A SOFTWARE SOLUTION FOR IMAGE IDENTIFICATION AND ARTISTIC SKILLS FOR VISUALLY IMPAIRED PEOPLE USING BRAILLE

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Abstract- At present, visually impaired individuals have no method to perform or engage much in art. They do not draw paintings because of the absence of the ability to draw a world unknown and unseen before. New immerging software are developed within the world and the success of it is enjoyed only by the visually impaired who can afford it. The conversion of an image to braille and getting a braille printout of the image is the main aim of the new software application. By studying previously developed systems, new features were identified. Reducing the complexity of the software solution and providing the main output of a well converted image from the basic shape to complex image conversions will be made possible. With the results of the survey conducted for the research it emphasized the necessity of a software solution to give the opportunity to the visual impaired to engage in art using braille.

Keywords- Braille, Visually impaired, Art, Image Identification

I. INTRODUCTION

Visual impaired refers to when you lose part or all of your ability in vision. Life beyond an unseen world and a world to experience while feeling it is done by them. It is also referred as Blindness. Blindness is not a reason for failing in life and it is a challenge to make the outer environment in reach with other perceptions except vision. Perceptions refer to the ability to hear, feel by touch and smell to visualize the outer world. As stated below, " A loss or lack of vision does not deny an individual of all aesthetic pleasures since vision is only one of the senses which any of us perceive the world around us" (Irving Faber Lukoff, Oscar Cohen(1972)).

285 million people are estimated to be visually impaired worldwide, 39 million are blind and 246 have low vision according to the World Health Organization Reports (www.who.int, 2017). About 90% of the world's visually impaired live in low income settings (Deepti Samant Raja, 2016). With that scientists and doctors are concern to build new technological methods for the blind to retrieve their sight back. In reality, those methods are still in the experimental stage with new technological advancements.

In addition, those methods are normally considered as expensive technological equipment or surgeries which will be further explained in the literature review. As mentioned above the newly implanting methods will not be able to be afforded by the visually impaired people because there are expensive.

Due to the above reasons the necessity of a software solution for visually impaired people arise. In order to accomplish it the language of "Braille" was released by Louis Braille. He was completely blind and his touch sense characters of the alphabet helped the blind to read and gather knowledge about all areas in the unseen world. The alphabet was composed with embossed dots according to each specific letter. Braille is currently the most spread and successful methodology for blind people to interact with the world in aspects of learning and knowledge.

For visually impaired, blind visits or journeys around the world offer little or no information beyond verbal descriptions about the appearance, shape or feel of the actual pieces of art. The blind are at a serious disadvantage of experiencing the world beyond, due to the fact that they are not capable to touch all the objects in the world and some objects are impossible to touch with the human hand. The blind must rely upon the use of their remaining senses to develop and conceptualize a work of art and "touch, kinaesthetic experiences, and audition are the most important sensory avenues used for this purpose". They experience the world primarily through their sense of touch. A visually impaired individual "can gain knowledge of the spatial qualities of objects only by touch observations" and in order to do so "direct contact must be made with the object to be observed" (Lowenfeld, 1973).

Visually impaired people use their sense and memory to recognize where they are with the aid of a white cane. But the main concern of this project is the ability to identify the real image by touch and help the person to make his own image in the place he or she was told. "Creating art can provide positive feelings of accomplishment and achievement" for students with severe visual impairments (Shih and Chao, 2010). Therefore the conclusion on the participation of the visually impaired towards art can be stated out with a proper method to identify images around and visually recreate them in their mental perceptions.

The main objective of this research is to invent a more effective method for image identification and artistic skills using computerized braille. Researching on previous technologies used in computerized braille and in addition finding the new features to be included with the software to make it more effective to the visually impaired people is another main objective.

II. LITERATURE REVIEW

When considering the work done in the previous braille convertors and image identification softwares, all the systems will be reviewed and it will be beneficial to get the best features in order to develop the most effective software.

The problem existing in the world is the accuracy of whether image identification and artistic skills methods are beneficial for visually impaired in order to make themselves also a part with awareness on the environment and gain creativity through it.

Considering image identification there are many methods to identify images and the most common method used at present is imagination through sense perceptions which are not accurate to get a clear image of all the objects in the world. Using touch and white canes to identify the places and objects around with smell and taste senses to get awareness about the around environment also can be found commonly. The current techniques used for processing an image are image acquisition, image enhancement, filtering and edge detection.

Template matching with rule base is one technology used processing an image. The process consists of 5 main steps. Conversion to binary is done with these 5 steps such as binarization and pixel inversion, noise removal, segmentation and clustering, line identification and character extraction. (Mohd Solahuddin Bin Jaafar ,2011). In order to identify the processed image and braille characters which will be observed a GUT is introduced. The accuracy will be ensured by this GUT. The ability in displaying braille characters will be complied with a hardware device using Led. Though the system the visually impaired will be able to easily get a text picture with the hardware device to input a digital image to the software. A camera can be used in this instance. After that the input will be converted into braille characters.

In another previously invented converter the program involved in the recognition process was prepared with paint and imported into the OCR algorithm (Mohd Solahuddin Bin Jaafar , 2011). In the program the user can import their text images using scanners, digital camera or they can make it with Paint. The output such as text document can be printed out or observed on the computer screen. The initial setup of the project with the use of scanner of smart phone for image digitization, personal computer for image processing and printer for output observation.

Accurate text details provision can is achieved by a system called the Arabic Optical Braille Recognition System Technology. In this system the ability for the blind people to read text documents with more detail is given a solution with Optical Braille Recognition (OBR). The main hardware devices are the flatbed scanners and OBR software (Mohd Solahuddin Bin Jaafar, 2011). The braille letters are identified and converted into string characters. The braille characters are divided into cells and each character consisting in the cell is converted to text. It is a character recognition method used not involving any image.

New methods to improve semantic memory from the task are introduced with improved technologies by examined picture matching (Heller, 2002). The visually impaired were given to match images from what they felt. Four images were touched and felt by them and to test the accuracy of the matching it was timed. Within the people there were blindfolded people, people who were late blind, low vision and congenitally blind people. The very low vision people are braille users and used white canes for mobility. They tended to refer to themselves as blind, since they had no remaining pattern vision, or it was minimal. Most of these persons claimed that they could not see the close hand motion.

This system is to recognize characters for a single braille document and present an extensive review for braille. Recognition systems and related research efforts. This Braille recognition system is flexible for the size of the scanned image. It is improved in each step starting from the image acquisition until the Braille cell recognition final stage. The system includes an image acquisition stage, image pre-processing for noise removal, feature extraction, modified image segmentation, feature extraction, and then character recognition. In addition the system is applicable to any language and to both Grades one and two.

In the system made by Bhagya R Navada, Santhosh K V, Prajwal S and Harikishan B Shetty of Dept. of instrumentation and control engineering , Manipal Institute of Technology ,Manipal, India it is a system to detect colour for colour blind and identifying the edges of an image. Because of colour blindness the exclusion from some job opportunities can be found. The main reason is losing the ability to distinguish between colours. A solution for this problem is given by this new technology. To identify the colours image processing is used by representing the edges of images in similar colours. Colour detection and edge detection is done on a LabVIEW platform. By using a wireless camera the images are captured with its original colours and processed with LabVIEW colours. The processed image will be represented on the panel of the LabVIEW panel.

III. METHODOLOGY

In order to implement such a software first the image should be identified and filtered according to the following specifications. Removing the image noise, Sharpen edges, filter main image components and edge detection. The conversion to braille can be done after analysing the images edges by assigning a braille letter along the edge.

This methodology will be more effective than printing a typed braille image on a paper through the computer, minimizing the wastage of time with improved performance.

The research was mainly done in order to develop the artistic skills of a visually impaired based on the below 2 criteria's.

1. Image identification skills
2. Artistic development

After studying the different systems used, the pros and cons are identified as follows. Every system was able to do a conversion as they expected, but the final outcome is not very effective in comparison because at present a visually impaired individual can be given a much better software for image identification and continue in art through it.

First the image can be embossed by braille letters with the outline of the images to identify what this object. A feature to identify objects such as large monuments and structures with the conversion to braille will be achievable. Image colour identification to paint colours and description of the image on what image that the visually impaired is going to identify (Description translation input to braille) can be included. Texture identification through braille on the image for light and dark colours will able the artist to improve drawing skills.

Consisting of a foundation drawing converted to braille for beginners, colour identification braille conversion to draw art using colours, displaying the names of the colours of the original image to the braille converted image to draw and paint the image, colour intensity drawings for advance shading after practise from the initial stage and braille converted image which doesn't obstruct the image after converted to draw are considered.

The software solution consists of the following modules in order to get the final output. As inputs the JPG or png format images will be uploaded into the system for conversions in the image acquisition module.

Pre-processing is done for Image enhancement and feature extraction. Through these steps the image will be more elaborated to a format for the edge detection for the braille conversion. Converting to grayscale, removal of noise and image convolution will be done in the image pre-processing module.

In the image segmentation module background removal and binary thresholding will be applied. A Sobel filter is used to reconstruct the border of the main object in the image. Next, threshold to Zero, Inverted thresholding is performed to the image obtained from pre-processing. The image is then subjected to a combination of binary thresholding and Otsu's thresholding and a binary image of the image is produced.

The Edge detected image will be converted to braille by creating an image canvas and further more converting the ASCII image into a braille converted image. The creation of the braille image is mainly done by the ASCII art creation and image data to braille dot map algorithm.

Main steps of proposed new software solution are as follows; Adding new artist details, Consisting of a grid view ,editing or deleting details ,uploading images for further conversions ,braille conversions according to the skill level ,In this step, image processing steps; image pre-processing, noise removal, edge detection of overlapping and isolated cells, feature extraction and conversion will take place ,viewing the converted image and printing the converted image.

The image can be embossed with braille letters first with the outline of the images to identify what this object is. The embossed outline for the visually impaired to identify images will be according to the skill levels as in figure 1.

The design of the software solution is elaborated from figure 1 on all the modules of the application in order to get the final output braille images with additional features.

In the design the details of the artist will be stored and the images of the conversion will be saved within the database for further drawing requirements with more usability of the software. Image conversions will be done under the required stage of art for the blind artist. Three main stages such as Amateur, Intermediate and Professional will be

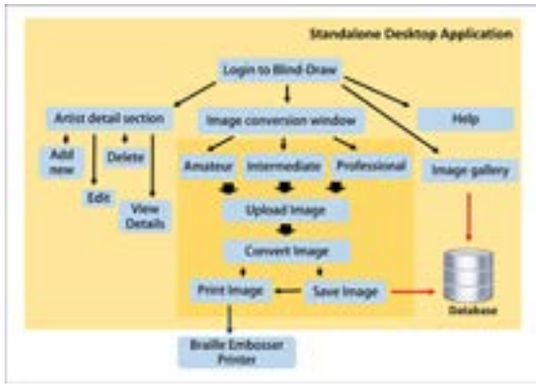

Figure 1. System Model Design
Source: Author

provided to start by drawing and improve the skill into the next level.

Simple navigations to access to features are used in order to make the software more user friendly and easy to access. The software solution is made from a ribbon form with user controls designed by C# and DevExpress for making the software more efficient to use.

IV. RESULTS

Considering the edge of the image the conversion should be done for the blind artist first by identifying the image in braille and there after use it as a basic foundation drawing to draw it. The printed braille output should be generated with the standard braille letters and though that the artist can engage in art.

A blind individual is not capable of using complex images as a beginning to drawings because an unknown world and it will be hard to be recognized with braille. Simple shapes such as circles, triangles, squares rectangles, trapezium will be converted and practised to draw via the hardcopy output of the software application.

In the conversion of the image primary images were selected at first. The basic shape of a circle as denoted in figure 2 will be converted into braille for the user to identify the shape of it. There after the user can use a braille conversion to colour on it with the respective colour denotations with the converted image.

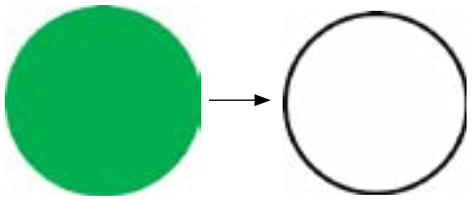

Figure 2. Circle image and edge detected of the circle
Source: Author

The edge of the JPG image will be extracted after pre-processing techniques using the image conversion module and the edge will be inverted for the braille conversion of the input.

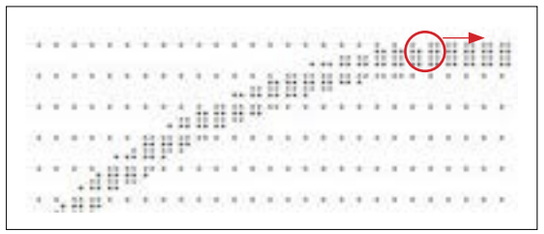

Figure 3. Enlarged portion of a braille converted image
Source: Author

The braille converted image will be converted as in a format which the blind people read normal braille as sentences and there after the artist should follow the image conversion to identify the image under the instructions provided with the braille conversion. The artist is guided with a starting point at the first line braille letter point which will be provided in the instructions.

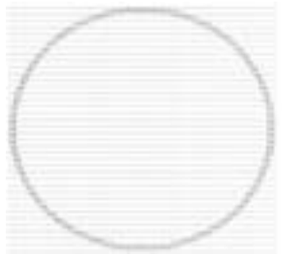

Figure 4. Braille converted image
Source: Author

In figure 4 it represents the braille converted image. The edge detected image will be converted to an ASCII image canvas and plotted with the braille dots within the conversion. Standard braille letter translations are used in order to make the blind artist to take his or her hand along the conversion to identify the image clearly. The image will be enhanced to the user to identify the image with the description the image as shown in figure 5.

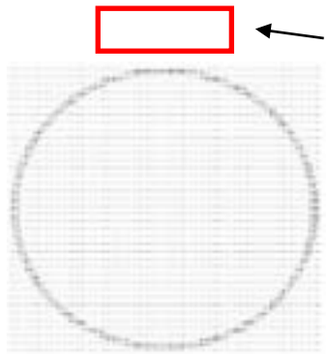

Figure 5. Braille converted image with the description
Source: Author

The blind artist can use a pencil or other sketch medium to draw on the printed copy of the conversion and there after using memory to remember the shape in the mind they can use it for further drawings.

Adding more skill the blind artist can convert the image according to the shape and colour in order to paint the image along with the braille printed hardcopy provided. Through this feature the user will be able to paint the respective shapes colour and in more improved skill level it can be used to indicate specific colours of specific shapes. An example conversion of the figure 1 of a green circle will be converted to denote its colour as shown in figure 6. In the conversion the colour will be represented in braille letters after translating to braille representation for colour identification and to paint that using that colour.

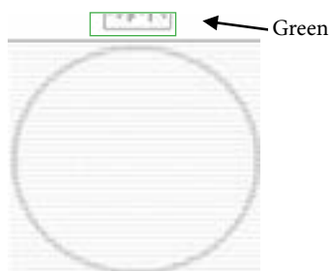

Figure 6. Braille converted image with the colour description
Source: Author

The colour identification and representation will be further improved for professional artists by indicating combined colours in one single hardcopy of a braille conversion. The primary stage of painting will be done by introducing the single colour with a primary shape in the amateur level of the application.

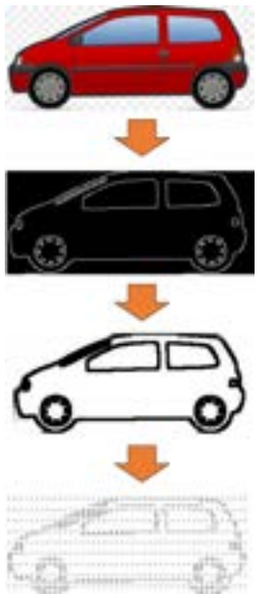

Figure 7. Braille conversion process of a complex image
Source: Author

The whole process for the braille conversion is shown in figure 7. A complex image of a car is represented in the diagram and such an image consists of smaller skill level shapes (circle, rectangles, trapezium etc.) which will be accessed in the amateur level within the application. The instructions for the blind artist should be provided in order to visualize the image in the mind and sketch it in the braille printed hardcopy.

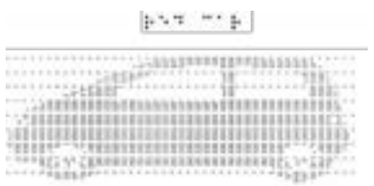

Figure 8. Braille conversion with description of a complex image
Source: Author

The description for painting the braille hardcopy is provided as shown in figure 8. The heading "Red car" is provided in the braille text line at the beginning.

V. DISCUSSION

The aim of this research was to identify the software solution effectiveness for Image Identification and Artistic skills for visually impaired people using braille and develop an application for blind individuals to engage in art. In order to create a fully functional image identifying computer based software through braille it is necessary to research on all the available technologies how beneficial it will for all the visually impaired personals.

The software was tested with the blind community of a sample of 20 students at the blind school and the students were able to identify the main standard shapes with the respective named label. Complex images were at a stage for the most creative students to identify and needed further improvements.

To recognize the effectiveness of such a research interaction with fellow artists, visual impaired people, lecturers and others who are concerned in such research areas was done from different age groups.

With the information gathered through the survey conducted the public awareness for the issue was gained on whether such an implementation in future will be beneficial for the visually impaired community. Considering the cost and software effectiveness the response to the braille converted image for image identification and art was highly appreciated. With less concern of people for such an area because they determine that the blind and visually impaired do not require any such subject modules a factor raised for doing a research whether creativity can be developed in each visually impaired individual by improving their image identification ability and artistic capabilities.

VI. CONCLUSION AND FURTHER WORKS

Image Identification and improving Artistic skills for visually impaired can be achieved by developing a computer based software solution. If such computerized technology is used, it will be a solution for the problem. The effectiveness of a software solution based on braille

will be simpler and less costly also will be influential for a successful mechanism to the visually impaired to identify the world through image identification and improve artistic skills through it.

To gain a conclusion on such a statement the information on the effectiveness of the software solution was gathered by a survey and the results gave the points to be considered in developing such a software in future.

As further work building an improved braille converting system with new features such as a method inventing a feature to guide the artist along the drawing and more improved colour representations within a conversion can be done. The using of braille conversion more mobile platforms will be also noted within future work.

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