Primary Education for the Specially-abled

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***Abstract*— Technology can support the children who require special needs, who if given the proper training and opportunity, can compete on a basis of equality with their peers. This should be the basic philosophy of a programmer who designs programs, standards for programs, or evaluation of programs. Proper education for these children will lead to enhancing their capability to lead a dignified life and also help them to earn a square meal. Technology is needed to teach them and hence the necessity can clearly be seen for further research and development in this field. In addition to software being used as teaching tools at schools and at-home, the learning process should be more interesting so that child should feel engaged. A daily routine, not only a syllabus/homework, using technologies such as text to speech conversion and image morphology is needed to both help them understand concepts of classroom syllabus and motivate them to learn more at home as specially-abled children need to be given enough motivation, as well as time, to succeed. The system developed proves to be useful to specially-abled children to memorize rhymes, recognize common sounds (like that of animals) as well as develop haptic abilities using a game like interface.**

***Keywords* — visually impaired, developmentally challenged, software, text to speech conversion, image morphology, Independent Component analysis, Scale Invariant Feature Transform.**

I. INTRODUCTION

An attempt has been made to develop a socially-inclusive education platform for primary education to be used to learn as well as test the child , with special needs, using existing image processing and text-to-speech algorithms that can be easily run on systems (as Java runs on a variety of platforms). Thus we aim to help the tutor to effectively cater to different needs a system that caters to specially-abled children, as well as can be used by any normal child as well.The biggest challenge for a teacher is to meet individual needs A typical child in a classroom can either be a normal child with average capabilities or an exceptional or specially-abled one, who requires more attention from the teacher.

Specially-abled people need to become as independent as possible in their daily life in order to guarantee a fully social inclusion. It is often noted that such students need more attention, as class room education does not suffice.“Inclusion, “full inclusion”, and “inclusive education”terms which recently have been narrowly defined by some (primarily educators of students “Inclusion, “full inclusion”, -and “inclusive education”) are terms which recently have been narrowly defined by some (primarily educators of students with severe disabilities) to promote the philosophy that all students ,irrespective of their disabilities receive a wholesome education, within the regular education system. Providing equal access to all individuals with disabilities is the key element of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992. (1)

Children with specific learning disabilities and speech or visual impairment make up the majority of children in special education system. Based upon the individual needs of children and input from their parents and educators, specialized schools, or classes employ strategies to educate such children. In addition, special schools frequently provide outreach support and technical assistance to public schools in their states.

This paper proposes a module that addresses the need for an integrated system that helps children at the primary level with visual, vocal and hearing disability acquire the position in society which is based on their intellectual abilities rather than their physical disabilities. So we need two modules, created to tutor the specially–abled, teaching them using images, objects and sounds, one of them which will serve them at school, and the other will serve them at home, using a game like interface that will keep the child motivated.

II. RELATED WORK

Efforts throughout the history of education for students with impairments have been focused on the right of these persons to full participation in an inclusive society. To this effect, quality education has been seen as the right measure. Since the early days, schools were made for the specially-abled children recognizing their needs of a different education system. In 1900, in the United States, the first class for visually impaired students in a regular day school was founded in Chicago, to satisfy the individual needs of the students.

By 1950, about 15 urban areas were serving students with visual impairments in their local schools. The decades of the 1950s and 1960s marked a period of time when parents and educators first became aware of the need for an array of service options for students with visual impairments, and efforts to provide services based on the assessed needs of individual students began.

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The Pinebrook Report (American Foundation for the Blind, 1953) provided the first written definition of local school service delivery systems for students with visual impairments. This book clearly decides itinerant services, resource room services, and cooperative efforts between classroom teachers and teachers of students with visual impairments [1]. This report went a long way in promoting the idea that visually impaired students need a wider array of service points, not just at school.

"Education for all" has been a motto for countries across the world. Good work in this regard has been happening across schools, such as Asha Deepa school for the blind, where computer skills are imparted to blind children as well as Vocational skills. Educators at the Washington State School for the Blind too produce software attempting to bring the visually impaired into mainstream education..

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In a developing country like India which has abundant human capital human resource should be tended properly through education and training to engage it successfully in the nation building activity. There are number of initiatives taken in pursuance of this objective like The Indian Education Commission (1964-66) and Integrated education for Disabled Children (IEDC, 1974), which focus on providing education in schools that caters to students with special needs. The participation of teachers and parents in this field has also been highlighted [2] as they are a major source of motivation.

Well-known linear transformation methods include principal component analysis, fact or analysis, and projection pursuit. Independent component analysis (ICA)[3] is a recently developed method in which the goal is to find a linear representation of non-Gaussian data so that the components are statistically independent, or as independent as possible. Such a representation seems to capture the essential structure of the data in many applications, including feature extraction and signal separation.

We demonstrate that this algorithm is effective in classifying complex image textures such as trees and rocks in natural scenes. The algorithm [4] is useful for de-noising and filling in missing pixels in images with complex structures. The advantage of this model is that image codes can be learned with increasing numbers of basis function classes.

However, we have seen that often, such software have been focused towards addressing 'handicap' of one kind. Our system will bring education, using universal design principles, to children at primary education level, that can be used as a testing-cum- learning software.

III. PROPOSED SYSTEM

The system proposed here has the goal to promote education software as a dual purpose - teaching and testing. Thus, we create a game based learning system, to teach simple animal sounds, such as those of a cat, or a dog, and then move onto rhymes as well. This system will use visual aids – to enable the mentally challenged students [5], as well as sounds, to enable the blind child to 'play' the game. Every sound, correctly guessed, has a score associated with it, thus arousing the child's interest to learn as well as remember the sounds.

This game will be built in java, that will have a .jar file associated with it, enabling it to run on java –enabled systems. The system will use TTS- Text-to-speech conversion that will produce the required sounds for the game. The Java Media Framework API (JMF) enables audio, video and other time- based media to be added to applications and applets built on Java technology. This optional package, which can capture, playback, stream, and transcode multiple media formats, extends the Java 2 Platform, Standard Edition (J2SE) for multimedia developers by providing a powerful toolkit to develop scalable, cross-platform technology. Voice Manager Class, in Java, provides access to voices for all of FreeTTS [3]. FreeTTS is at light-weigt speech synthesis system written entirely in the JavaTM programming language. It is based upon Flite: a small run-time speech synthesis engine developed at Carnegie Mellon University. Flite is derived from the Festival Speech Synthesis System from the University of Edinburgh and the FestVox project from Carnegie Mellon University There is only one instance of the Voice Manager. Each call to getVoices() – a function call, creates a new instance of each voice. Thus, we can also use standard voice names- such as Kevin, for example, while using the getVoices function which has a standard speaking tone. Thus all the speech, that is fed into the system, will be spoken out in the voice of 'Kevin'.

To allow for the system to be dynamic, we can allow for an "add learning object" functionality, where in we can add objects that we want to learn or test (for teachers). This will allow adding new sounds to the system, and each sound, whenever played, will expect an answer, in the form of text typed via a keyboard. Each key-press will be voiced out, by the standard voice- say here Kevin, as well as be visible on a text box on the screen. The controls will be symbol – a key will be allocated to repeat the sound, and another one to exit.

The system needs to be forgiving, as well as encouraging. Thus each user will have 3 chances at guessing the sound each right answer will be met with the sound of an applause, as after having spent time with user- feasibility study, as well as recent studies suggest, that students with learning disabilities need to be constantly motivated and kept in good frame of mind. For allowing visual aid to suit the deaf and dumb community, each question will have a sound as well as a picture/symbol depicted on the screen.There will be buttons

created using JButtons within frames – created using JFrames for the User interface. The rationale- for using such a system will be that using computers for such children will take some time and thus will not be easy to use unless the children are well acquainted.

Fig. 1.Teacher's Module

Each rank-ordered vector $\bar{r}$ is a permutation of the set of integers
$\{1, \ldots, N\}$. There are a total of $N!$ unique rank ordered vectors, each of normalized squared length

$$||\bar{r}||^2 = \sum_{i=1}^{N} i^2 = (N(N+1)(2N+1))/6 .$$

There it will be compared against a predefined set of stored images
– called the training set. For example, if we have images of, say an "apple" stored, the student will be given an assortment of objects in front of him. The system will sound the words – "pick up an apple", and the visually-impaired student can 'feel' the objects kept, pick up the right one and point it near the camera. If correct, the student will be motivated with the words- 'well done' and another object is tested. Mentally challenged students, as well as deaf and dumb students can also use the system as it will have a visual as well as sound interface associated with it.
Thus, haptic senses of visually impaired students will be developed, as well as they can learn using the game-based system ie. 'Fun while you learn'. For mentally challenged students too, we observed the students to find such methods of learning more appreciative.

Along with this, we will have an image processing tutorial system as well (an At-Home Module). This will involve a web- cam or another camera connected to the computer. A video stream input will be taken from the camera and frames will be captured from it, if a button called 'Capture' is pressed. The captured frame is stored in a variable and it undergoes pre- processing by ICA algorithm to de-noise the image - for comparison with the image in the training set. After the test image is de-noised and preprocessed it is compared with the image in the training set using the SIFT algorithm.

The SIFT[6][7] algorithm works on the principle of matching the objects/images by comparing the corner points that define the dimension of the object/image. When many similarities or matches are found, images are declared to be similar. At this stage, the interest points, which are called keypoints in the SIFT framework, are detected.
Ordinal description considers descriptor vector elements in terms of their ranks in an array sorted according measurement values. Let $\bar{x} = \{x1, \ldots, xN\}$ denote a vector of N unique, scalar- valued image measurements. Ordinal description begins by transforming $\bar{x}$ to its rank-order form $\bar{r} = \{r1, \ldots, rN\}$. The rank-order value ri corresponding to measurement value xi is defined as:

$$ri = |\{xk : xk \leq xi\}|.$$

The complexity of rank-order transform is $O(N \log N)$
time complexity by sorting $\bar{x}$, then setting element ri according to the index of xi in the sorted vector.[8][9]

Pseudo code: Teacher's Module

```
{
START
VoiceManagervoiceManager=VoiceManager.getInstance();
voice1=voiceManager.getVoice("KEVIN");
create()          // to create the frame, with the buttons and
controls
read_f();  // read sound file, and then create the sounds
describe(); //  check if what the user enters is correct.
If yes :
    goto5
Else
    goto 4
score();      //calculate the score at each round… and speak it
aloud srt(); //final message – the score as well as "a bid  adieu".
END
}
```

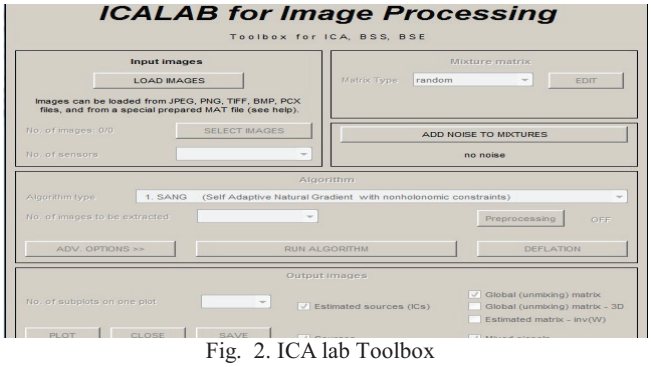

Fig. 2. ICA lab Toolbox

Fig. 3. GUI for 'At- home' Module

Fig. 4. Test set flower with SIFT points
(marked by red crosses)

Fig. 5. Training set flower with SIFT points
(marked by red crosses)

Fig. 6. Matching the similar SIFT points.

Pseudo Code: At-Home Module:

```
START {
Function varargout = myCameraGUI(varargin)
myCameraGUI_OpeningFcn                  //when toolbox called
function startStopCamera_Callback       //when camerastarted
1. function captureImage_Callback       //image captured
2. currentframe = getsnapshot(handles.video)
3. function process_Callback            //image processing
4. load('currentFrame.mat','currentframe'); //loading saved
                                          //image processing
5. function compare_Callback            //to compare pictures
6. goto 1 to repeat proc                // to repeat procedure
7. function startStopCamera_Callback    // stop camera
8. function close_Callback
9. close(gcbf);                         //to close the GUI
} End
```

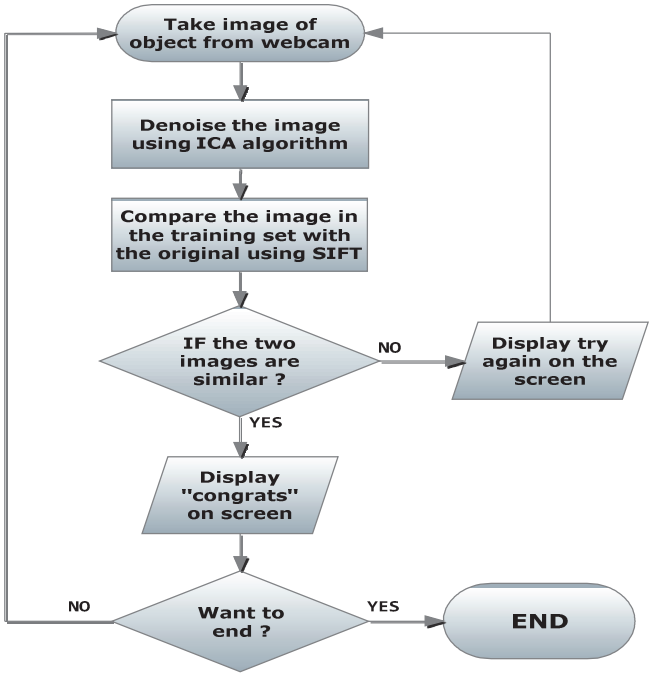

Fig. 7. Flow Diagram: At-Home module

CONCLUSION

Visually impaired students need a n educational system that meets the individual needs of all students, promoting independence , that helps them be successful in society. This needs to start early, at a primary level. Vision and speech are fundamental to the learning process and are the primary factors upon which most traditional education strategies are based. Also, students that are specially-abled still lack "inclusive" education, at a primary level. Hence, a game like interface that can serve as a teaching and testing module is needed.

This paper presents an approach towards recognition of sound for visually impaired people and recognition of items, objects for vocally disabled people. This system can be used by any child, despite its focus on the specially-abled. The proposed system finds its application for the mentioned audience, providing a communication link between normal and the specially-abled people through sound and image processing.

It provides access to the latest technology so that every blind or visually impaired student benefits from computer-based educational programs, such as those delivered via the Internet or multimedia education software. Parents and families of children who are blind or visually impaired are provided with the information they need to determine the best educational option for their child. The system can also be used to suit testing purposes, besides learning, thus playing a dual role, while maintaining the child's interest by using a game like interface.

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