Android based Assistive Toolkit for the Mini Brain Stroke Patients

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ABSTRACT
The proposed android-based application helps the mini-brain stroke patients in detecting and providing remedies of brain stroke to minimize effect caused. This application is useful for the user to recover from the after effect of the mini brain stroke. This application uses automated F.A.S.T technique to detect brain stroke. This project gives instant help to the user in case of emergency by connecting them to their caretaker. The goal of this project is to provide regular therapies for the improvisation of their motor skills, which includes speaking, upper limb movement and memory.

Keywords
Android, mini-stroke, therapy, detection, recovery, F.A.S.T

1. INTRODUCTION
Stroke, also called brain attack, is a brain injury caused by a sudden interruption in the blood supply of the brain. Due to this interruption, brain cells die due to insufficient supply of oxygen and nutrients, which could lead to long-term disabilities, or death. Damage done by stroke on person's body depends on the part of brain where the stroke occurs. People who have larger strokes may be permanently paralyzed on one side or lose their ability to speak. Some people recover completely from strokes, but more than 2/3 of survivors will some type of disability [1].There is a highly low possibility for a successful recovery from stroke but the survivors will have some type of disability like speaking, limbs movement, vision loss.

Some of the common physical problems that arise as an effect of stroke are limb movement and balance, vision, swallowing, and excessive tiredness. However, the signs that are rarely noticed are issues with communication, memory and thinking, emotional and behavioral changes. The problems generated by occurrence of stroke on left side of the brain are Aphasia, Apraxia. Whereas, the right side of the brain controls the ability to pay attention, recognize things you see (Anomia), hear or touch, and be aware of your own body [2]. Posterior stroke includes Ataxia (loss of limb coordination), double vision, vertigo, visual field loss. Effect of stroke varies from person to person. That is why stroke requires prompt treatment. Complications generated due to brain stroke can be minimized.

This application offers remedies to the users, which are useful for the users to reduce the after effect of the mini brain stroke.

There are three types of stroke:

    I. Hemorrhagic Stroke

    II. Ischemic Stroke

    III. Transient Ischemic Attack (TIA), also known as mini-strokes.

Symptoms may include sudden numbness or weakness of face, arm, and leg or on one side of the body, sudden confusion, trouble speaking or understanding, sudden trouble in vision, unsteadiness, dizziness, sudden severe headache with no known cause.

2. EXISTING APPLICATIONS FOR BRAIN STROKE
Stroke is one of the neurological injuries, which requires therapeutic help during the early stage when detected. Applications are an adaptive and therapeutic method, which helps people to become self-independent and improves the quality of their life. Patients can use the application therapy at home or work according to their preference.

Following are some of the applications, which provide cognitive therapy to the damaged mental abilities and language skills caused by a stroke [3].

2.1 Constant Therapy [4]
This application helps to improve the patient's speech, language, cognition, memory, reading, attention and comprehension skills. It helps the people recovering from stroke or any traumatic brain injury. The application aims to provide timely, responsive, and professional customer service, delivered with compassion and patience for each person with whom they connect.

2.2 Fit Brains Trainer [5]
The application focuses mainly on memory, speed of thinking, concentration, problem solving, language and visual-spatial. It also targets on self-control, self-awareness, social awareness and social skills, which concentrates on emotional intelligence.

2.3 CogniFit Brain Fitness [6]
It trains the cognitive abilities like memory and concentration of the patient by providing enticing games for their therapy. CogniFit is targets toward individuals, families and schools: by playing different mental games. CogniFIt calculates the cognitive state of each individual and offers a personalized brain training program with the help of advanced algorithms. By precisely measuring the performance of brain functions, CogniFit automatically generates a personalized training program for each individual.

2.4 Lumosity - Brain Training [7]
The application gives cognitive games as a daily training program which challenges the patient in variety of cognitive tasks such as memory, attention and more. It gives the users daily workouts, which includes approximately 25 brain games to challenge and 5 core cognitive abilities.

2.5 Eidetic - Learn & remember anything [8]

It uses a spaced repetition technique to help the patient memories anything from important phone numbers to famous quotes or facts. By continuous training, the user can retain the information in long-term memory. This application uses Dictionary words, Phone number, facts, quotes, notes as their flashcard types, which improves the memory the patient.

The drawbacks of the mentioned applications

- There is no application for detection of stroke.
- An application does not focus immediate effects of stroke.
- It does not help the patient in all the daily aspects such as emergency call or medicine reminders.
- Does not give importance to other effects of the stroke such as speaking problem.
- The above applications are paid which restricts the use for all the stroke patients.
- It uses the apple platform for the running of application.

3. OUR APPROACH

The main purpose of our application is to detect stroke by automating the F.A.S.T. technique and to provide therapies for the recovery from effects caused by mini-stroke [9]. F.A.S.T. is a technique, which shows the sudden signs of stroke,

F (Face drooling): The person experiences facial weakness such as drooling of one side of eye and mouth, which changes the look of person. Face drooling differs from person to person; some may get major drool while other patient drooling might not even be visible.

A (Arm weakness): It is difficult for the patient to raise both their hands and hold them.

S (Speech difficulty): The patient finds it difficult to recollect and speak the name of regular objects.

T (Time to call emergency): When all the symptoms are positively experienced then the patient will be suffering from stroke.

The proposed application helps in stroke detection and tries to eliminate major effects caused by stroke. Following is brief description of the proposed application block diagram shown in Fig.1.

- The user is required to text type a sentence displayed on the screen and processes it for the therapy or detection process. The input text is processed for calculating the accuracy in the typed sentenced. The user will receive the corresponding typing scores as an output.

- The user is supposed to recognize the object on the screen and voice input the name of object. The noise in the input voice will be removed and the clear sound gets converted to text. The converted text will be matched with object name string, if matched the user will receive positive points as output.

- For detection the user has to camera capture his/her picture. The image will be processed for feature extraction and calculate the lip drooling rate from the image. The user will be alerted if the rate of the drool is less than the average.

- The user schedules his/her medicine timings along with the customized details such as weekly or daily according to his/her needs. The application gives notification reminder to the user on the scheduled timing.

- The user has to register with at least 2 emergency contact numbers such as family, friend or doctor. When the stroke is detected the application connects to the registered numbers.
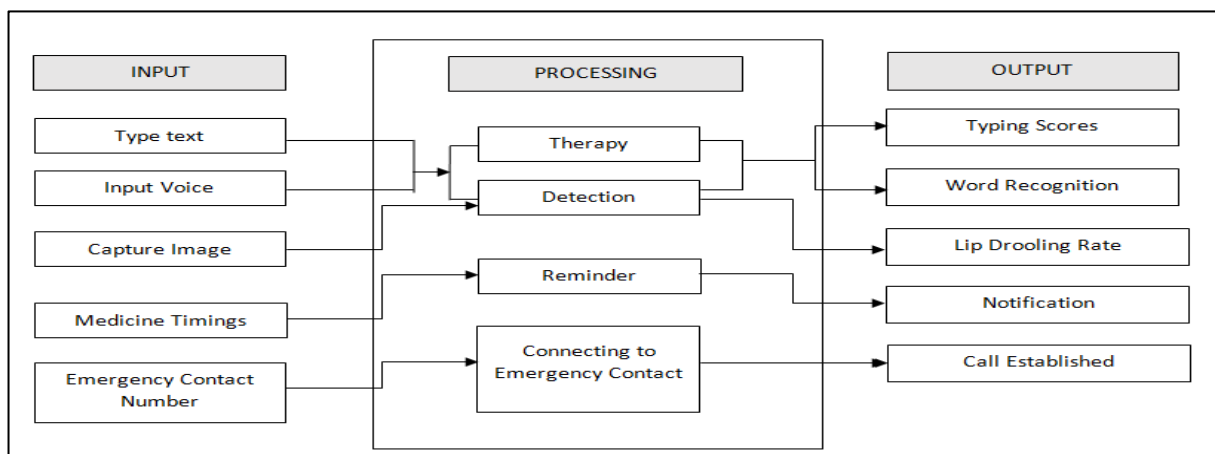

Fig 1: Block Diagram of Mini-Brain Stroke Application

4. IMPLEMENTATION

The application is android based which has a requirement of minimum android version of 4.0. Following are the features of the application:

Home page in fig 2 depicts the main features of the application, which are game, detection, reminder and emergency call set up. Detection helps in calculating the chances of occurrence of stroke. The Game provides therapy to users in form of games which will entertain the users during their therapy sessions. Reminder takes the daily medical routine form the user and gives notifications to alert them about their scheduled medicine timing. The function call

connects the user to it's registered emergency contact number which can also be connected manually by the user.

Fig 2: Home page

The game session in the application gives the therapy to user which will contribute in the recovery from effects caused by mini-stroke. The therapies are divided into three categories memory, speech and text as shown in fig 3. The first therapy 'Memory Challenge' which contributes in working of human's memory by providing some brain exercise. The next therapy is for training user's speaking skill, the device will show some objects on the screen which the user is has to recognize and voice record the name of object. The final therapy provided is for the limb movement where the user is required to touch type the displayed quote or sentence on the screen.
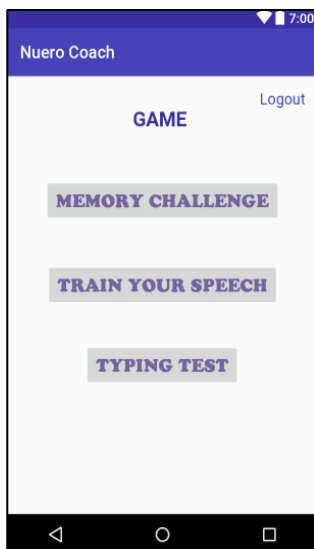
Fig 3: Game

The fig. 4 shows the 'Memory Challenge' game provided to the user as a therapy for the improving the concentration level and the memory skills of the patient. The game displays an image for few seconds and based on that image questions are asked. The user is expected to remember the details of the image shown and answer the questions correctly.
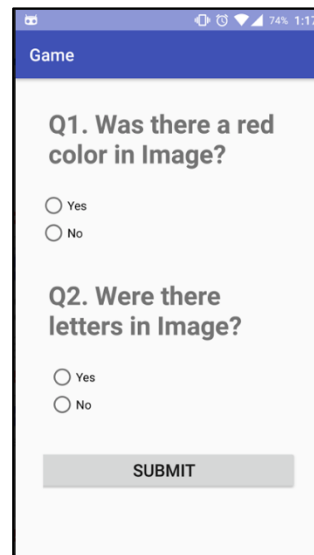

Fig 4: Memory Challenge

In fig 5, a remedial task for speech train is shown. It is a basic level in which the user is expected to voice the name of pictures displayed on their screen respectively. Positive points will be given on right and clear pronunciation. The microphone in the image indicates the user to record their voice in the mic. This game helps users to overcome their speaking difficulty faced by the patient.
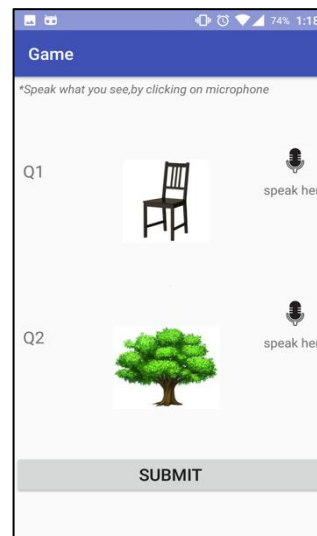

Fig 5: Train your speech

Fig. 6, depicts a typing game which helps to improve the motor skills of the user. The idea behind mixing of small and capital alphabets is to improve the typing speed keeping in mind that they have to switch the keypads in order to type each alphabet case carefully, since the challenge is case sensitive.
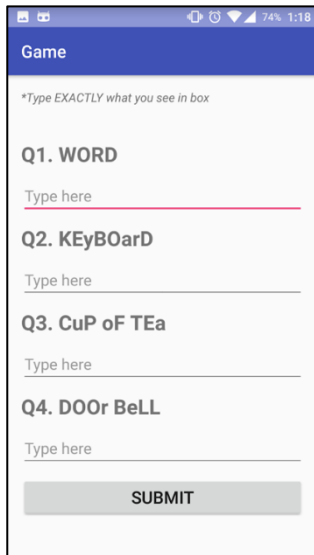
Fig 6: Typing Test

5. TESTING

The statistical reports of application tested on a patient are displayed below. These are weekly statistical report of the features like Therapy, Reminder and Emergency calls of the application used by the user.

Fig 7 shows the statistical report of Therapy sessions taken by the user each week. As seen the user gradually increases the sessions of therapy weekly. The increment in sessions shows that the therapy might have some positive affect on the status of the patient i.e., there might be recovery from the effects caused as a result of mini-stroke.
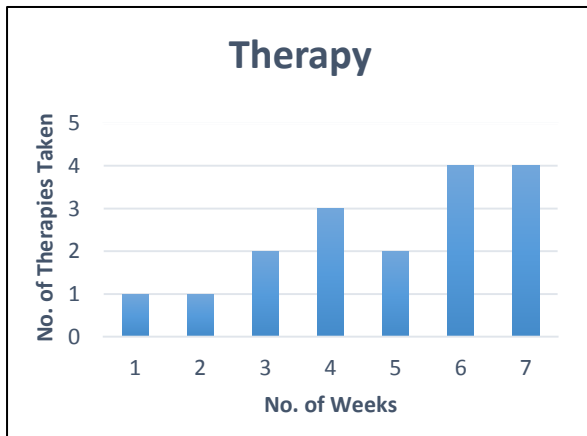

Fig 7: Therapy report

Fig. 8 displays the medicine reminders received by the user generated through notification successfully. The graph clarifies that the app generated on-time alerts for the user's scheduled medicine reminders. The user has to input the medicine details into to application with information such as time, days, name of medicine. The application gives a pop-up notification on the user's device.

Fig 8: Reminder report

Fig 9 gives the statistical report for the number of emergency calls, which the application automatically connects the user to their emergency contact in case stroke is detected. The application helps the user to detect the occurance of TIA stroke by capturing their image through front camera. The facial extraction gives the calculation for the angle of lip drooling if presence of stroke. The degree of lip inclination gives the seriousness of stroke, if the degree is greater than the average rate the application automatically connects the user to its emergency contact registered during the installation. It will help the user to get care as soon as possible. The given graph of a user shows the frequency of stroke was high on the fifth week.
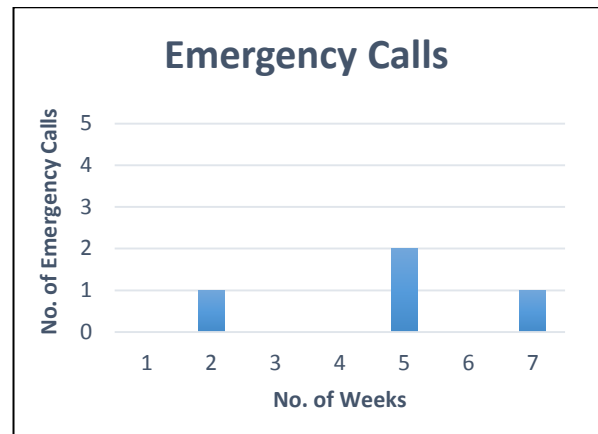

Fig 9: Emergency call report

6. CONCLUSION

Stroke can be a reason for neurological issues like difficulty in speaking, limb movement. Memory of the patient can be effected which causes confusion or partial memory loss. This system works towards the detection of mini brain stroke and provide therapies to patients to overcome after effects of mini brain stroke. The therapies are designed to improve the user's mobility. This system can detect the mini brain stroke by following the given steps. All the propose therapies help the user in recovery of memory loss, speaking disability and difficulty in hand movement. It is very easy to configure this application. This application is of low cost, as it does not ask for the physical therapist. The application gives quick games as therapies, which will be 10-15 min so that user will not be exhaust. This system will show the immediate results to the user in static format, which will depict the progress of the patient in terms of therapy. The system auto connects the call

of user to their caretaker in case of emergency. The user receives the reminder for their daily medical routine through notification on the device. This application helps in minimizing the effect cost by mini brain stroke.

7. ACKNOWLEDMENT

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