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Robotic Process Automation: Diagnosis of Dementia on Aged People

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Abstract: ***In modern day technology, among the elderly population, there is an increased cases of dementia. However, there is a delay in dementia diagnosis over the past years. So there is a primary requirement for improving diagnosis of dementia in every part of the nation across the world. However, Dementia screening remains controversial, although strong preference is given for screening dementia, mainly for hospital inpatients. Here the objective is to implement screening, to alert family members about the condition of patients. The entire screening process is achieved using Robotic Process Automation where automatic screening and validation of the mental state of the elderly people is recognized and shared with their respective family members***

Keywords: Dementia, Delay in diagnosis, Screening process, Robotic Process Automation.

I. INTRODUCTION

In order to be diagonized with dementia, the elderly people are required to see medical professionals or operate the application on tablet/ PC. This means they need to go all the way to the hospital to get operated on those devices to feel a lot of pressure to take the test which has a psychologically and physiologically imposed strain on them. Moreover, the questioning, rating, preparation of machines and providing feedback to the elderly people takes a lot of time for the medical professionals who conduct the tests for dementia detection. Also missing opportunity to take the test also leads to upward progression in dementia without any realization by the elderly people. So dementia should be detected at the starting stages and also it should not provide any kind of discomfort throughout the entire screening process for the elderly. Therefore, we developed a system that uses a communication robot which objectively evaluates dementia based on conversation with the elderly and alerting their family members through social media about the progress.

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I. MOTIVATION

Since dementia is a type of cognitive disease whose progress takes a lengthy period of time, finding a cure for it, once it has affected the elderly people on a large scale is not effective.

Thus to achieve prevention of dementia it is necessary to have a detection of dementia at the early stages thus stopping it to some extent. The detection process is achieved by home monitoring by means of an interactive session which evaluates their psychometric and linguistic skills. This paper tells how human-computer interaction is implemented to achieve dementia detection at initial stages.

A. Scope

The scope of this project is maximum avoidance of cognitive impairment and other advanced levels of dementia at early stages.

B. Objective

1. Early detection of dementia
2. Reduces questioning and feedback time for medical professionals
3. Relieves stress from patients.
4. Alerts family members on patient's state of health

II. ALGORITHM

The algorithm proposed for this project is based on **Mini Cog test** which is a simple memory-recall test and also consists of a Clock Drawing Test(CDT) which would be informative if the scores obtained in the memory recall test is not sufficient to evaluate the mental state of the patient. Moreover, Mini Cog test detects mild cognitive impairment. The Mini cog test is primarily used to check the memory level of patients by having an interactive oral session which would be interchanged with CDT in the mid-session.

III. EXISTING METHODOLOGY

Generally, in Mini Cog test the patients would be asked to repeat a set of words or sentences and later they would be asked to repeat some of the words or sentences which were given previously. If the patient answers the required number of words to be said without any errors, then that patient is termed negative for cognitive screening if not the patient's state is evaluated using CDT.

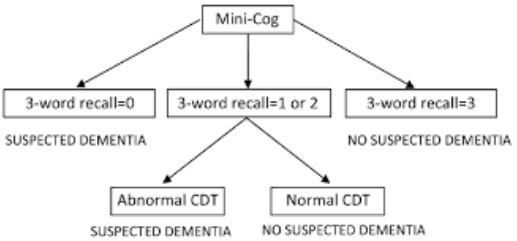

Fig.1 Mini Cog Test – Working

IV. PROPOSED METHODOLOGY

Our proposal is that we introduce a robot which performs the test so that it reduces the stress on the patients who are in search of medical professionals. Also by using a robot the manual effort provided by them would be less if most of the activities are carried out using voice recognition and hand-written systems. Moreover, along with the usual set of question in Mini Cog test, we have added certain questions based on shape identification and object recognition. Questions related to their personal experience would also be discussed and analyzed. The scores of these questions would also be considered for evaluation

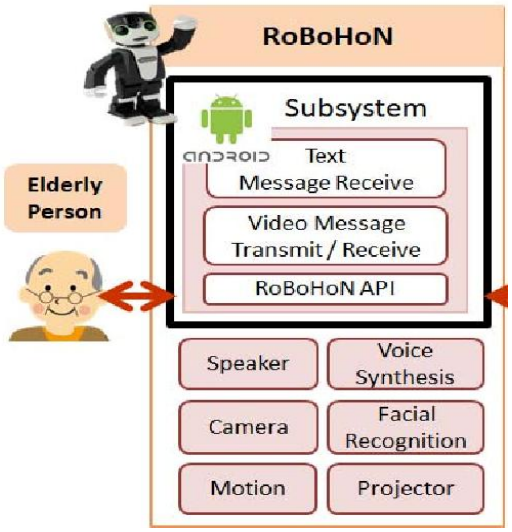

Fig.2 Robot Interaction with elderly people

B. Questions for Analysis

The inclusion of psychometric skills along with the set of question framed for the Mini Cog Test is to evaluate the mental capabilities and behavioral style of patients, that is how well do they have a basic sense of knowledge in personality characteristics and cognitive abilities. This provides how much the user is attentive and interactive to the current state. The cognitive abilities of the user are evaluated based on the following sample categories

Fig.3 Sample Mini Cog Test

The above figure deals with the sample set of questions for a Mini Cog test where patients would be asked to repeat these set of words or sentences orally and later they would be asked again to check their recall memory.

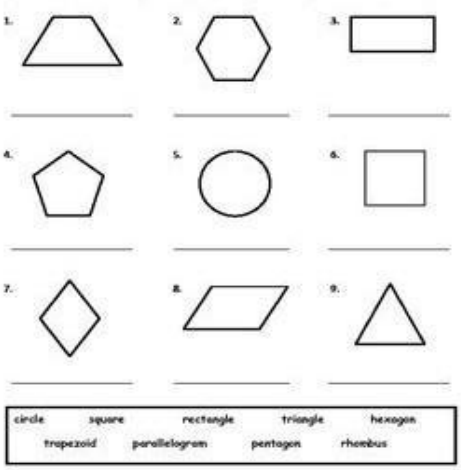

Fig.4 Shape Recognition

The above figure deals naming the objects from the list of options given. The subject may get confused over the shape selection due to multiple choices and this provokes their cognitive abilities.

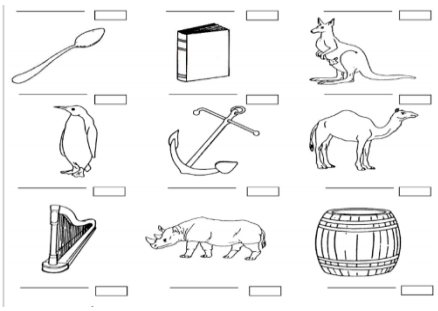

Fig.5 Sample questions for Object Recognition

This figure consists of set of objects which we would come across in our day to day life. The patients would be asked to name the objects which can be identified by them. Therefore, it also evaluates the agnostic abilities of the patient to a minor extent.

C. Personal Experiences

The communication robot would interact with the patients about their personal experiences by posing certain questions like 'their date of birth, family member's details or recent activities like what they ate for afternoon, etc. The answers for some pre-defined questions would be gathered from the family members so that they are evaluated in a right manner.

V. WORKING

The working process of this project has been divided into five different phases to perform the entire screening process which are listed and explained as follows:

1) Data Acquisition Phase

As discussed earlier the personal details of the patient would be gathered from their family members in this phase. Those details would be collected and fed into the robot.

Also the set of questions based on Mini Cog Test and Psychometric Analysis are also fed to the robot.

2)Communication phase

In this phase the bot interacts with the patient by means of posing various questions on personal and psychometric levels. Also the questions based on Mini Cog Test methodology is also given in order to check the patient's memory recall ability. The robot monitors the patient's response to these activities and records their answers which would be utilized in the further stages.

3)Interpretation phase

The patient's responses which has been recorded would be analyzed in this stage where the robot ensures whether the patient has attended all the activities correctly if not they would be required to complete the unanswered questions or activities and so which takes them back to the Communication phase.

4)Evaluation Phase

The responses which have been collected from the patient would be validated in order to test their cognitive abilities. If the scores acquired are equal to or above the threshold value (for example the patient scores 5 out of 10) then the patient is labelled as **normal or negative for cognitive impairment** but if the scores obtained are less than the threshold value, then patient is labelled as **abnormal or positive for cognitive impairment.** Thus, this stage categorizes the patient's health state.

5)Dispatch Phase

After the results have been generated the scores should be delivered to the family members, whose information have already been acquired by the robot initially, via any kind of messaging service like SMS, E-mail, etc. The alert message would be conveyed to the family members no matter whatever the patients score.

These activities and questionnaires would be conducted by the robot periodically (say weekly wise) and the scores acquired in each set of time period would be collected to produce the aggregate result which would be compared with the threshold value. Graphical representation is used to compare the periodic scores obtained by the patient

VI. ARCHITECTURE AND WORKFLOW

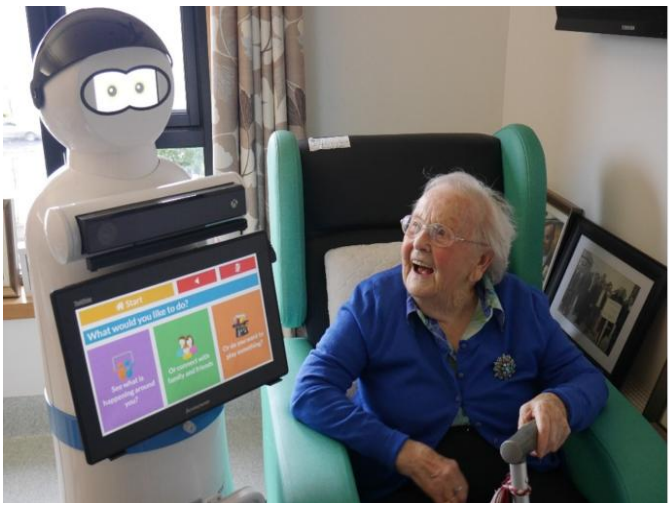

Fig.6 Robot Interaction with Patient

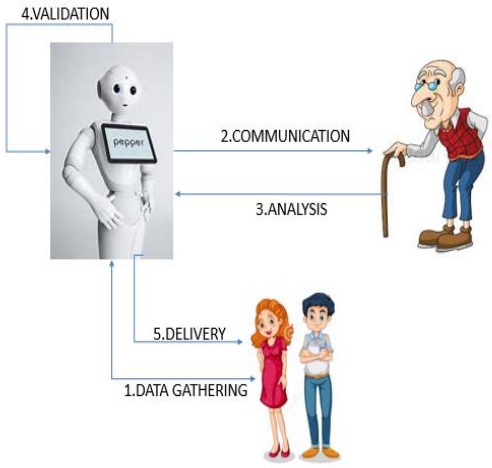

Fig.7 System Architecture

The above figure explains the flow of process in our project where patient data and family member's data are acquired and fed to the robot which later involves interacting with the patient who may respond to the activities imposed by the robot and the robot analyses the activities performed by the patient validates it compares it with the threshold value and finally sends an alert message to the family members of the patient. The communication, analysis and validation process is performed in a periodic manner and then the final results would be sent as an alert to the family members via social media or any other communication medium.

VII. RESULTS AND OUTPUT

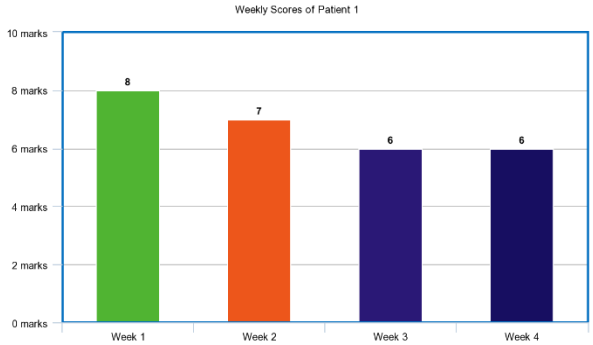

Fig.8 Weekly scores of Patient 1

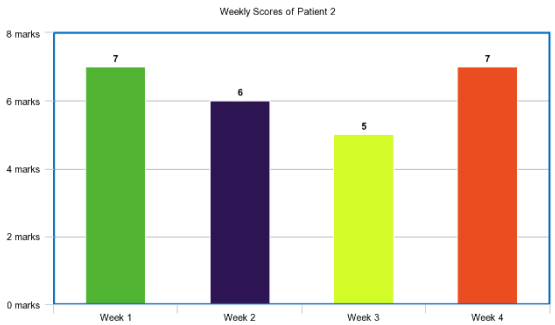

Fig.9 Weekly scores of Patient 2

VIII. FUTURE SCOPE

As of now, we are focusing only the detection process. Therefore, early stage of diagnosis would be carried out in the future. Also measures are taken for performing these activities in various recognizable languages across the globe which would be an added merit for the people.

IX. CONCLUSION

By efficient usage of robot for performing the tests, it removes the burden on both the affected patients and the medical professionals. The graphical representation of patient's progress in a periodic manner also comes in handy. Also the family members would come to know about the status quo of the patients as and when required and thus provides an alert over the mental state of the patient.

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Conflict of Interest: NIL

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Mrs. Suganya M is currently working as an Assistant Professor in the Department of Computer Science and Engineering at Jeppiaar Institute of Technology, Chennai. She has 1 year and 8 months of Teaching & 2 plus years of Industrial Experience. She was awarded 6th rank in Anna University rank list among 984 candidates in her PG degree. She has published papers in Scopus Indexed Journals and also presented 10+ papers in various National and International Conferences. She has good exposure to programming skills and Cloud technologies. She has been awarded "Young Research Engineer" award for carrying out vibrant activities related to small satellites, involving students and academic institutions under the banner of UNISEC India in the areas of Nanosats, Cansats and Cubesats. Her area of Interest is Cloud Computing; in which she's doing her research work.

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