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Design And Construction Of An Electric Wireless Talking Drum

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ABSTRACT:*African societies have relied on talking drums as the primary means of communication for decades. Her ability to engage with his social, economic, and political surroundings has been made possible by human people' natural curiosity.The talking drum does not give the percussionist access to move around within the environment the instrument is played, and there have not been any electrical upgrades in the aspect of our local drum (Talking drum). The objective of this paper is toimplement the idea of a modern electric instrument in our local percussion instrument (talking drum). To achieve this, a dynamic microphone is used to pick up the audio signal from the Talking Drum, a Wireless HiFi Transmitter and Receiver, and the preamplifier to filter the unwanted signals before sending the audio signal from the talking drum to the mixer and then to the public address system. The transmitter and the receiver were able to communicate to each order in an open distance of100m and can be affected by obstacles/blockage or boundary conditions. It can be concluded that it makes the percussionist play the talking drum at convenience within the range of the transmitter and can communicate with the receive with higher fidelity.*

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I. INTRODUCTION

Background Information of the Study

In African society, traditional communication is essential for meaningful development and harmonious coexistence in all spheres of life[1]. It comprises the acts of communicating information from one person to another by means of channels that connect them to their languages and symbolic codes [2]

Talking drums is one of the oldest and most traditional forms of communication in African culture. Humans have been able to connect with their social, economic, and political contexts[9] because of their natural urge to explore, socialize, and evolve. Only the communication mechanism makes this contact feasible [3].

The simplicity of usage and new avenues for personal expression that newly created technologies offer have led most musicians to embrace them. While disentangling cause and effect in a world of music where excitation can be separated from sound production, the use of technologies like amplification, electric pick-ups, and mobile computing has opened up creative possibilities for performers and new experiences for audiences as science advances. One area of musical instrument design that has had commercial success is electronic percussion [4]. Wireless communication, according to [5], is a technique for data transmission and reception without the use of cables or wires.

With the advancing technology, the world is being digitalized so the need for modern communication [6] is also necessary for the area of our local musical instruments. Thispaper deals with applying the idea of an electric drum 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 percussionist to play their drums[11] in a particular geographical area with more freedom of movement where the musical is been used[7]. Usually, it requires a larger length of microphone cables which affects the quality of sound and picking of noise which also disturbs the frequency signal but with the wireless transmission, the whole issue of poor sound quality and unnecessary cabling can be avoided while still providing high quality sound output and till date[8], there haven't been any electrical upgrades in the aspect of our local drum (Talking drum) i.e. digitalizing our local talking drum by the use of ultra-high frequency (UHF) wireless transmitter and receiver into our local drum[10].

II. METHODOLOGY

Selection of Material

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

Table 1: *Material used in the construction*

Material	Rating
ISM HiFi Wireless Stereo Audio Transmitter & Receiver	DC 5V, 2.4G 16bit, 44.1KSPS and radio frequency air rate is up to 5Mbps
Dual NE5532 Preamplifier Board	AC 5 - 16V or DC 6 -24V
Talking drum	300mm circumference
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	3.7V 9V 5V Adjustable step up 18650 Li-ion Battery
Audio cable	1.5m length

Design Analysis

Figure 1 shows the block diagram design of the electric wireless talking drum, the design is centered on implementing high fidelity (HiFi) transmitting and receiving sound signals to our local drum with the use of a wireless transmitter and receiver which covers a length of less than or equal to a hundred meters. The preamplifier is used to amplify the signal receives from the receiver and filter the unwanted signal (noise) which is connected to the output. The output is connected to the public address system.

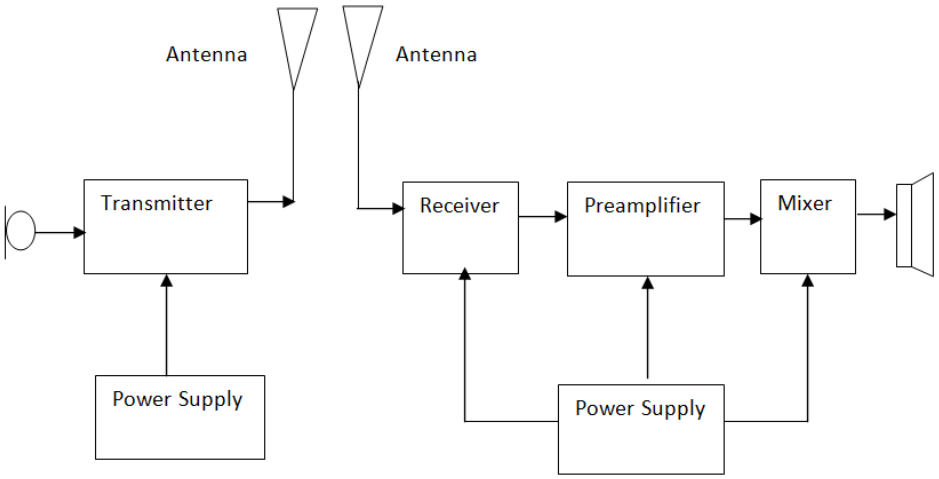

Figure 1: Block Diagram of an electric wireless Talking Drum

Power section

Figure 2 shows the circuit diagram of a 12V DC output using proteus software to simulate the circuit. The transformer is 12v- 0-12v at the secondary side of the transformer and is used to step down the voltage at the same frequency. The two terminals of the 5V DC module are connected respectively with the primary side of the transformer. One wire of the primary side is connected directly to an SPST switch before being connected to the power terminal and the other wire is connected directly to the power terminal.

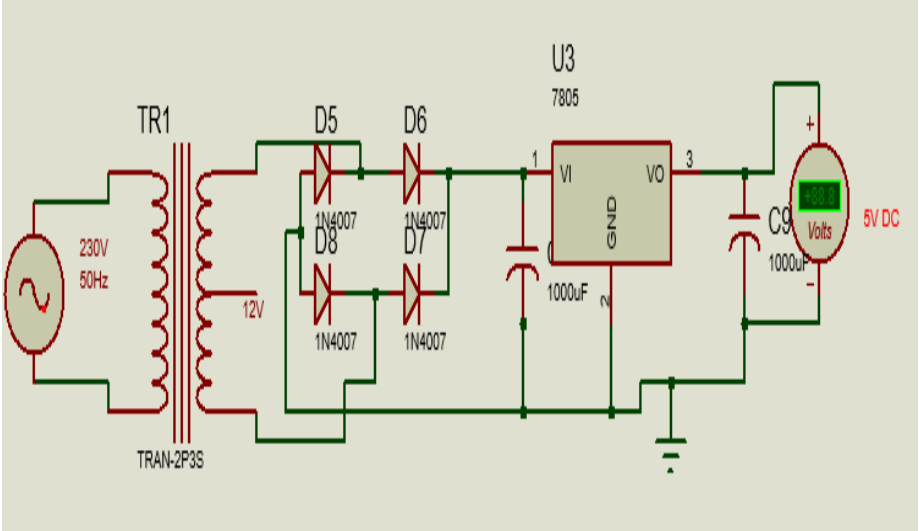

Figure 2: Circuit diagram of a DC 12V

Four diodes of 1N4007 were use to build the rectifier circuit. Due to some ripples, a capacitor of 1000uf is use to filter by outputting a smooth DC voltage. A regulator of 7812 is used to regulate the dc voltage to 12v. So, it can power the preamplifier and the output of the 5V DC module to power the receiver.
Three rechargeable batteries of 3.7V each are connected in series to add up the current of the three batteries while the BMS module is used to amplify the voltage of the batteries to 5V and regulate the charging of the batteries and prevent the battery from overcharging.

The Transmitter and Receiver section
Fig 3. shows how the local instrument allows an audio signal to be sent using a 3.5mm audio cable to connect the transducer and the transmitter.

Fig 3: Dynamic Microphone with the 3.5mm female port in the talking drum cylinder

Fig 4 shows the transmitter that transmits the signals with the antenna at 2.4G with a range greater than or equal to 100m in an open distance.

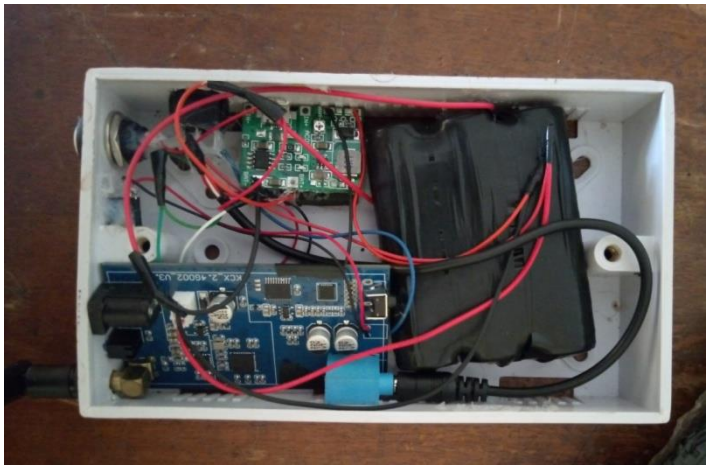

Figure 4: The transmitter unit

Fig 5: shows the receiver that receives the signal sent from the transmitter antenna while the signal is sent to the preamplifier to filter the unwanted signal and amplify the wanted signal before is been sent to the mixer or public address system.

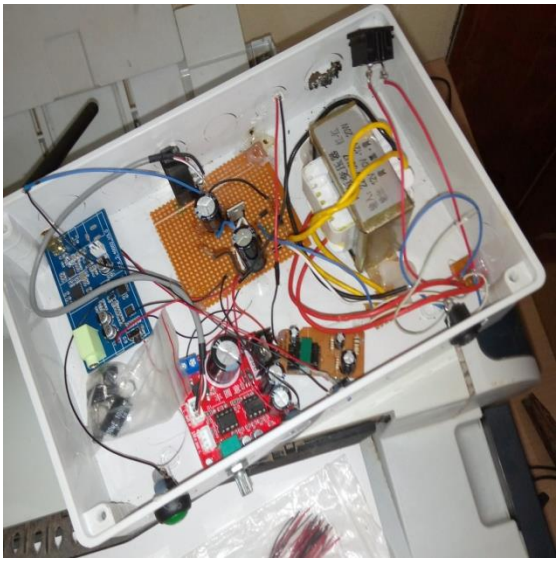

Fig 5: The receiver unit

III. RESULT AND DISCUSSION

Tests were carried out to ascertain the full operational functionality of the innovation of the constructed wireless electric talking drum. The Cubase 5 software is used to record the audio signal sent from the talking drum to the receiver for 89 seconds and named GANGAN.mp3. Matlab analysis code of the GANGAN.wav is[12];

```
[x, fs] = audioread('GANGAN.wav');
x = x (:, 1);
N= length(x);
t = (0: N-1)/fs;
N/fs;
%plot time domain signal
plot(t,x)
grid on
%set(gca, 'FrontName', 'Time New Roman','FrontSize', 12)
xlabel('Time (s)')
ylabel ('Ampl')
title ('Signal in Time domain')
%start information
maxValue = max(x);
```

```
minValue = min(x);
maenValue = mean(x);
stdValue = std(x);
spectrogram(x, 1024, 512, 1024, fs, 'yaxis')
title('Spectrogram of signal')
%Periodogram Plot
W = hanning (N, 'periodic');
periodogram (x, W, N, fs, 'power')
[X, f] = periodogram (x, W, N, fs, 'power');
X = 20*log10(sqrt(X)* sqrt (2));
semilogx (f, X)
```

Matlab software is used for the analysis, and it was observed that Figure 6 shows the signal in time domain of amplitude against time, Figure 7 show the spectrogram of signal, Figure 8 shows the periodogram power spectrum estimate, and Figure 8 shows the spectra analyze base on periodogram of X value in Appendix: Matlab analysis code of the GANGAN.wavof how the Talking Drum is been stuck and squeezing the leather cords. Plate 12 shows the working state of the receiver while Plate 13 shows the working state of the transmitter.

When the transmitter and receiver are not connected, push buttons are used to link them together. A 6.35mm audio cable is connected to both the receiver and the public address system or mixer. It connects the transmitter through a 3.5mm audio cable to the local instrument (Talking Drum). The battery is charged using an android charger to charge it through the BMS. It indicates RED while charging and BLUE when the battery is full and prevents it from overcharging. The transmitting range reduces as the batteries discharge.

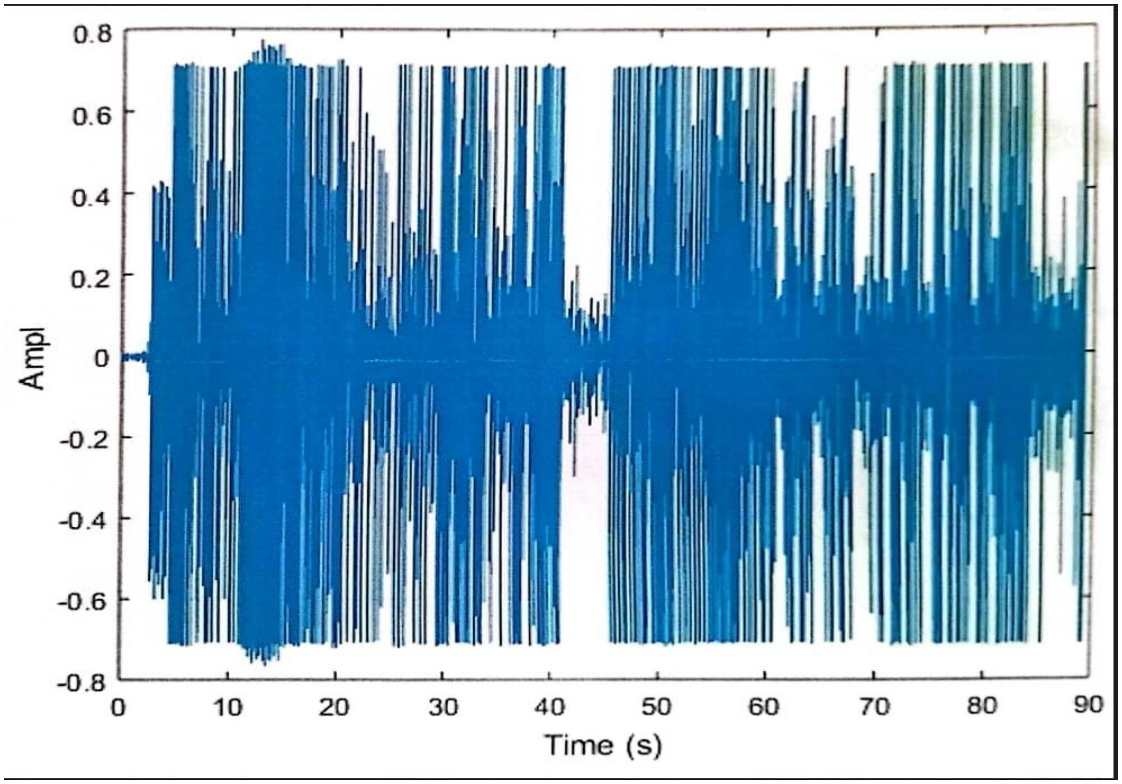

Figure 6: Signal in time domain of GANGAN.wav

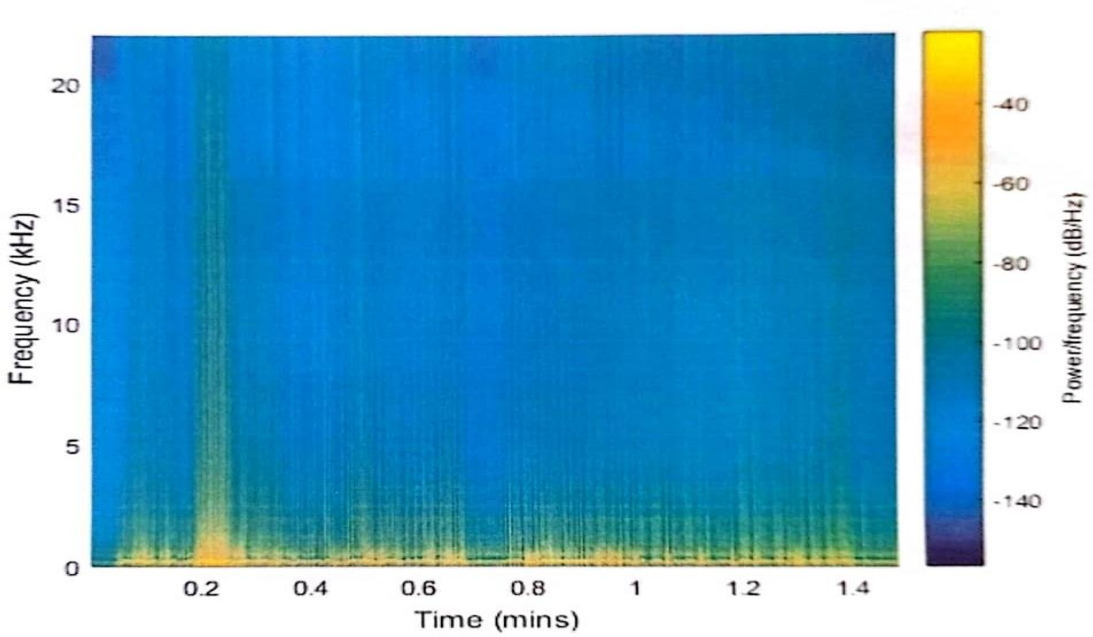

Figure 7: Spectrogram of signalof GANGAN.wav

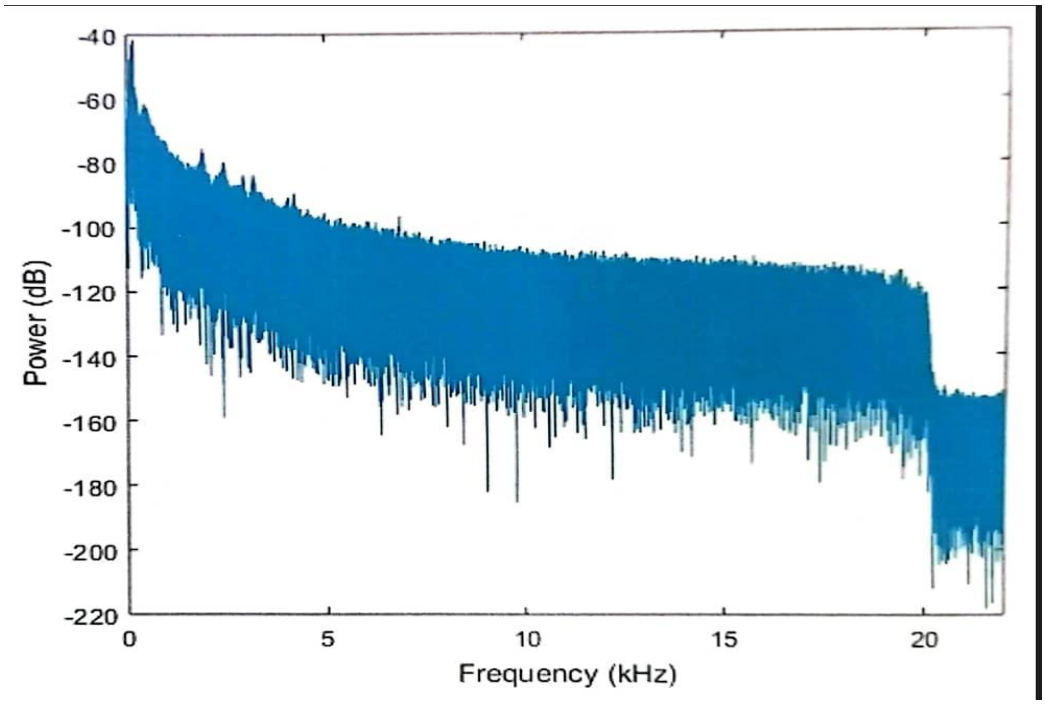

Figure8 :Periodogram power spectrum estimate of GANGAN.wav

IV. CONCLUSION

This paper was used to improve our local instrument (Talking Drum) 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. It also improve fidelity of the instrument because of the presence of acoustic system incorporated into the talking drum directly. Figure 6-8 shows the operability of the system when put to use.

Since this is an innovation to digitalize the use of talking drums, further research are in progress for improvement and to extend it to other local African instruments.

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