

## **Integrated Mobile Based Smart Wireless Public Address System.**

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**Abstract-** The art of communication is a bidirectional sequence which breeds understanding amidst the participants. Communication system is an essential tool in the organization of seminars, symposiums, lectures, etc especially an indoor program. In most of these events, we experience delays, lots of movements in the auditorium in a bid to make microphone available to a participant for feedback. In some other auditorium, each participant has a microphone attached to him or her. This actually makes the Public Address System (PAS) very expensive to deploy and also the auditorium expensive to hire. In a bid to reduce the cost of deploying PAS, seamless connectivity and to control the human movement during an event, we propose an Integrated Mobile Based Smart Wireless PAS (IMSW-PAS). The proposed system consists of a Mobile Device (MD), Integrated Controller (IC) and Smart Wireless Rechargeable Micro-Speakers (SWMS). The mobile application in the MD allows the participant to register with an access code, and participate in the meeting. The integrated control panel allows the meeting host to efficiently and effectively moderate the meeting while keeping the environment serene and coordinated. The system will improve learning in our tertiary institution by give more student opportunity to participate effectively in a large classroom as occasioned by COVID-19 physical distancing rule. Virtual meetings cannot be implemented in all situations especially in the third world country where Internet connectivity issues, cost of internet access is still a huge problem. This proposed system will help solve the problem of meeting/event moderation and control that largely depend on communication tool, reduces the cost of deploying PAS, reduce the rental cost of an auditorium and ultimately help improve learning in our tertiary institution.

**Keyword:** *Control, PAS, IMEW-PAS, Auditorium, Communication.*

### **1. Introduction**

Prior to the advent of Public Address Systems, humans have been using different ways to enhance information dissemination to members of a community, large gatherings or group of people, of which Town Crier (TC) was a major means at that time. Town Criers are humans with exceptionally loud vocal pitch. These people were contracted to disseminate vital information to a community or a congregation. With the advent of technology, PAS was developed to replace the primitive ineffective and inefficient means of disseminating information to a group of people or a community. As the human race continues to evolve with new challenges, in the same manner PAS technology has gone through several stages of development and upgrade so as to solve the challenges of the moment.

The current PAS is divided into two major areas: Conventional PAS (C-PAS) and Advanced or Addressable PAS (A-PAS). Some of the examples of the conventional PAS are Standalone Bluetooth Speaker, Wired Analogue PAS, Mobile Battery powered PAS etc. and that of Addressable PAS is a Network based PAS. The major advantages of C-PAS over the A-PAS is they are cheaper, low energy consumption, mobility ease, easy to install; whereas A-PAS does better in scalability and adequate management and control especially in a special conference or meetings. In most of our private and public institutions, C-PAS is mostly in use because of the aforementioned merits but this system could give rise to rowdy session because the input devices are not personalized and therefore produces a situation whereby the microphone has to be moved from one position to the other. Public physical contact has been

discouraged as a result of the COVID-19 pandemic and hence has placed a serious challenge in the use of C-PAS in conference. Meanwhile, A-PAS is very expensive to deploy and installed. Currently, most meetings, conferences, seminars have gone virtual but it is not all meetings that can be hosted virtually. In fact, in Nigeria virtual conferences experience a lot of challenges as a result of poor network coverage, poor QoS, and in most cases the lack of relevant equipment. For example, most public universities lack relevant E-learning facility and most students don't have access to the Internet but for those that do, it is not affordable and sustainable.

In a bid to develop a functional system that can leverage on some key strength of the two major types of PAS and is also in line with the COVID-19 prevention protocol, we propose an Integrated Mobile based Smart Wireless PAS that embodied some of these key features.



**Figure1: Examples of modern C-PAS and A-PAS**

The proposed system is scalable; the input devices (MDs) is personalised like in A-PAS. It is energy efficient, easy to install and with great deal of control functions.

The paper is organised as follows: section 2 talked extensively about the proposed system, the testing of the proposed system was briefly discussed in section 3 while section 4 discussed the benefits and future upgrade areas in the work.

## 2. Proposed System

In this section, we will be making an effective description of the IMSW public address system: as stated in section one, the system is developed to provide an optimal performance by utilizing the key advantages of C-PAS and A-PAS. The system is grouped into three major components, which are as follows: the input device, the output device and the control centre as shown in fig. 2.

The proposed system consists of a Mobile Device (MD), Integrated Controller (IC) and Smart Wireless Rechargeable Micro-Speakers (SWMS). The mobile application in the MD allows the participant to register with an access code, and participate in the meeting. The meeting host controls the meeting by giving communication access to each participant that wishes to make contribution or ask question through the integrated control panel synchronized with the system. To reduce the effect of sound reverberation in an auditorium without an acoustic wall, the SWMS is equipped with motion sensor to detect human presence within its optimal audible zone. This was built on a Wi-Fi link because of the obvious advantage over zigbee wireless technology [1,2].



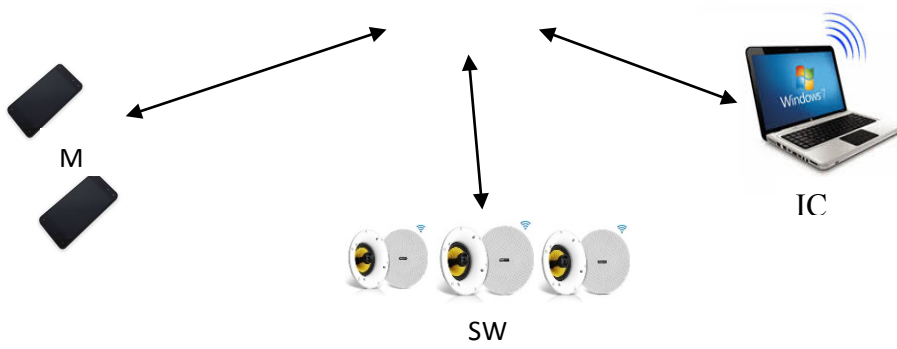


Figure 2: Proposed Integrated Mobile Based Smart Wireless PAS Physical Components.

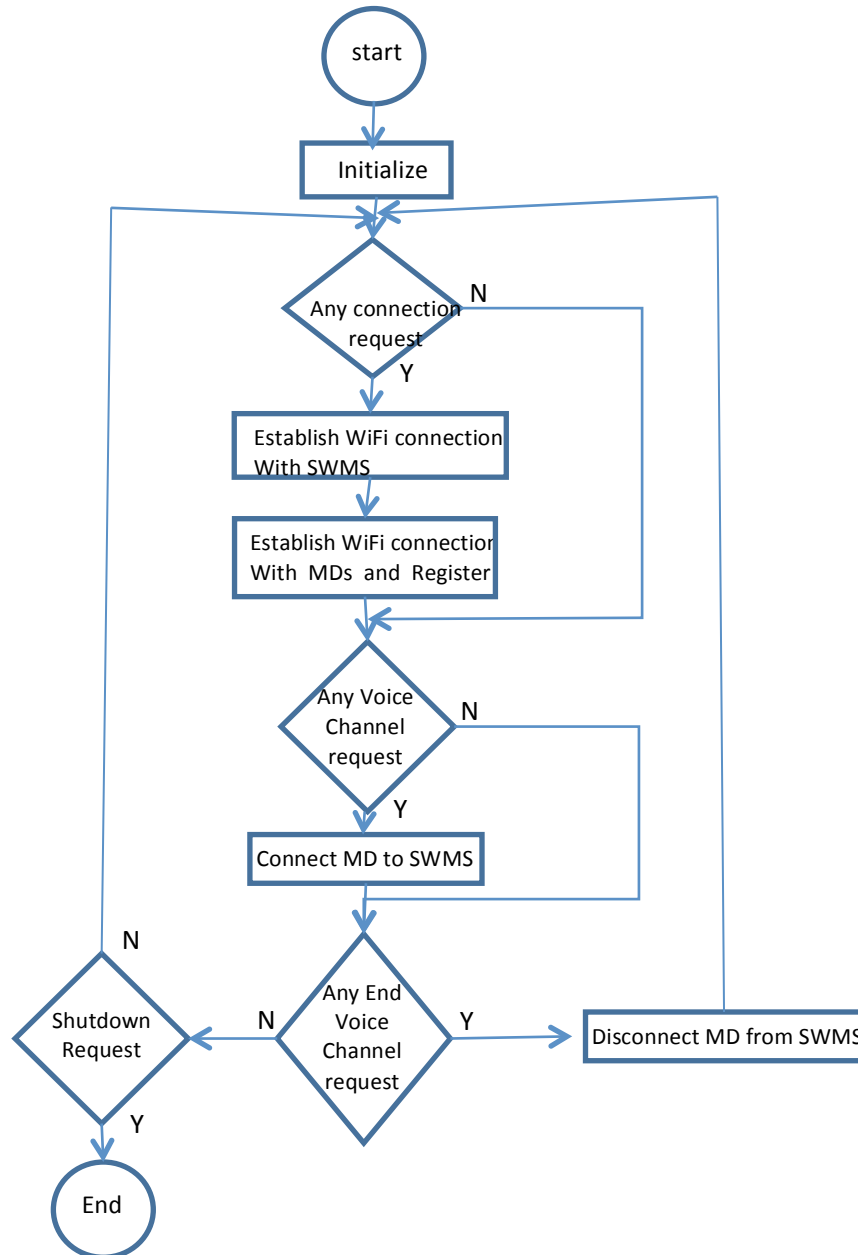


Figure 3: Proposed system operation flow chat.

### 2.1. Mobile Unit

This unit consists of a mobile phone and a mobile application. Leveraging on the voice application module, we developed a mobile app that was able to make connection through the wireless module of a smart mobile telephone [3,4]. The voice mobile app was developed for both IOS and Android platform because of their wide application among mobile phone manufacturers. The application was developed using the flow chat as shown in figure 4.

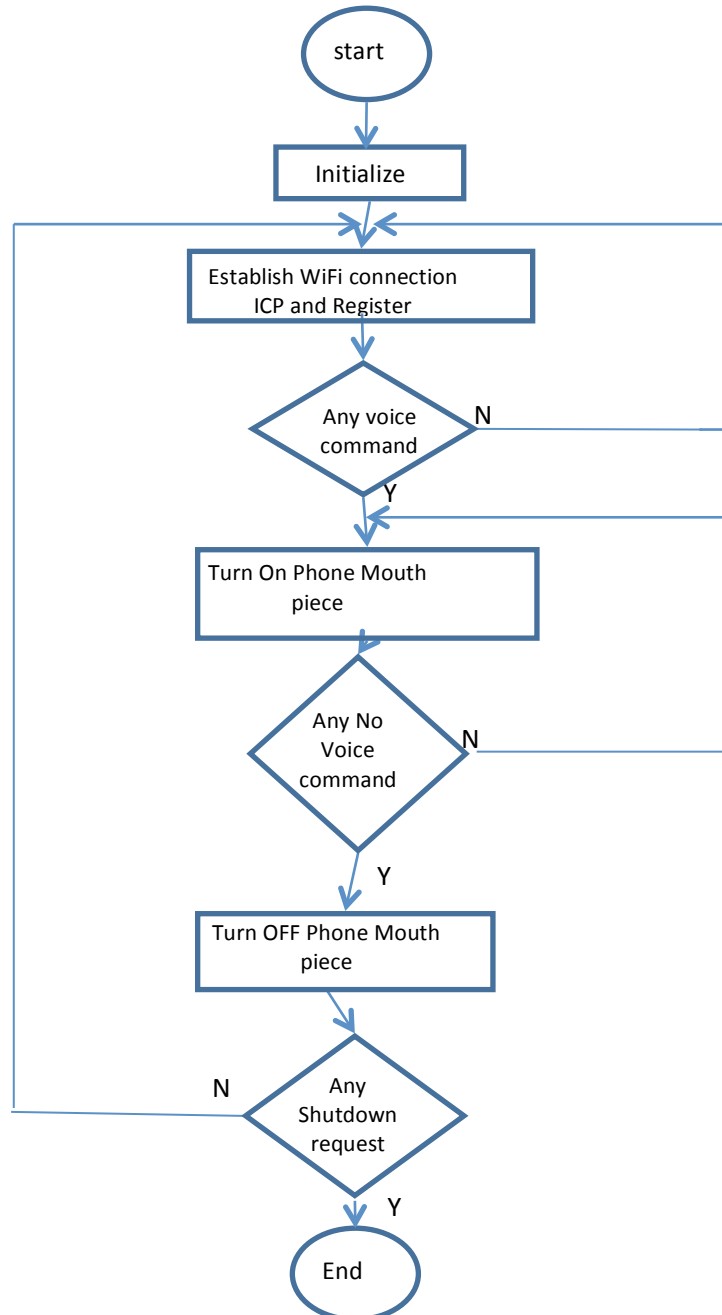


Figure 4: Flow Chart Diagram of the Microphone App Installed on the MDs

## 2.2. Smart Wireless Micro-Speaker

This speaker system was developed from the existing model of regular Bluetooth mini speaker. The Bluetooth module was replaced by a Wi-Fi module and also incorporated an energy management unit together with the power supply module. The speaker is also equipped with a proximity sensor to help detect motion [6]. All these components are

controlled by a microcontroller and for the project we used arduino uno as depicted in figure 5. The energy management unit also charges a 2.4AH 7.2V lithium ion battery that supports the system during an external power failure. The speaker connects directly to the IC through a wireless router.

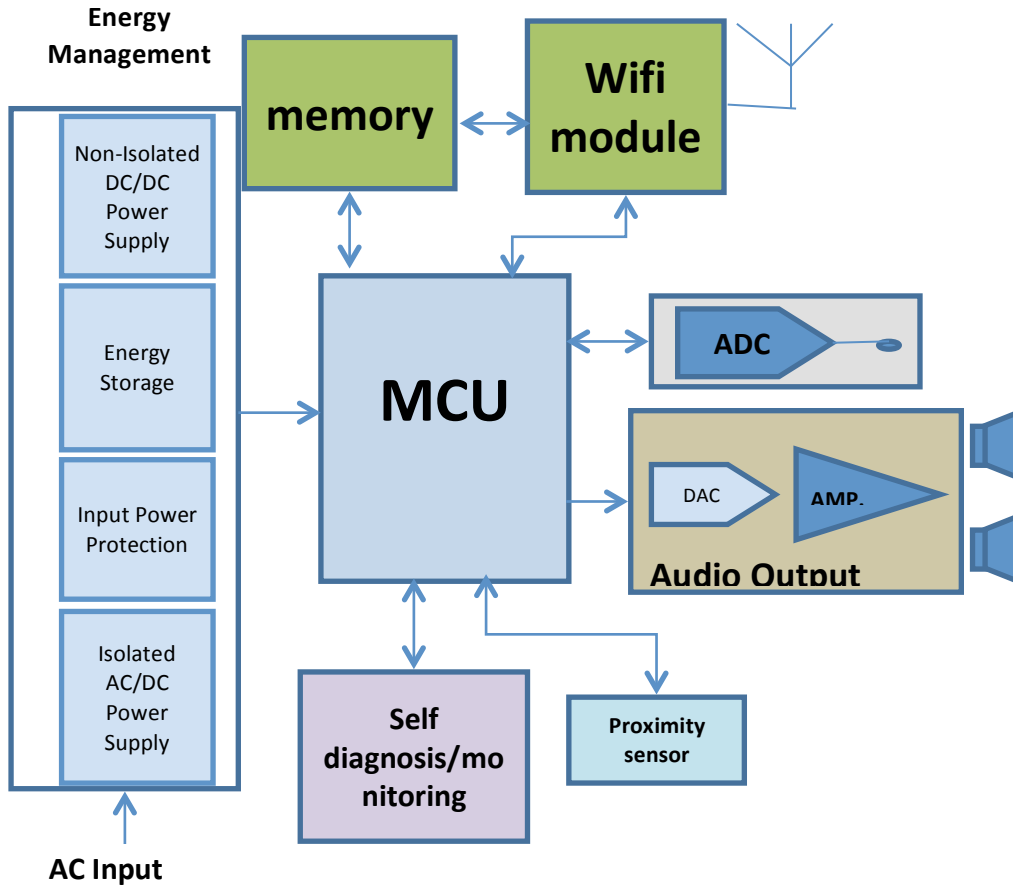


Figure 5: SWMS Unit Functional Block Diagram.

### 2.3. Integrated Controller

A network-based management application was developed to control the various individual components of the system. This controller serves as a message pager but this time, it is implemented in voice routing over a WLAN through a predefined port to all the wireless speakers connected to the router. The scalability advantage of a WLAN is used and can be expanded assuming there are more areas to cover and this can be done with access points (APs).

Once the integrated controller receives a request from a registered MD, it alerts the system manager for the next available action. There are four available actions to be taken by the manager on the request and they are as follows: drop it, wait, retry or granted. If a request is granted, the IC instructs the router to open the output channel to the particular MD and thereby allowing the signal through the speakers.

### 3. System performance

The system was set up, which comprises of a wireless router, two sets of SWMS, an android phone and a laptop. The performance of the system in terms of connectivity was good with a

considerable good audio quality though we did not factor in the sound quality, which connected to the fidelity of the amplifying circuit. And with a well-designed amplifying circuit, the sound quality will be much better.

#### 4. Conclusion

PA Systems are essential tool in communicating to a group of persons within a central or dispersed (distributed) location. The commonly used systems are wired. Heavy wiring has to be done to cover a wider area and expansion is complex and time consuming. Wireless PA Systems based on Bluetooth are not efficient in terms of communication distance, number of end devices and quality. The proposed system based on Wi-Fi protocol offer more secure, scalable, high data rate, more coverage, more end devices and distributed capability.

In the future, more work should be dedicated to full development of operational systems. The accurate analysis of data rate, power management and sound delivery accurately and efficiently were not deeply analyzed.

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