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Driving the New Wave of Mobile Innovation

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Journal on Mobile Applications & Technologies

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Mobile application development is the process by which application software is developed for low-power handheld devices which can be pre-installed on phones during manufacturing, downloaded by customers from various mobile software distribution platforms, or delivered as web applications using server-side or client-side processing (e.g. JavaScript) to provide an "application-like" experience within a Web browser. i-manager's Journal on Mobile Applications and Technologies focus on how innovative applications and technologies will change our daily lives and how it will redefine businesses across industries.

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All submissions will undergo an abstract review and a double blind review on the full papers. The abstracts would be reviewed initially and the acceptance and rejection of the abstracts would be notified to the corresponding authors. Once the authors submit the full papers in accordance to the suggestions in the abstract review report, the papers would be forwarded for final review. The final selection of the papers would be based on the report of the review panel members.

Format for Citing Papers

Author surname, initials (s.) (2020). Title of paper. i-manager's Journal on Mobile Applications & Technologies, 7(2), xx-xx.

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EDITORIAL

This volume of i-manager's Journal on Mobile Applications and Technologies (JMT), (July – December 2020: Volume-7, Issue-2) has five peer reviewed research papers that covers diverse topics in mobile applications and technologies. The aim of the journal is to address the latest developments in the field to meet the challenges of the present world. The current issue focuses on U-FARM: the unified framework for agricultural extension, COVID-19 android-based text-to-speech application: an inclusion of people living with reading and sighting disabilities, deep learning design for character recognition with position-free touchscreen-based braille input method, IoT based health monitoring system with voice control module, and guardian application using android studio.

Latha developed U-FARM: the unified framework for agricultural extension. This article provides details on mobile apps available in India for agricultural extension activities and 24 x 7 services available for farmers. Mobile apps are many in number, fragmented data, and information overload with redundant data. The key idea of this paper is to propose a unified platform where all agricultural extension can be promulgated for the benefit of farmers, eliminating the drawback of multiform data across common platforms.

Yahaya et al. proposed a COVID-19 android-based text-to-speech application: an inclusion of people living with reading and sighting disabilities. This research aim at developing mobile text-to-speech application for public awareness on the existence, risks and preventive measures against contacting and spread of COVID-19 pandemic from English text to English speech. The App has proven promising results in the campaign against contracting and spread of novel COVID-19 pandemic to people who can read and understand English and people who have English reading and sighting disabilities (example the blind) and it is, therefore, recommended for use in any part of the globe that is experiencing Corona Virus pandemic.

Shenbagavadivu et al. investigated on a deep learning design for character recognition with position-free touchscreen-based braille input method. The proposed system focuses on position free touchscreen method which would be easy to place dots anywhere on the screen. This is an innovative Braille input method using smartphone. Datasets were trained and tested in three languages such as English, Tamil and Hindi. Then by using deep learning techniques the character is identified and the same is given as audio output. This paper is useful to visually impaired people who want to use smartphone with position free touchscreen method.

Nazeeya and Balaji developed an IoT based health monitoring system with voice control module. This paper proposes a solution based on IoT for monitoring patients on a daily basis. The solution will be open platform-based intelligent healthcare system with enhanced connectivity and interoperability for device and service integration. Flexible and wearable bio-medical sensor device enabled by system on-chip voice module helps to reduce the cost of healthcare while simultaneously improving outcomes. The proposed work integrates IoT devices with healthcare services for an improved user experience and better service.

Rajashree et al. studied on guardian application using android studio. The goal of this project is to provide a simple offline android application which solves the issues faced by the user when the phone is misplaced. Some of the essential details can be accessed from the phone and the only requirement is to send an SMS from any mobile device with the pass code that is set on the guardian android app. The app works totally in the background. The app will automatically detect the incoming messages and filter it to search for the pass code, and on success, it reads the command and perform the task as per the requirements given by the user.

We extend our sincere thanks to the authors for their contribution towards this issue and we are grateful to the reviewers for spending their quality time in reviewing these papers. Our special thanks to the Editor-in-Chief, Dr. M. V. Subramanyam for his continuous support and efforts in further improving the quality of the Journal.

Hope this issue imparts an enlightening reading experience! Enjoy reading!

Warm regards,

Christal K.
Technical Editor
i-manager Publications

COVID-19 ANDROID-BASED TEXT-TO-SPEECH APPLICATION: AN INCLUSION OF PEOPLE LIVING WITH READING AND SIGHTING DISABILITIES

By

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ABSTRACT

Research has shown that Coronaviruses (CoV) are a dangerous virus species that are capable of causing Severe Acute Respiratory Syndrome (SARS-CoV) and Middle East Respiratory Syndrome (MERS-CoV). The most recent is Coronavirus Infectious Disease (COVID-19) that was first found in Wuhan, in the people's Democratic Republic of China as another new form of pneumonia disease. Since its discovery in late 2019, the number of people infected by this virus, and the number of deaths is on the increase daily going by the reports of the World Health Organization (WHO). For now, there is no substantial solution to the pandemic, however, an important task that is done was creating aggressive awareness among the people to educate them on the symptoms, threat, and prevention of the disease as this would contribute a lot in controlling the spread of the pandemic. Most awareness strategies adopted so far include campaigns, flyers, jingles, advert, messages, etc. These strategies are however challenging to the populace with reading and sighting disabilities. Given the aforementioned, Android-Based Text-to-Speech Enabled Public Awareness Application of COVID-19 using Agile Methodology for Mobile Application Development and Android Studio Version 3.4 was developed to provide public awareness information on the danger, safety, and preventive measures against contact and spread of coronavirus pandemic by translating written messages to audio messages. The developed Application has succeeded in achieving the cardinal objective of the research by providing efficient and effective COVID-19 awareness information to people living with both English reading and sighting disabilities and is, therefore, recommended for use to the general public. It is recommended as further research to translate text to other local indigenous languages.

Keywords: Coronavirus, Text-to-Speech, Android-based, Pandemic, Awareness, Information.

INTRODUCTION

Corona Viruses (CoV) are one of the deadly diseases that are capable of causing severe Acute Respiratory Syndrome (SARS-CoV) and the Middle East Respiratory Syndrome (MERS-CoV). The most recent Corona Virus is Corona Virus Infectious Disease (COVID-19) that was discovered in Wuhan, China. According to the World Health Organization (WHO), the number of people infected by this virus and the number of deaths is on the increase globally. Daily reports from various Centers for Disease Controls across many countries agreed with the deadly nature of the disease (Hemdan et al., 2020; Mao et al., 2020; Mohammed et al., 2020; Zhou et al., 2020). The virus can easily pass from person to person which makes it spread rapidly. Several studies have described typical clinical manifestations including fever, cough, diarrhea, and fatigue. Early detection of the Corona Virus symptoms is one of the suitable ways to prevent the spreading of Corona Virus (Mohammedet al., 2020). Historically,

pandemics are known to threaten human race. One of the crucial tasks to take during a pandemic is to create an intensive awareness among the populace. Aggressive awareness has a vital role to play in controlling any pandemic.

The newly emergent Corona Virus is resulting in high fatality rates and incapacitated health systems. Preventing further transmission is a priority (Ferretti et al., 2020). The present Corona Virus pandemic has motivated researchers, particularly in the health sector to train several healthcare workers/responders to act swiftly whenever there is a suspected case of the disease (Ros & Neuwirth, , 2020). The Corona Virus pandemic requires the deployment of novel surveillance strategies to curtail the further spread of the disease in the community. Participatory disease surveillance mechanisms have already been adopted by many countries for this pandemic (Garg et al., 2020).

Considering the mode of spread and the severity of the disease, it is, therefore, necessary to bring awareness to the people on various safety precautions needed to curtail the spread of the disease. Such precautionary measures include regular washing of hands with soap and water, using sanitizers, and maintaining social distancing. If these safety precautions are done, the spread of the disease could be reduced drastically. The methods used to educate the people about the existence of the disease and its effects are being carried out through the use of online media, print media, audio/video awareness programs, and advertisements (Venigalla et al., 2020; Pandey, et al., 2020). However, to achieve the goal of awareness as a precautionary measure, the population with a disability must be considered so that they can also be aware of the pandemic and how to control the spread. The scope of this study is limited to those with reading and sighting disabilities.

Android text-to-speech permits you to convert text to voice. It also permits you to speak texts in different understandable languages (in this case English Language). Android operating system devices provide Text-to-Speech class for this purpose (Tutorials Point, 2020). Arising from the foregoing, this research is aimed at developing Android-based text-to-speech application using Agile Methodology for Mobile Application Development and Android Studio 3.4 that will provide timely COVID-19 awareness update to able-bodied people, people living with English reading and sighting disabilities who understand English in both text and speech format and those who understand English in speech format only (people who can hear English but cannot read out the text format, for instance, the blind people and people with English reading disabilities).

This research work is organized as follows: Section 1 presents a review of related literature. Section 2 explained telemedicine in the COVID-19 era. While Section 3 discusses why the COVID-19 response should be disability-inclusive, Section 4 explains Agile Methodology for Mobile Application Development. The research methodology is discussed in Section 5. The implementation is described in Section 6, Section 7 is System Testing Evaluation, while the last section is that of the conclusion.

1. Review of Related Works

In order to educate people about the safety precautions on COVID-19 when they are not in their homes, Venigalla et al., (2020) proposed a two-dimension survival-based game by combining social separation and the use of face covering mechanisms, and sterilizers to curtail the spread. Survived COVID-19 was designed as an Android-based mobile game. The evaluation of this application was done through qualitative survey considering 20 volunteers. The outcome of the survey questions have a mean value greater than 3.6. The weakness of this research was that the game supports only Android mobile devices and does not have text-to-speech concept. In the same vein, Ros and Neuwirth (2020) developed COVID-19 global awareness healthcare guidelines by applying FPV training tutorials. The authors used educational audiovisual contents through 'first person point-of-view' to train healthcare providers on COVID-19. This technology provides eight new tutorials to assist healthcare workers or respondents taking care of COVID-19 patients. After the completion of the study, the tutorial offered efficient and swift public health educational tool globally that could address COVID-19 pandemic awareness program. However, it does not take into consideration the issue of people with English reading disability into consideration.

The work of (Smith et al., 2020) gives an all-inclusive direction on how to quickly fit in telemedicine into practice during and after the pandemic. The authors construct a toolkit that comprise of eight vital components for fruitful execution of a telemedicine platform. This includes: providing relevant training for staff, educating the patient, providing an electronic medical record system for patients and make available all necessary investment in the hardware. Other support that are necessary include the integration of the billing and coding, support for all information technology infrastructure, and most importantly the inclusion of caregiver.

Hemdan et al (2020) proposed 'COVIDX-Net' a framework that is used for deep contact tracing instrument for public health workers and local communities to combat the spread of the virus. In this research, ways to build an app for contact tracing was not addressed. Conspicuously, the authors did not report the engineering behind applying bluetooth to enable such a feature. The authors also did not tackle the possibility of location data collection that could be used for assisting epidemiologists in forecasting disease spread.

Mohammed et al (2020) proposed the design of system that is capable of detecting the Corona Virus with less human interaction repeatedly from the thermal image and using the smart helmet mounted Thermal Imaging System. The proposed system is equipped with the facial-recognition technology. The proposed system can also display the pedestrian's personal information which can automatically take pedestrians' temperatures. However, this research was a mere design as it was not implemented.

Reeves et al. (2020) proposed a rapid response to COVID-19 by creating an Incident Command Center when the crisis was early to help identify Electronic Health Record (EHR)-based tools to provide support for clinical care. EHR tool is useful if a rapid deployment of standardized processes is needed. The challenge is that there is the need to regularly regulate growing requirements, communication, and adoption to meet the need of the people. The need to coordinate numerous stakeholders to maintain pre-pandemic medical care with great concern is necessary.

Lee and Lee (2020) in an article South Korea's quick response to the COVID-19 pandemic, reported on the situations of the COVID-19 outbreak in South Korea. The authors' application of low-contact testing to scale up diagnostics reduce health care worker's exposure to COVID-19. The authors also showed how online mapping can promote mobile apps in the tracking of the spread of COVID-19 and thereafter alert the public of their risk of exposure. In this research, the authors did not deeply investigate the rapid development and manufacturing of COVID-19 diagnostic tests, which was very necessary to enable the government develop strategy of widespread testing.

In view of the literature reviewed, there is no research work that address text-to-speech aspect in the diagnosis, treatment and in creating public awareness in COVID-19 pandemic. This research aims at developing Mobile Text-to-Speech App for public awareness on the existence, risks and preventive measures against contacting and spread of COVID-19 pandemic from English text to English speech.

2. Telemedicine in Covid-19 Era

One of the recommendation for COVID-19 disease strategy to stop its spread was social distancing. This step has resulted in restriction of access to in-person visits by medical practitioners. The maintenance of suitable patient care has caused a great challenge while making effort to avert a considerable backlog of patients once stay-at-home restrictions are over. There are practices that are naïve to tele-health which when implemented, will make majority of staff to experience challenges with telemedicine. The implementation of telemedicine warrants access to, and continuous patient care while limiting needless exposure to COVID-19 and other infectious diseases (Smith et al., 2020; Daniel et al., 2020). Tackling the adverse impact of COVID-19 should be primary focus in the healthcare system. This implies maintaining core and critical clinical services. The spread of CoVID-19 and other infectious diseases can be minimized by the application of Information and Communication Technology (ICT) tools by various healthcare systems globally. Setting up of virtual clinics through the use of telemedicine is desirable. The implementation of this strategy would help in the treatment

of the disease remotely while maintaining social distancing and thereby reducing overcrowding of patients in the hospital (Ting et al., 2020).

3. Inclusion of Disability in the Covid-19 Response

Recent statistics show that there are over one billion individuals identified as People Living with disability (PLWD) globally. The present pandemic is most likely going to excessively affect these individuals in the society. The PLWD might be at high mortality and morbidity risk because of the difficulty involved in providing healthcare service to these group of people. If this happens, the global health vision of achieving Universal Health Coverage (UHC) would be thwarted. There are inequities in accessing public health messaging among PLWD. The need of PLWD is that all communication if possible should be provided in plain language in an accessible and understandable format. This could be done through the use of mass media and digital channels. More so, developing strategies for communication must be safe and accessible through the use of sign language interpreters and wearing of transparent face masks by the healthcare service providers to allow lip reading. In a bit to mitigate strategies, it should be done in such a way that it does not lead to segregation. Instead, protective measures should be prioritized for these communities. Finally, PLWD stand a high risk of contracting SARS-CoV 2 infection because of the existence of comorbidities. If this is not checked, it might cause a barrier to health care givers during the pandemic. To overcome this, healthcare staff should be well informed through awareness training programmes on the rights and various needs of the PLWD in order to maintain their dignity, safeguarding against discrimination, and preventing imbalances in care given (Richard & Laura, 2020).

4. Methodology

This research was carried out using Agile Method for Mobile Application Development. The authors' choice of 'Agile' method of application development is because this approach creates an enabling environment to combine the effort of the project development team and the customer in making sure requirements and solutions evolve throughout the development process. Agile method encourages adaptive planning, evolutionary growth, early delivery and continuous improvements. In this method, a large project can be split into smaller parts before applying agile methodology principle to each smaller parts of the project. The Agile System Development Life Cycle (SDLC) model which includes but not limited to programming development and project management involves breaking down of project into smaller modules. However, integrating documentation and testing is carried out at each stage.

In this section, the proposed framework for COVID-19 Text-To-Speech App would be discussed.

The conceptual representation of how the various component of a text-to-speech engine work is shown in Figure 1.

Step 1: Gathering of COVID-19 awareness update

Mobile Text-to-Speech App developer gathered COVID-19 awareness update in English text format and sent it to the people via Text-to-Speech App. Then the Text-to-Speech converter converts the English text into English speech as follows:

4.1 Text Analysis

Once the 'Listen' button is clicked, it will activate the text to speech engine and the first component that comes alive is the Text analysis component which analyses the text, sort it and prepare it in order to retrieve machine readable facts.

4.2 Linguistic Analysis

This component is grouped into subcomponent. This phase sorts the texts and arrange the text in the order, so that they will be pronounced or spoken while the intonation component sets the voice. Voice texture of the engine and duration is set by how fast or slow the engine should use when making pronunciations or speeches.

4.3 Wave Form Generation

After the foregoing process, the public receives the message (s) in both English text and speech depending on the choice of user. Wave form generation helps to produce the final out put which is speech.

Step 2. Text-to- Speech Chart Diagram

The flow chart (Figure 2) shows the step by step graphical representation of how this system work. Once the system is

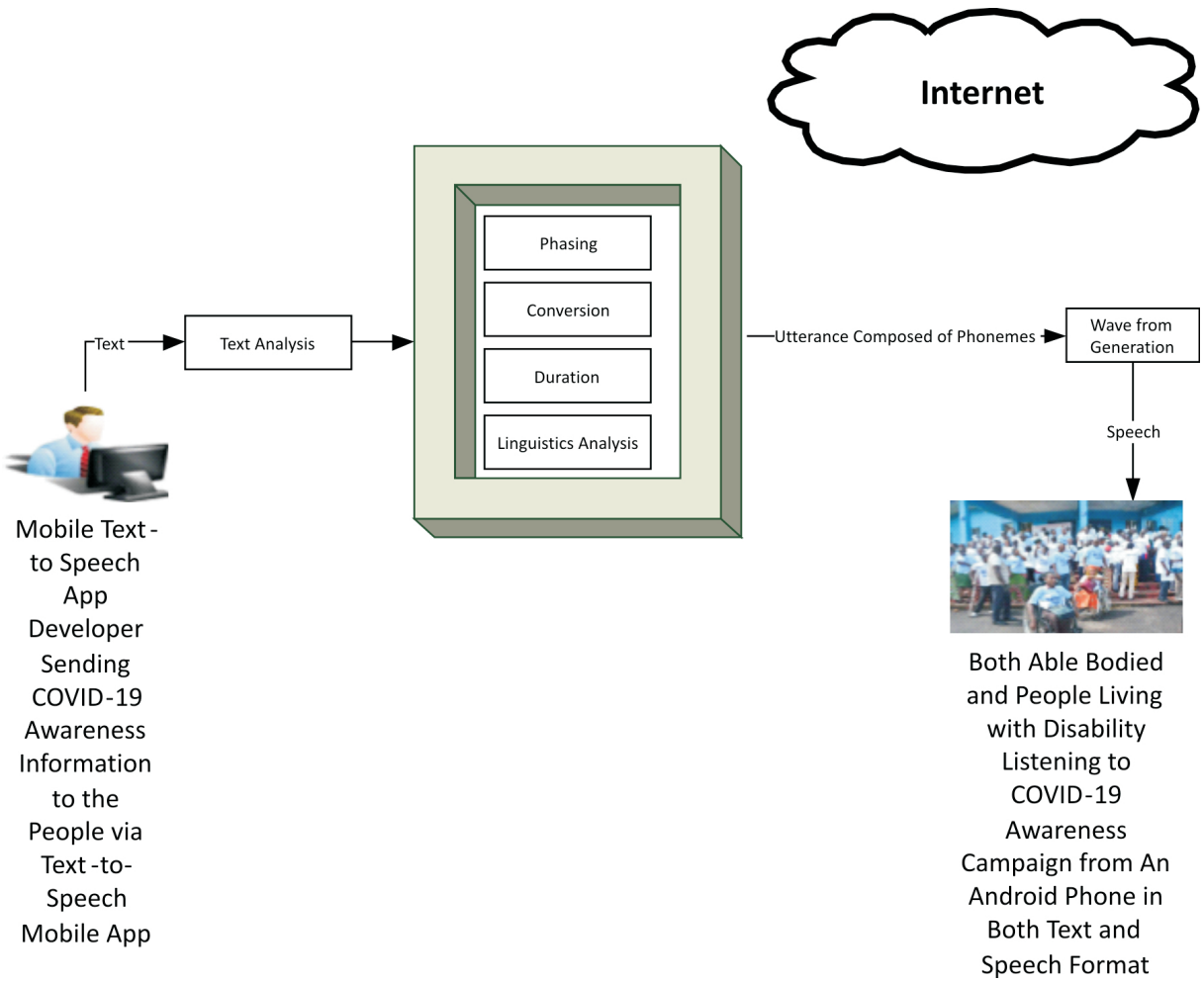

Figure 1 Proposed Framework for COVID-19 Text-to-Speech Public Awareness

launched (start), user is expected to click "Get started" and that will launch the first activity of this system. User can then click on the 'Listen' button (input) to activate the text to speech engine. User can continue to the next activity on the system by clicking button "Continue" and if clicked, it will launch the next activity, but if 'Previous' happened to be clicked at this level which is the first activity, the system will print "Can't go back". The subsequent conditions check, if button "Continue" or "Previous" is clicked. In a case whereby a "Previous" button is not selected on the first activity, the system goes back to the activity before the current one. This system will reach the end of its flow chart once the button continues equal to a string output of "no new content."

Step 3. Text-to-Speech Use Case Diagram

There is only one user acting on this system and the user can only act on four activities which are the 'Get Started' button, 'Continue' button, 'Listen' button and the 'Previous' button. 'Get started' launch the first activity and second interface on the app, 'Continue' button takes the user to the next interface, 'Previous' button takes the user back to the previous interface/activity, and the 'Listen' button activates the text to speech engine. Figure 3 shows the COVID-19 text-to-speech public awareness use case diagram.

5. Covid-19 Information Application Implementation Menus

The section describes all the necessary menus that useful for the user. It also explains how these menus are related and interconnected.

5.1 Get Started Interface

This is the first interface (Figure 4) that appears when the

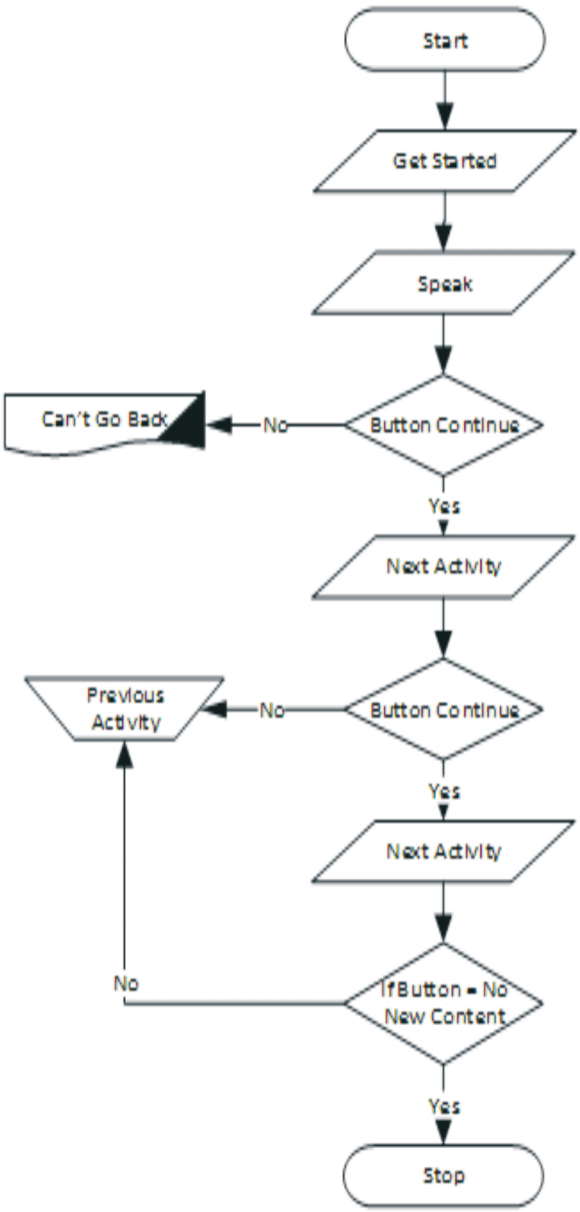

Figure 2. COVID-19 Text-to-Speech Public Awareness Flowchart

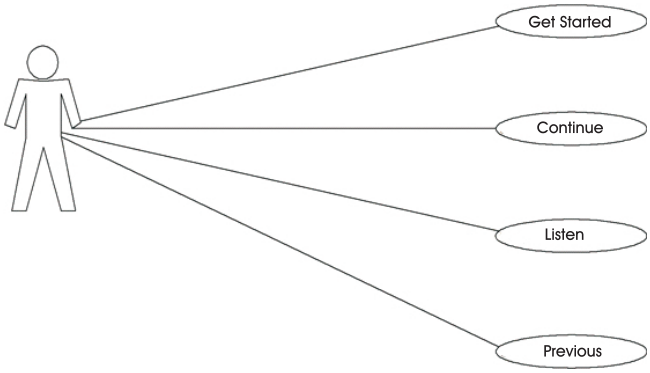

Figure 3. COVID-19 Text-to-Speech Public Awareness Use Case Diagram

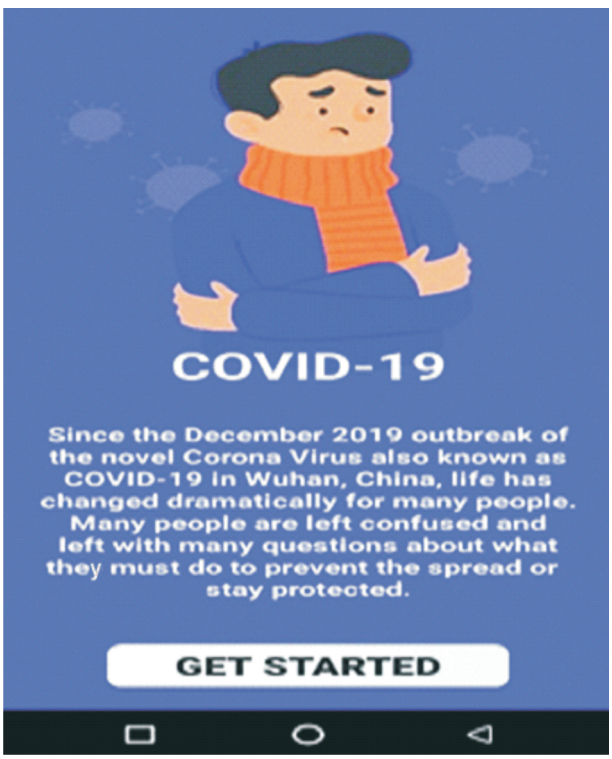

Figure 4. Get Started Interface

app is launched. It gives a brief introduction to how COVID-19 started and how it has changed our life style. It features a button "Get Started" that leads to the next activity.

5.2 Virus and Respiratory Infection Interface

This interface (Figure 5) gives information about COVID-19 as a respiratory virus and an overview of how it causes damage to the host respiratory organ. Symptoms of COVID-19 are also introduced. This interface features an image showing how the virus enters and spread in the respiratory tracts. It also features three clickable buttons which are; "Previous", "Listen" and "Continue." The 'Previous' Button when clicked allows users to go back to the previous interface while the 'Listen' button activates the Text-To-Speech engine that reads the text on the interface in human language and finally the 'Continue' button allows user to navigate to the next activity.

5.3 Mode of Transmission Interface

The Mode of transmission interface (Figure 6) features three clickable images which are labelled; Droplet Transmission, Contact Transmission and Airborne Transmission. It also

features the 'Previous', 'Listen' and 'Continue' buttons which all serve the same functions as it does in the Virus and Respiratory infection, and throughout this app lifecycle.

5.4 Droplet Transmission

An interface (Figure 7) that shows brief information on how one can get infected with COVID-19 through droplets from an infected individual or substance. This interface also features the 'Previous', 'Listen' and 'Continue' buttons respectively.

5.5 Contact Transmission

An interface (Figure 8) that shows brief information on how one can get infected with COVID-19 through physical contact from an infected individual or substance by direct or indirect contact. This interface also features the 'Previous', 'Listen' and 'Continue' buttons respectively.

5.6 Airborne Transmission

An interface (Figure 9) that shows information on how on can get infected with COVID-19 through airborne transmission. This interface also features the 'Previous', 'Listen' and 'Continue' buttons respectively.

5.7 Chains of Infection

This interface (Figure 10) helps app users to understand how infection is spread in a chain circle which are six in number.

5.8 Symptoms and prevention interface

This interface (Figure 11) gives information on the virus symptoms and preventions.

6. System Testing and Evaluation

Table 1 shows the results obtained from the distributed questionnaire in order to evaluate the system usability and testing, and the histogram is presented in Figure 12.

System Evaluation testing is a software testing where both integrated and complete software is verified. The rationale behind this test, is to evaluate the Application functionality based on some usability criteria to ensure users approval with the system. The Android-based text-to-speech Application was validated with Fifty-One Validation (51) forms and was administered for response by the following stakeholders/respondents who were randomly selected as

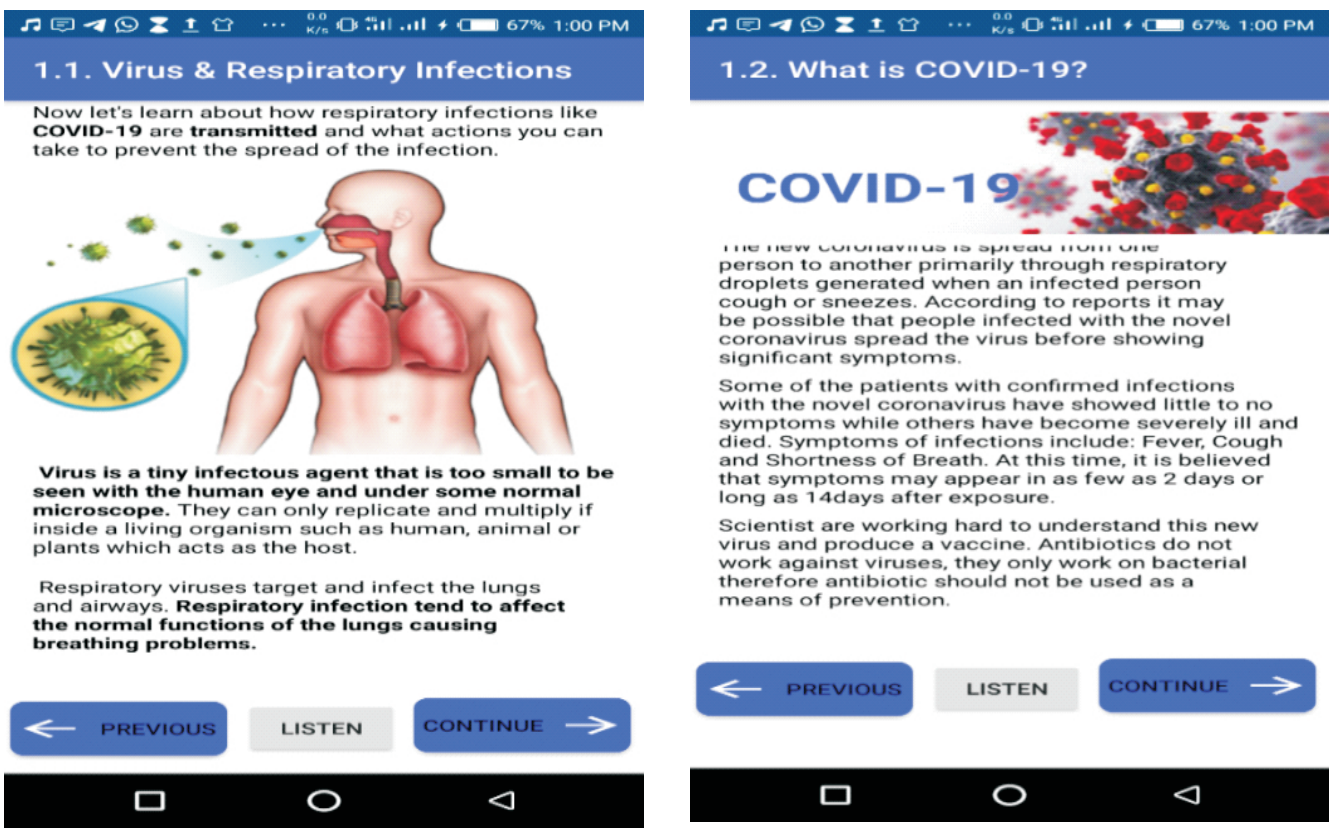

Figure 5. Virus and Respiratory Infection Interface

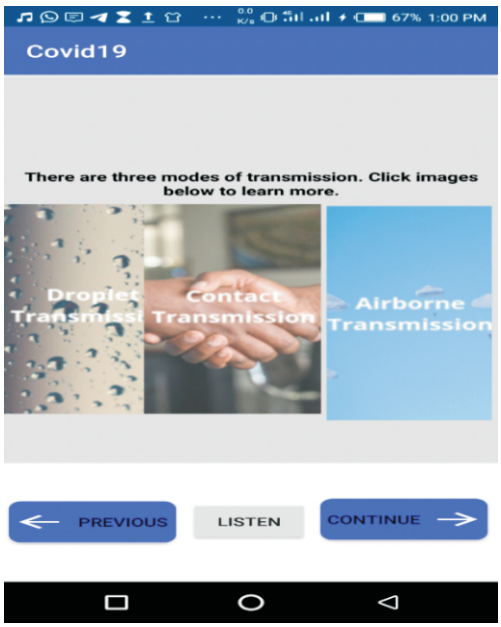

Figure 6. Mode of Transmission Interface

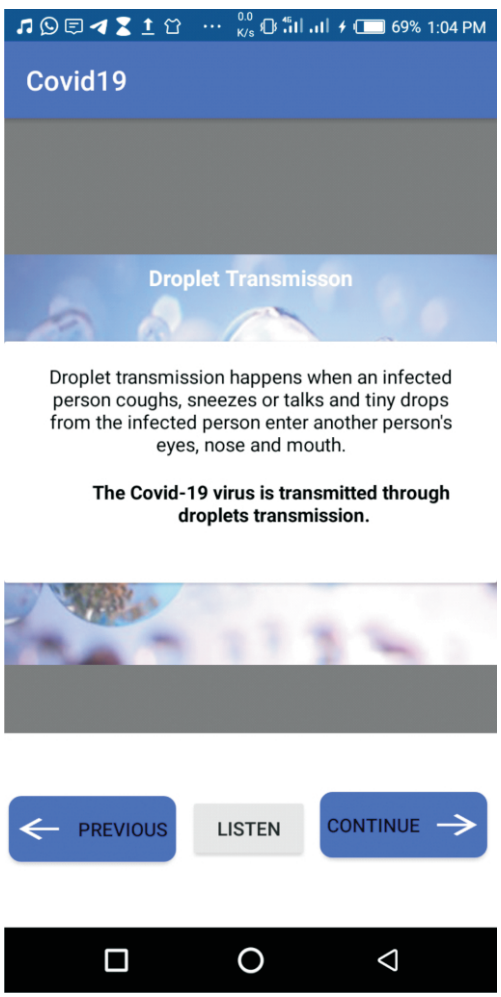

Figure 7. Droplet Transmission

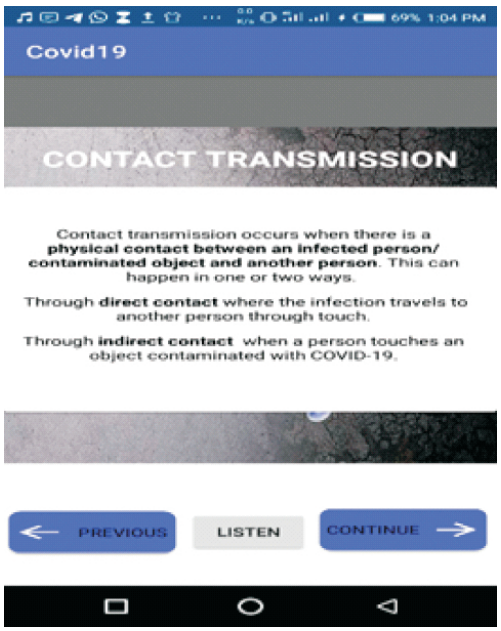

Figure 8. Contact Transmission

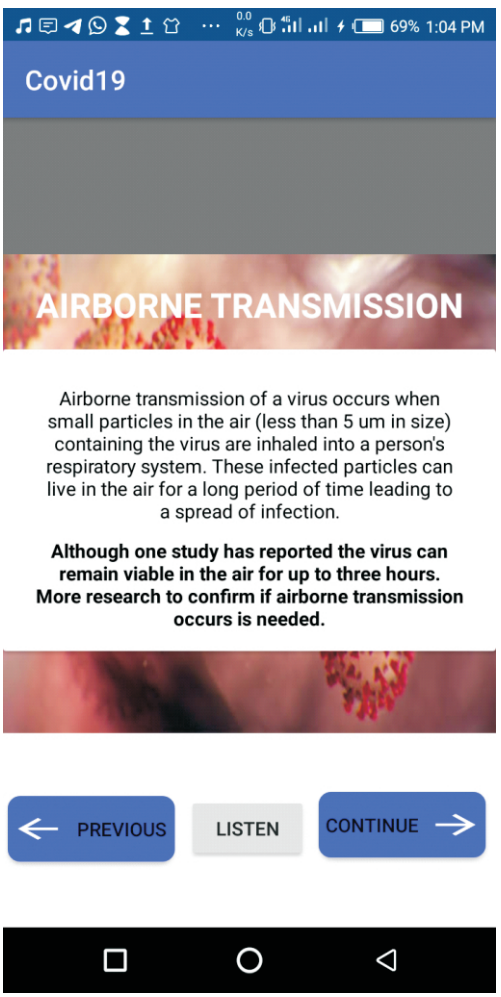

Figure 9. Airborne Transmission

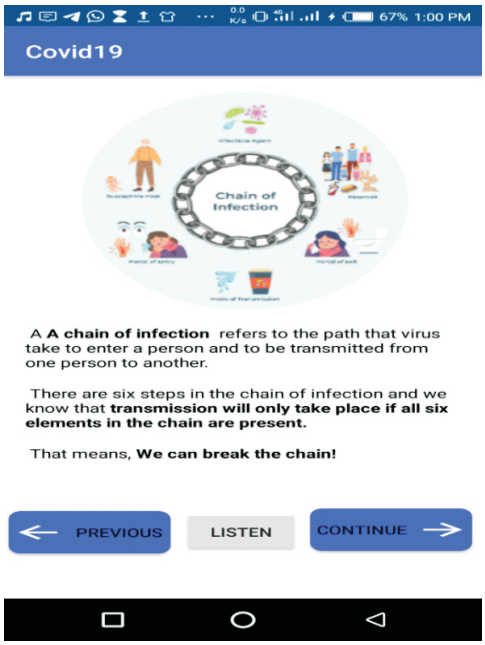

Figure 10. Chain of Infection

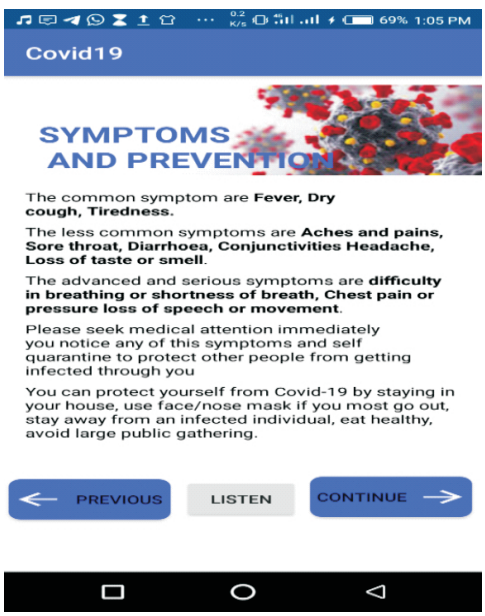

Figure 11. Symptoms and Prevention

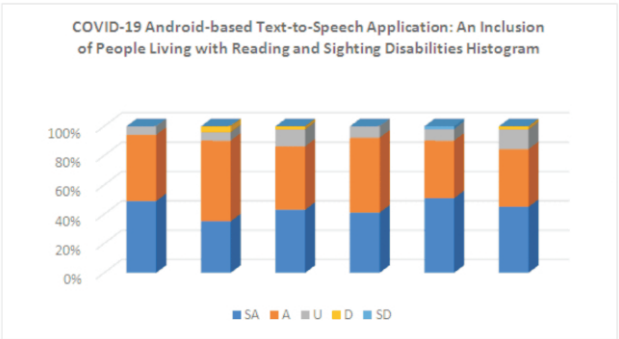

Figure 12. System Usability Testing Evaluation Histogram

follows: Two (2) Mobile Application Development Experts and Forty-Nine (49) respondents all from Minna Metropolis-Nigeria. The responses were collated from the respondents based on software testing evaluation usability criteria such as: Navigability, Efficiency, Task Success, User-Friendliness, Accessibility as well as Text-to-Speech translation of the Application. Their responses were appraised based on the following parameters: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD) respectively. From Table 1, 25 respondents strongly agreed with the navigability of the system, 23 agreed while 3 were undecided, 0 disagreed and 0 respondent strongly disagreed. 18 respondents strongly agreed with the efficiency of the Mobile Application, 28 agreed 3 were undecided, 2 disagreed and 0 respondent strongly disagreed. 22 respondents strongly agreed with the task success of the Mobile Application, 22 agreed, 6 were undecided, 1 disagreed and respondent 0 strongly disagreed. More so, 21 respondents strongly agreed with the user-friendliness of the Mobile Application, 26 agreed, 4 were undecided, 0 disagreed and respondent 0 respondent strongly disagreed.26 respondents strongly agreed with the accessibility of the Mobile Application, 20 agreed 4 were undecided, 0 disagreed and 1 respondent

Questions	SA	A	U	D	SD
Do you agree with the navigability of the mobile Application?	25	23	3	0	0
Do you agree with the efficiency of the mobile Application?	18	28	3	2	0
Do you agree with the task success of the mobile Application?	22	22	6	1	0
Do you agree with the user-friendliness of the mobile Application?	21	26	4	0	0
Do you agree with the accessibility of the mobile Application?	26	20	4	0	1
Do you agree with the text-to-speech translation of the Application?	23	20	7	1	0

Table 1. System Usability Testing Evaluation on Criteria

strongly disagreed. Ultimately, 23 respondents strongly agreed with the Text-to-Speech translation of the Application, 20 agreed 7 were undecided, 1 disagreed and 0 respondent strongly disagreed. From the foregoing analysis, it can be deduced that the tested Mobile Application has demonstrated efficiency, reliability and ease of use in translating COVID-19 Android-Based Text-to-Speech Application from English text to speech. The Mobile Application usability evaluation chart (histogram) shown in Figure 12, shows graphically the analysis in Table 1.

Conclusion

A COVID-19 Android-Based Text-to-Speech Enabled Public Awareness App with Inclusion of People Living with Reading and Physical Disabilities has been developed. The App provides novel COVID-19 safety and preventive measures and public awareness information against contracting and spread of Corona Virus that is currently raving the world. The App has proven promising results in the campaign against contracting and spread of novel COVID-19 virus to people, who can read and understand English and people who have English reading and sighting disabilities. It is therefore, recommended for use in any part of the globe that is experiencing Corona Virus pandemic. It is recommended to explore further research in translating text to other local indigenous languages.

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