Gaze Controlled Navigation in Video Games

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Background and Motivation:
Video games are enjoyed by millions of people worldwide. Traditional control schemes such as the keyboard and mouse have been used for a long time, however, they are not without their limitations. Almost all control schemes require the user to have dexterous and precise hand movements, which for many people is an impossibility. Additionally, using a controller / keyboard and mouse is a very unnatural way to explore 3D worlds. Gaze controlled navigation takes the focus away from the hands, allowing users to look around and explore virtual worlds using only their eyes, stepping away from the boundaries and limitations of the keyboard and mouse.

Evaluating the gaze-controlled navigation system
A 3D world was constructed in Unity, based on the free "Island Demo," to test the control system. A series of tasks were created for users to carry out, using both gaze controls and standard keyboard/mouse controls. The gaze location, "foot location" and timestamp were all logged, and graphed to compare the gaze controls with traditional controls. This data was graphed, as can be seen to the left: with red lines for where the gaze-controlled character "walked," and blue for traditional keyboard and mouse controls.

How does gaze tracking work?
The gaze-controlled navigation system is built upon ITU’s OpenGazer software.
The hardware consists of an infrared (IR) camera, and two IR light sources, which are positioned at the bottom of the monitor. The IR light causes the pupil to appear to the IR camera as a well-defined dark circle, with two "glints" in each eye where the IR light reflects off the back of the eye - one glint from each light source.
By tracking the relative locations of the pupil and glints to the eye, calibrated by looking at known locations on the screen, the gaze location can be accurately determined in real time.

Results:
No formal play testing was able to be conducted due to time constraints – however, informal play testing feedback has been overwhelmingly positive.
Most users found the controls somewhat difficult at first, but after a minute or two they found them very natural and intuitive.
At the end of playing, users commented that the controls were natural, enjoyable, and "very cool".

Conclusions:
The gaze-controlled navigation system is potentially an effective replacement for the traditional keyboard and mouse controls utilised on current 3D games.
Further investigation is needed to determine the full effectiveness of gaze-controlled navigation as a game input device.