Towards Dignity-Preserving HRI: Addressing Surveillance Anxiety, Identity Erasure, and Dehumanization in Robotic Immigration Kiosks

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***Abstract*— The deployment of robotic immigration kiosks at international borders signals a growing reliance on automation in migration governance. While these systems promise efficiency, they also raise profound ethical concerns, particularly for vulnerable groups such as asylum seekers, refugees, and trafficking survivors. Existing Human-Robot Interaction (HRI) research often overlooks the coercive and culturally sensitive nature of border encounters, focusing instead on voluntary, laboratory-based scenarios. This paper presents a conceptual analysis of three critical sociotechnical risks associated with robotic immigration kiosks: surveillance anxiety, identity erasure, and dehumanization. We argue that these risks are not merely technical challenges but are rooted in broader power dynamics, cultural asymmetries, and histories of trauma. To address these concerns, we propose new directions for HRI research that prioritize user dignity, cultural responsiveness, and ethical accountability. Our analysis lays the groundwork for rethinking HRI design and evaluation in contexts where human rights and systemic vulnerability are at stake.**

I. Introduction

The integration of autonomous systems into border control infrastructures marks a profound shift in how states manage migration, with robotic immigration kiosks now appearing at international airports and checkpoints worldwide [1], [2]. These systems, such as SITA's KATE (Kinetic Assistance for Traveler Experience), combine mobile robotics, artificial intelligence, and biometric verification to enable self-service processing [3], [4]. Unlike traditional e-gates, robotic kiosks possess autonomous mobility and deploy advanced AI-based screening capabilities, including the AVATAR platform's multimodal behavioral analysis for lie detection [5], [6]. Yet, the deployment of these technologies in the highly sensitive and coercive space of immigration raises significant ethical concerns. Border control is not a neutral setting—it is charged with asymmetrical power relations, legal ambiguity, and the vulnerability of those subjected to its processes. While recent scholarship has examined privacy violations, algorithmic discrimination, accountability gaps, and the psychological toll of automated border systems [7], [8], [9], [10], these critiques often remain rooted in technical diagnostics and mitigation strategies. In doing so, they risk overlooking the deeper sociotechnical entanglements through which harm is enacted. This paper is motivated by the idea that the ethical challenges posed by robotic immigration kiosks are not reducible to technical flaws but are fundamentally sociotechnical in nature. The anxieties these systems provoke—ranging from surveillance-induced distress and identity erasure to dehumanization—emerge from the collision of automation with the lived experiences, cultural frameworks, and precarious legal positions of migrants, asylum seekers, and refugees [11], [12]. Addressing these harms thus requires an expansion of Human-Robot Interaction (HRI) research beyond its conventional paradigms, which too often presume voluntary, affectively neutral, and culturally homogeneous interactional contexts. We propose a conceptual reframing of HRI to address the unique risks associated with robotic systems in coercive and culturally sensitive environments. Specifically, we identify three domains of concern—surveillance anxiety, identity erasure, and dehumanization—and argue that current HRI approaches are insufficiently equipped to address them. For each domain, we outline a corresponding research direction grounded in ethical, culturally responsive, and human-centered design. While the paper is conceptual in nature, it offers foundational insights for an HRI agenda that foregrounds human dignity, particularly in immigration and asylum contexts where the stakes of robotic interaction are especially high.

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II. Sociotechnical Risks from Robotic Immigration Kiosks

In this section, we identify and analyze three primary sociotechnical risks that robotic immigration kiosks pose to users, particularly vulnerable populations such as asylum seekers, refugees, and trafficking survivors. Through examination of surveillance anxiety, identity erasure, and dehumanization, we demonstrate how these risks emerge from the intersection of autonomous systems with complex human experiences and cannot be adequately addressed through technical solutions alone, thus requiring a new agenda for human-centred robotics research.

A. Surveillance Anxiety

Robotic immigration kiosks potentially create surveillance anxiety through their continuous biometric monitoring and behavioral analysis capabilities. These systems capture fingerprints, scan facial features, record voice patterns, and track eye movements while simultaneously analyzing user behavior for signs of deception or stress [13], [14]. The kiosks may employ real-time lie detection algorithms that monitor micro-expressions, voice fluctuations, and physiological indicators, creating an environment of intensive automated surveillance. This could happen as use of lie detection algorithms have already been demonstrated in other sensitive areas such as judicial decision making and policing [15], [16]. For example, when a refugee family approaches

a robotic kiosk, the system might immediately begin recording their interactions, analyzing their facial expressions for signs of anxiety, and flagging any "suspicious" behavior patterns—all while the family is simply trying to complete required immigration paperwork. Research suggests that immigrants potentially experience "extremely heightened anxiety" during encounters with autonomous monitoring systems, with specific fears about "non-human surveillance and threats to safety" [17]. Pato identifies the "intimate relationship between people and technologies that collect biological and behavioral characteristics," creating concerns about the "seemingly irrevocable link between biometric traits and persistent information records" [18]. For individuals with trauma histories from authoritarian regimes where surveillance was used for persecution, these robotic monitoring systems could trigger severe psychological distress regardless of their stated security purposes.

B. Identity Erasure

Robotic immigration kiosks potentially engage in identity erasure by applying standardized processing protocols that fail to accommodate diverse cultural identities and lived experiences. These systems may use automated language processing that penalizes non-native accents, employ risk assessment algorithms trained on limited demographic data, and enforce universal interaction patterns that ignore cultural norms around privacy, family dynamics, and appropriate communication. For example, a Somali family seeking asylum might encounter a robotic kiosk programmed to conduct individual interviews, violating cultural norms that prioritize family-based decision-making and gender-appropriate interactions. The system might flag the family's reluctance to separate for individual processing as "non-compliance," failing to recognize that their behavior reflects cultural values rather than deception. Voice analysis algorithms potentially penalize non-native accents and speech patterns, with studies indicating that Automatic Speech Recognition shows 28% higher error rates for non-standard accents [19]. Meta-analytic evidence shows standard-accented candidates perceived as more favorable with effect sizes of d = 0.47 [20], suggesting that these systems may systematically disadvantage individuals whose linguistic identity differs from algorithmic expectations. Prior research identifies "critical incompatibility between European notions of discrimination and algorithmic fairness metrics" [21], further indicating that robotic kiosks may reduce complex human identities to simplified categorical variables while rendering invisible those who cannot fit prescribed algorithmic expectations.

C. Dehumanization

Robotic immigration kiosks potentially create dehumanization by replacing human immigration officers with automated systems that lack empathy, cultural understanding, and the ability to recognize individual circumstances requiring compassionate consideration. These systems may process immigration cases as purely technical problems, applying rigid algorithmic rules without consideration for trauma histories, family separations, or complex personal circumstances that require human judgment. For example, a trafficking survivor approaching a robotic kiosk might exhibit signs of severe trauma—trembling, difficulty speaking, inability to maintain eye contact—that a human officer would recognize as indicators requiring specialized support. However, the robotic system might interpret these same behaviors as suspicious activity, flagging the individual for additional screening or rejection without understanding the underlying trauma. The kiosk continues its automated processing protocol regardless of user distress, potentially retraumatizing vulnerable individuals through its clinical impersonality. Trauma-informed computing research reveals that "digital technologies can cause and exacerbate trauma," particularly among displaced populations [22], with studies indicating that children in immigration contexts show PTSD rates of 26-33% when exposed to automated systems without human support [23]. Prior research suggests that dehumanizing interactions may increase support for harsh policies, making individuals feel "not part of society, more emotionally hostile" [24], while current automated approaches "cannot simulate empathy" and fail to capture the "lived reality of humans in surveilled society" [25].

III. HRI Research Directions for Addressing Sociotechnical Risks

In this section, we identify three critical directions for advancing HRI research to better address emerging sociotechnical risks from robotic immigration kiosks and discuss their applicability for the broader embodiment of security technologies experienced by refugees, immigrants and asylum applicants. These directions—HRI for surveillance anxiety, identity preservation, and prevention of dehumanization—highlight how current approaches in the domain often overlook coercive, culturally complex, and ethically sensitive contexts. By taking inspiration from current modalities in human computer interaction research (HCI) foregrounding user agency, cultural affirmation, and human dignity, these research trajectories call for a shift from system-centered optimization to human-centered responsibility in HRI design and evaluation.

A. HRI Research for Surveillance Anxiety

The surveillance anxiety created by robotic immigration kiosks' continuous monitoring capabilities highlights critical gaps in HRI research. As robots are increasingly deployed in surveillance and border security contexts, HRI research has not kept pace with the ethical complexities of involuntary and coercive interactions. Much of the existing work assumes voluntary participation and mutual benefit [26], leading to trust frameworks that prioritize system performance over user protection. These models optimize for task compliance while ignoring the psychological consequences of constant monitoring. For instance, the Human-Robot Trust Scale excludes considerations relevant to coercive environments, where individuals cannot opt out of surveillance. Real-world evidence from border surveillance systems reveals chronic

stress and social withdrawal—effects largely unaddressed in controlled laboratory settings. This disconnect between HRI research assumptions and immigration realities reveals several critical research gaps. First, existing trust frameworks assume users can opt out of interactions, which is impossible in mandatory border processing. Second, current HRI metrics prioritize system performance over psychological safety, failing to account for the chronic stress induced by involuntary surveillance. Third, laboratory-based studies cannot capture the cultural and trauma-related factors that shape how vulnerable populations experience robotic monitoring. Addressing surveillance anxiety in immigration contexts requires HRI research that prioritizes user protection over system optimization. This includes developing interaction paradigms that minimize psychological distress while maintaining security functions, creating transparent communication protocols that help users understand robotic sensing without increasing anxiety, and establishing design principles that preserve human agency even within coercive environments. Future research must examine how cultural backgrounds influence perceptions of robotic surveillance, investigate methods for reducing stress responses during mandatory interactions, and develop participatory design approaches that center the experiences of immigrant and refugee communities.

B. HRI Research for Identity Preservation

The identity erasure experienced when robotic kiosks apply standardized processing protocols highlights critical gaps in HRI's approach to cultural competence. With robots entering socially and culturally diverse environments, HRI research has not sufficiently addressed how these systems affect users' sense of identity, particularly among historically marginalized groups. Cultural competence in HRI often reduces culture to user preferences or cosmetic features, failing to engage with culture as a lived, systemic worldview. The ABOT database highlights a lack of visual and contextual diversity in robot representations, while real-world deployments—such as facial recognition systems—exhibit disproportionate errors for darker-skinned users, pointing to entrenched Western-centric design norms [27]. Current "cultural robotics" frameworks emphasize robot adaptation without considering how systems might affirm or undermine users' identities. Intersectionality remains notably absent, as most studies isolate single identity dimensions and neglect how multiple marginalizations shape user experience. These omissions are often reproduced by the demographic homogeneity of the HRI research community itself, influencing which problems are deemed worth solving. Although there is growing attention to robot cultural awareness, few studies develop frameworks for designing robots that actively affirm diverse identities. This pattern of identity erasure exposes fundamental limitations in how HRI approaches cultural diversity. Current research treats culture as surface-level preferences rather than examining how robotic interactions can systematically marginalize non-Western ways of being. Most HRI studies assume universal interaction norms, failing to recognize that standardized robotic behaviors may inherently privilege dominant cultural groups while pathologizing minority practices as deviant or suspicious. Developing identity-preserving HRI requires moving beyond superficial cultural adaptations toward systems that actively affirm diverse ways of knowing and being. This includes creating adaptive interaction protocols that recognize and accommodate different cultural communication patterns, developing assessment frameworks that distinguish between genuine security concerns and cultural differences, and establishing design processes that involve affected communities as co-creators rather than subjects of study. Research priorities include examining how robotic behaviors reinforce existing power structures, investigating methods for preserving cultural identity within automated systems, and developing intersectional approaches that recognize how multiple forms of marginalization compound identity erasure.

C. HRI Research for Preventing Dehumanization

The dehumanization that occurs when robotic systems lack empathy and cultural understanding reveals fundamental limitations in how HRI conceptualizes empathy and human dignity. While robots are increasingly designed to simulate empathy, HRI research often equates empathy with surface-level emotional responsiveness, neglecting the deeper ethical imperative of preserving human dignity. This instrumental approach frames empathy as a mechanism for improving user perception, rather than fostering genuine recognition of human worth. Studies of social presence tend to prioritize robot attentiveness and emotional mimicry, with little consideration of how such interactions affect users' agency or dignity [28]. Cases such as immigration-focused AI systems exemplify how emotional simulation can enable dehumanization, reducing complex human narratives to algorithmic outputs. Moreover, empathic behaviors in robots have been shown to increase user compliance without interrogating the ethical boundaries between influence and manipulation. Most existing work focuses on short-term interactions, missing insights into long-term psychological effects or emotional dependencies. Metrics for evaluating these interactions often assess robot performance, not their impact on human well-being or autonomy. This reduction of complex human experiences to algorithmic outputs reveals a fundamental misunderstanding of empathy in HRI design. Current approaches focus on making robots appear more empathetic without addressing whether automated processing inherently diminishes human dignity. The emphasis on emotional simulation masks deeper questions about whether certain decisions—particularly those affecting human rights and safety—should remain within human purview regardless of technological capabilities. Preventing dehumanization requires reconceptualizing the role of robots in sensitive contexts. Rather than seeking to replace human judgment with algorithmic processing, HRI research should explore how robotic systems can augment human decision-making while preserving the irreplaceable elements of human empathy and moral reasoning. This includes developing frameworks that maintain meaningful human oversight

in high-stakes situations, creating interaction designs that preserve user agency and choice, and establishing ethical boundaries that prevent the inappropriate automation of fundamentally human responsibilities. Critical research questions include examining the long-term social consequences of replacing human empathy with algorithmic simulation, investigating design approaches that enhance rather than diminish human dignity, and developing evaluation methods that prioritize human wellbeing over system efficiency.

IV. Conclusion

This paper demonstrates that Human-Robot Interaction research must fundamentally expand its scope to address the ethical complexities of robotic systems deployed in coercive and culturally sensitive environments. Our examination of robotic immigration kiosks reveals three critical sociotechnical risks—surveillance anxiety, identity erasure, and dehumanization—that current HRI frameworks inadequately address due to their focus on voluntary, laboratory-based interactions rather than real-world power dynamics. The analysis highlights a significant gap between HRI research assumptions and the lived experiences of vulnerable populations encountering robotic systems at borders. Traditional HRI metrics prioritizing system performance prove insufficient when individuals cannot opt out of interactions and where cultural competence becomes paramount. Our findings suggest the field requires new theoretical foundations accounting for involuntary interactions, cultural diversity, and human dignity preservation as core design requirements. Future work must develop methodological approaches for studying HRI in sensitive contexts, innovations in cross-cultural interaction design, and greater collaboration between researchers and affected communities. By centering human dignity in HRI research, we can work toward robotic systems that enhance rather than diminish humanity—representing a moral imperative for the HRI community.

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