A Sign Language Control Based ATM Access System for the Blind Using AI/ML

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Abstract: Nowadays technology is reaching its high levels. There are several types of equipment which are made to help the physically impaired person with the help of technology. So, during our research, we found that the visually impaired person usually face the problem to withdraw money from the ATM Machine. Still, we have keypads in the ATM for further transactions, but the visually impaired person cannot be able to see the keypad. So, it is of no use for them. Also, they have to take someone or ask someone to withdraw the money for them and for that they have to share their pin with others, and it is not safe, or either they have to visit the bank physically. So, we decided why not just build a system where a visually impaired person can go to the ATM and access it by showing the signs to the camera and at the same time person can be able to hear the voice instruction in the Ear. So, we will be going to build a system that will help the visually impaired person use the ATM individually with ease.

Keywords: ATM; Blind; Image Processing; Security; Video Processing

I. INTRODUCTION

The world today has overcome several problems with the help of the technology. Right from developing electronic wheelchair to navigated cones, several equipments have been developed to serve humanity, including for those who are physically challenged. But one of the main problems faced by them is performing monetary transactions. To Withdraw money from the ATM for physically Disabled person is very Challenging. They have to share their personal passwords to others to withdraw money and this is very risky.

Thus, in order to enhance his experience with ATM, we plan to develop a sign language based ATM accessing algorithm , where is its easier to use the software developed.

In general, the utilized techniques are classified to be either vision-based or glove based. Through vision-based methodology, gestures are captured by a camera and then images features are extracted to interpret gestures meaning. In glove-based technique, the user wears a glove and through a set of sensors, gestures are translated into audio or text speech.

Although image-based techniques are more realistic, they require complex processes such as features extraction and images processing. Moreover, the background and the position of the camera are crucial for this technique. Unlikely, glove-based technique is characterized by a less computational complexity, fast response, and portability. In general, both techniques are utilized to interpret the sign language in forms of isolated words or continuous words.

II. LITERATURE SURVEY

In this section, papers published from 2012 has been reviewed and summary of the same is presented below. The findings have been tabulated in Table 1. their full forms have to be mentioned only for the first time they are used.

Paper	Description	Drawbacks
Sign Language Recognition Based on Intelligent Glove Using Machine Learning Techniques (2018)]1]	Machine learning algorithm (DROP3) to store each alphabet with sign language with less data sets to train the algorithm	Only classifies for alphabets.
Sign Language Communication and Authentication using sensor Fusion of Hand Glove and Photometric Signal (2017) [2]	Sign Language Interpretation system by a combination of data glove and photoplethysmography sensor measurements collecting concurrently from data glove and PPG devices.	Sensors recommended was based on only six subjects involved and only four experiments were conducted.
Design of ATM Accessing System for Blind using Real-Time Video Processing through Gestures (2015) [3]	The possibility of simple hand gesture based input which provides secure transactions.	Gestures should be shown properly, and Indian sign language should be known.
Real-Time Translation of Indian Sign Language using LSTM (2019) [4]	A sensor-based gloves can be used to convert the sign language gestures using the fingering moments of the person.	Low accuracy
Atm Machine for Blind People (2016) [5]	The static hand gestures are captured, and the pictures are translated into their respective meanings, using a 2D convolutional neural network. This procedure is mainly used to help the visually impaired people.	The accuracy obtained by using this technique is slightly as the number of signs increases from 5 to 9
Sensor Based Hand Guesture Recognition System for English Alphabets used is Sign Language of Deaf-Mute People (2018) [6]	The flex sensor has measured the bent of fingers and movement of a hand transform alphabet and text then show output in form of voice by passing a mini speaker which trapped to a glove for better understanding between disable and normal people.	It has only 7 alphabets and 4 basic words which accuracy less than 100%.
Electronic Device Control Using Hand Gesture Recognition System for Differently Abled (2018) [7]	A real time hand gestures recognition system is used to detect the hand gesture in mid-air and also to control the appliances related to the input gestures. It is hence the combination of hand gesture recognition with real time hand detection by using HOG (Histogram of oriented radiance).	Low quality camera or the physical constraint of training data set.
Android Mobile App for Real Time Bilateral Arabic Sign Language Translation Using Leap Motion Controller (2017) [8]	For the translation of real time Arabic sign language e, an android mobile application is introduced. The mobile application is designed such that it makes the bi lateral communication for the deaf community easier.	Currently by using this system only 15 sign language words can be obtained. Meanwhile, the recognition of continuous sign language sentences are much complex.
Human Computer Interaction based on Gestural Recognition/ Sign Language to Text Conversion (2018) [9]	Sign Language Interpretation system by a combination of data glove and photoplethysmography sensor measurements collecting concurrently from data glove and PPG devices.	Only employed for static gesture.
Performance Enhancement by Combining Visuals Clues to Identify Sign Language Motion (2017) [10]	Gloves with colored regions and optical camera are the key elements used in the sign language recognition method. The moment of the colored region are used to identify the motions of hand and fingers.	Low accuracy

Table 1. Literature Survey

III. METHODOLOGY

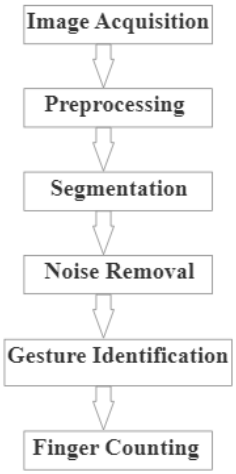

Fig 1. Flowchart

A. *Image Acquisition*

In image processing we are retrieving an image from a source, usually hardware systems like cameras, sensors, etc. It is the first and the most important step in the workflow sequence because, without an image, no actual processing is possible by the system. The image that is acquired by the system is usually completely unprocessed.

In the image acquisition process, incoming light energy from an object is converted into an electrical signal by the combination of sensors that are sensitive to the particular type of energy. These minute subsystems work together to provide your machine vision algorithm with the most accurate representation of the object.

B. *Preprocessing*

In Data preprocessing we are going to prepare the raw data and making it suitable for a machine learning model. Here we will be going to perform some operations on raw data. In our project the raw data is in the form of RGB images. So, we will be checking different color models in the taken image. The color models we will be taking are RGB, YCbCr and HSV.

So, we will check which color model is the best differentiating the object and the background in the Image. Based on that observation we will be going to choose that particular color model to perform other operations down the flow.

C. *Segmentation*

In segmentation, we will be going to differentiate the object of interest from the Image. Based on the color model we choose in the preprocessing, we will be performing the segmentation on that color model and will focus on differentiating our object of interest from the image, As we just want fingers for our interest, so will separate the fingers from the background.

After applying segmentation you will be able to see the fingers and background separately.

D. *Noise Removal*

a) *Erosion:* Choose a 3*3 square at left top(window), check the center pixel below the square if the color is black then paste it in a new matrix. If the center is white check all around the pixel are black even anyone is black we don't copy we make that copied black in copied image, else copy paste white image.

b) *Dilation :* After erosion there would be some part of finger lost we need to retrieve it back. Hence we choose a structuring element as disc of some radius .here we check the center pixel of surroundings is white then paste white for that pixel.

E. *Gesture Recognition*

Gesture recognition is the most important part in here. Here we will be going to train our model in such a way that it can understand what sign the user is showing and how to recognize that sign and tell the system to perform particular operations to withdraw the money from the ATM.

We will be saving the data of the user in the form of username and password in the local database. Whenever the user shows the sign to the camera and if the sign matches the credentials then the user will proceed for further steps.

F. *Finger Counting*

In this step will be going to count the fingers shown in the camera. Will be developing a algorithm in which a machine can easily understand how many fingers a person is showing to the camera and based on the input we will be performing next steps to withdraw the money from the ATM machine. Below image is the example of fingers shown to the camera.

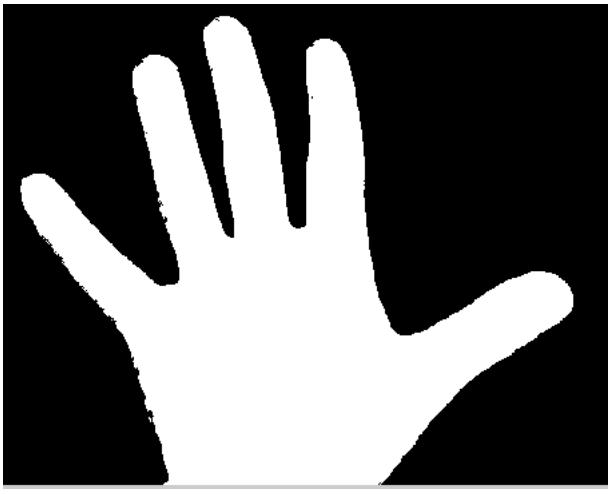

Fig 2. Fingers Shown to the Camera

IV. RESULTS

Fig. 3 and Fig 4 showcase the tables used for the development of the algorithm.

Image Name	Minimum value
1	0.48
2	0.51, 0.47
3	0.50 , 0.47 ,0.48 ,0.54
4	0.48, 0.48, 0.44
5	0.42, 0.46
6	0.47, 0.46, 0.46
7	0.45, 0.45, 0.41, 0.45
8	0.47, 0.45, 0.48, 0.45
9	0.44
10	0.49
11	0.46
12	0.44
13	0.40, 0.39
14	0.44
15	0.46, 0.43
16	0.51, 0.51, 0.44
17	0.48, 0.42, 0.46, 0.54
18	0.58, 0.40, 0.51, 0.60, 0.54
19	0.48
20	0.49, 0.43
21	0.57, 0.49, 0.48
22	0.57, 0.44, 0.49, 0.49
23	
24	0.44, 0.49, 0.49, 0.49
25	0.42, 0.43, 0.46
26	0.44, 0.36, 0.48, 0.39
27	0.39
28	0.41, 0.44
29	0.47, 0.40
30	0.43, 0.43, 0.40
31	0.35, 0.42, 0.45, 0.45
32	0.49, 0.54, 0.55, 0.53, 0.47
33	0.51
34	0.47, 0.53
35	0.64, 0.49, 0.51
36	0.51, 0.47, 0.54, 0.49
37	0.48, 0.51, 0.49, 0.48
38	0.41
39	0.40, 0.41
40	0.44, 0.41, 0.43
41	0.43, 0.41, 0.34, 0.31
42	0.47, 0.37, 0.47, 0.38, 0.39
43	0.38
44	0.54, 0.50, 0.26
45	0.61, 0.43, 0.23, 0.43

Fig 3. Segmentation

Fig 4. V. CONCLUSION

In this project, we presented a sign language control-based ATM access system for the blind using AI/ML.

This project is designed to reduce the communication gap between blind people and normal people. It translates hand gestures into meaningful information in the forms of numbers. The outcome is a vocalized speech. In fact, the system is characterized by ease of interface, portability, no prior training, and low costs.

So in this way user can able to withdraw the money from the ATM on its own and most important in the end the person will be satisfied.

	Color Model					
Image name	Y	Cb	Cr	H	S	v
1	✔✔	✔	✔	✱	✔✔	✔✔
2	✔✔	✔	✔	✱	✔✔	✔✔
3	✔✔	✔	✔	✱	✔✔	✔✔
4	✔✔	✔	✔	✱	✔✔	✔✔
5	✔✔	✔	✔	✱	✔✔	✔✔
6	✔✔	✔	✔	✱	✔	✔
7	✔✔	✔	✔	✱	✔✔	✔✔
8	✔✔	✱	✱	✱	✔	✔✔
9	✔✔	✱	✔	✱	✔	✔✔
10	✔✔	✔	✔	✱	✔✔	✔✔
11	✔✔	✔	✔	✱	✔✔	✔✔
12	✔✔	✔	✔	✱	✔✔	✔✔
13	✔✔	✔	✔	✱	✔✔	✔✔
14	✔✔	✔	✔	✱	✔✔	✔✔
15	✔✔	✔	✔	✱	✔✔	✔✔
16	✔✔	✔	✔	✱	✔✔	✔✔
17	✔✔	✔	✔	✱	✔✔	✔✔
18	✔✔	✱	✔	✱	✔✔	✔✔
19	✔✔	✱	✔	✱	✔✔	✔✔
20	✔✔	✔	✔	✱	✔✔	✔✔
21	✔✔	✔	✔	✱	✔✔	✔✔
22	✔✔	✔	✔	✱	✔✔	✔✔
23	✔✔	✔	✔	✱	✔✔	✔✔
24	✔✔	✔	✔	✱	✔✔	✔✔
25	✔✔	✔	✔	✱	✔✔	✔✔
26	✔✔	✱	✔	✱	✔✔	✔✔
27	✔✔	✔	✔	✱	✔✔	✔✔
28	✔✔	✱	✔	✱	✔✔	✔✔
29	✔✔	✔	✔	✱	✔✔	✔✔
30	✔✔	✱	✔	✱	✔✔	✔✔
31	✔✔	✱	✔	✱	✔✔	✔✔
32	✔✔	✱	✱	✱	✔✔	✔✔
33	✔✔	✱	✱	✱	✔✔	✔✔
34	✔✔	✱	✱	✱	✔✔	✔✔
35	✔✔	✱	✱	✱	✔✔	✔✔
36	✔✔	✱	✱	✱	✔✔	✔✔
37	✔✔	✱	✱	✱	✔✔	✔✔
38	✔✔	✱	✱	✱	✔✔	✔✔
39	✔✔	✱	✱	✱	✔✔	✔✔
40	✔✔	✱	✱	✱	✔✔	✔✔
41	✔✔	✱	✱	✱	✔✔	✔✔
42	✔✔	✔	✔	✱	✔✔	✔✔
43	✔✔	✱	✱	✱	✔✔	✔✔
44	✔✔	✱	✔	✱	✔✔	✔✔
45	✔✔	✱	✔	✱	✔✔	✔✔

Fig 5. Color Model

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