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A Vision for Blind People using AI Technology

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Abstract: India has over one-third of world blind population. Unless with any transplantations blindness cannot be cured completely. Blind people cannot go around the world all alone. In this paper a method to support blind people to travel everywhere with an idea of outer world is proposed. Everything comes before the blind people will be monitored and delivered to them using AI technology and a voice module. This paper comprises how AI is being used to support the blind people.
Keywords: Blindness, AI, Neural network, Voice module, MATLAB

I. INTRODUCTION

A visually impaired people are like "a bat in the dark" of all their life. There is no clue for them to know where they are travelling and what object is present around them. Someone must assist them in all ways but it's an impossible fact. Usually all blind people would use a walking stick to find the obstacle. Recent days the guiding person and walking stick has been replaced by assistive devices to assist them easily. The walking stick itself made to be an assistive device. Walking stick is made with three ultrasonic sensors to detect the obstacles in three different directions like left, right and front. With respective to an obstacle direction different type of beep sounds will be produced. These sound producing speakers and ultrasonic sensors are controlled by a microcontroller.

II. VISUAL IMPAIRMENT

Visual impairment or blindness is one's inability to distinguish between bright light and darkness. Visual impairment is not the one corrected with eye glasses, contact lenses, medicine or surgery. Blindness could be the reason for many causes such as glaucoma, retinal detachment, traumatic injuries, cataracts, hypertensive retinopathy and so on. Some types of blindness like myopia, hyperopia and astigmatsism can be corrected using specific lens to focus the image on retina. Damage to the optic nerve cuts
Down the information being passed to the brain from the eye thus resulting in blindness. Some of the risk factors of visual impairment are prenatal care, premature birth, aging, poor nutrition, poor hygiene, hereditary background of blindness, diabetes, blood pressure and cardiovascular diseases. Visual impairment has a combination with intellectual disability such as autism spectrum disorders, cerebral palsy, hearing impairments and epilepsy.

III. AI TECHNOLOGY

AI, artificial intelligence rules the whole world with their hands of huge technologies. Artificial intelligence is also called machine intelligence where a machine is taught with human and animal intelligence. The AI field draws upon computer science, mathematics, psychology, linguistics, philosophy and many others. The field was founded on the claim that human intelligence "can be so precisely described that a machine can be made to simulate it". One of the types of AI is neural network, which works as the neurons of the human brain. Neural network is modelled based on the human nervous system. Neural network learn by the examples of huge database to perform some specific task. For example, to identify an object, the object's physical features like architecture, structure, weight etc. are considered. Based on these features the objects are identified with a probability of various objects. An artificial neural network is a collection of nodes called artificial neurons which is similar to the network of human brain neurons. Like the synapses present in human brain transmitting the signals to one neuron to another neuron, the artificial neurons also process the signal which is connected to one another.

IV. METHODOLOGY

The basic method of neural network is used here in this project to make a smooth way to blind people without any hurdles in their way. With the help of neural network, the database are analyzed for the object and once it matches any database object with the sample object of same architecture, weight and structure it makes the blind person to know about the object or obstacle details. Here in this project, since it deals with the object images, image processing plays a vital role to process and find an object. Image processing incorporation with neural network process the obstacle detected and provides valuable information about the obstacle.

V. BLOCK DIAGRAM

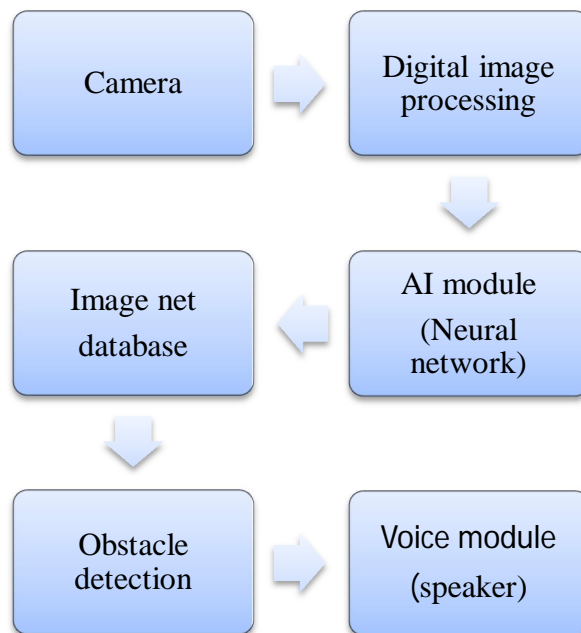The block diagram would clearly explain the process happens to find an obstacle in step by step format.

Fig. 1. Block diagram of proposed sytem

When the programming of neural network combined with digital image processing done in MATLAB is compiled and run the program, the camera is switched on. The camera captures all objects lively as a video format. But all objects provided within the video are sent to the neural network as lot of image frames to compare with the inbuilt image databases. As early explained in methodology, the physical features are compared and the objects in a frame are given with their names and delivered to blind people via the voice module. Based on the provided information about the object or obstacle they act according to their purposes.

VI. PROGRAMMING AND DESIGNING ANN MODELS

Designing and programming of the ANN model involve five basic steps. They are collection of data, preprocessing data, building network, training network and testing network. In first step, the sample data are collected. Data like objects of different kind with the structure, edges, weight and architecture.
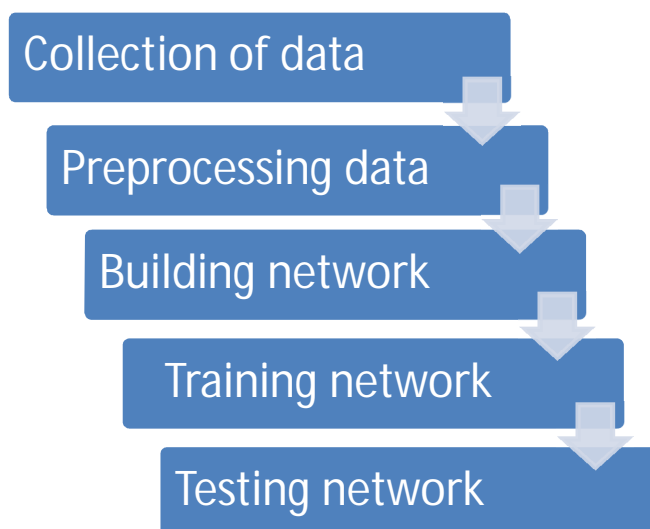
Fig. 2. Designing steps of ANN model

In preprocessing data step, huge data base of images are loaded in. Those data base are used to compare the captured image with them. In building the network, neural network uses multilayer perceptron which consist of three layers of nodes: an input layer, hidden layer and an output layer. In training the network, some of the databases are altered to get the output closed to it.

Programming of the ANN model is done in MATLAB. MATLAB is a numerical computing environment and also a programming language. It allows easy matrix manipulation, plotting of functions and data, implementation of algorithms, creating user interfaces and interfacing with programs in other languages. The Neural Network Toolbox contains the MATLAB tools for designing, implementing, visualizing and simulating neural networks.

VII.   RESULTS AND DISCUSSIONS

Some of the outputs of this project are shown here. Using web camera some of the objects are detected and delivered to blind people using speaker. And also some objects are detected with a probability graph.
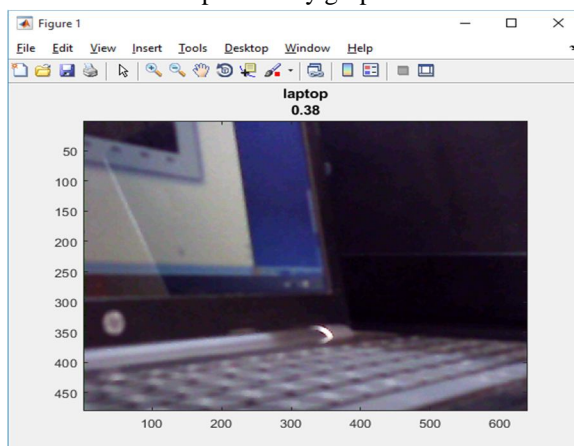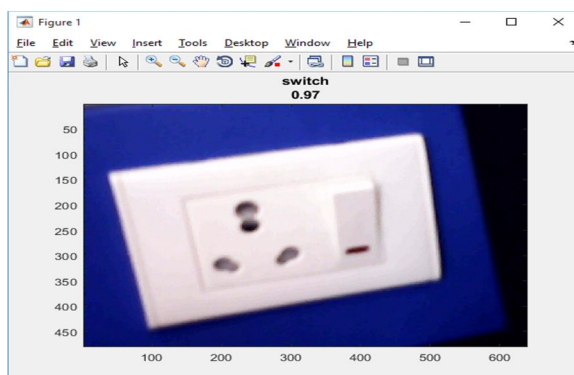

Fig. 3. Output showing laptop
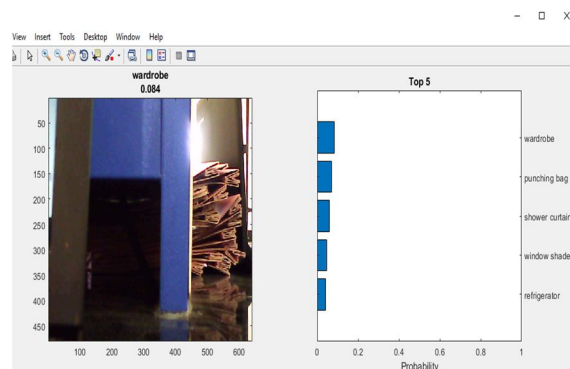

Fig. 4. Output showing switch

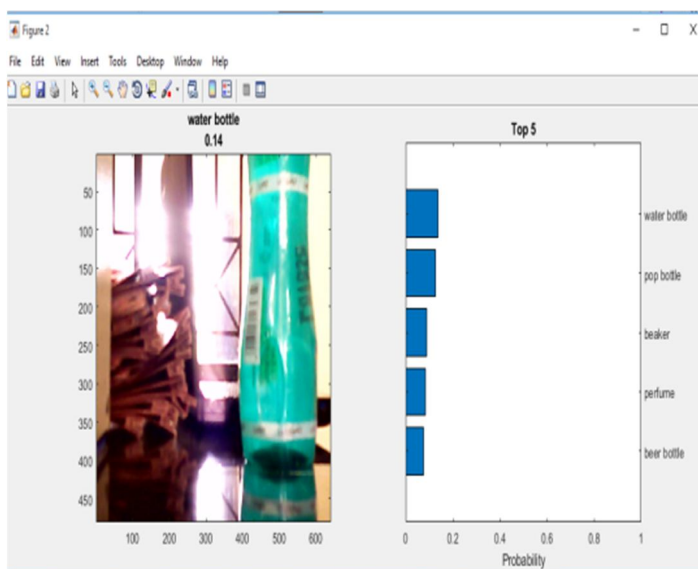Fig. 5. Output showing wardrobe

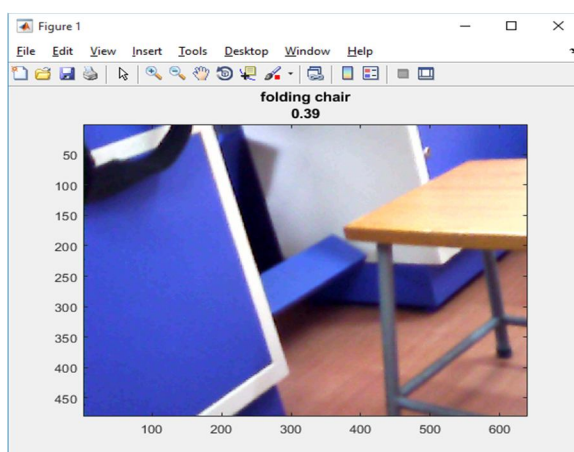Fig. 6. Output showing water bottle
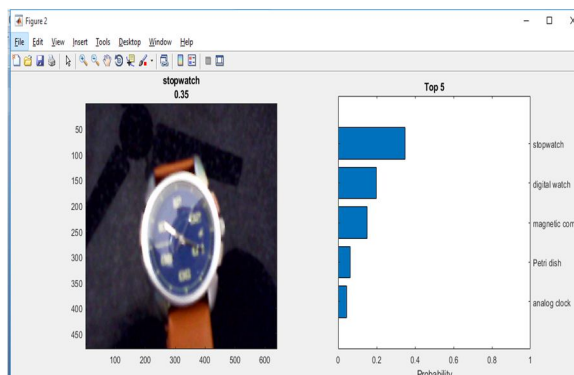

Fig. 7. Output showing chair

Fig. 8. Output showing stopwatch

Fig. 8 showing some of the probabilities of analog watch at the same time other figures of output are showing the exact object details of what it is. These are some of the examples provided to blind people using voice module.

VIII.   CONCLUSION AND FUTURE SCOPE

We conclude with the point that a blind person can know all the objects present in front of them with the help of our project. This will help a vision impaired people to take and handle everything they want to access. And they can also know the object which acts as an obstacle to move according to it. To bring out this project as a gadget to market, programmed raspberry pi interfaced with camera is used. That makes the gadget more handy and comfortable for the blind pedestrians.

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