



ABSTRACT

The Covid-19 pandemic teaches many things, one of which is the importance to prevent disease transmission. Public facilities such as touch screens are vulnerable to spreading germs. Eye-tracking enables touchless and seamless interactions therefore very potential to be developed for more hygiene public facilities. Spontaneous gaze-based application with horizontal and vertical trajectories is a means of spontaneous and natural touchless interaction. However, there have been several problems that exist in spontaneous gaze-based application with horizontal and vertical trajectories, namely high missed detection, linear time-invariant (LTI) system issue, and prior probabilistic model issue. These problems cause the application to be less accurate and responsive. In this research, we propose 2D Correlation as similarity measure and I-VDT (Velocity and Dispersion Threshold Identification) as event detection to improve the performance of spontaneous gaze-based object selection. We compared our proposed method with state-of-the-art approaches such as HMM (Hidden Markov Model), Rotated Correlation, Spearman, Kendall, EMA (Exponential Moving Average), I-VVT (Velocity and Velocity Threshold Identification), and I-VMP (Velocity and Movement Pattern Threshold Identification). Our results showed that 2D Correlation and I-VDT as object selection technique increased the application accuracy up to $95.67\% \pm 3.49\%$. Furthermore, our proposed method decreased the error of object selection up to 4.33% with 0% missed detection. This study succeeded in investigating object selection technique that overcomes three main problems in spontaneous gaze-based application with horizontal and vertical trajectories. In future, our proposed method is promising for future development of touchless interactive technologies that comply with health protocols of World Health Organization during Covid-19 pandemic.

Keywords: touchless, eye-tracking, gaze gesture, interactive application, object selection, smooth pursuit



INTISARI

Pandemi Covid-19 mengajarkan banyak hal, salah satunya adalah pentingnya mencegah penularan penyakit. Fasilitas umum seperti layar sentuh rentan menyebarkan bibit penyakit. *Eye-tracking* memungkinkan interaksi tanpa sentuhan dan tidak mencolok sehingga sangat potensial untuk dikembangkan sebagai alat pengendali papan informasi digital (digital signage) yang lebih higienis. Aplikasi spontan berbasis pandangan mata dengan lintasan tombol pengendali yang bergerak dengan arah horizontal dan vertikal adalah sarana interaksi tanpa sentuhan yang alami. Namun, terdapat beberapa permasalahan yang ada pada berbasis pandangan mata dengan lintasan tombol yang bergerak di arah horizontal dan vertikal, yaitu *high missed detection*, masalah sistem *linear time-invariant (LTI)*, dan masalah *prior probabilistic model*. Permasalahan tersebut menyebabkan aplikasi menjadi kurang akurat dan kurang responsif. Dalam penelitian ini, kami mengusulkan *2D Correlation* sebagai *similarity measure* dan *I-VDT (Velocity and Dispersion Threshold Identification)* sebagai *event detection* untuk meningkatkan kinerja pemilihan objek berbasis pandangan mata spontan. Kami membandingkan metode yang kami usulkan dengan pendekatan mutakhir seperti *HMM (Hidden Markov Model)*, *Rotated Correlation*, Spearman, Kendall, *EMA (Exponential Moving Average)*, *I-VVT (Velocity and Velocity Threshold Identification)*, dan *I-VMP (Velocity and Movement Pattern Threshold Identification)*. Hasil penelitian menunjukkan *2D Correlation* dan *I-VDT* sebagai teknik pemilihan objek meningkatkan akurasi aplikasi hingga $95.67\% \pm 3.49\%$. Selain itu, metode yang diusulkan berhasil menurunkan *error* aplikasi hingga 4.33% dan *missed detection* 0% . Penelitian ini berhasil menyelidiki teknik pemilihan objek yang mampu mengatasi tiga masalah utama dalam aplikasi spontan berbasis pandangan mata dengan lintasan horizontal dan vertikal. Di masa depan, metode yang kami usulkan menjanjikan untuk pengembangan teknologi interaktif tanpa sentuhan yang sesuai dengan protokol kesehatan World Health Organization selama pandemi Covid-19.

Kata kunci: *touchless, eye-tracking, gaze gesture*, aplikasi interaktif, pemilihan objek, *smooth pursuit*