting place in Apala music due to its tonal and rhythmic compatibility. As Olusoji (2008), Lasisi (2012), and Ajetunmobi & Adepoju (2013) explain, the instrument typically features four or five upward-bent metal strips mounted on a large acoustic box. Three of these strips are tuned to the low, mid, and high tones characteristic of the Yoruba language, allowing the instrument to mimic Yoruba speech patterns.

This tonal capability enables the Agidigbo to function as a musical communicator, capable of expressing linguistic messages that can only be fully understood by those familiar with Yoruba phonology. The instrument is most commonly found in the Ibadan and Ijebu regions of Yorubaland. Notable musicians such as Adeolu Akinsanya, Haruna Ishola, Fatai Rolling Dollar, and Ebenezer Obey contributed significantly to the popularization and continued use of the Agidigbo in modern Yoruba music.

Communicative Attributes of the Agidigbo

The Yoruba language, like many other sub-Saharan African languages, is a tonal language—meaning that the pitch or tone used when pronouncing a word can change its meaning entirely. In tonal languages, diacritical marks (accents) are placed over vowels to indicate these pitch differences. Thus, even if two words are phonetically identical, their meanings can differ based on tonal inflection (Akinlabi, 2004; Fajobi, 2005).

This feature of the Yoruba language is fundamental in analyzing the communicative potential of the Agidigbo, a traditional lamellophone instrument. Since the language relies heavily on tone for semantic meaning, instruments like the Agidigbo, which can mimic these pitch levels, serve as musical extensions of spoken language.

The Agidigbo typically features metal strips that are tuned to correspond with the three primary phonemic tones of the Yoruba language: low, mid, and high. These are used similarly to the talking drum ensemble, where the metal strips known as Ìyá-ìlù (mother drum), Àdàmò (assistant drum), and Aró (support drum) are played to replicate speech patterns. For example, a one-syllable Yoruba word could have three distinct meanings based on tone, and these differences can be articulated musically using the appropriate Agidigbo strips.

Tuning and Performance Style of the Agidigbo

The Agidigbo consists of a large wooden resonator box on which eleven thin metal strips (tongues) are mounted. These strips are intentionally bent upward to enhance their ability to vibrate and resonate, producing a clear and sustained sound. Additionally, shakers may be attached to the instrument to create extra percussive texture during performance.

The Agidigbo is typically played with both hands and resembles a piano in its layout and playing technique. The musician either sits with the instrument on their lap or wears it around the neck using a strap, allowing it to rest at the abdomen level. During fieldwork, it was observed that skilled players use multiple fingers simultaneously to strike the tongues. They may also tap the sides of the box with finger rings or use their thumbs to strike the surface, adding complexity to the rhythmic patterns.

Each of the metal strips is named in Yoruba based on its percussive function, drawing a parallel to the talking drum (*dundun*) ensemble. The instrument can be tuned to a musical scale, allowing it to be played both melodically (like a piano) and rhythmically (like a drum). This versatility gives the Agidigbo its distinctive acoustic timbre, characterized by soothing, sonorous tones that are both melodic and percussive in nature.

Introduction To Wireless Communication

Wireless communication refers to the transmission of information between two or more devices without the use of wires, cables, or any physical conductors. This broad term encompasses all forms of data transfer carried out through wireless signals using radio frequencies, infrared, satellite, or Bluetooth technologies.

Wireless communication enables devices to connect and exchange data over distances, making it an essential component of modern telecommunication systems. Common examples include mobile phones, Wi-

Fi networks, satellite links, and two-way radios. Its significance lies in the ability to support real-time, flexible, and remote interaction without physical infrastructure.

Methodology

This discusses the design, procedure, the choice of component and Figure 1. shows the block diagram of achieving the implementation of an electric lamellophone by applying the idea of an electric musical instrument with the use of transmitting audio signals through a wireless medium to transmit sound from our local musical instrument and to make it easier for a idiophonist to play their instrument in a particular geographical area where the musical instrument is been used and the overall comparison of these applications and characteristics such as standard, bandwidth, battery life, data rate, and maximum transmission range etc.

Selection of Material

The highlights in Table 1 are the material selection process for the design and construction of wireless electric lamellophone. This process is a complicated technical method that aims at selecting a set of material while taking into consideration a large number of factors.

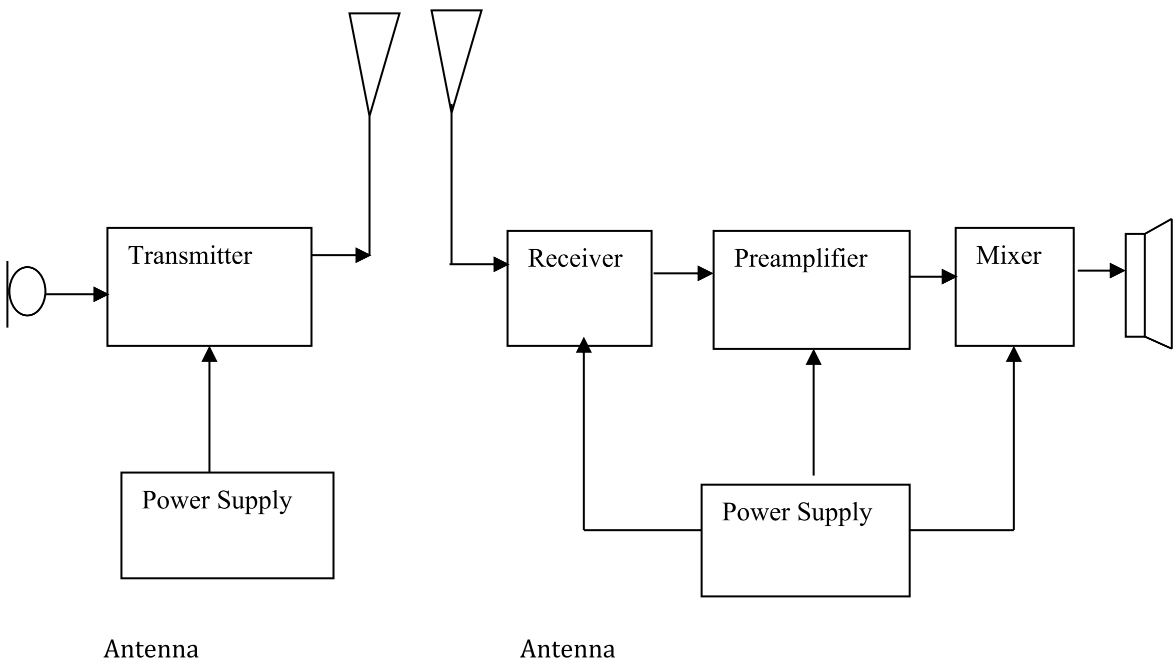

Figure 1: Block Diagram of an electric wireless Talking Drum

Table 1: Material selected for construction of a wireless electric lamellophone

Material	Rating
ISM HiFi Wireless Stereo Audio Transmitter & Receiver	DC 5V, 2.4G 16bit, 44.1KSPS and radio frequency air rate is 5Mbps
Dual NE5532 Preamplifier Board	AC 5 - 16V or DC 6 -24V
Lamellophone	7742mm by 392mm
Dynamic Microphone	Dynamic Microphone with 3.5mm jack
Transformer	12 - 0 -12V center tap transformer 1Amp
L7812	Max 35V, 12Vout , output current 1.5A, Min 14V
Capacitor	1000uf 50V
Diode	1N4007, 1Amp, 1000V
L7805CV	Max 35V, 5Vout, output current 1.5A, Min 7V
Rechargeable Battery	3.7V, 3000mAh
BMS	Adjustable step up 3.7V ,9V, 5V 18650 Li-ion Battery
Audio cable	1.5m length

RESULT AND DISCUSSION

Tests were carried out to ascertain the operational functionality of the innovation of a wireless electric talking drum, to determine the area where adjustment is needed, and to make use of possible ways to solve the error and ensure the effective working of the entire system.

Performance Test

The system was tested at various levels of implantation to ensure that it is working properly. The initial test on the power circuit was conducted using the same rectifier and it was detected that it was only able to power the preamplifier and receiver for 53 seconds before going OFF. The same result reoccurred when the switch was ON. Different rectifier is later used with two outputs; 5V and 12V. The 5V power circuit generated noise which created a feedback into the system and to remove this, a separate 5V DC module was used to power the receiver, and the 12V was used to power the preamplifier, while the distance at which the transmitter and the receiver can communicate to each order in an open distance is greater than or equal to 50m and can be affected by obstacles/ blockages.

During the process of testing Cubase 5 software is used to record the audio signal sent from the talking drum to the receiver for 60 seconds

The result shown in figure 2.

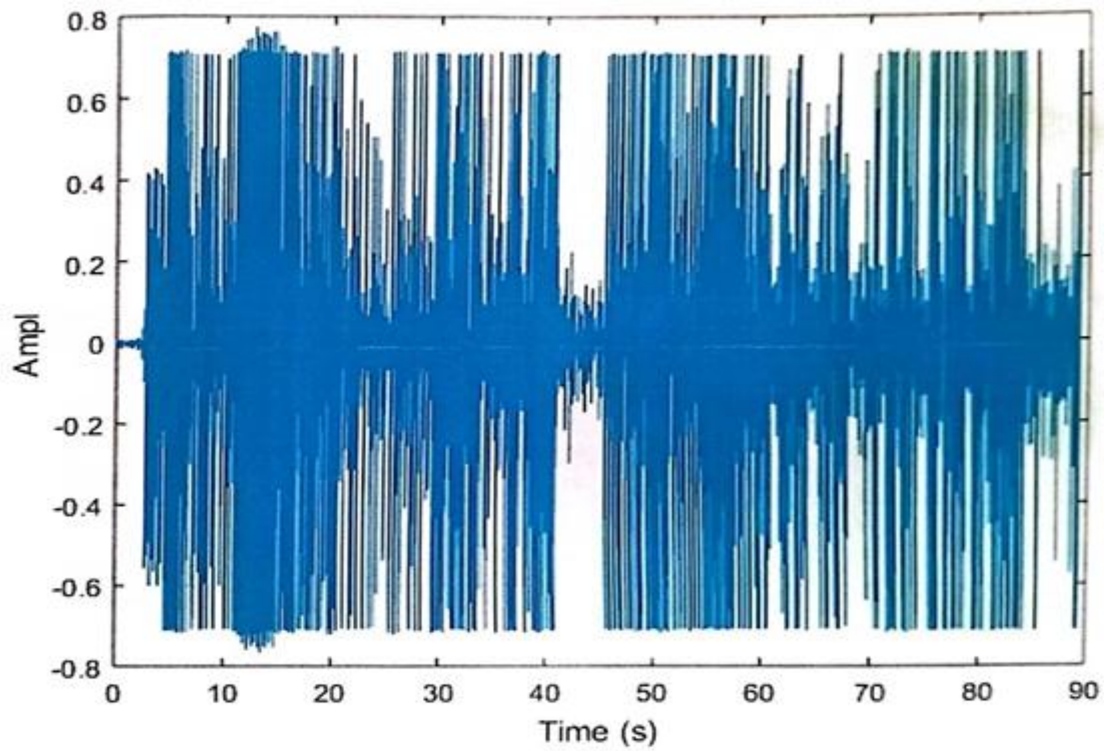

Figure 2: Recorded Output wave

Conclusion

This project was used to improve our local instrument (Lamellophone) and to allow the percussionist to move around within the range where the receiver and transmitter can cover by also implementing the use of ultra-high frequency (UHF) wireless transmitter and receiver into our local drum. Picture of construction can be seen in the appendix

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

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Appendix

Figure 3: Receiver at the Mixer

Figure 4: Transmitter with the idiophonic

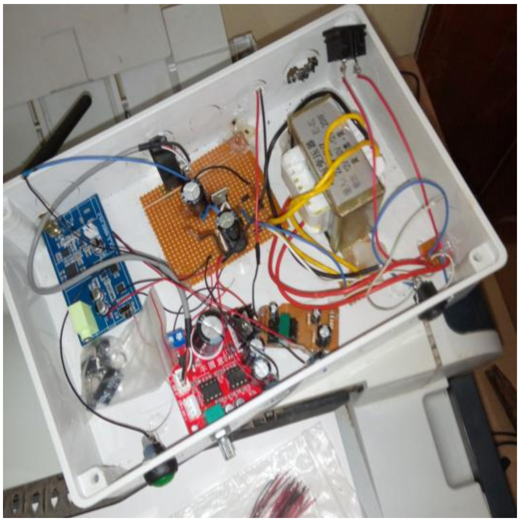

Figure 5: Internal construction of wireless lamellophone receiver **Figure 6:** The external view of the wireless lamellophone

Figure 7: Internal construction of transmitter