Chapter 13
Artificial Intelligence Solutions for the Visually Impaired: A Review

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ABSTRACT

The major population of visually impaired and blind peoples were overlooked for years. Technology always keeps advancing and being developed in all aspects. Numerous solutions were being discovered for any current day problems of humans, but not for the people having low vision, partially impaired vision, and blind people. In this paper, the authors focused on the research papers that are available on the topic of AI solutions for the visually impair and reviewed the papers. This chapter is different from other review papers, giving the review of more than 30 research papers in one place, which are speaking about the new concepts that would make people's lives easy. The review paper covers the research paper, the technology used, the solutions offered, and their solutions. Some recommendations are also being given based on the limitations found in the different papers.

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INTRODUCTION

According to WHO, across the globe there are more than 285 million visually challenged people. And according to a report estimated No. of visual impaired people in India is more than 66 million; of these, 57 million persons have low vision, and 9 million are blind (Bagwan & Sankpal, 2015). The daily life of people having problems is far different than people with normal vision. Being blind or having someone close to us with low or blind vision needs effort and care towards people.

Eyesight is the most important sense a person needs to have for performing his task. Visually impaired or blind people needed most assistance in situations like travelling around, performing any activity out of their daily habituated area like home (Shadi et al., 2019). The oldest paper in the research papers we reviewed goes back to 2009 offering a solution with image recognition technology with help of small mini cameras on the both ends of the glasses that person wears and the paper claims to develop a text reading system. From then the papers had solutions offered to people with low vision and visual impaired are using the following technologies Navbelt guidance system, Personal digital assistant, Inverse Dynamic Pattern System Algorithm, Color coding, Convolution Neural Networks and Recurrent Neural Networks, Text to speech engine, Deformable Grid, few geometric formulae and Algorithms, Technology used in autonomous cars is currently under testing for navigation of visually challenged people, Real time semantic segmentation, Radio Frequency Identification, ORB-SLAM2 is a versatile and accurate monocular SLAM system module, Various algorithms, ultrasonic sensors, text speech module, Tensor flow objection detection API and CNN (Meena et al., 2022; Mohbey et al., 2022) models and more (Balachandran et al., 2003). All the research papers their solutions, technologies and the limitations they have are mentioned in the paper chronologically.

EXISTING SOLUTIONS TO HELP VISUALLY IMPAIRED PEOPLE

Currently, there are few applications and also few devices which are helping visually impaired people to lead their life like others. But there are certain problems with the available applications and devices. Here are some of the applications and devices that are available:

VisualPal a Mobile App for Object Recognition for the Visually Impaired

It is an application that is helping visually challenged users to recognize/identify objects. This application detects the color, name of the object that is given. Visual pal application uses Scale Invariant Feature Transform (SIFT) algorithm. This algorithm generally measures the Euclidean distance, if the variation is in range that is acceptable then the application spells the name/color of the image but when error is more than acceptable range then application classifies it as a new object and ask the user to enter the input which difficult for an impaired person. This application works as follows: When a visually impaired person captures an image, this application analyzes, processes the image and then gives a response in speech as output. But this application doesn't support recognition of landmarks, text and it also doesn't support voice input which is important for any application which is used by visually challenged people. Accuracy of this application registered around 71% and user interface is not much acceptable as visually impaired people find it difficult to use it. This application can be successful when it adds advanced technology and it should be cost effectively and user friendly (Bagwan & Sankpal, 2015).