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Emotional Wellbeing Assessment for Elderly Using Multi-Language Robot Interface

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Abstract: There is always necessity prevailing for the exposed platforms under the vigilance of experts, incorporated with the capability of developing and gathering enquiries followed up by the analysis and remedial measures based on the long duration laborious medical follow-up. So the work carried out in the paper initiates to cultivate a robotic interface with the multi-language capability to assist in monitoring and assessing the emotional health of the elderly people by extending conversations. For this purpose the proposed method utilizes the voice interface to put forward, enquires from the experts and the robotic interface developed converses automatically to the clients with the supervisions of the experts to course the replies. The proposed system would be compatible in any room as it is carried out on an embedded platform designed for the edge computing. The advantage of the system was understood by subjecting it to the answer files in the audio form and validating it in the terms of the recognition scores, and the percentage of estimation accuracy.

Keywords: Emotional Well-Being, Voice Interface, Edge Computing, Embedded Plat Form, Robotic Interface

1. Introduction

The advancements and the progress in the mobile technology has reached a wide spectrum ranging from the grocery purchase to health care monitoring , diagnosis and remedial measure, as they are capable of providing assistance that are more handy. nowadays there are huge amount mobile applications to monitor the health status of a person some of the most prominent smart phone apps that enable the health care surveillance and the mental status evaluation are CHAD-Mon [1] and MIMO-SYS [2] respectively. This is becoming a basic entailment of people in their everyday routine as the health assistance and mental health care are always not accessible at ease, especially on the situations of emergency due to the financial averages, locations or the social reasons. The figure.1 mentioned below shows the percentage of mobile applications developed to monitor the health status form the year 2015-2019.

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Numerous of mobile applications as mentioned above were developed for observing the health status of the common people considering the various aspects such as the efficiency of the clinic, the destined remedies, and the medical benefits etc.

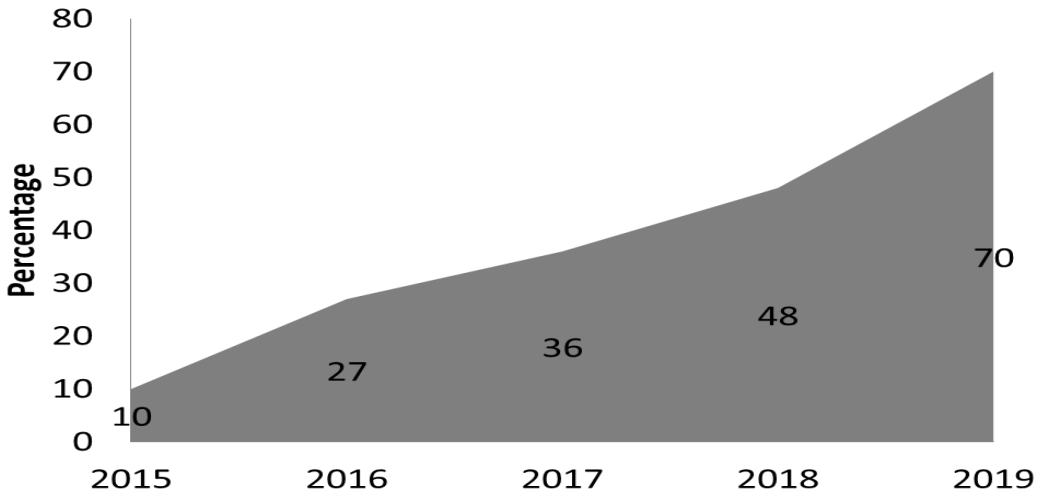

Figure.1 Percentage of Health Care Mobile Application

. The vivid ecosystem developed by the mobile health applications is dynamic offering boundless potentials. The adoption of the mobile in the health care industry has also caused immense benefits and business opportunities for the mobile based health care applications. The innovations in the mobile apps for the health care is progressing rapidly and grasps great promise, with the evidence of these tools taking a positive role in both the outcomes of the patient as well as the cost necessary for the medical care. A shown in figure.1 the number of the mobile applications has increased to a substantial amount in the year 2018 and 2019 there are now more than 320,000 health applications available on the app store worldwide. All the applications so far mainly concentrated only on the three aspects such as the benefits endured by the clinics the efficiency of the clinic and remedies to be taken as stated above and did not emphasis much on the diagnosis, report analyses, as the expert supervision was neglected. As the analysis and the laboratory diagnosis are the essentials in the clinical as well as the proper evaluation, this paves way for the requirement of an exposed platform with the expert vigilance to diagnose the health care enquires gathered based on the clinical outcome of a patient.

Recently the prominence of the smart phones enables the user to have the self –supporting applications to be downloaded and used, but in most cases they applications are not user-friendly especially in case of the elderly who are unaccustomed in handling the applications and the technology used. To kindle their interest

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and make them have a free hand conversation the mobile application with the robot or voice were developed. This voice enabled technologies are used in multiples of applications ranging from home automations to automotives. The voice assistant such as the OK Google, Amazon, empowers to make several product searches, benefitting the product supporters. The emergence of the voice assistance remains more benefitting in varying applications such as finance, agriculture, real-estate, organizations, industries ecommerce, hospital etc.

Specifically in case of the health observations of the elderly the voice assistant seems more promising even for the persons with low handiness and eye sight, more over saves time enhancing the productivity in the previously ordered tasks, as the time required to gather the electronic patient history (EPH) and the patient feedback are very low as the voice technology and the NLP are utilized. Hence the proposed system develops an open platform with a voice based conversation and the robotic interface with the supervision of the experts to observe the emotional well-being of the old people.

The proposed system scopes in developing a voice platform with the capability of extending bilingual conversation and protocols supporting the expert's intermediation to empower the automated evaluation of the elderly people emotions. The paper remaining is arranged as follows with the literature survey on the voice based applications in 2. The proposed open platform development for the old people emotional status monitoring in section 3 and results acquired in term of the recognition and accuracy percentage in section.4 and the conclusion in section 5.

2. Literature Survey

The section present the advantages engulfed in the home based automation using the voice technology and artificial intelligence. The paper by Hoy et al [3] elaborates the capabilities of the voice assistant in changing the interaction methods between the human and the computers and bridges the information's gaps for the users with low dexterity and eyesight. Further highlights the challenges prevailing in the voice recognition technology and the voice assistant software. Rathnayake et al [4] "the prototype in the paper is built with the interface that is demonstrating the controlling of the voice utilizing the kinetic sensor as the voice receiver for training a computer system to identify the set of voices". David et al [5] proposes the "intelligent home automation that answers the enquiries of the clients using the parser analyzer to process the natural language spoken by the clients".

Kumar et al [6] the paper proposes the home automation for the paralyzed people using the "voice recognition and the Arduino microcontroller". Feng, et al [7] in this paper the author describes the voice based assistant's named 'VAUTH' in the simultaneous authentication proving to be compatible with the many existing voice assistants and enhancing the security features.Celebre et al [8] the author in this paper

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utilizes the voice based digital assistants such as the apple's Siri and the raspberry pi to attain automation in the home devices especially the door, windows, Television, lights, air cooler etc. Thakur et al [9] the paper puts forth the automated home system with the voice recognizer developed using the "Zigbee that has defined a rate of 250 Kbits /seconds, best suited for the periodic and the intermittent data or a single signal transmission".

Eslambolchi, et al [10] utilizes the remote voice controls, to regulate the signals to perform desired activity, In Krishna, et a [11] the low cost RF Zigbee wireless communication modules that are relatively cheap are put into action for transmitting and as well as receiving the Voice to and fro the ARM 9 controller to translate the voice in the require d format. Erić et al [12] in his paper discusses the possible architectures that are utilized in the automated homes and also presents the over view of the accessible engines for the text to speech and vice versa examining the possibilities of using them in the system. Ralston et al [13] has put forth the "A Voice Interactive Multilingual Student Support System using IBM Watson." Smys, S., et al [14] has proposed a robotic design in the automotive industry in performing the pick and place, the author in this paper discusses the robotic utilization in diverse fields. The Pandian, A. Pasumpon. et al [15] proposes the edge computing model to enhance the capabilities of the IOT when processing a Big data applications.

Sivaganesan, D. et al [16] puts forth the artificial intelligence empowered edge computing in the IOT applications and Manoharan et al [17] presets the significance of Tele-robots and the need for the delay reduction in them. Pandian, A. Pasumpon et al [18] details the application of the AI in smart warehousing. The proposed method in the paper scopes in developing a multilingual voice interaction that is compatible with the edge computing.

3. Proposed Architecture

The emergence of artificial intelligence has made possible the many mobile based applications that are user friendly and hands free in wide range of application starting from simple gaming applications to the home automation. The natural language system integrated with the artificial intelligence has improved the possible ways of the extending interaction between the patient and the physician, allowing a real time patient examination and EPH text form generation. Utilizing the voice technology and the AI based natural language scribes to develop a hands-free smart system enabled with the multilingual voice interaction to monitor the emotional well-being of the old people.

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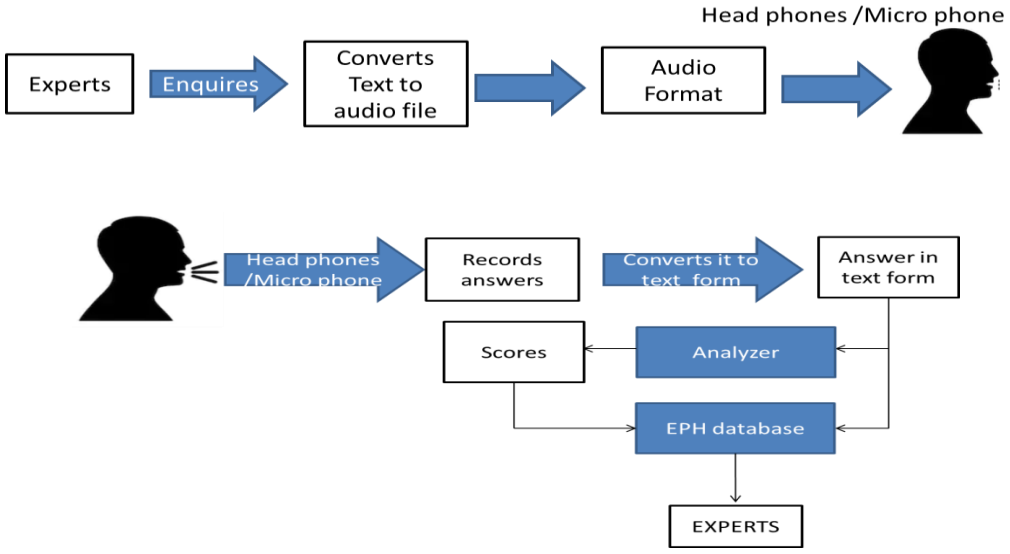

Fig.2 System Architecture

The block diagram in the figure.2 is the proposed voice interaction architecture empowered by the Pycharm web interface. The hardware driver such as the head phones and the speaker are engaged at the user end along with the real time audio processor programmed and imported through the Application interface and the hardware library respectively to receive and provide the information's to the clients. A programmable system on chip belonging to the family of the Zynq-7000 family is programmed utilizing the python libraries of cloud text to speech API and the IBM Watson [13] distinguish the languages of the clients and compute the enquires and the replies that are stored in the EPH database

The archetype was implemented over the Xilinx python productivity for ZYNQ –Z1 which is an open source empowering the embedded programmers to use the hardware capabilities that are reconfigurable on the system on chip. The flow chart below in the figure.3 shows the steps involved in the proposed bilingual voice interface. The platform is accessed through the web server hosting the Pycharm an

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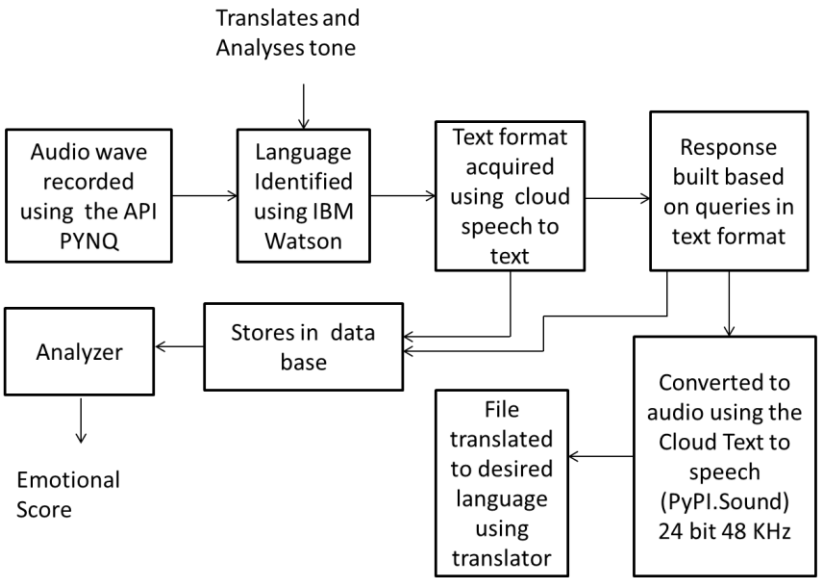

Figure .3Proposed Flow

Integrated development environment that includes the Python programming language with the complete task executed on a Linux or a macOS or windows. The audio processing in the system is carried out using the temp file and the Pygame.

4. Performance Evaluation

The complete system was instigated over a Python productivity ZYNQ- Z1 board for the purpose of assessment. The developed model incorporates the Pycharm web interface to handle the complete process. This would enable the changes to be endured even during the development phase. The language identification process uses the cloud text to speech API powered by Google to convert the text to audio and utilizes IBM Watson to identify the user language; this in turn yields back the files that hold a several languages that are evaluated. The emotions of the persons are identified using the analyzer that identifies the emotions only based on text replies. The figure.4 below shows the estimation accuracy of the proposed model in analyzing the emotions of the old people.

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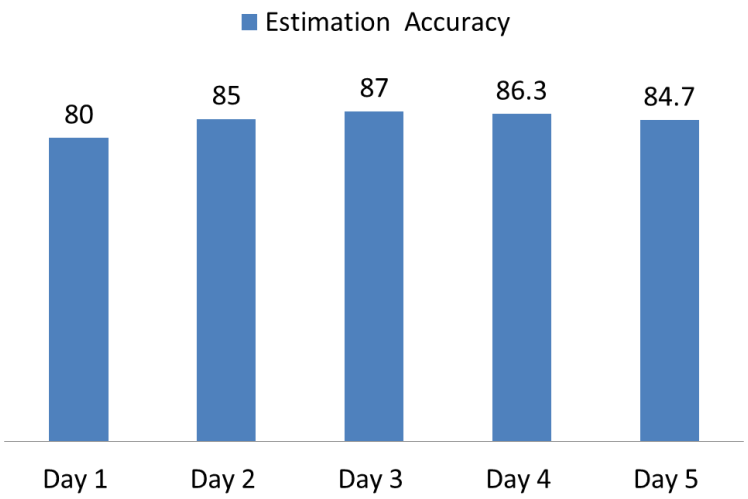

Figure.4 Estimation Accuracy

The estimation accuracy received for the proposed model from various scenarios shows that the hand free – bilingual voice interface has 90 % of accuracy in recognizing the emotions of the old people. However the analyzer Watson faces difficulties when the answers are very short and irrelevant.

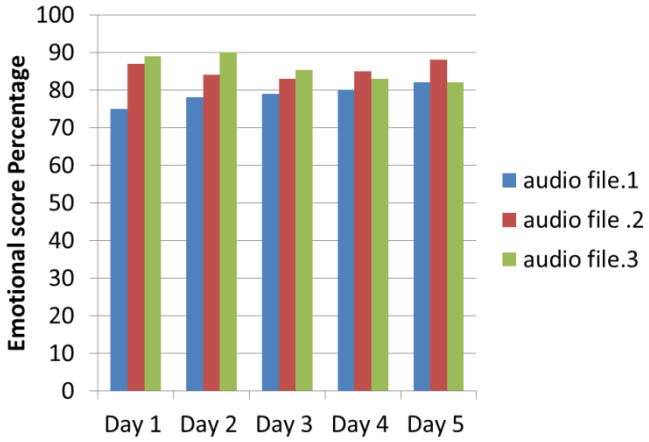

Figure.5 Emotional Scores

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The figure.5 is presents the emotion recognition scores observed form different scenarios based on the audio recordings observed over various days in form of chart, the recognition scores that are generated by the analyzer are presented in the form chart. The recognition percentage acquired even for the accurate answer is usually 100% and the scores are always below 90% the table. 1 below presents the results of the emotional observed through the audio files and the segregates the files based on the emotions such as the sadness, joy, anger fear etc.

Audio file	Recognition percentage	Joy %	Anger %	Sadness %	Fear %	Expected	Final
.wav 1	100	.875	.01	.04	.01	Joy	Joy
.wav 2	100	.091	.05	.03	.76	Fear	Fear
.wav3	100	.023	.85	.86	.01	sadness	Sadness

Table.1 Observed Emotions

5. Conclusion

The proposed work developed to process bilingual enquires and the replies of the elderly to gain insights about their emotional well-being, designs an archetype over the embedded platform that is compatible with the edge computing to process the enquires in form of the text from the host and the replies from the clients. The proposed framework enables to have an exposed platform with the capability to collect long term enquires and process results accordingly. The platform created reduces the time consumed in manual creation of the electronic patient's history and also enables to have an appropriate estimation of the emotions of the elderly. The result obtained evinces the performance capacity of the proposed bilingual robot interface. The developed architecture could be further enhanced by providing audiovisual aid responses that are automated.

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