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Harmonizing Diversity through Streaming Audio-Format for Podcasts Users in Nigeria

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ABSTRACT

Cloud computing and mobile connectivity has continued to reposition interactive access to data. Audio contents have also evolved in its production, and consumption due to the rise in the use of streaming platforms. Sales of physical audio copies continue to decline significantly especially with the mandatory streaming as contents are reinvented using these platforms services as a key part of its business development. Online streaming of contents enable access to a vast collection in commercial and governmental databases, without need for a permanent transfer of data to and from a user's device. Eliminating the issues of security and content misuse by users. Study aims to select features for audio content consumption via streaming platforms in relation to diversity in content formats particularly studying the intention to adopt premium (paid) versions of an audio content in streaming service and recommend them. Measuring diversity of content format yields some issues. Traditional tools are not effective as power irregularities cohabit the birth of new dominant players. Results shows the developed system is able to recognize the various content diversity, stream the audio content for the user and ensure security of the audio content.

1. INTRODUCTION

Streaming media is video/audio content sent in compressed form over the internet and played immediately on a user's device; rather than it being saved to the device drive. With streaming, the media file is played on user's device as retrieved from a remote location, and transmitted continuously over Internet via wire(less) connection (Hall, 2019).

Listening to your favourite audio content or podcast is only possible due to audio streaming technology. With audio streaming, user can listen to his favourite audio content on demand, which is more convenient than traditional radio broadcasting. The users can pause, rewind, and fast-forward contents, and can access it from any device with an internet connection (Allenotor et al., 2015; Allenotor & Ojugo, 2017; Eboka & Ojugo, 2020).

The Internet birthed and transformed our society today with the capability to access data and content anywhere and anytime. At the crux of this, is digital convergence and a growing Internet that allows for immediate, universal and interactive access to contents regardless of geographical coverage and the physical barriers (Okobah & Ojugo, 2018; Yoro & Ojugo, 2019). Data content available via such media can be in printed books, CDs, journals, or DVDs require physical mobility to be delivered and received (Hall, P. 2019). However, they can be and, indeed, are often delivered electronically and increasingly in a mobile and ubiquitous way. Many Internet users harness the potential benefits from the variety of content options available online

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from a vast array of sources essentially run aground against the fact that much of this information may not be available in their native language (Sandvine 2012).

Fuelled by advances in technology and evolving consumer preferences, turnover and profits in the global recording industry began their steady decline in 2005. This created a decline in the sales of physical and digital albums and tracks along with changing audio consumption preferences. In the US, during the period between the first quarter of 2017 and the fourth quarter of 2018, the sale of physical albums declined by 33.3 percent, digital albums by 25.3% and digital tracks by 27.7% (Recording Industry Association of America 2019). Audio streaming as preferred consumption exploded in 2011 (Lobato, 2018; Ojugo, Ejeh, Akazue, Ashioba, et al., 2023; Ojugo, Odiakaose, Emordi, Ejeh, et al., 2023; Ojugo, Ugboh, et al., 2013). Streaming helps the global recorded music market grow by 9.7 percent. This was the fourth consecutive year of global growth and the highest growth since 1997. It was also the first time since 1999 that U.S. music revenues grew for more than two years in a row. Digital revenues now account for 58.9 percent of the global recorded music market. Total streaming revenues grew by 34 percent and now account for 46.9 percent of the global recorded music industry's total revenue. Paid streaming revenues have also increased by 32.9%, and there are over 255-million users by 2018 for paid subscription globally, with 79 million having been added during the year (Meier & Manzerolle, 2019).

1.1 Streaming: A Theoretical Framework

All streaming technologies use density to shrink the size of the audio and video file format so they can be retrieved and played by remote viewers in real time. Common video compression tech or video codecs include the MPEG-4, VP6 and VP8, Windows Media Video (WMV) and MPEG-1/2. And common audio codecs include AAC (Advanced Audio Coding), Windows Media Audio (WMA), and MP (Ce Zhu, Yuenan Li &XiamuNiu 2011).

Streaming media most often refers to the transfer of audio and video data, though it can be applied to almost any other kind of data, such as static images and text. This latter, broader scope is further referred to as online access to content, i.e. access without the permanent transfer of data to the user's computing device, regardless of technological means which assure that such transfer is avoided or managed ex-post. This development is a new approach of doing business based on access to services rather than the sale of products (Prey, 2018).

On the diversity of contents, the majority of studies so far have approached it in its linguistic dimension. Although important, it is necessary to go beyond those frontiers and to integrate other dimensions in the analysis of diversity. Question of evolution towards a new ecosystem created both more contents and format diversity, proposed by (McQuail 2019) as a political, geographical and socio-cultural feat. Also, it yields a measure in its relationship to content recycling confronting their originality levels and reutilization.

This development goes hand in hand with a shift from industrial production to cultural production in which the focus lies on the marketing of cultural resources in the form of paid-for personal entertainment12. It is often referred to as digital media revolution consisting of a suite of digital, media-capable devices and services poised to deliver the promise of anywhere-anytime access to information.

Digital content streaming applications allow digital media users to access a seemingly unlimited amount of music. If constantly connected to the Internet, users can get up-to-date music content continuously. However, an abundant amount of audio content may lead users to face the dilemma of having too many songs from which to choose (Herbert, Lotz, & Marshall 2018). The problem is resolved appropriately via recommendation that uses the playlists to guide users in consuming music. The playlist system exemplifies content curation function in digital media, recommending music content

in digital streaming applications. The playlist system and recommendation is seen as part of a changing consumption pattern that endorses a curation system to help users navigate certain content. A recommendation system marked by curated catalogs is a new perspective that has become characteristic of streaming services (Lobato 2018).

A way to distinguish between content is via diverse endorsement so that users can navigate and identify relevant items faster in the exploratory stage. Several dimensions of diversity by previous studies include entities diversity (i.e., people, and groups), topic diversity, viewpoint diversity (e.g., different angles), and medium diversity (e.g., audio, video). Such dimensions do not take podcasts' unique attributes into account as some non-textual features unique to podcasts can/may also contribute to a differentiated listening experience such as energy, seriousness, vibe, novelty of the episode, duration, popularity, etc as suggested in previous research. Many studies have explored specific dimensions of how podcasts differ from each other, a holistic view of how users perceive these differences is underexplored. As a result, we propose that providing ways to differentiate can help listeners make better choices (R. Hu, P. Pu, 2011).

It is not a single program or movie that enfolds an overpowering effect on an audience or on an individual person. Over decades cultural studies have elaborated on the subject and have shown that it is much more the everyday cultural interaction through and with media that is shaping our shared meanings in representations (Hall, 2013). How people are portrayed and how their gender is represented in the media creates ideas of the life world and of identities, which have an impact on the identity construction of the recipients (Klaus, 2005).

However, it is important to acknowledge that this media picture is not a mirror of society, but it rather actively produces and reproduces role models and representations of people as well as identities that are based in the structure of an existing media production industry (Klaus, 2005).

1.2. The Streaming Working Structure

Streaming files such as audio, video and others -- are stored on a server somewhere on the World Wide Web (WWW). When a user requests the file, it gets transmitted over the web as sequential packets of data that are streamed instantly. Since streaming data is broken down into data packets, its transmission is similar to that of other types of data sent over the internet (Chevalier et al., 2003; Ojugo et al., 2015; Ojugo & Eboka, 2014; Ojugo & Otakore, 2018; Okobah & Ojugo, 2018; Tarafdar & Zhang, 2005).

The file is played within a browser on the client's device. (Birkel, M., Kerkau, F., Reichert, M., & Scholl, E. 2020). An audio or video player hosted by the browser accepts the flow of data packets from the streaming service's remote server and interprets them as video or audio, then plays the media for the user. Unlike traditional media systems where files are downloaded and stored on the device, streaming media are deleted automatically once the user ends the streaming.

Some streaming services rely on User Datagram Protocol (UDP) to stream their content, while others use Transmission Control Protocol (TCP). Both UDP and TCP are transport protocols used to move data packets across networks. TCP opens a dedicated connection before transmitting data, which makes it a more reliable protocol than UDP. However, TCP also takes longer to transmit data compared to UDP. TCP and UDP are both used with the Internet Protocol (IP). Most streaming services use content delivery networks (CDNs) to store content in locations that are closer to users. Such proximity reduces streaming latency, speeds up content delivery and reduces buffering.

The study is motivated (Ojugo, Eboka, et al., 2015a, 2015b; Ojugo, Akazue, Ejeh, Odiakaose, et al., 2023) as thus:

1. Device compatibility: the media used to stream the audio content is it compatible with the audio content format? If NO? Then the application links the browser to

a website where such audio format can be downloaded or installed directly on your device before streaming is down (Ojugo & Ekurume, 2021a, 2021b; Ojugo & Otakore, 2020).

2. Limited Compatibility: The system may be limited in terms of upgrading to new audio content format from WAV to mp3 or mpeg. It might not be universally compatible with all smartphones or other listening devices which may result to compatibility issues with website designs.
3. Available bandwidth: Unstable Internet connection due to Wi-Fi problems, results in interrupted streaming and a poor user experience. Refreshing Wi-Fi router may stabilize/improve streaming performance. But, a streaming software is needed with a minimum Wi-Fi speed for audio content streaming (Alakbarov & Hashimov, 2018; Datta et al., 2021; Joshi et al., 2021; Ojugo & Yoro, 2020; Pradeepa & Parveen, 2020).
4. Security Concerns: Existing system could be vulnerable to unauthorized cloning or interception of audio content. A robust authentication protocols is implemented to ensure a higher security and protection against breaches (Ojugo & Eboka, 2021).
5. **Resilience**: In case of system failures due to connectivity, system will incorporate a fail-safe (i.e. an alternative backup access method) to avoid system downtimes.
6. **Integration with Legacy Systems**: If the existing system is integrated into a registered online streaming platform with legacy access control solutions, compatibility and integration challenges might arise due to content format. The new system will be design with flexibility in mind to facilitate smooth integration with different streaming platform.
7. **User Interface Improvements**: The user interface of the existing system and administrative interface might have room for improvement in terms of usability and visual aesthetic

Study proposes a web-based podcast that can resolve the problem of interoperability and format diversity.

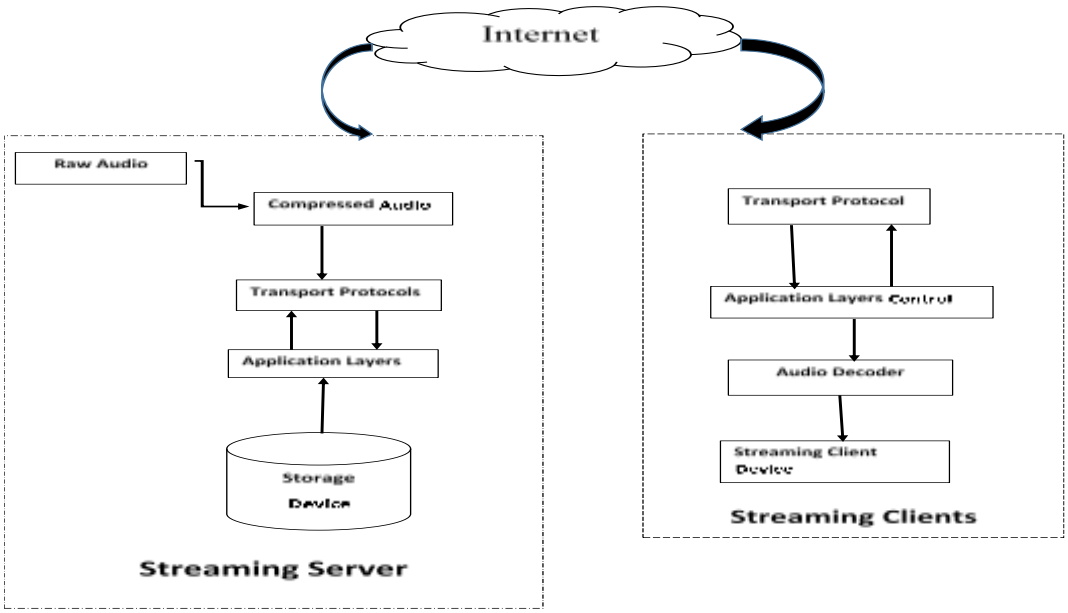

Figure 1. The schematic diagram of streaming (Ojugo et al., 2021a, 2021b)

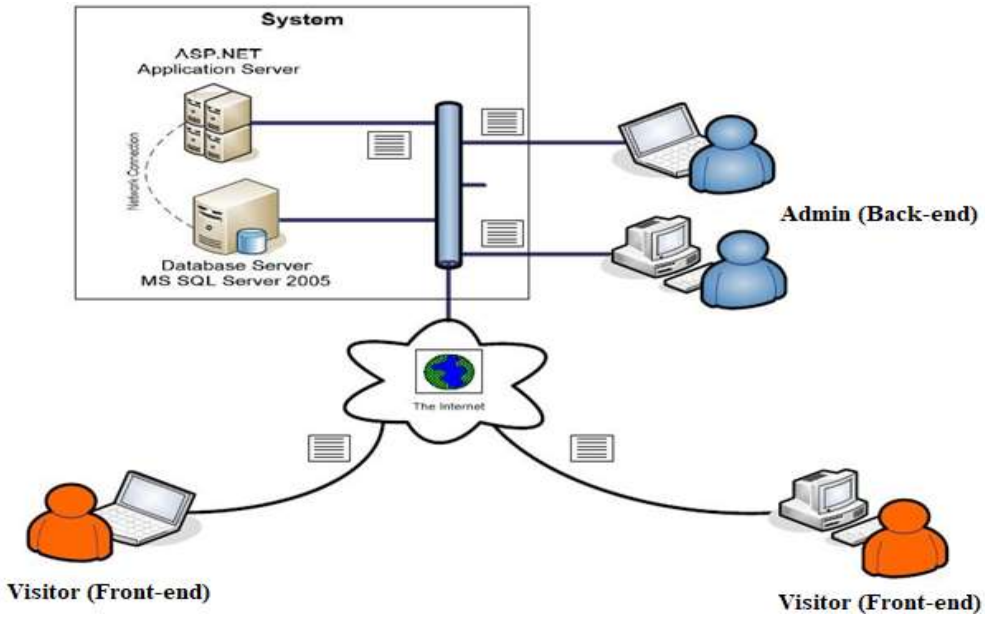

Figure 2. The output from the existing system

2. MATERIALS AND METHODS

2.1. The Existing System

As foundation to develop an online audio streaming content with capacity to store and allow users to download audio content in WAV format has been thoroughly analyzed to understand its functionalities and limitations (Ma et al., 2021). We explore the structured system analysis and design mode to facilitate audio content streaming which audio content file is large runs in Megabytes to Gigabytes and slow download rates thereby needs more data usage to achieve successful download. During the analysis phase, key aspects of the system were evaluated, including the output design and identified gaps (Lu et al., 2010).

The source is the basis of the audio content where the computer is used to mix all the audio together (that audio could be either music or live voice) and then convert all the digital data into a series of packets that are sent to the server. A server is also known as a provider because it is used to clean the data that was sent from the computer and dispense that data among the channels that were designed to share the data packets with the end users. End users are also called listeners because they 'listen' – both their ears and computers – to the transmission when the stream is online (Taylor, Katz, & Grajeda, 2012).

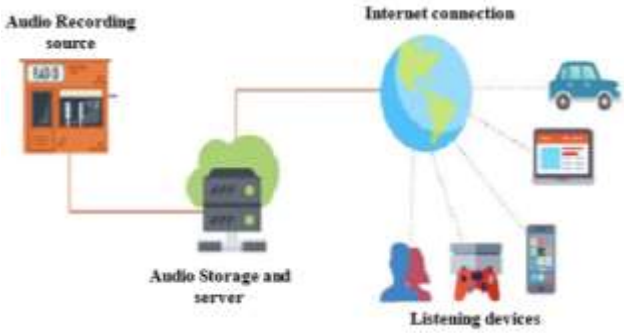

Figure 3. System analysis and design method

The output design of the existing audio content streaming platform revolves around providing a seamless and efficient audio content diversity over Internet with emphasis on source diversity, content diversity, and global acceptability as in figure 2.

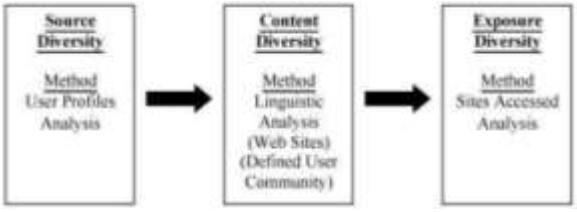

Figure 4. Output design of existing system

The **Audio/Content Source**: The number of

hours of streaming (transmission) is determined by factors including the costs (per hour) of production and the size of the available audience (and thus revenue) at different hours of the day, within a geographic area (Briggs, 2019), as a result audio content source can either be Live through the live studio or pre-recorded through a storage device depending on the type of production and size of available audience, provided the audio will be stream 24/7.

Transmission Mode: the content diversity mode of transmission is through terrestrial and server base mode of transmission while the audio content is from one source, A server is also known as a provider because it is used to clean the data that was sent from the computer and dispense that data among the channels that were designed to share the data packets with the end users. This computer has streaming software that can change the live or pre-recorded audio into internet streaming format. While the terrestrial transmission use the FM Band to transmit the audio content either live or pre-recorded to the audience through the antenna (K. W. Brown & Armstrong, 2023; W. Brown & Armstrong, 2015).

2.2. The Proposed System

We take a more comprehensive approach to energy optimization than existing solutions. The proposed system consists live stream and automatically updated audio archives. Audio streaming system for this service will include: (a) a permanent real-time digitizing and encoding of analogue live audio signal into a stream able format, (b) permanent updating of the audio archives by recording parts or the whole encoded live audio data on hard disk, (c) a streaming server, capable of serving the live stream and the recorded streams, and (d) streaming clients which receive and play the audio data stream on the client host's audio system.

Audio streaming is embedded on a local website, streamed on a streaming player, making sure your audio will play back on a range of devices and connection speeds, knowing the baseline can be helpful, audio streaming uses 128Kbps which is the standard bitrate for internet radio, but 64 Kbps is suitable for certain types of broadcasts, and 320 Kbps for others. The following assumptions were taken into consideration for effective performance of the design: (a) a recording source will be provided for pre-record audio materials and compressed in a format suitable for internet streaming before saving in the storage device to avoid losing the audio quality during further compression, and (b) a storage device with a minimum of five terabyte to store audio materials and music to be scheduled on demand.

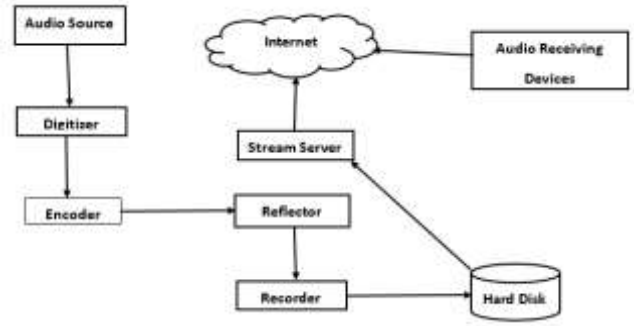

Figure 5. Design Framework

Its many benefits include (Oyemade et al., 2016; Oyemade & Ojugo, 2020, 2021):

1. **Interconnectivity** in IoT seeks to have all devices approximate interconnected with the worldwide records and conversation infrastructure.
2. **Heterogeneity** ensures such IoT gadgets are based on extraordinary hardware and cross-cutting platform/network so they can interact effectively with other devices or system provider.
3. **Dynamic change in improved accuracy measurement:** A device state constantly changes (e.g. sleep, (dis)connect, speed, active, location, etc). These changes can result in faults. Number of devices can change flexibly. Thus, the system must be robust and adaptable so as learn these

changes as well as measure accurately the products within the tank.

4. **Enormous scale:** The number of devices to be managed and communicated with will be an order of magnitude larger than the gadgets connected to the present-day Internet. Even more important may be the control of the information generated and its interpretation for software purposes. This relates to the semantics of data, as well as efficient data handling.
5. **Safety:** As benefits are gained from the IoT, safety must not be forgotten. As both the creators and recipients of the IoT, protection should be paramount inside the design. This consists of the safety of our records and the protection of our physical well-being. Securing endpoints, networks, and the data moving across all of it means creating a security model that will scale.
6. **Connectivity** permits community access and compatibility. Accessibility is getting into a community; And, compatibility seek to provide users with the unusual potentials of proposed system to consume and produce data.

2.3. Rationale for Proposed System

The system rationale and significance lies in its access control via the integration of advanced secured and user-friendly features – all of which improves user experiences and task efficiency with these feats (Allenotor et al., 2015; Allenotor & Ojugo, 2017; Ibor et al., 2023; Ojugo & Eboka, 2018):

1. **More data better decisions** With added sensors, these devices can collect a large amount of data in many different areas.
2. **Ability to track/monitor:** Tracking data for use greatly benefits a user. IoTs have the ability to capture current motion and save as data (Aghware et al., 2023).
3. **Lighten the workload with automation** Streaming platforms saves time, cost and yields reduced intervention, allowing them to operate entirely on their own.
4. **Better Life** Having your devices track and order things, turn light switches off for you, and help manage important tasks that you may not have the time to do yourself certainly takes away a lot of stress (Malasowe et al., 2023; Ojugo, Akazue, Ejeh, Ashioba, et al., 2023; Ojugo, Ejeh, Odiakaose, et al., 2023; Yoro, Aghware, Akazue, et al., 2023; Yoro, Aghware, Malasowe, et al., 2023).

3. RESULT AND DISCUSSION

3.1. Result Findings and Discussion

The performance and capabilities of the system were critically validated during the testing procedure. Extensive testing under numerous conditions and scenarios revealed that the implementation satisfies the criteria for accurate occupancy detection, dependable automation, palpable energy savings, and user controls (Cerf, 2020; Charan et al., 2020; Manickam et al., 2022; Ojugo, Abere, et al., 2013; Ojugo, Yoro, et al., 2013).

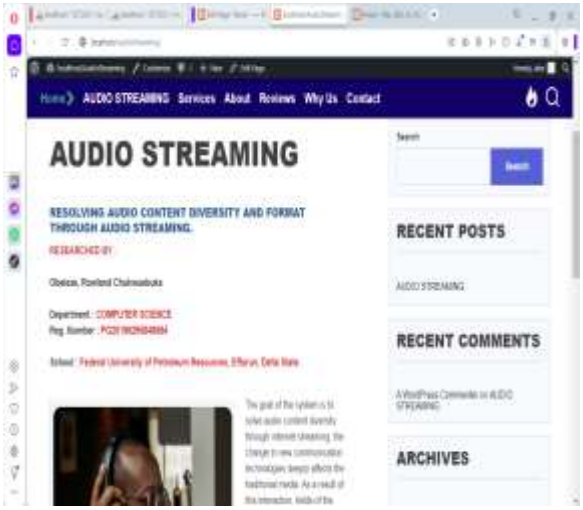

Figure 6. Front-end Page of Proposed System

Figure 7. Login Page of Back-end

Audio experts examined and evaluated the codecs that can be fixed as bit rates for all audio file format, all four codecs had some success, but certain codecs did emerge as more successful than others for music and speech content. For music codec, WMA and RA were preferred by the experts at bit rates of 32 kbit/s and 64 kbit/s. WMA was ranked first for 32 kbit/s and shared the highest rank with RA at 64 kbit/s (Ojugo & Yoro, 2020). For bit rates of 128 kbit/s, the experts preferred QuickTime and MP3, which shared highest rank. The speech codec comparisons yielded different results, with QuickTime being the overall preferred codec with the highest rankings of the 128 kbit/s and 64 kbit/s samples. WMA was the highest ranked speech codec at 32 kbit/s and MP3 ranked the weakest codec of the four for both speech and music. The need for podcast web-designer to consider the audio format and the amount of audio bites to be used over the internet at minimum cost is critical in the growth of the industry.(Ojugo et al., 2015; Ojugo & Eboka, 2019; Yoro & Ojugo, 2019; D. Zhang et al., 2020; S. Zhang et al., 2019).

4. CONCLUSION

Diversity in audio format for internet streaming's future is uncertain as broadband technologies are more popular than ever, audio content sponsors are focusing their efforts online and listeners are increasingly turning to the Internet to find information and music. Audio podcast for download is hoping to build online audiences through the use of simulcasting, a method of streaming with an improbable future which relies on a model of broadcasting designed for terrestrial use.

The most significant streaming costs are legal and technical in nature, with laws requiring webcasters to pay fees for streaming copyrighted sound recordings, the need for podcast web-designer to consider the audio format and the amount of audio bites to be used over the internet at minimum cost is every important for the growth of the industry.

Streaming is the encoding and decoding of information between two locations in real time. While contemporary use in the context of the Internet describes digital packets of audio and video information synchronously transmitted and received by PCs via Internet, terrestrial television and radio stations have operated similarly for decades, with air serving as the transmission medium and AM/FM as the encoding method. To that extent, the system therefore recommends the following: (a) continuous research on current audio streaming format should be done to avoid a broken website which may connect to a wrong URL, (b) backend admin staff should be trained in streaming for effective content delivery (J. Zhang & Bhatt, 2014; Y. Zhang et al., 2007), and (c) suitable reward should be adopted by the organization in order to boost the motivation and performance of its staff in the daily discharge of their responsibilities.

Conflict of Interest

The authors declare that there is no conflict of interest.

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