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MANEUVERING LENSES IN MOBILE GADGETS BY DINT OF SMART GLASS

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Abstract

Smart glass is user-friendly real-time device which is used to array concurring information to users through vision using augmented reality methodologies. It can be used to perform many smart works in execution of tasks, checking for connectivity issues and so on. There is plethora of ways to implement it. Gesture recognition is one way to coordinate the performances and recognize the task which is required. It is also used in various social activities. This paper discusses the various existing procedures and utilities of smart glasses and the tenet of implementing lenses in smart gadget to incorporate as a vision enhancer. The architecture of smart glasses and the way of encompassing lens in a mobile camera are confabulated. The pixel size of the camera and the role of image clarity with the inculcation of camera lens can make it as a modifiable spectacle. The camera and the technique of gesture recognition are elucidated. The evolution of head worn computer to smart glass concept is discussed with enhancing spectacle feature in the smart glass.

I. Introduction

The research with respect to various methods of implementing smart glasses in gadgets are considerably increasing. The conveniences and compromises available in these smart glasses have made curiosity in

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research oriented to enhance the smart glasses. With the pros and cons of existing gadgets, new methodology to interact and implement the required work is seeking attention. One major requirement of smart glasses [1-5] is to provide information and services related to their utilities. The gadgets especially mobile devices can be used to read a context, write, reply to mails and SMS, make note of any events and to reply to the phone calls. This paper discusses a model which can include all these features as well as enable an option to utilize mobile device as a specs too. The smart glasses which aid in easiness of interaction with gadgets and apps can also be used to integrate with the rear camera of the mobile phone so as to act as a specs with the specification as of a power glass to improve vision.

II. Related Papers

Smart glasses are used in various gadgets for varying purposes. The different locations of using smart glasses are in palm, forearm, finger, face and ear. The glasses can be attached to any location and the utilities to interact with the gadget or availing response from and through the gadget is possible. The forearm region holds the gadget and with the click of the glass, the information is portrayed on the forearm. The forearm acts as a place to track the information. The interaction between forearm and finger is achieved using requires sensors like optical or vibration based fixed on arm. It is considered as skin input and due to enhancement in virtual instancing, smart glasses do provide simpler inference. The smart glasses of current releases have a wide range of coverage area for instance the one manufactured by Microsoft like Hololens. The screen can be projected in the region of forearm. The four different categories of interactions are integrated with the widget of forearm encompasses sense of touch, dragging, rotating or sliding. The forearm interactions are identified with aid of infrared sensors that are incorporated in gadget to be held or attached to head set. The interactions induced with drag and touch process are used to select and control the response by the scrolling bar. The process of sliding is done with the flow of movement slide means one hand slides from the wrist to the elbow of another hand, and the menu switches accordingly. Rotation is designed for adjusting parameters on the widget such as increasing the volume of a music player. The sensors which are sensitive to light sense the force which is exerted and use tactile cues and visual effects to interpret the information. A palm-based keyboard is used to enter the text. In the model like OmniTouch, virtual keyboard displays for interaction. The keyboard QWERTY gets projected on optical display. The wrist can also be used to enact as a keyboard. The user can make interaction through interaction with the virtual key board display on the wrist or palm. To evaluate any data, there are three modes to enter details. They are achieved by means of touch pad, squared and optimized keyboards. Touch control is done by means of Moverio glasses of Epson, keyboard projected through palm and keyboard of QWERTY. On a overall comparison, the palm touch type is better compared to touch one. The above results give a cue that the mapping of virtual interfaces on the body surface can influence the task performance. The palm can be used for dynamic interaction in easier way compared as a writing display too. Likea palm surface, the finger portion can also used for visual display. The interaction is in a way of gestures and controlled through a action of hand or finger. The thumb can be used to view the information and also use finger touch to respond to the information. The movement of each finger like thumb, index, middle, ring fingers provide different pressure of interaction, This movement is interpreted with their gesture in terms of tap and stroke are used. The first and second phalanx of the index and middle fingers provide better usage. Face is also used as a medium of interaction. The gestures [6-9] provided through face actions like eye winking, nod of head. The face region has frequent access and provides ease in usage. The expressions and interactions should be with accepted social behavior. Users prefer subtle gestures with face in public. While using a gadget in public, users do make minimal actions of face. Making touch interactions with face frequently leads to low acceptance in social communication as this gesture is less likely. This delimitation with face interaction in public usage creates an urge to identify new gestures with precise interaction still making less expressions with respect to facial actions. The gestures can be used for enlarging the object or to view in varying angles. The face gestures are used for easiness and comfort in interaction. But due to the drawbacks of makeup disturbance, oily skin or irritation of repeated access, face hand interaction is less preferred. The ear portion can also be used to touch as input trigger. The eye free interaction is possible with this trigger. Ear helix like devices can be used. Single tapping, sliding of ear surface and multiple touches can be used. Still real-time social usage is less likely. The input can also be provided in touchless methods too. To achieve this touchless inputs are available. Gestural inputs and visual clues provide easy way of interaction. Head movements and voice enabled smart glasses to seek attention. In recognizing voice, google glass, Microsoft Holens deploy this method. It has both pros and cons like convenience and environmental disturbances. Gestures are recognized through gyroscopes and accelerometers. The text input is obtained with user authentication and as per the interpretation of gestures, the response to the gadget is made. Glass gesture, Pac-Man game are examples of it. Gaze movement can also be used to point the cursor. To increase the speed, manipulation of objects [11-15] is done by multi-modal system. The gestures are used for enlarging, rotating or rescaling the object. Ubigaze embeds messages in form of picture and as per gaze movement, the information is retrieved. Beyond this tongue can also act as an input.

III. Proposed Method

The proposed method is to integrate the smart glass lens with the vision glass to get it as a spectacle in case of emergency and easiness. In the architecture of the camera as in Figure 1, the lens is used to collect the input of the image and provide processing of the image as required for sensing and responding. The special microprocessor chip DSP (Digital Signal Processor) [16-19] is used to perform filtering, evaluation and fast Fourier transform the signals to obtain processed image from the input signals. This technique is mainly used in machine learning and neural networking. This makes the necessity of DSP over general-purpose processors. The general purpose processing unit collects the image signals and the proper image is obtained. There are different types of input provided. The input can also be done in touch-less way. Here interaction is done in freehand manner. The hand gestures are mainly used. There are eight different ways to interact in hand gesture. They are shown in table 1.

Table I. Various hand gestures.

S. No	Type	Purpose
1	Semaphoric-Static	Thumps up for like, Flat hand for stop
2	Semaphoric-dynamic	Time running out by clockwise rotation
3	Pointing	Index finger, single finger, Multiple fingers
4	Semaphoric-Stroke	Next or previous page
5	Pantomimic	With acting person to indicate move or drop object
6	Iconic-Static	Creating shape of oval cupping hands
7	Iconic-Dynamic	Creating circle shape with circular hand movement.
8	Manipulation	Motions with virtual image

The gloves can also be used for interaction. The device vulture use hand gesture interaction in air to enter text and the gloves senses hand and finger actions [17-20]. Myopoint, uses muscular movement with motion sensors like electromyography and inertia motion for interaction of information. Cameras are used for image processing and gesture identification using either model or appearance-based approaches. Smart glasses as shown in Figure 2 is used for freehand vision based interaction with a plethora of gestural interactions. For the incorporation of gestural recognition, 2D and 3D objects [21] in virtual concept are used in augmented reality. In WeAR Hand, using hands in wearable AR environment objects can be moved. The Pinch watch and shoe-sense use finger gestures.

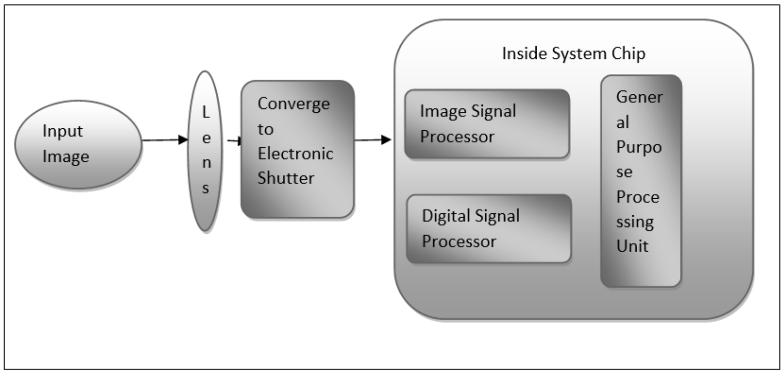

Figure 1. Design of camera in the smart glass.

Figure 2. Smart glass.

In spite of comforts available, there are many challenges ion smart glasses. In hybrid mode, virtual interaction is represented with both 2D and 3D objects [22] which create complex scenarios. Energy consumption should be considered as the benefit that is achieved and the task which is prioritised either comfort or cost of the device. The acceptance of society and social manners is also another challenge in the design of the system. Hand gesture are used to interact in smart devices using 3D virtual contents [23]. In real-time application, user has to create a focus of the location of the actual 3D object by direct contact to the touch surface and making movement around the surface area of the object. To make user interface in hybrid manner, the incorporation of touch and touchless input is done. The incorporation achieves enhanced coverage of surface area of the object. The touch input is included as a complimentary addition to the touchless input. The existing configurations are the interface in touch mode featured for vision based interaction attached to fingers and a tactile glove based haptic textile incorporated with sensors to aid touchless interaction. To evade the hindrances in a smart glass, multi input sensors can be used. A plethora of slants can be included in the design of smart glasses considering varying input technologies for interaction with the device. By integrating both touch and touch-free interactions, the smart glass supports in a sophisticated manner to represent augmented reality. With the enhancement in this smart glass, further better research scopes can be achieved as the device becomes capable of multi-input gadget. In the implementation part of the gadget, the touch surface is designed to be a haptic interface with buttons or track-pads. This surface is used in the spectacle frame. To incorporate multiport input, the surface area is supposed to be large so that the input can be obtained in the format of text, voice or gestures. The conversion of voice to text format is also done to ease the user friendliness of the smart glass. The device can be finger attached or head attached and can be incorporated as a smart augmented device. The vision based interactions can be used to create a comfort in interaction of the smart glass to be used as a smart glass as well as a spectacle. The cameras act in an efficient way such that can recognize 3D objects as well as can be resized to act as a spectacle used for vision purpose. The 3D property of the camera will make it capture and recognize gestures as well. The intensity and the brightness of the lens are adaptable and can be adjusted on ad hoc basis with the technology of liquid crystal and the normalization of the intensity of light and brightness. Filtering brightness in lenses which are photochromic or transitional can reduce the need of sun glasses.

A. Power Glass

Many people have issue in reading text at age of 40 or above. This is due to the less clarity in viewing text [24]. The eyes start feeling more tired after a period of time in reading. People after the age of 40 get this power because of the progressive nature of presbyopia. The requirement of low power glass as in Figure 3 at age of 40s makes the need to increase to high power at the age of 60s. The power of the glass remains standard after 60 years. The power of the non-prescription glass used for reading ranges within +0.75 diopter to +3.00 diopters (D) and can be integrated in smart glass to ease reading purpose. The glass can be adjustable as per the age of the person as in table.2.

Figure 3. Power glass.

Table II. Various power glass used in general.

S. No.	Age	Diopter Reading	Usage
1	40 to 44 years	+0.75 to +1.00 diopters	Adjusts presbyopia
2	45 to 49	+1.00 to +1.50 diopters	Sufficient visibility obtained
3	50 to 54 years old: As	+1.50 and +2.00 diopters	continuing presbyopia can be adjusted
4	55 to 59 years	+2.00 to	Suits for

		+2.25 diopter	presbyopia
5	60 and above For older adults, can.	+2.25 to +2.50 diopters	adjusts more progressed presbyopia

When the viewing objects in longer distance, the power required in the glass is less [25-26]. The to read things closer or very small, strong power glasses are required. In case when both power glasses seem to be suitable, the lower power one will be the better option.

B. Algorithm

In this paper, the smart glasses utilities and features were discussed with those available in the market. The algorithm details the concept of smart glasses and their utilities. To serve these utilities, the architecture of the smart glass is incorporated such that the device acts as a smart device as well as can be used as a vision glass at ease. The algorithm focuses on the interactions possible with the device. Both the feature of intact and contactless interaction is incorporated with the inclusion of liquid crystal glass which is controlled with the aid of sensors. The input is provided through multimode method to make the device more compatible with sensors and controlled through coding to react to the input provided. This hybrid method makes the smart glass to be more responsive for the user interaction with non delayed response. In augmented reality with mobile devices, the incorporation of the smart glass with the enhanced feature of vision glass is also used. While designing a hybrid model with the features of smart glass and vision glass, the glass is to be sophisticated with the vision glass features. The display unit is enriched with the sensors to enact as a smart glass. The rear camera is incorporated such as can be used for vision purpose. The gesture recognition is sensed and the device should adapt as a smart glass as well as a vision glass. Mainly the concentration was on power glasses to be used commonly by people to increase or decrease the vision of the object which is focused. This paper proposes a potential research direction of creating multi-modal input by combining various input approaches as discussed. When the power glass is integrated with the smart glass, the utility of the smart glass in indeed enhanced. In the smart glass as shown in Figure 5, the power glass can also be integrated in the smart glass.

Figure 4. Power glass integrated with smart glass (a)Palm with Fingers used for recognition (b)False palm (c)Palm with finger cover (d)Closure of finger cover

Figure 5. Smart Glass in Mobile phone.

IV. Conclusion

As discussed in the paper, the smart glasses are used in a plethora of utilities. The smart glasses are getting more fascinated in recent days. As the device is integrated with many gadgets, the device upgraded with the utility of vision glass acts as a better gadget in day to day life. The integration of the smart glass with the specification of the vision glass is to be done with customization. Based on interaction methods used in smart glasses, they were classified with their key characteristics such as input modality, form factor, existence of tactile feedback, and interaction areas. As internet of things is getting used [27], the integration of smart glasses can be very user friendly. The existing research efforts and the interaction challenges on smart glasses were discussed. The long term use of the device can bring lot of ease and comfort to the customers. The proposed method was discussed in this aspect with gaining the benefit of both the smart glass as well as getting rid of wearing glasses in some aspects. Though the futuristic interactions of smart glasses is highly uncertain, the current works, touch and touch-less input, give vivid ideas to the research domain.

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