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Eye Tracking

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Abstract: Eye tracking basically the part of Brain Astronomy.Eye tracking is a sensor technology that enables a device to know exactly where your eyes are focused. It determines your presence, attention, focus, drowsiness, consciousness or other mental states. This information can be used to gain deep insights into consumer behavior or to design revolutionary new user interfaces across various devices.

I. INTRODUCTION

1.1 Understanding the Human Behaviour:
We take in the world around us using our eyes. Eye tracking interprets natural human behavior which helps us to gain deep insights into people's attention and actions. As a result we can also draw conclusions about the factors that drive certain behaviors.

1.2 Enable Hands Free Interaction:
By using the eyes as a “pointer” on a screen, eye tracking facilitates interactions with computers and other devices when the user cannot or does not wish to use their hands as the input form.

1.3New User Experiences and Humanized user interfaces:
By combining eye tracking with other input modalities, for example keyboard, touchpad and voice, we are paving the way for creating new user experiences and innovating interfaces for regular consumer devices. These will be more intuitive, natural, engaging and efficient than conventional user interfaces.

II. DEFINATION

Eye tracking is the field of monitoring what people do with their eyes – observing what people choose to look at, how their eyes move, how their visual activities behave. Eye trackers are the instruments that measure our eye behavior. They measure the directions that our eyes are pointed and predict our gaze points, i.e. the locations of the objects in space that we look at.

Many modern eye trackers are based on video cameras that observe our eyes and produce high-resolution images of our irises, pupils, and sclera’s. Light emitting diodes illuminate the eyes, and these LEDs produce reflections off the corneal surfaces to provide critical geometric information about the orientation of the eyeball.

Behind the cameras that capture the images of the eyes, an essential part of an eye tracker is the image processing function that identifies the eyes within the images, measures the geometric features of the eye elements, and computes the spatial positions and orientations of the eyes. Finally, eye trackers project the spatial locations of the eye’s gaze points. If a person is looking at a computer screen, for example, the gaze point may be expressed in x,y screen coordinates.

III. SIGNIFICANCE

Our eyes and vision systems are our brain’s primary tools for gathering current information about our environment. They are the means through which we live the visual dimension of our life experience. At the same time, our eyes can only look one place at a time. Our brains have evolved a highly sophisticated strategy to point our eyes at what we predict will provide the most useful visual information available to us at the time.

With eye trackers researchers can observe what our brains choose to look at. While eye tracking instruments cannot explain why our brain chooses to look at specific things, they do measure and record the sequence of visual pointing decisions the brain ultimately makes. From eye tracking data we can make powerful inferences about what is visually important to people’s underlying cognitive processes.

IV. THE CHALLENGE

My team has gradually developed a stellar technology that is number one today through relentless focus on research and development, and through building expertise in a range of specialist areas.

Our ambition is to make eye tracking a standard in computers, tablets, cars, and other everyday devices.

To develop a simple eye tracker that works in controlled environments is not very difficult. To make a system that works for everyone, always, is enormously challenging. But for eye tracking to become a widespread technology within its respective application areas, this is a basic requirement.
Anitya's leading eye tracking technology is based on a number of innovations that make the system suited to natural human behavior and use in various environments.
Key innovation areas are:

- Optics that is unaffected by ambient light.
- Algorithms that accommodate users who move around and look different.
- Applications that create intuitive user experiences and insights.

V. EYE MOUSE

We use the ASL 504 Pan/Tilt Optics Eye Tracker manufactured by Applied Science Laboratories. We normally calibrate the system at the beginning of each test run to ensure the validity and correctness of the data points collected. We use a 9-point calibration. All control experiments are written in Microsoft Visual C++ with MFC, Java and/or Matlab. Data recording takes place via the external port, XDAT serial port using the communication protocol set by ASL, using a 2 monitor workstation running Windows XP. One monitor is viewed by the subject and the other is used by the experimenter. We set the ASL eye tracking frequency to the default value of 60 Hz. We use the "demand" mode where the host workstation requests data from the eye tracker by sending one byte. The eye tracker, in turn, returns an 8 byte message containing the pupil diameter, the x-component and y-component of the point of gaze, all in a 16-bit representation. To construct a visual mouse click, we define an eye fixation counter that counts the number of collected eye fixations Δn, within a certain amount of time $\Delta t0$ within a certain bounding square of dimensions Δx and Δy. Δn, $\Delta t0$, Δx, Δy are user configurable. To claim a visual click all of the Δn points must be collected within the designated area, $\Delta x \Delta y$. If the subject blinks or moves out of the imaginary square during the designated time interval, the counter is reset to a new start. If the subject successfully completes all Δn fixations within the designated area in the designated time interval, then a visual tap is recorded. To calculate the position of the tap (p0), we compute the moving average of both the x and y components of all successful fixations. In our implementation of the eye mouse, the basic assumption we make is the subject in a default state of an "incomplete" drag-and-drop. To complete this operation, the system waits for another click (a visual tap + position i.e. D-U-p1) at another position p1 ($p1 \neq p0$). The second click must occur within a user definable time $\Delta t1$. When the subject continues to gaze within the same square area of $\Delta x * \Delta y$ for a time period equal to or slightly greater than $2\Delta t0$ the drag-and-drop state changes to a double click state (D-U-p0 + D-U-p0) and a double click is recorded and a suitable action is carried out . We have made a design decision to make all parameters $\Delta t0$, Δx, Δy be user configurable to accommodate both the changing user requirements as well as the application interaction environment. We, however, have set default values that are based on usability studies that we have conducted in our laboratory. We have set the $\Delta t0$ to a default of one second in both the Matlab and C++ implementations. In Java the default value of this $\Delta t0$ is set at .75 second. Additionally, the number of points that are needed to define one visual click is user definable but initially set to a default value of 10. These choices seem to provide a comfortable environment for subjects we have used. All events defined above are reset to their initial values when a blink is encountered or when the eye gets distracted outside the tolerance region $\Delta x \Delta y$. While a click would normally be followed by a drag and drop or by another click to form a double click, there are instances where the user just visually clicks but never follows this click with any additional action. This renders the sequence of events incomplete leading to a reset, where the eye mouse system goes back to its initial state.

VI. VOICE CONTROL TECHNOLOGY

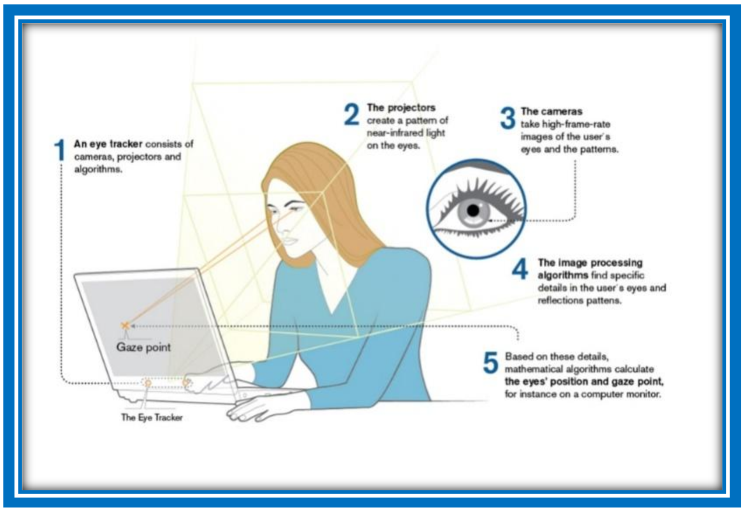
Desire for new ways to interact with computer devices is bringing attention to companies that specialize in touchscreen, sensor, haptic, camera and digital voice technologies. Apple's Siri voice assistant, Samsung's eye tracking and Leap Motion's gesture recognition device that will be used in future PCs by HP are instances where these technologies are helping smartphone, tablet and computer makers innovate and differentiate products. For users, this means personal computers and devices are becoming more human with perceptual hardware and software that bring sight, hearing and touch interactions.

VII. INNOVATION OF VOICE

By extracting the voice from any surrounding noise and enhancing it we can now make that voice appear very clear to the listener at the other end. No matter if you're in a restaurant, train station or on the street, you can actually talk on your mobile phone and be heard clearly while talking in a normal voice. This enhances overall communication by allowing mobile devices to be useful anywhere.

By enhancing the voice, speech recognizer technology can find and deliver accurate results regardless of the environment around you. Now voice can be a very natural way of interacting with a mobile device. High-quality voice is becoming more important as voice command experiences become more mainstream.
Europe is leading the way with an initiative called HD Voice, a set of voice call quality standards as the industry moves to wideband. It is analogous to television's development from black and white to color and today's HD TV. Moving to HD Voice will bring higher-quality voice on devices in a quiet or noisy environment.
The other advances are happening in the network. For example, LTE gives a much bigger pipe for data to and from the consumer, so more bandwidth is available for very natural voice call quality and device interaction.

VIII. DIAGRAMMATIC REFLECTION TO EXPLAIN



Shows the working of the Eye Tracking

IX. CONCLUSION

Custom-designed sensors — the hardware is designed to be a high-performance sensor, and not for taking nice pictures. It consists of custom designed projectors, customized image sensors and optics as well as custom processing with embedded algorithms.
Advanced algorithms — Algorithms are the brain of the system, which interprets the image stream generated by the sensors.
User-oriented applications — an intelligent application layer is added to enable the various ways the technology can be used.

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