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SMART ASSISTIVE ACTIVITY RECOGNITION DEVICE FOR DIFFERENTLY ABLED PEOPLE BASED ON MACHINE LEARNING - SAARD

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Abstract: Science and Technology have made human life addictive to comfort, yet concurrently there exists an oppressed gathering of individuals who are battling for tracking down a creative way that can make their life easier for them. After concentrating and highlighting the problems faced by the differently abled people like blind and deaf, solving it through a device alone is a very hard task. A ton of exploration has been done on every issue and arrangements have been proposed independently. Objective of the smart assistive device SAARD (Smart Assistive Activity Recognition Device for Differently Abled People) is to recognize activity for differently abled people so; they feel confident and independent by helping them to know objects surrounding them. The Proposed device SAARD help the differently abled people by taking images and give the output in form of audio. Along with that it also detects obstacles and surrounding sound which alert them.

***Index Terms*- Alert, Assistive device, Audio, Buzzer, Differently abled, HAR, Vibration.**

I. INTRODUCTION

Around 1300 million individuals have some sort of greatly reduced vision among which 18.85 crore individuals have a light blindness disability, 21,700 crores have medium to extreme vision blindness disability,3.6 crore individuals are visionless and person beyond 50 years age have vision blindness. India is estimated as home to the greatest amount of visually challenged individuals. According to WHO, among the total populace around 5% or 46.6 crore individuals are deaf. Human activity recognition (HAR) refers to the task of measuring the physical activity of a person via the use of objective technology. This task is extremely challenging owing to the complexity and diversity of human activities. HAR is considered as one of the most promising assistive technology tools to support differently abled daily. AI branch ML which can naturally take in itself and improve automatically from its activities without being expressly programmed. AI is wide-going piece of programming stressed over building splendid machines fit for performing the piece of work that customarily require human understanding. Internet of things (IoT) portrays the organization of actual articles— "things" or objects. IoT connects many objects to the Internet. It engages the exchanging of data never open, and brings customers the information in a much safer way. These technologies are used to develop the proposed device. Existing tools can't be utilized to process real time information in the world. The proposed device SAARD is designed for differently abled people so that they can use this device in real time. Every selective day might have issues while knowing and connecting using their current circumstance, especially the obscure.

Existing System: The prior works on this system has issues like it is only for blind or deaf or dumb. The system which is built for all is used for communication purpose it only helps them to communicate with each other or others it doesn't help them with the surrounding environment objects so that they can go anywhere with confident. Many of the differently abled people are illiterate they can't read the text on screen which makes them feel dependent on others.

Proposed System: The proposed device SAARD is used to help differently abled people by recognizing daily activity by giving them information about the surrounding environment. All the design and layout is done bearing in mind of differently abled people. First it will convert picture to text and then text to audio for the differently abled person who deserve to live independently by using You Only Look Once (YOLO) algorithm that goes through a variety of a very mind-boggling convolutional neural organization design called the darknet with OpenCV and google text to speech. The proposed device SAARD will continuously capture multiple frames using a camera interfaced on Arduino uno microcontroller board and the frames then converted to audio segment, the obtained results achieve the success of the proposed SAARD prototype in giving differently abled users the capability to understand unfamiliar surroundings by recognizing the surrounding activity, through an easily adaptable device with this profound object identification model.

II. RELATED WORKS

This section discusses various research work on machine learning and object detection to support differently abled people.

1. SHAROJAN BRIDGE the framework model of this framework depicted the work to beat any issues during the time spent correspondence between the Blind, Deaf and Peaceful individuals. Extension SHAROJAN BRIDGE will employ Wearable Technology, Texas Arrangement Circuitry and Arduino circuit gatherings to be able to offer a method to talk to men and women who are special.
2. Brilliant Glass Vision are specific for the individual that outwardly impeded talk whether it could find restrictions and measure miles utilizing ultrasonic and microcontroller. Close up to getting proportions from the environment, its miles sent to outwardly impeded individuals through headsets. The SIM900A GSM/GPRS (Global Systems for Mobile/ General Packet Radio Service) module is useful to gain data through the net. The swap is discovered with all the construction that is usually useful for crisis commitments like sending text, comprising moment, temperature and different regions controlled by typically the watchmen if they are deadened there can end up being a hazard. With using brilliant glass, out there of entryways could possibly be the person that may be frail can go walking the neighborhood regarding indoor and out there of entryways. A great instrument which could no route may need to fast apparent inability in addition to be outfitted to offer orders to typically the applicable.
3. Inside examined different noticeable replacement buildings which have recently been created recently. He or she additionally intends to be able to present a method that re-establishes typically the critical factor regarding the apparent device to the identifiable proof of encompassing things. The strategy depends upon video check and interpretation. Within this way, there is a commitment in order to uncover a visible replacement machine dependent absolutely at the particular assessment of the quick and amazing set up of rules with regard to distinguishing and finding contraptions in image.
4. Eye improvement appraisal is another divided way to cope with the adjustment associated with action in [10] that will show eye development data recorded the particular utilization of the electrooculography (EOG) framework. This individual initially portrayed plus assessed estimations in order to recognize 3 credit of eye development from EOG indicators - saccades, obsessions, and flashes -- and proposed techniques for looking at situations of obscured vision improvement. By then, create 90 precise brilliant lights that depend on those ascribe and choose the part that utilizes one of the most un-comprehensive bumbles thorough of assurance (mRMR).

III. PROPOSED SYSTEM ARCHITECTURES

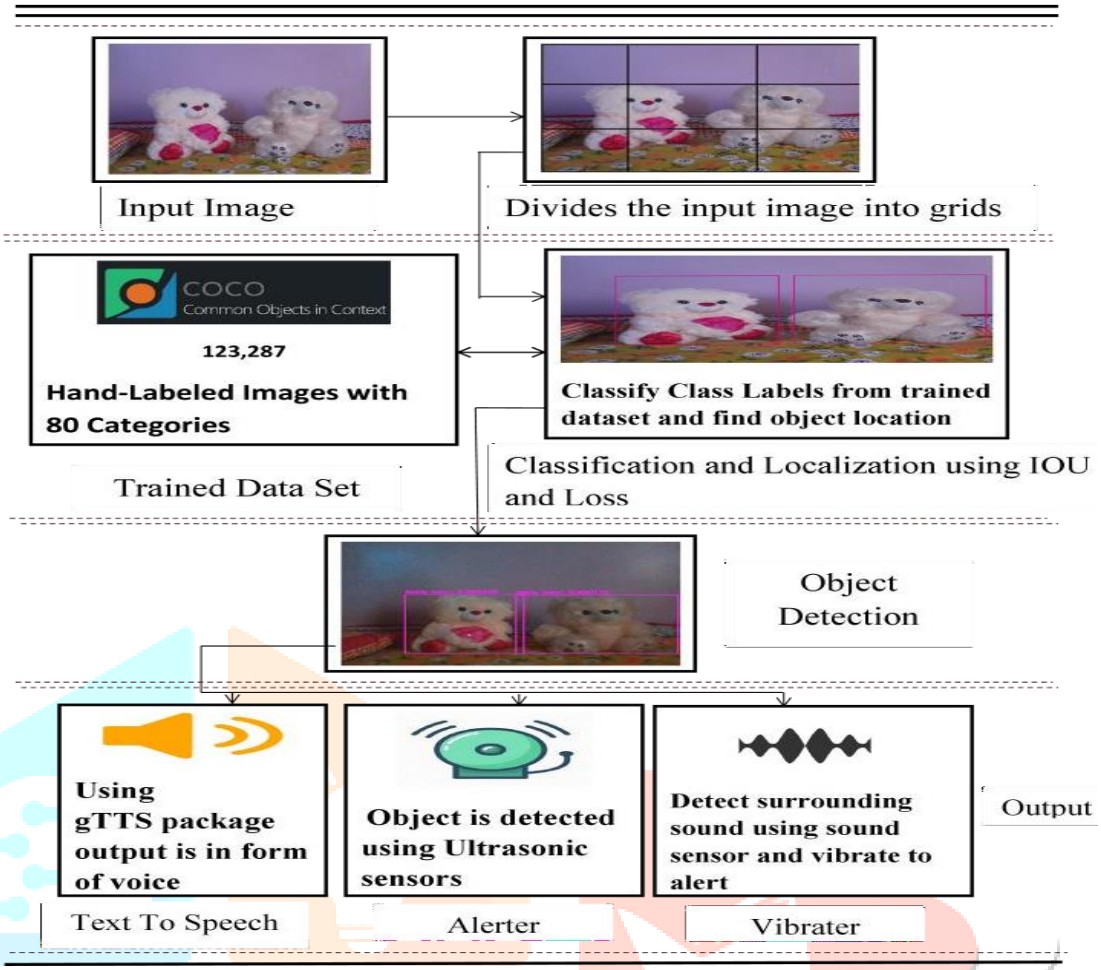

Figure 1 Block diagram of proposed device SAARD

The main motive of proposed device SAARD is to introduce an idea that can help the differently abled people by providing the surrounding information by detecting the activities like what objects are there around them or any obstacle is there on their way so, that they can go anywhere without being dependent on others. This section includes system architecture, algorithm of the proposed device SAARD and algorithm . The block diagram of proposed SAARD device is shown in figure 1. In phase 1 first it takes the input image from camera at 45 frames-per-second and then divide the input image into a grid cell of S x S. In phase the model is trained with the Common Objects in Context (COCO) dataset. Image classification and localization are applied on each grid. While classifying each grid (You only look once) YOLOv3 predicts the bounding boxes based on the center of object and their corresponding class probabilities for objects and identify the object using class labels from the trained COCO dataset. If it predicts more than one bounding box for same object, then it uses Intersection over Union (IOU) and Non-Max Suppression on that object and gives the final or one bounding box for that object by calculating its confidence score so that we don't end up predicting multiple bounding boxes of same object. Finally, in phase 3 it detects object with bounding box along with the confidence score. The output is given as soon as object is detected it is converted to speech, the text description is then sent to the Google Text-to-Speech API using the gTTS package and the speech output is given through headphones.

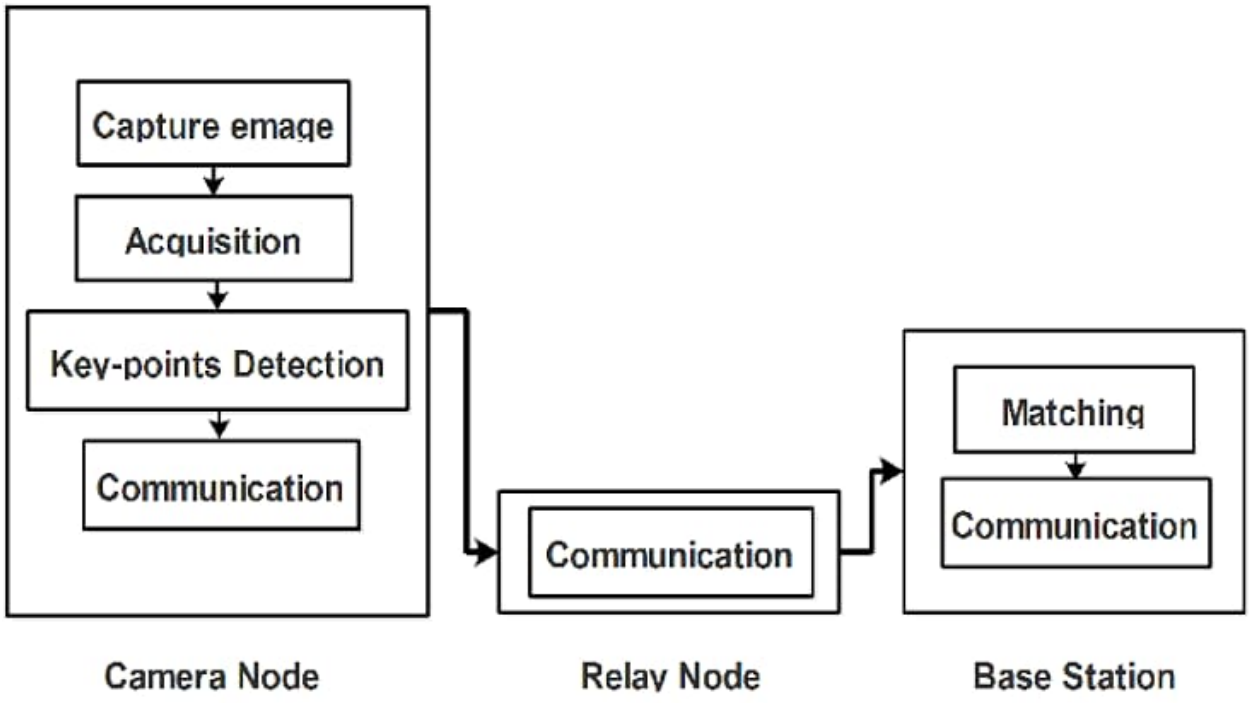

Figure 2. Architecture Diagram

Architectural diagrams help to clarify a building, relationships between elements of a building, or a process connected to a building. They have no unified appearance but they distil unwieldy, hard-to understand concepts into discrete, easy-to-understand images. There are three nodes in this diagram first one is Camera node and Second one is Relay node at last third one is Base station node , and these are related to one another and help in the process of architecture .In the first diagram the camera capture the image after the receiving the image , The key points in the image detected after the detection the communication or the voice will send to detect the object and from this the voice will send to Relay node after this process Matching of the communication take place in Base Station through the Communication.

A. SYSTEM ANALYSIS AND DISCUSSION

Table.1 Comparison of Performances of different assistive devices.

References	Algorithm/classifiers	Results	Classes	Limitation	Frames per sec	Accuracy
Md. Razu Miah, Md. Sanwar Hussain[2]	Naive Bayes, Nearest Neighbor Decision Tree LibSVM.	Smart glass for visually impaired people.	40 Features/ Activities	They are not as accurate as vision-based approaches. The outward appearance isn't captured	-	Intra-Subject Validation = 96.16% Intra-Subject Cross Session Testing = 85.24%
Nishajith.A, Nivedha.J, Shilpa.S.Nair, Proff Mohammed Shaffi J.[3]	(CNN), Convolutional Neural Network model TensorFlow API, open-source library.	Visual Guidance System.	90 objects	Detects only 90 classes of objects.	7	Accuracy results are not mentioned.
Necati Cihan Camgoz, Ahmet Alp Kındıroglu and Lale Akarun.[5]	Dynamic Time Warping (DTW), k-Nearest Neighbour's (k-NN) algorithm.	Sign Language Recognition	6 users	Not satisfied with users acting signs and symptoms with greater region and speed variations. ¤	-	97.88%.
Haney Jabnoun, Faouzi Benzarti,and Hamid Amiri.[9]	Scale Invariant Features Transform approach (SIFT), Speeded Up Robust Features (SURF).	Object Recognition.	1 user	Improving the rate of recognition. Adding an auditory translation for identified objects.	23	SIFT = 82% SURF= 18%

Andreas Bulling, Jamie A. Ward, Hans Gellersen, and Gerhard.[10]	Support vector machine (SVM) approach.	Activity Recognition using Eye Movement.	90 Features	Challenge to define a single identifiable activity. Browsing the net is more hard due to the one-of-a-kind eye actions available	30	76.1%
Jayashree Agarkhed, Lubna Tahreem	CNN, YOLOv3, COCO model.	Provide information about surrounding objects and detect obstacles and surrounding sound for differently abled people	1000 or more features/ objects	If object has less accuracy it ignores the object.	45	98%

Table 2. Comparison of no of services.

No of Services	**Unique Smart Eye Glass**	**Iot Based Assistive Device**	**Smart cap**	**Novel Approach sharojan Bridge**	**HospiSign Sign Language**	**Object Recognition**	**SAARD**
Object detection	✓		✓			✓	✓
Sending SMS	✓						
Text to speech		✓		✓			✓
Speech to text		✓		✓			
Audio to Audio				✓			✓
Image to speech			✓				✓
Hand Gesture					✓		
Obstacle Detection							✓
Sound Detection							✓

The proposed device SAARD is compared with the existing systems by checking number of end services supported by each system and a conclusion is drawn that the proposed system tends to provide service that are not provided by other systems. All the existing system help differently abled people by means of communication to help them communicate with each other or with others and some systems provide services only to individual disability person but our proposed device SAARD help them to live independent of others and be confident to go anywhere anytime. It helps by recognizing activities to differently abled people by giving information about the surrounding object and also alert them if any object is detected or by detecting the surrounding sound and alert them through buzzer and vibration.

to recognize activities to differently abled people by giving information about surrounding objects but also help them to know surrounding sounds so that they don't get into accidents while crossing or walking on roads. It also helps them to detect the obstacle on their way if any and alert them, so they won't fall on ground and hurt themselves and can go anywhere without depending on others .

The SAARD device is compared with the existing devices by checking number of end services supported by each device and a conclusion is drawn that the SAARD device tends to provide the majority of end services and helps differently abled people to move from one place to another without any support of others.

The table 1 shown above shows the performance of existing system over SAARD device and how SAARD performance is better than other device .

By seeing the table 2 the no of services provided by SAARD is more than other devices so, the efficiency for no services provided by SAARD is greater than it not only helps to detect activities of objects but also detect obstacle, sounds and convert text to speech, image to speech, audio to audio. So, the differently able can live their life somewhat easy.

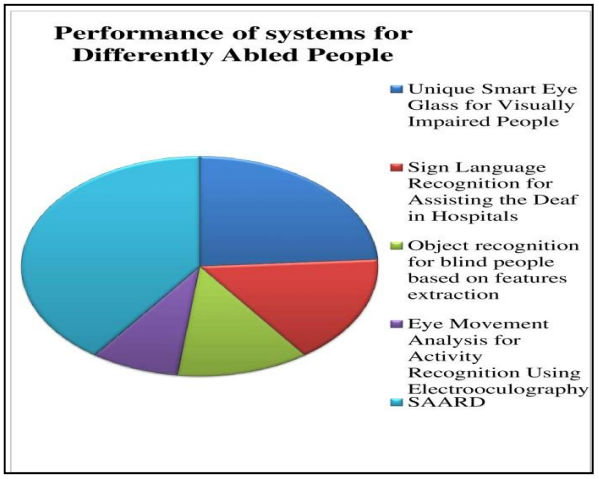

Figure 3 Performance of SAARD over different systems

As shown in Figure 3 above the performance of SAARD is greater than other systems as the proposed device SAARD provide accuracy greater than other systems and the percentage of efficiency provided by SAARD in terms of service is more and different from others as shown in Fig 5.

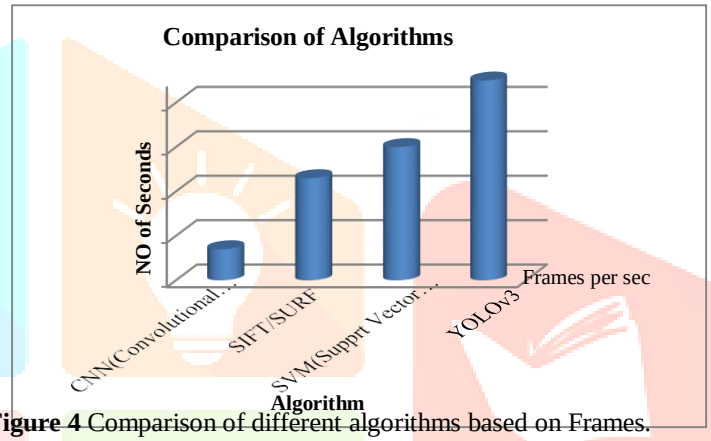

Figure 4 Comparison of different algorithms based on Frames.

The Figure 4 shows how different algorithms take the image frames per sec. Our proposed method YOLOv3 take 45 frames per sec and is high comparative to others such as CNN takes 7 frames per sec. SIFT/SURF takes 23 frames per sec, SVM takes 30 frames per sec.

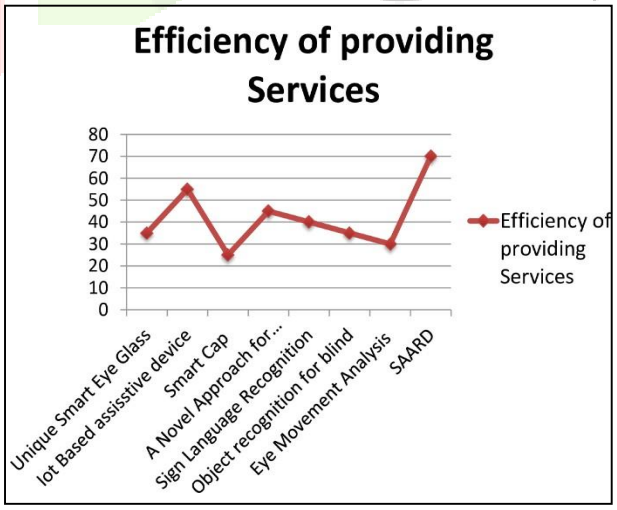

Figure 5. SAARD with approximately 70% efficiency

As some systems provide service to only particular type of disability and some systems provide service to differently abled people but to help them to communicate with other but, the SAARD not only help to recognize activities to differently abled people by giving information about surrounding objects but also help them to know surrounding sounds so that they don't get into accidents while crossing or walking on roads. It also helps them to detect the obstacle on their way if any and alert them, so they won't fall on ground and hurt themselves and can go anywhere without depending on others.

IV. SNAPSHOTS

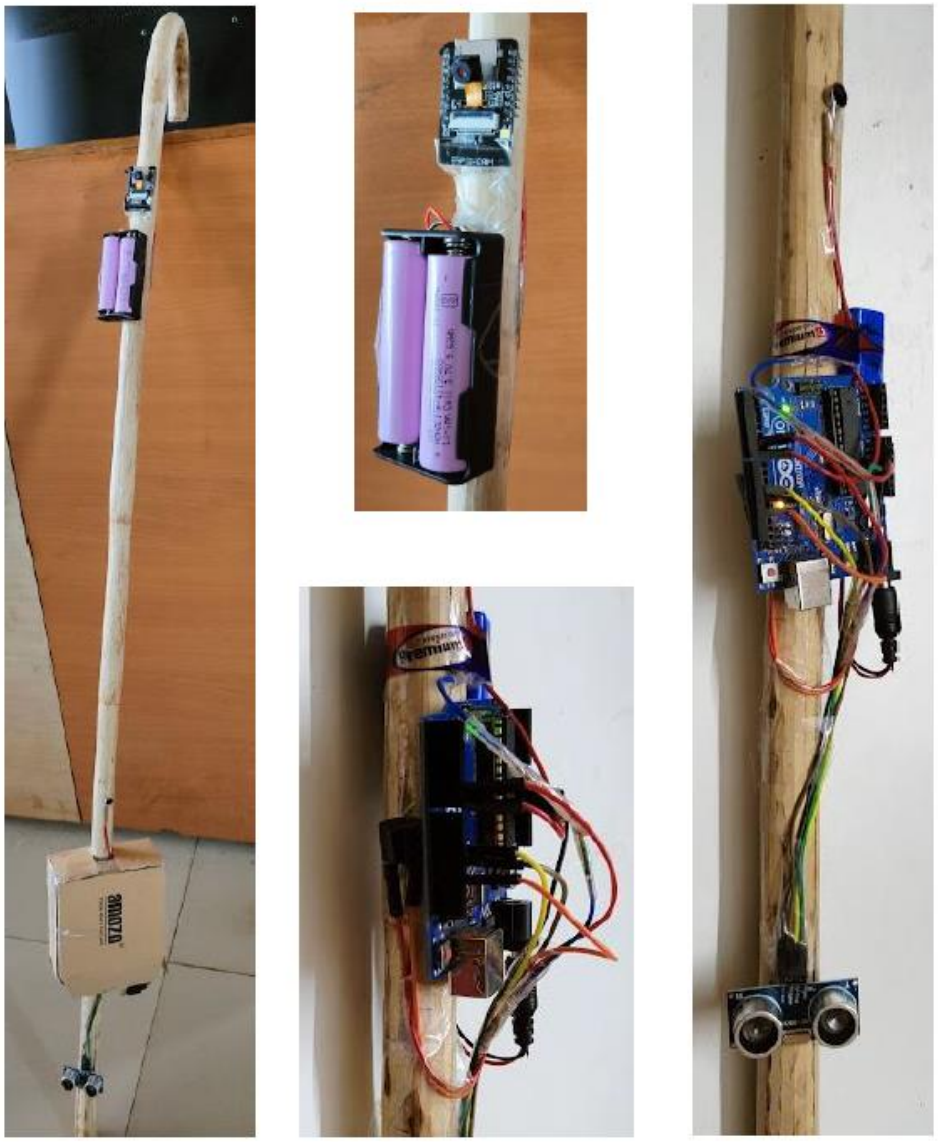

Figure 6. Snap shots

V. CONCLUSIONS

Critical Evaluation of System

- SAARD proposed now not the simplest cognizance at the development and facilitation of other those who are different, but additionally compact and saves resources.
- The advanced technologies and habits make this device transportable, adaptable and convenient. The equipment proposed by using SAARD can be a high quality help in dealing with a number of the demanding situations faced by means of distinctive areas.
- To raise the task, the device can be made extra compact so that it is simple for users to use.
- The limitation is it doesn't have sign language support as it requires separate database and algorithm but, for future work we can use this and make device more effective.
- Another limitation is it doesn't recognize traffic signal lights and signs because it should be trained more to recognize the picture while pattern matching techniques also changes here and also require separate database.
- Can also extend this limitation to future work and can further improve device by giving audio directions whether to go right or left if there is an obstacle on way so that they can walk more freely

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