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Smart Message Dissemination Using Voice and SMS Enabled Remote Notice Boards

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Abstract: *Notice boards are communication media used in many organizations, institutions or public places such as schools, shopping malls, churches, hospitals, bus and railway stations, to effectively display messages numerous individuals. The information content of a notice board especially the traditional type requiresmonitoring and also non-instantaneous updates aredone by designatedindividual on regular basis. With advent of mobile communication technology such as Bluetooth, Wi-Fi, which supports voice service in the form of call, SMS, MIME, and so on, a new horizon have been created, that fast track monitoring and update of information content on the notice boards. In this paper, a remote notice board that support both voice and sms is designed for smart message dissemination in Academic Institutionfocusing on Yaba College Technology as main user. The system was designed used using hardware components:Android Mobile phone, LED Display Strip, Bluetooth Module HC-05, Microcontroller ATMEGA 328, PCB, Crystal Oscillator 16MHZ, Over clocking capacitor and 5V DC Power Pack. These hardware components were complemented with C Programming Language and text editor-"Visual Studio Code v1.29.1" software to properly format the source code for easeof readability. The system provide an overall solution to all staff and students concernedby ensuring that up-to-dateinformation reached the students. The voice and sms enable remote notice board offers flexibility to display vital updates and other information faster compare tomany programmable system.*

Keywords: *Smart, Mobile, Message, Dissemination, Remote, Voice, SMS, Android, Bluetooth, Wi-Fi, Wireless, notice board, Smartphone*

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I. Introduction

The notice boards are defacto tools for message dissemination in educational institutions as well as other organizations. Basically, these notice boards are constructed using "wooden frame with a soft central square of cork" for pasting memos or bulletin for the students. Most educational institution till date still made use of these manual notice boards to disseminate messages in memos, bulletins, and posters, which usually are pasted on the notice boards. The use of paper based notice boards require lots of administrative and clerical time to manage message display on regular basis and when messages like change of dates for events are made, they aredisseminated in an untimely manner, which can incitesunrestfor students of a given Programme. For instance, to dissemination of information about the beginning of new academic session semester examination timetable, a straightforward bit of paper is inexactly stuck at the front entryway notice boards in the department or school offices and in most cases the fonts are usually printed in black inks, which might not attractive enough to clutch the students' attention. With this mode of message display, many students do not get the critical message, leading them often to submit their assignment very late and which can be attributed to educational institution's faults irrespective of the students' aptitudes.With the advent of information technology, most educational institution has gradually shifted attention towards the use of electronic notice board as a replacement of paper-based notice boards due to its pragmatic implementation and application in both educational institution and corporate environment.

Problem Statement

Yaba College Technology as the study reference, currently uses memos, bulletin or circulars pasted in notice boards to convey information to the students. The nature of this channel of communication, consumes administrative as well as clerical time required to bring up-to-date messages for the students. Also,numerous students may not know about the messages showed on notice boards especially if they are not very attractive. In the existing system, update of message requires new hardcopy to replace thecurrently displayedmessage and separate person is also required to take careof these notices daily.

II. Literature Review

The electronic notice boardis a medium of communication that display messages on LCD device connected to a sender controlled system via wired or wirelesschannel.The advancements in wireless communication technologies such as Wi-Fi, GSM, Bluetooth, RF, etc., has revolutionized the development of varieties of wireless electronic notice boards used to disseminate messages to remote display screen.We discussed below, a review of related work on the application of wireless communication technologies in the design of Wireless Electronic Notice Boards.

Electronic Notice Board based on RF

TheRF-based electronic Notice boards were designed using RF wireless technology combined with microcontroller to send message onto the LCD display. In[32] adesigned of wireless notice board, which has a both transmitter and receiver modules using a short range RF Transmitter - 433.92MHz FM-TX1 and to Receiver -FM-RX1 together with microcontroller - MC68HC11A1 was proposed.The RF Transmitter module is integrated withfourcomponents keypad, liquid crystal display (LCD), microcontroller, and encoderwhile theRF Receiver moduleis integrated with three components: decoder, microcontroller, and dot matrix. The operations of the microcontroller was programmed in Assembly language. This notice board offers user flexibility to manage message display within the range of 25m -30m in a wave's obstructive environment and 200m range in free waves. In 2016, Sonawane et al designed RF Based Wireless Notice board, which can be used to display various scrolling messages for latest information anywhere such as colleges, shops, railway stations and different types of places[29].

Electronic Notice Board based on WPAN

The WPAN-based electronic Notice boards were designed using wireless personal area network (**WPAN**) technology together with a microcontroller to send message onto the LCD display. The WPAN technology enable devices such as personal digital assistants (PDA), smartphones computers, tablets to be connected via ZIGBEE, Bluetooth, Infrared Data Association (IrDA), wireless USB. The ZIGBEE-based electronic notice board that form mesh network between nodes was designed in [11], which supports short range coverage of expanded and multiple individual node. The ZIGBEE-Based electronic notice board used an XBee explorer toreceive and retrieve data from the PC and sends it within a certain range of 300-400m to the microcontroller that subsequently displays it on the LCD. In [18], anARM Based Electronic Notice Board through ZigBee with Room Lights Control using PIR Sensor was proposed. The e-notice boardcombineZigBee modem and ARM 7-LPC 2138 connected todisplay device to show all kinds notices.

Similarly, the Bluetooth-based electronic notice board, which allows messages to be sent from Bluetooth-enabled device and received viaHC-05 or HC-06 Bluetooth module connected to a microcontroller that forward it to the display unit was designed in [25]. The Bluetooth-based electronic notice board offers greater flexibility and convenience message update using smartphones, tabletswithin atransmission range of about 100m.A design & implementation of wireless notice board display based on Arduino and Bluetooth technology was presented in [9]. In this system,the Bluetooth module is used to sendinformation to the notice board and GSM module send the SMS to the registeredmobile number of the students. In [7],a "Smart rolling LED Display using Arduino and Bluetooth" with low cost that permit user access to multiple applications was proposed.

Electronic Notice Board based on Wi-Fi

The smart electronic notice board using Wi-Fi was proposed by[4],where message is sent from personal computer through WI-FI networkthat interfaced with ARM cortex connected to the display system. The proposed system was implemented using WI-FI transceiver, the ATMEGA-328 chip as ARM cortex together with 20 characters and 4 rows LCD display.In [30],a "Voice over Wi-Fi Based Smart Wireless Notice Board"to transmit short notification utilizing grounds Wi-Fi to achieve understudies rapidly in the homerooms was proposed. The proposed framework is ease and vitality effective framework as utilizes Raspberry pi controller to get notification and show on LCD or terminal.In[27], "an electronic notice board using Wi-Fi with the objective to provide its users with a simple, fast and reliable way display messages on monitor" was designed. The system sent notice via a web page to the Raspberry Pi 3 model B which hasARM version 8 processor in it and which is interfacedwith the monitor using HDMI cable. All received data on raspberry pi model are stored in the database but retrieved and displayed on the monitor web page.

In[23],a notice board system using an Arduino board with Wi-Fi being remotely controlled by any Android OS smart phone was designed and implemented. The system was implemented using one Arduinomaster board as main controller and four Arduino boards as slaves. When information is given through Wi-Fi master Arduino takes receives data from Wi-Fi according to coding it feds to slave Arduino and display on LED notice board at same time information gradually shifting with controlled by shift register. With help of

shift register data moving from one location to next location like this gradually scrolling. In system all slave lines are displaying different data with scrolling received from master. A Wi-Fi Based Notification System was also implemented in [22] usingWi-Fi Device -RN-171, Microcontroller -PICF4620, VGA module-µVGA II, RTC-DS1307 and Graphic LCD - JHD12864E. Likewise,[28]developed a notice board system using an Arduino board with Wi-Fi being remotely controlled by any Android OS smart phone.

Electronic Notice Board based on GSM

GSM-based notice boards allow message to be sent from mobile phones or tablets to a display unit through a GSM module interfaced with microcontroller. An implementation is reported in [10][12], who develop a GSM based notice board whose contents can be updated simply through an SMS which is realized through an embedded system containing GSM module interfaced with the Arduino microcontroller. An "SMS-Based Automated E-Notice Board using Mobile Technology" was proposed in[2][24], which uses GSM module to receives information to be displayed as SMS, conveys the information through the COM port to the microcontroller to authenticate the SMS and shows the information on the LCD display.In the same way, an "SMS Controlled Smart e-Notice Board" was designed by [19].Also a wireless e-notice board using raspberry pi connected to Wi-Fi that allow a user sends to a message through the android application was proposed in[31]. This wireless e-notice board uses the Raspberrian OS installed in the SD card, stored data in My SQL, connect android app to the LCD display via HTTP web link for data access or transfer andoutputit in LCD with help of PHP display.

Notable reportson electronic notice boards that implemented GSM and Arduino technologies are "Wireless electronic notice board- Our Real-Time Solution [8], GSM based e-Notice Board: Wireless Communication [13], Wireless Electronic Display Board Using GSM Technology [26], Wireless Electronic Notice Board Using GSM Technology [17], GSM based electronic noticeboard via SMS[21], GSM Based Digital Notice Board[3]". In [6],a design and implementation of a wireless message display system using ATMEGA328 Microcontroller mounted on an Arduino board, a Bluetooth Module (HC-06) and an LCD screen was presented. An Android Phone Speech Recognition Sensed Notice Board Display was implemented in [1][5][16][14][20][30]. GSM Based Intelligent Notice Board which integrates both hardware and software with microcontroller, GSM module, PIR sensor, and LED display was implemented in [15] where message is sent through a mobile that is accepted by a GSM module SIM 900 and authentication of the mobile number is done by the AT89S52 microcontroller.

In view of the above literature, we presents a design of Voice and SMS-Enabled Remote Noticeboard based on Android GSM and AMRAudio Codec Technologies that facilitates instant message dissemination on electronic noticeboard, which the bottleneck of the defacto notice boards with manual update mechanism. The system is based on real time process and provides a more stress free automated method for message update and display.

III. Methodology

We designed the Voice and SMS-Enabled Remote Noticeboard based on Android GSM and AMRAudio CodecTechnologies, which support both sms and voice data fed as input to the LED display via the HC-05 Bluetooth and Microcontroller.

Materials

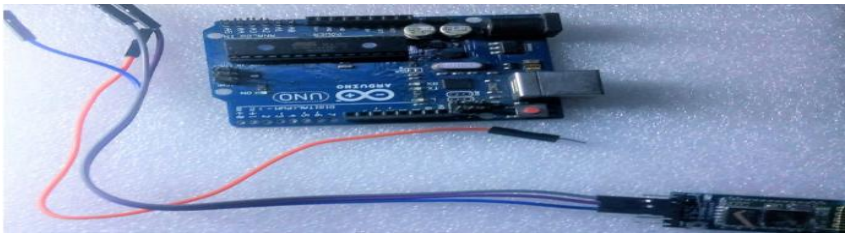
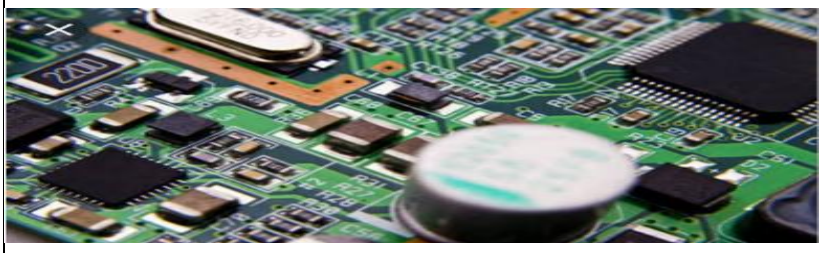
The system design utilized the following hardware component: LED Display Strip, Bluetooth Module HC-05, Microcontroller ATMEGA 328, PCB, Crystal Oscillator 16MHZ, Over clocking capacitor and 5v DC Power Pack. The software deployed to complement the hardware components in order to achieve our desired goal of the system design consist of operating system, C Programming Language and text editor-"Visual Studio Code v1.29.1" to properly formatting the source code for easy readability.

Hardware Component: The LED Strip is a set of addressable RGB led units arranged on a single strip that runs on 5V DC and stacked together to give the effect of a LED module. The Bluetooth Module HC-05, enables data transfers from the Android GSM device to the Microcontroller, which forward it to the display unit. It is made up of two serial communication lines: TX-transmission and RX-receiver lines as well as two power lines positive and negative dc 5V power supply. The Microcontroller ATMEGA 328 determines how the information from the Bluetooth module HC-05 is placed on each LED dots on the display unit. The microcontroller has 2kb program space and runs on 5V DC supply.

The PCB [Printed Circuit Board] embodies all the required components to process the data coming from the android device including the microcontroller, oscillator, etc. the circuit diagram used in preparing the PCB [Yellow FR_4] Was designed using a professional PCB design software, after which the blueprint of the diagram was captured, transferred and taken through some chemical process using Fe_2Cl [Iron Chloride] to

complete the board making process. The board was then drilled accordingly and components were placed and soldered using soldering lead and Iron. Crystal Oscillator 16MHZ. Crystal Oscillator 16MHZ:The atmega 328 runs at a specified speed which is determined by an external component called oscillator. The oscillator used is made of crystal and runs at the speed of 16MHz [Sixteen Mega Hertz] reliably, except that sometimes it overclocks which may affect the flow of instructions in the microcontroller unit. Over clocking Capacitor:The Oscillator speed can be pinned at the specified speed without overclocking using a pair of capacitors of 22pf [Pico farads]. These capacitors connect the oscillator to ground to stabilize its speed. 5v DC Power pack: The power pack supplies the whole system with the required amount of voltage 5V DC at 60 Amps, more than enough to give a very bright display effect on the LED strip. The power pack takes 220V AC and converts it to 5V DC at 60 Amps.

Table 1: Hardware Component

COMPONENT	**IMAGE**
LED Display strip/Module	
Bluetooth Module HC-05	
Microcontroller ATMEGA 328	
Printed Circuit Board	
Crystal Oscillator 16MHZ	

Over clocking capacitor	
5v DC Power Pack	

Software Component: Although the microcontroller was not specifically designed for such task but we were able to achieve this using Bit Banging methodology of addressing each pin in a microcontroller port to allow data streaming on a specified port which allows addressing of each LED possible [only if we are using LED strip].

Methods

The hardware components presented in table 1 were technically assembled and configured based system architecture in fig 1. In this system Architecture, the sender through an android GSM device send message to the AMR-Voice server, which does the voice conversion, and then sends the converted voice message to the display unit in form of text. The information shown on the display unit can be edited, update or deleted from the database. The receiver is able to read clearly from the display unit any information been sent to it from the sender. The HC-05 connects to the microcontroller board from which the message is directed to the display.

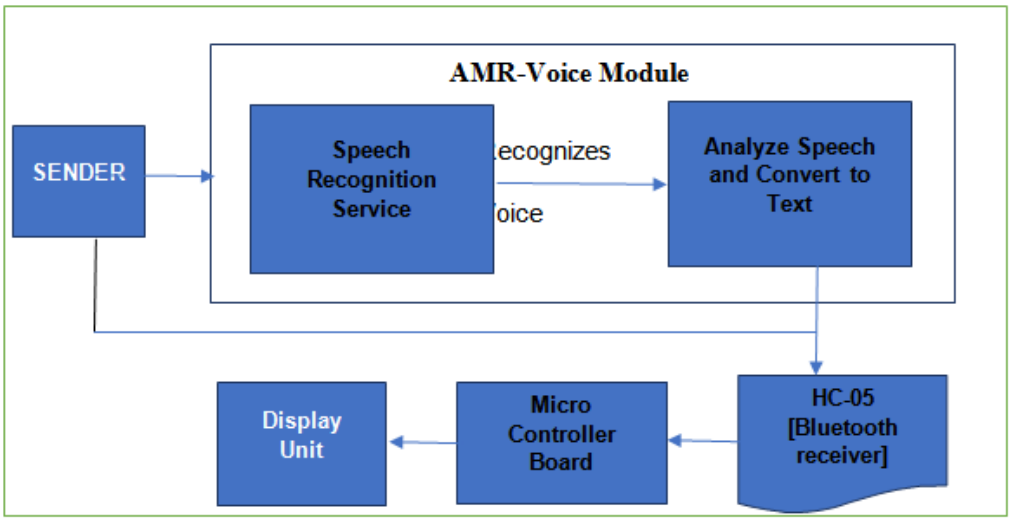
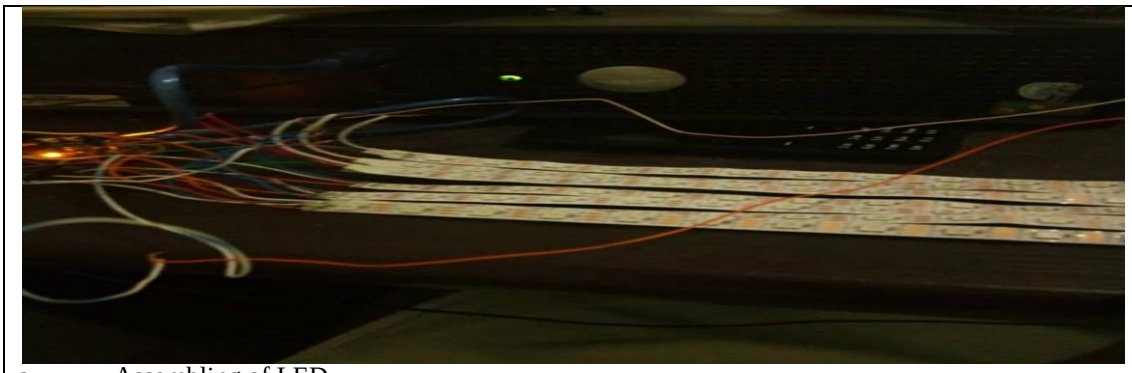


Fig 1: Voice-SMS Based Notice board Architecture

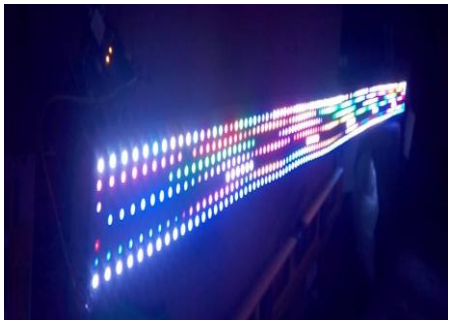
The Android GSM device was integrated with the assembled Voice-SMS Based Noticeboard using C Language program developed in Visual Studio Code v1.29.1. The program interfaced with two mobile applications installed on the Android GSM device: AMR_Voice and Arduino Bluetooth Control to provide enhanced optimum functionality of the designed system.AMR deploys"android mobiles internal voice recognition mechanism to pass voice commands to your robot Pairs with Bluetooth serial modules" and sends in the recognized voice as a text message while Arduino Bluetooth Control used to control Arduino board to receive text message via Bluetooth.

Assembly and Testing of LED Strip Light: The LED strip light is a adaptable circuit board colonized by surface mounted light-emitting diodes (SMD LEDs) and other components,whichmostlyemanates from adhesive support. Non-statics in strip lighting consists of water resistance, colour, adhesives, choice of SMD, driving voltage, control type and whether it is constant current or constant voltage layout. The arrangement on the LED strip light on the layout surface is shown in Fig 2a -2g and it allows us to test each of the LED strip to determine their colour and brightness.

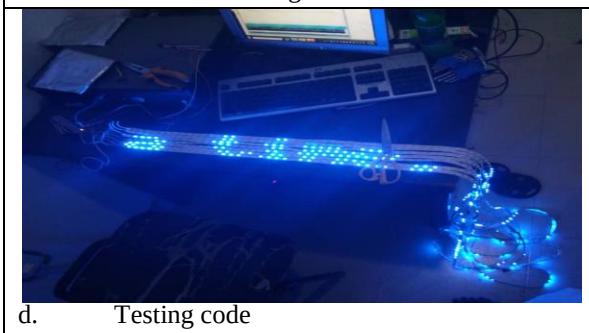


a. Assembling of LED

b. First time testing



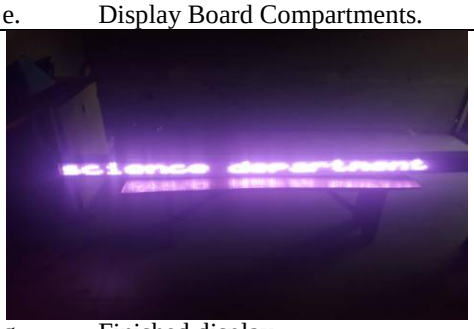
c. Testing of all colors



d. Testing code

e. Display Board Compartments.

f. Full Length Picture of the Display Screen



g. Finished display

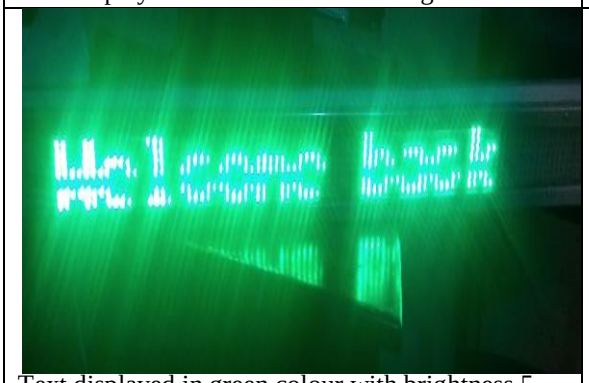
Fig.2: Assembly and Testing of LED Strip Light

IV. Result & Discussion

Operating this system is very simple as it is controlled via a voice input and no much of navigating and exploring. User have an option to select between two mobile applications (AMR_Voice and Arduino Bluetooth Control). With a given operation mode of AMR_Voice or Arduino Bluetooth Control, different ranges of outputs can be generated bythe command **change** text, **change**colour and **change**brightness. For instance, using the "Welcome Back" generated various outputs, displayed in different colour and brightness as shown in fig. 3.

Text displayed in blue colour with brightness 8

Text displayed in purple colour with brightness 7



Text displayed in green colour with brightness 5

Text displayed in white colour with brightness 10

Text displayed in red colour with brightness 5

Text displayed in yellow colour with brightness 7

Fig. 3: Different Display of Text, Colour and Brightness

V. Conclusion

In this paper, we designed and implemented a voice/sms enabled remote notice board for smart message dissemination to both staff and students in Yaba College Technology, Lagos-Nigeria.The system offers flexibility to display vital updates and other information faster compare to theexisting system in the Campus.We can show the messages with less blunders and less upkeep. This system has served to discarding the utilization of papers and manual showcase of notice board. Despite the fact that the system can just show 60 characters because of the size of the LCD applied, it very well may be reached out to a greater display utilizing a similar innovation. The system demonstrates to be cost-effective by taking the benefits of the cheap components utilized. For further research, we recommend an improved design that makes use of larger size LCD display board, which can accommodate more messages.

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