A Survey Based on E-Commerce Website for Visual Impaired People

Sarbanshu Sanyal and V.Mercy Rajaselvi

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Sarbanshu
Sanyal(sarbanshus@gmail.com)
*M.E (Dept. of computer science and
Engineering)*
Easwari Engineering College
Chennai, India

Dr,V.Mercy Rajaselvi
Associate Professor
*(Department of Computer Science and
Engineering)*
Easwari Engineering College,Chennai,
India
Mercyrajaselvi.v@eec.srmrmp.edu.in

Abstract—**As we all know that the E-commerce websites are evolving rapidly and are in demand for purchasing various things, The E-commerce websites make things easier for both sellers and consumers. But the E-commerce companies give less importance to those customers who are visually impaired. This survey paper will deal with the various aspects of E-commerce websites which are being used by visually impaired people independently without taking the help of others to choose and buy the things. This paper will also deal with how with the help of various machine learning techniques the visually impaired people can do each and every step, i.e from registering into an E-commerce website to making the payment independently just by their voice and hovering over the computer screen. This will also help the visually impaired person to purchase the things from the E-commerce website independently without any hassle. This survey paper will also summarize the points on how the previous research work can be improved with various technologies.**

Keywords—E-commerce website, visual impairment people, machine learning, image processing, voice recognition

I. INTRODUCTION

E-Commerce websites are websites which are used to sell and buy things digitally. In an E-commerce website the consumer can do online payment for the product they buy. The use of E-Commerce websites are becoming more with the years. In a recent survey, in the year 2020, the E-commerce website had been used 18% more than the year 2019. E-commerce websites are providing a good platform for the seller to sell their product to genuine customers world wide without any hassle. The E-commerce website also gives a good platform to buy the product at a reasonable price.

The E-commerce websites can be made in both 2 tier and 3 tier architecture where client interacts with server and server interacts with database.

Visual impairment is one of the major problems in India. In India, visually impaired people increased from 24.1 million in 2010 to 31.6 million in 2020. The world's largest visually impaired population live in India comprising 15 % of the world's total population.

So, if we can bring the visually impaired people into the field of E-Commerce, then the E-commerce field can expand more. So, if we concentrate on E-commerce websites which can be easily used by visually impaired people on their own.

For making a visually impaired friendly E-commerce website, the latest technology like various machine learning techniques in voice recognition , image recognition and text recognition.

Machine Learning is the study of computer algorithms that can improve automatically through experience and by the use of the data.

In machine learning techniques, first it collects the data, prepares the data model, after preparing the data , it chooses the model on which it should be executed. After all this , it trains the machine model, after training the machine model it evaluates the sample data. After evaluating it has parameter tuning mechanisms and after that it predicts and inferring the results in real life scenarios.

Voice assistance relies on a mix of technology, including Natural language processing, artificial intelligence, voice recognition.

Audio recording device identification is a very important part of the audio technology which can verify the source, authenticity can be determined and the pitch of the voice also determined.

Many investigations have conducted in this field
- MFCC, LFCC and IMFCC are used to extract features
- Machine learning models
- Deep learning

There are many model which can used in the voice assistance:-
- Gaussian Mixture model (GMM)
- Speech normalization and data augmentation
- Hidden -semi Markov models

For clustering of the data, a K-mean clustering algorithm can be used.

For making a completely virtually impaired friendly E-commerce website there one requires to pay the payment online, so voice assistant mobile wallet and voice assistance internet banking proposal can be added to this E-commerce website for doing the payment at the end of the purchase.

Generally, the mode of the payment in the E-commerce website are as:-
- Cash on delivery
- Internet Banking
- Debit card and credit card
- UPI payment
- Mobile wallet

In most of the online payment the voice recognition mechanism is still not present so, if we can add the voice recognition in the online payment then virtually impaired people can use it for doing the online payment after purchasing the items from the E-commerce websites.

Many surveys were held on how the visually impaired people can be directly engaged in the E-commerce website. A study was held by Borodin, Bigham, Dausch and Ramakrishnan in 2010. According to that study people mostly use screen readers to read the text that is written on the screen.But in screen readers the hyperlinks and links interruptions were occurring on the screen which caused difficult for the visually impaired people to know about the text that was written on that particular web page.

Another survey was held by Lazar, Allen, Kleinman and Malarkey, in that survey the layout problem was occurring for the visually impaired people to read the text that was written on the web page.

Another survey was held where they compared the methods of speech recognition which can be used in developing websites which can recognise the speech of the visually impaired people and can work accordingly.
They focused on the 4 types of speech :-

- Isolated words
- Connected words
- Continuous words
- Continuous speech
- Spontaneous speech

Another survey was held in 2014 with Amazon where they found that the Tech Giant mainly focuses on the Information systems, Business strategies and eCRM and found that they are less focusing on the visually impaired people.

Many more researchers are researching on how the visually impaired people can independently use the E-Commerce website on their own.

But many of the researchers found solutions for the partially blind people like color blindness but still there is less work on the completely visually impaired people. In many research papers researchers are giving the solutions for the color blindness people or they are giving solutions with the help of a keyboard.

In most of the previous research, they proposed the machine learning mechanisms with speech recognition and image recognition to build the E-commerce website which can be used by the visually impaired people efficiently.

II.   LITERATURE REVIEW

Osama Shoib et al [1] [2019], in their paper named E-commerce Web Accessibility for people with disabilities, they gave solutions on how the persons with disabilities can use the website on their own. Their research proved to be 60 % success. They have the mean values for known problem =19.13, likely problem =5.87 and potential problem =782.13. They gave the proper solution for the partially blind people only not giving proper solutions for the fully virtually impaired people.

Mallika Chand et al [2] [2019], they gave the proposed method on how the visually impaired people can be taken to the E-commerce website and independently do the purchase on the E-commerce website. In their page they used the technology of the speech recognition techniques They achieved the 70% accuracy in their method.

Kunal Mohadikar et al [3] [2019], they proposed a system in which a virtually impaired friendly E-commerce website can be made with the techniques with the speech recognition and image recognition, the proposed method was successful on every 6 people out of the 10 people.

Hemalatha S et al [4] [2020], they also proposed a system for the website for the visually impaired people. They used the techniques of speech synthesis and GMM models in their project. The proposed project was 82 % successful.

S. Santoki et al [5] [2021] in this paper they mentioned about the problems and difficulties the visually impaired people faced while searching in the E-commerce Website. They gave the qualitative analysis technique through the Repertory technique. They found that if the visually impaired people are brought to the mainstream of the E-commerce business then it can enhance the business of the E-commerce company. They worked on the various machine learning models for which they had a success rate of 76%.

Rallabhandy S et al [6] [2020] in their research paper they have proposed a method for making the E-commerce website more user friendly for the visually impaired people. In this process they have used face recognition techniques. They have used the gTTS and speech recognition libraries.

The proposed system was not giving the methods of how the visually impaired people make the online payment after purchasing the items from the E-commerce websites.

Kevin Pereda et al [7] [2020], in this proposed method an E-commerce website for the visually impaired people with heuristics centered in a specific user experience aspect as is accessibility. Here in this paper, they have given more importance to the mobile application.

O.Shoaib et al [8] [2017], they have used Internet of Things and cloud computing for making the visually impaired friendly website. In this they have used cloud computing for the storing the data and the IoT techniques have been used to make it more user friendly to the visually impaired people.

Elisa Prati et al [9] [2021] they did a survey and found that E-commerce websites were giving less importance to the visually impaired people. They gave a proposal to make the website with various diversity in UX design.Here in this paper they proposed various UX design and guidelines to make a better experience for visually impaired people.

Ramiro Goncalves et al [10] [2018] they did a survey and found that user guidelines covered in WCAG 2.0 were giving solutions to the 50.4% of the problems encountered by the users covered in the WCAG 2.0, but the techniques did not solve the problems. They also found that the blind users can not use the E-commerce website because of the inappropriate functioning of the screen reader. While having the test they found that the screen reader was having the same description of link, text and images as ALT text which caused ambiguity among the users. In their system the ONCLICK event must have an equivalent ONKEYPRESS event that should have the alternative; these were the drawbacks of the proposed system. The proposed system was 24.86% successful.

Kian Meng Yep et al [11] [2019] in their research proposal they have used haptic assistive tools. Technologies such as voice one, Duxbury Braille Translator and text enlarger. They have used low-level application programming interface (API), scene graph API such as CHAI 3D and H3D, and programming languages such as C++ and Python.. The language barrier was found to be one of the major defects in the proposal.

Millicent Akotam Agangiba et al [12] [2019] have proposed the system of screen manifest and screen readers methods for the visually impaired people. In their projects the main issues were with lack of alternatives, text of images, missing tables. header and tags, lack of intra page linking, missing tabs etc. The proposed system was 88.4 % efficient.

Raneom R. Sagr et al [13] [2016] they researched for the visually impaired people, they have used mainly JAWS and VoiceOver. The issues identified that unlabeled web elements (No ALT) captcha, websites constantly changing layout.

Yida Wang et al [14] [2021] in this they have used cognitive psychology mechanism by audience's color matching of cross- border E-commerce websites. The system average efficiency was 68%.

Gamal H. Eladl et al [15] [2017] the author has proposed a system for the E-payment service for the visually impaired disable person where they integrated the idea of OCR, TTS, modules with NFC technology. Issue was good pairing of the devices needed which was missing in the system.

Vaishnav Kameswaran et al [16] [2019] they proposed the method of making an online payment wallet for the visually impaired people. They proposed the voice assistant, screen reader, two factor authentication, technologies to augment cash practices. The issues found was that the sample size for the testing people was less and in that also only 38% efficient.

Ahmad Ehsan et al [17] [2020] in this they proposed the system of how the visually impaired taken directly to the digital and banking services in the digital era. They mentioned OCR, screen readers and voice assistant mechanism for the system. In this system the main issue was found that the proposed system was not dealing with the security concerns in the project.

Hemn Barzan Abdalla et al [18] [2021] in their research proposal, they have given a solution for the E-commerce website for the visually impaired people, they have focused on the contrast of the images, used the open or close voice assistant including voice input and audio cues. They have also used cognitive assistance. The system mainly dealt with partially visually impaired people, not giving any good proposals for the completely visually impaired people.

Arunasalem Sambhantam et al [19] [2020] they have given various methods to improve the accessibility of the E-commerce website, where they have considered the visually impaired people also. They used the navigational techniques, voice assistance techniques alternate (ALT) text. They have 6t0 % success rate.

Bineeth Kuriakose et al [20] [2020] in their research work they have proposed for the navigation system for the visually and blind people, in which they have used the techniques of IP camera network, VSLAM, cloud and vision-based navigation system, IoT. The proposed system was 80% accurate.

III.   CONSOLIDATED LITERATURE SURVEY

S.No	Name of the Paper	Technique used	Issues Identified
1	E-commerce web	Screen	They gave

#	Title	Technology/Methods	Findings/Drawbacks
	Accessibility for people with disabilities	Reader, Voice assistance, JAWS	solutions for the partially blind people, solutions for the completely visually impaired people were not given.
2	Internet of Technology (IoT) in E-commerce: For people with disabilities	Cloud computing, IoT, speech recognition, Augmented reality,	Only basic proposal with IoT given but not what exact technologies can be used in the IoT was not being proposed in the system
3	Visually Impaired friendly E commerce Website	Speech synthesis and recognition	Assisting only for the partially blind people
4	E-Commerce based shopping for visually impaired people using speech recognition	Speech to text conversion techniques	The proposed system was tested live.
5	An examination on website accessibility for active engagement of visually impaired E-commerce customers	The qualitative analysis technique through the Repertory technique	They proposed the qualitative analysis techniques but not proposed the exact techniques which can be used
6	Keyboard-less online shopping for the visually impaired using natural processing and face recognition mechanisms	gTTS and speech recognition libraries, natural processing techniques	Not giving the exact ,method for the online payment after purchasing
			the item
7	Visually impaired accessibility Heuristics proposal for E-commerce mobile application	Heuristics centered in a specific user experience	They gave more importance to the mobile application, not to the web applications.
8	IoT in E-commerce for people with disabilities	IoT and Cloud computing	Not exactly what algorithm to be used not given by authors.
9	E-commerce usability guidelines for visually impaired users	Used various UX designs	Focused on the designing on the website.
10	E-commerce website accessibility and usability and E-commerce platform analysis with the inclusion of blindness	Screen reader, voice assistant Used ONCLICK and ONKEYPRESS events	System was only 24.86% successful, and inappropriate functioning of the screen reader also crete problem
11	3D Haptic- Audio Enabled Online shopping - Development and challenges of a new website for the visually impaired	Haptic assistive tools, VoiceOne, Duxbury Braille Translation, CHAI 3D, H3D	They find the main issue was the language barrier in their proposal
12	Web accessibility for the visually impaired: A case of higher Education Institution	Screen magnifier and Screen readers	Lack of alternative text of images, links, header and tags, lack of intra page linking and missing tabs

13	Blind and visually impaired users adaptation to users application : A quantitative study	JAWS, VoiceOne, Screen readers	Unlabeled web elements, captcha detection, websites constantly changing layout
14	The color matching design method of cross border E-commerce website under the guidance of cognitive psychology	Cognitive psychology mechanism by audience's color matching of cross border E-commerce website	Exact cognitive psychology was not been proposed
15	A proposed E-payment service for visually disabled	Integrated idea of OCR, TTS modules with NFC technology	Good pairing of devices needed which was missing
16	Cash, digital payments and accessibility- A case study from India	Voice assistant, screen reader, two factor authentication, augmented cash	The main issue found was that the sample size of the people was very less and in that also only 38% efficiency found
17	The exclusion of people with visual disabilities from digital banking services in the digitization era	OCR, Screen reader and voice assistant	security concerns was there, the paper was not properly dealt with the security
18	A new approach of E-commerce Web design for accessibility based on Game accessibility in Chinese market	They have proposed the system for the visually impaired people and used open or close audio cues, cognitive assistance	Not giving solutions for the completely virtually impaired people, in the paper they gave solutions for the partially

			blind people
19	Implications for improving accessibility to E-commerce websites in developing countries- A study of hotel websites	Navigational techniques, voice assistance	Lack of alternate text(ALT), common case of accessibility problems
20	Tools and technologies for blind and visually impaired navigation support: A review	IP camera network , VSLAM, cloud and vision-based navigation system	Was dealing with exact algorithms for the payment application in E-commerce website

IV. CONCLUSION

From above all information we can conclude that many works have been done on the E-commerce website. Many research works have been on the fields on how the E-commerce business can be increased in the world.

The main focus was on the visually impaired people who can not use the E-commerce website on their own. Many researchers are working on that to bring visually impaired people into the world of E-commerce. But many more works are to be done to make the visually impaired people completely independent to use the E-commerce website for not to buy things but also they can able to pay the bill on their own.

V. FUTURE SCOPE

Many researches will be held on the E-commerce website that can be used by visually impaired people. As we all know that the use of E-Commerce websites are becoming more and more popular with the years. In a recent survey, in the year 2020, the E-commerce website had been used 18% more than the year 2019. E-commerce websites are providing a good platform for the seller to sell their product to genuine customers world wide without any hassle. The E-commerce website also gives a good platform to buy the product at a reasonable price. So, if we can bring the visually impaired people in the fields of E-commerce it can increase the business of the E-commerce website more and more.

We should look into the matter that if we bring more people in the E-commerce business then not only the E-commerce will get benefited but also the small shopkeepers

can also get a help to enhance their business by selling their items to the world wide.

VI. ABBREVIATIONS

- **MFCC**- Mel Frequency Cepstral Interface
- **LFCC**- Linear Frequency Cepstral Interface
- **IMFCC**-Inverse Mel Frequency Cepstral Interface
- **IoT**- Internet of Things
- **UPI**- Unified Payment Interface
- **JAWS**- Job Access With Speech
- **gTTS**- Google's Text to Speech
- **TTS**- Text to Speech
- **CHAI3D**-Computer Haptics and Active Interface 3D
- **H3D**- Haptics 3D
- **OCR**- Optical Character Recognition
- **IP**- Internet Protocol
- **VSLAM**-Visual Simultaneous Location and Mapping
- **NFC**- Near Field Communication
- **WCAG**- Web Content Accessibility Guidelines

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