FORK-IN-SOCKETEERS' RECHESS

**THE IMPACT OF AUTOMATION ON HUMAN ACTIVITY AND ACCESSIBILITY
FOR INDIVIDUALS WITH DISABILITIES**

An Undergraduate Thesis Portfolio
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SOCIOTECHNICAL SYNTHESIS

The global automation market is projected to achieve a valuation of $168.5 billion by 2025, with an anticipated CAGR of 8.4%. Automation technologies are wielding an increasingly significant influence on modern culture, evident through ChatGPT's thinking functionalities and Tesla's self-driving capabilities. When viewed through a Social Construction of Technology (SCOT) framework, automation emerges as a potent instrument to bridge the chasm between specific technologies and smaller social groups, including the handicapped. ReChess, a moderately-coupled technical report, represents a state-of-the-art self-rearranging chessboard, highlighting the advantages of ethical automation usage. It offers a straightforward solution for complete chessboard rearrangement, triggered by the mere push of a button, enabling practically anyone to accomplish this task. Automation in chess can promote social inclusion and increase audience engagement, but it also poses risks to human development. The STS research examines the connection between automation and human development to guide future automation technology applications. The technical and STS topics are interlinked, exploring the advantages of automation. ReChess offers first-hand insights into the idea of automation functioning as a proxy for reaching out to social groups and broadening user engagement, while the research paper uses SCOT to explore how automation can foster social inclusivity.

The technical part of the project, ReChess, is an automatic self-rearranging chess board which can be used to return the pieces quickly and efficiently to their starting positions once a match has concluded. In order to determine the current game state, a camera suspended above the board can frequently capture the positions of the pieces. This data is processed using OpenCV computer vision and used by our algorithms to determine the correct sequence of moves. The actual piece movement is handled by a gantry system underneath the board, which

uses an electromagnet that is turned on and off to "pick up" pieces. The project enables anyone to easily and efficiently rearrange a chess board.

Overall, the technical project was a success and was completed in the Fall of 2020. During the 3-hour long demo session, our capstone functioned correctly with almost no intervention. The camera piece detection model never mislabeled or missed a chess piece, achieving a 100% recognition and detection rate. The project achieved the system metric of rearranging a board in less than 15 mins, with around an 8 minute average in our runs. There was only one instance out of the twenty-one runs in which the gantry's wires were tangled.

The research paper focuses on investigating how we can maximize the benefits of automation for human development. Through the analysis of specific case studies, the paper evaluates the advantages and disadvantages that automation has posed on humanity. The study applies Pinch and Bijker's Social Construction of Technology framework to better understand the societal and cultural factors that influence the design and implementation of automation technologies, and identifies the importance of incorporating inclusivity and accessibility considerations into the development process. Ultimately, the paper concludes that automation can be a powerful tool in breaking down barriers and improving accessibility for smaller social groups.

The incorporation of automation into a technology such as chess fosters increased audience engagement and promotes social inclusion among individuals who may have been previously excluded. Nonetheless, the power of automation has also demonstrated the potential to pose risks to human development. Throughout the STS report, instances where automation has been detrimental to humanity are analyzed, such as pilot training without an autopilot, self-driving car drivers falling asleep behind the wheel, and loss of vital life skills due to smart

technologies are some examples. As part of this initiative, the STS research seeks to evaluate the current link between automation and human development, with the objective of providing guidance for future automation technology applications.

To maximize the benefits and minimize drawbacks of autonomous technology for human development, stakeholders must consider socio-technical aspects such as user practices, audience, and system robustness. Governments can implement regulations and standards to ensure safety and accurate information about limitations and capabilities. Developers can also promote responsible usage by incorporating restrictions that allow users to regulate automation, as seen in Tesla's "keep your hands on the wheel" mode. While automation can promote social inclusivity, it also poses safety risks and requires the collaboration of government, development, and users to ensure safety and user-friendliness.

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