IMPACT OF SOCIAL MEDIA ON DISPROPORTIONATE GROUPS AND THE RESPONSIBILITY OF THE ENGINEER

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By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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INTRODUCTION TO SOCIAL MEDIA

Social media is a form of electronic communication where users create online communities to share information, ideas, messages, and other content which includes websites for blogging or for social networking. This has been around for most of the internet's lifespan and is apparent as one of many well-known applications such as Facebook, Twitter, YouTube, Instagram, Snapchat, and others. Social media is a form of technology that has thrived over the years, especially during the COVID-19 pandemic as separation from others inclined people to use social media for social connection (Anderson & Jiang, 2018, p. 1). With the construction of social media and the development that goes into this technology, there is the possibility of censorship and ways that social media may disproportionately affect groups of people based on their race, age, political ideology, and socioeconomic status (Cobbe, 2020, p. 473). As Cobbe, a department member of Computer Science at the University of Cambridge researched, some issues that can come from the social media engineering of censorship include the unintended censorship of African American tweets disproportionately (Cobbe, 2020, p. 755). A recent example of censorship has been seen by the company Facebook where they have taken a stance on censorship over free speech by suspending politicians like Donald Trump as reported by Abril in the Wall Street Journal (Abril, 2021, p. 1). A study done at the University of California, Davis, exemplifies how social media can affect groups through user interface especially for older people who have a harder time using the applications to communicate with younger people without proper help from the social media itself (Kim & Feng, 2021, p. 2).

Another issue that comes from social media is the addiction to social technologies as well as mental effects on individuals. Especially with youth, social media has become a widespread commodity in conjunction with smartphones globally. One example of this global phenomena

includes places such as India where studies done showed that with pre-university college students had 74.2% social media users and 36.9% of the students had what was determined to be social media addiction (Ramesh Masthi, Pruthvi, & Phaneendra, 2018, p. 181). This technology is designed to keep users engaged and continuously dependent upon it by, deliberately or not, fostering insecurity, providing entertainment through observing the ideal image and lives of others, and compensation for lack of social interaction which leads to further addiction (Kuss & Griffiths, 2011, p. 3544). Social media is designed to be addictive to keep users within the applications for the benefit of the organizations developing the technology.

With these apparent problems in society, this leads to the question: How does the technology of social media disproportionately affect different groups based on critical differences, and how do engineers contribute to this problem while also bearing responsibility for protecting these users? The perspective that will best resolve this issue is Latour's Actor Network Theory which describes the world through a lens of active roles of technology and actors the display the social effects resulting from these associations of actors (Cresswell. et al., 2010, p. 2). This will display the role of the engineer within this form of technology, and then an example of an implementation of a technology that addresses the problems of social media and how to fix them will come in the form of the Capstone. The Capstone project is a Connect 4 robot designed in a team with two other members, Kellan Delaney and Roman Kaker, and guided by a technical advisor, Professor Harry Powell, that aims to develop technology that can play Connect 4 with a human player. This Capstone project addresses a possible way for engineers to design technology with the end user in mind, and it will also act as another alternative to social media as people grow addicted to the technology. This means that the project

will avoid any biases that would discriminate against groups and keep safety, addiction, and fun as high priorities to engage users while minimizing any possible problems that may arise.

SOCIAL MEDIA AND ENGINEERING

During the spread of COVID-19, there has been a highlighting of continual discrimination between different groups of people even on social media such as the discrimination towards Asians and Asian Americans during the coronavirus era (Yang, Tsai, & Pan, 2020, p. 869). Such actions as these are reasons that social media has factored in censorship which may target certain groups. The most famous example of this is in China, where political dissent or anti-government humor is censored due to being perceived as a threat to the stability of the government (Luqui, 2017, p. 123). Other problems with social media may include the fact that it also disproportionately affects women in terms of body positivity due to the targeting of women on social media with the "ideal" standards that negatively impact these individuals (Perloff, 2014, p. 363). There is also the addictive factor of social media where it draws the user to continually use the technology and come back to it for repeated use for the reasons such as social interaction, information seeking, pass time, entertainment, and how convenient the technology is to use (Whiting & Williams, 2013, p. 366). This insight shows why users keep coming back to social media despite the many negative effects that it has on society.

The reason for all these factors is due to the social media engineering that occurs, because it stimulates feelings of gratification for the user while also targeting groups such that it can censor groups or target people for fulfilling agendas or profits for advertising. The figure on page 4 displays a sociotechnical diagram employing the Actor Network Theory to display the influence of technology, society, and organizations with social media. As seen Figure 1 on page 4, the diagram highlights how social media as a technology fosters a relationship between users

and the developers of this application along with other aspects of society such as politics in the form of government.

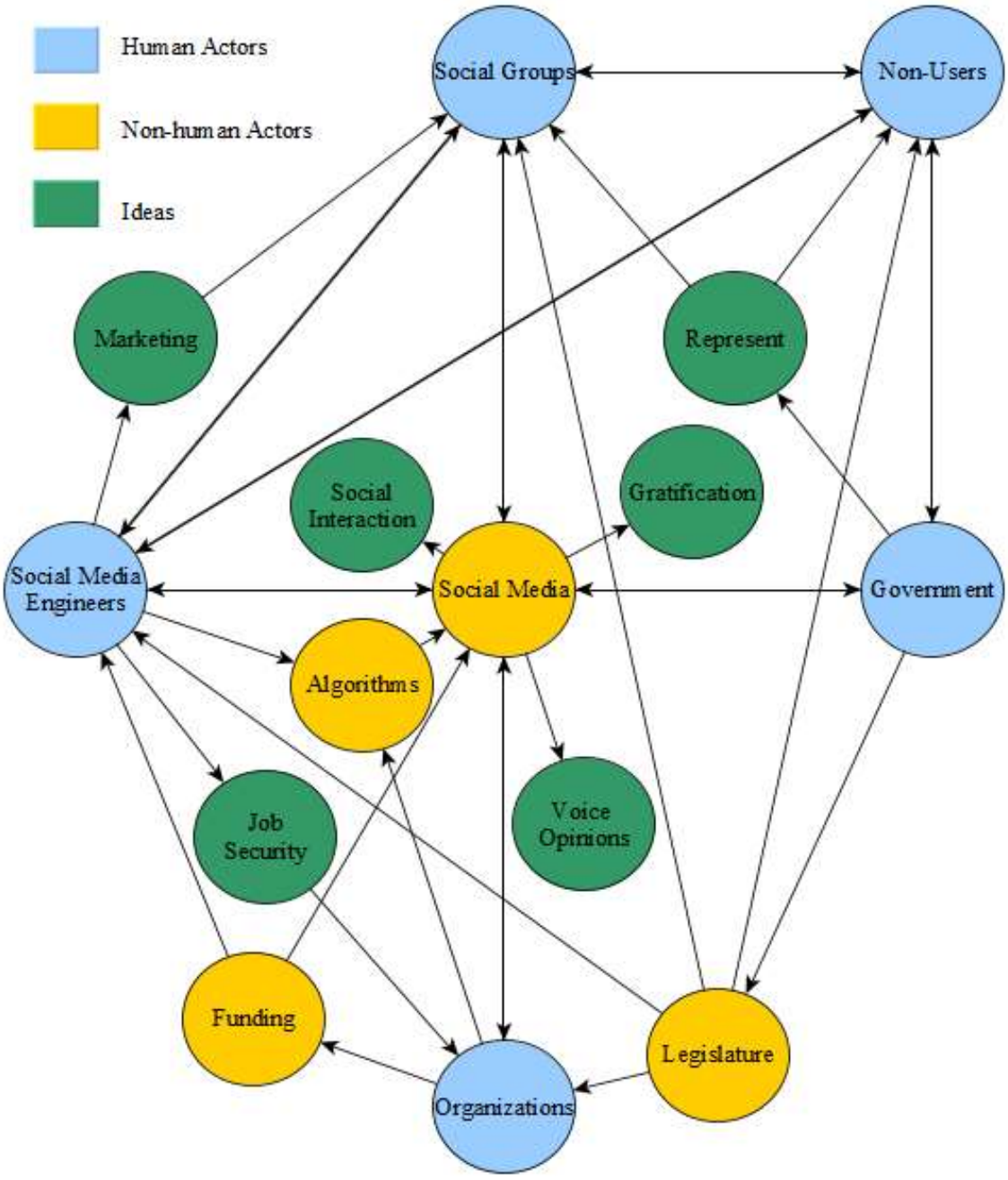

Figure 1: Sociotechnical Actor Network Model: The solution of conflicting human values that lie within social media technology is the interaction between human and non-human actors, and their related ideas (Tyranski, 2021a).

From this model, there is a relationship between social groups such as the ones disproportionately affected by social media such as minority groups or groups with certain traits. The network is facilitated through social media, whereas the actors affecting society include the social media engineers and the organizations. The actors that are most affected by social media are the social groups that use the technology, non-users due to association with users, and the government since this entity can use social media as a tool for the people to voice their opinions. There is also the separation of social media engineers as an entity that works with organizations to create social media since organizations fund the technology and the engineers who then have job security creating what the organizations desire. The appeals of social media are shown through the ideas of using social media for social interaction, voicing opinions, and the general addictive nature that social media supplies gratification from usage. The government is also a factor that affects social media such that legislation can be passed affecting the technology or the organizations behind the technology. Some important factors to note are that while organizations are behind the creation and maintenance of social media, social media engineers are the designers of the technology and the algorithms that organizations hire them to create, and so they can interact with the social groups to market the technology to engage users and try to attract more non-users to use social media.

With this framework in mind, the sociotechnical diagram gives context for why certain actions occur within social media, and how they are influenced by social media engineers. For governments such as the Chinese government, they may order social media organizations to censor certain political groups or opinions to which the organizations enlist the social media engineers to implement these changes within the social media (Luqui, 2017, p. 123). For women that are disproportionately affected by body image issues, organizations may be utilizing social

media as a form of advertisement to social groups which social media engineers then design the applications to market to groups to convince them to consume products or brands to improve their body image (Perloff, 2014, p. 363). This all culminates into the greatest role of the social media engineer which is to create and design social media that appeals to social groups and users to keep them engaged with the application for the benefit of the company whether it has a positive or negative effect on the user. This is done by designing the technology to gratify the users to keep them hooked which includes the convenience of using the technology, expressing opinions online, social interaction with other users, and knowledge seeking to market the product to the users (Whiting & Williams, 2013, p. 366). This results in a deliverable to the organization that gains profits and revenue from the input of the social media engineer.

THE RESPONSIBILITY OF THE ENGINEER

With all of this in mind, a large part of the social problems with social media affecting minority or disadvantaged groups within society are caused by social media engineers designing the technology to target and censor these groups. From Actor Network Theory, it is important for all engineers to be cognizant of their effects on society and how they can take control of their actions to make changes for the better to improve society. This gives an opportunity for the social media engineers behind this technology to dismantle the systemic problems of social media such as discrimination, targeting, censorship, and the addiction of social media by changing the technology and utilizing their unique position between social groups and organizations to further create technologies that build greater societies.

Once social media organizations and social media engineers are made aware of the problems and their influence over the solutions, using their control as actors within the network of social media will allow for an implemented solution. The solution the social media engineers

could take on the suggestions, but the main goal would be to convince the social media engineers to see their role within this technology and work toward steps that will assist rather than harm people and society with social media.

An example of the solution being implemented has been Apple allowing for privacy on social media apps such that Facebook cannot take advantage of data from users which could potentially be used against them such as with targeted ads (Bobrowsky, 2022, p. 1). Actions like these highlight the most effective method of study is the Actor Network theory as social media is the network which the engineers and organizations are the actors that affect the treatment of users and the design of the technology.

Employing ethical perspectives, engineers are building societies in the technologies that they develop, and with this power over society there are bound to be lasting effects whether intended or accidental. As written by Martin and Schinzinger, two lead engineers in their respective fields that had focused on the ethics of engineering, “Moral values are embedded in engineering projects as standards of excellence, not “tacked on” as external burdens” (2009, p. 2). Some of the potential moral problems that come from engineers in the technology that they design are a lack of vision, a silo mentality also known as compartmentalizing issues and not taking responsibility for other actions for the technology, and inattention (Martin & Schinzinger, 2009, p. 7). A lack of vision for social media could be the widespread use of the technology especially who uses it such as older people who would need accommodations to understand a new technology, or teenagers that could be easily addicted to the technology. A silo mentality could be in the form of simply doing what was told by the organizations to build the technology without questioning the actions being taken. Inattention would be not caring about the larger implications of the technology on society.

For engineers building technologies, there is a moral responsibility to take care of others through an ethical lens such as duty ethics and utilitarianism. As universal ethical systems, medical researchers have defined duty ethics to be based on the nature of the action to find morality such as a doctor-patient interaction (Mandal, Ponnambath, & Parija, 2016, p. 5). Utilitarianism focuses on the most benefit for the most individuals possible such as target goals for hospitals to take care of a certain number of patients (Mandal, Ponnambath, & Parija, 2016, p. 5). Duty ethics focuses on the responsibility of the engineer in this context because they assisted in the development of this technology, and so they have a moral obligation to ensure that the technology is not harming people or society. Utilitarianism focuses mainly on assisting people in society with a net good outcome where developing social media would result in a net good for society, such as health benefits associated with efficiency criteria for a mass number of people as studied by Marseille and Kahn (2019, p. 1).

From this perspective of ethics, there are failures from the engineers that have developed social media. Social media engineers failing to take responsibility to remedy the problems that have affected society through social media. Hence, the Capstone project developed is intended to demonstrate how technology can be developed to take away the user from social media while also aiming towards a net good for society and caring for the user.

CONNECT 4 TECHNOLOGY AND ITS IMPACT

With the era of COVID-19 and lockdowns over the past year, there has been an increased isolation among people and increased depression (Tulane University, 2021, p. 1). Many people use social media as a method to keep in touch with others online when they could not interact with others face-to-face. With this lack of social interaction comes a desire to fill that void and leads to further isolation and addiction to social media with the negative effects of social media

leading to possible mental illnesses (Kuss & Griffiths, 2011, p. 3530). During the COVID-19 pandemic, there has been a vast spike in the growth of the consumer robotics industry most likely due to the similar role of filling the void of social interaction with a product for entertainment and recreation (Edwards, 2021, p. 1).

Individuals can engage in recreational activities with friends and family through board games, and for this project the chosen game was Connect 4. Connect 4 is a game in which two players have different colored chips taking turns inserting chips into a seven-column board to align four chips horizontally, vertically, or diagonally to win the game. In building technologies, engineers build societies, and so with the increasing consumer robotics market and the isolating event of the COVID-19 pandemic, a proposed solution to the addictive and discriminatory nature of social media is the creation of a robotic Connect 4 game. Since it is possible to produce revenue for a consumer robotic toy such as a new rendition of a classic board game, this project would provide an alternative activity away from social media (Edwards, 2021, p. 1).

Due to the addictive nature of social media and the disproportionate negative impact on certain groups of people, the Connect 4 robot is designed to be engaging by being interactive and engaging to users with non-discriminatory and inclusive approaches to all people. The method of design for this robot is that there are different options for difficulty based on the user's preference. The robot can either be directed to try to win against the human player or play at an easier level where the moves are more random to be fair. As seen in the Figure 2 on page 10, a flowchart displays the interaction between the robot and the human player.

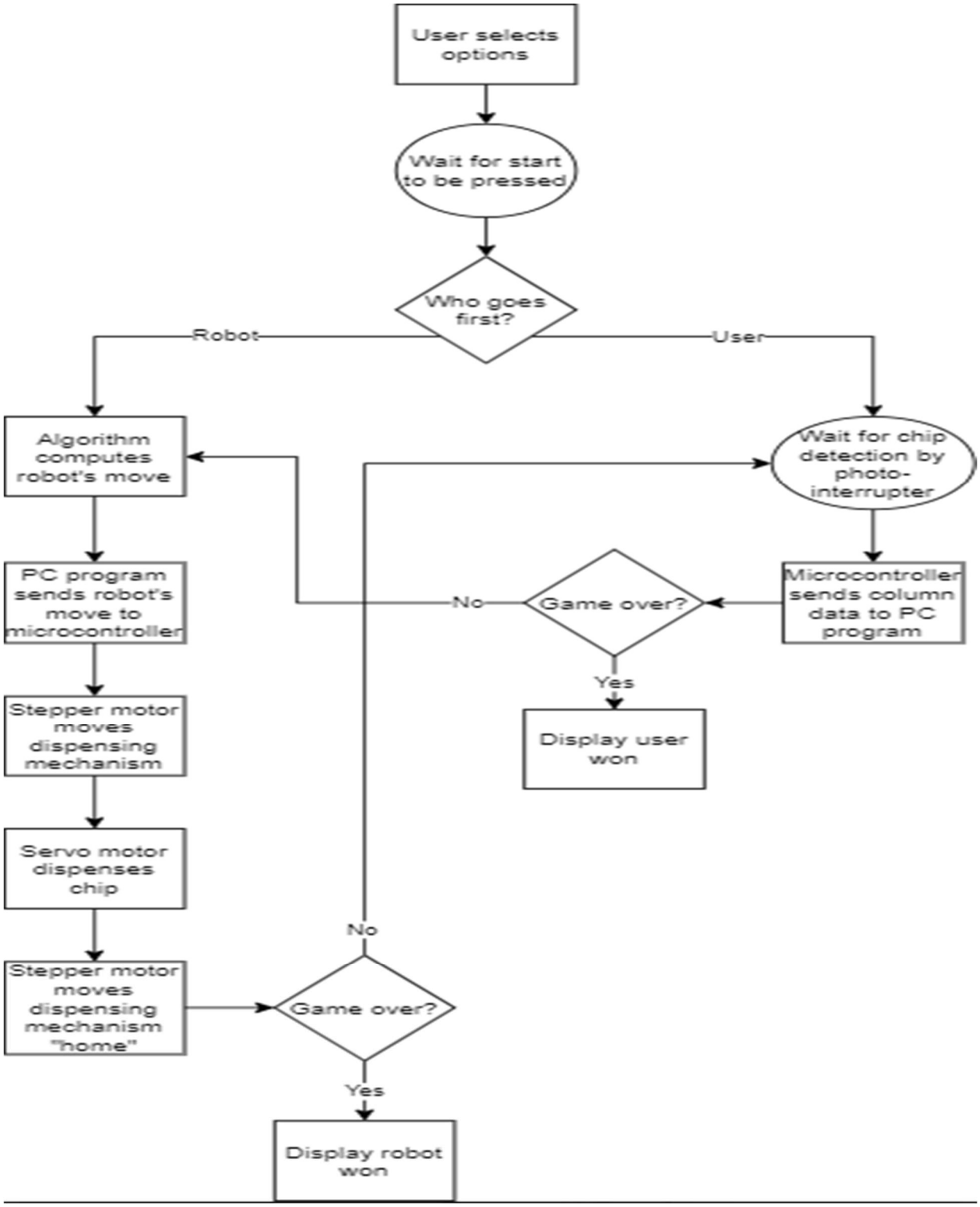

Figure 2: Connect 4 Robot Gameplay Flowchart: This Diagram displays the flow of the game and the code the robot utilizes to process information sent into the system. In this figure for shapes, diamonds represent binary outcomes, circles represent pauses in the code for human input, and rectangles represent the actions of the robot within the game (Tyranski, 2021b).

The robot will sense moves when it is the player's turn and act accordingly to play a piece and determine after each move if there is a winner for the game. Another way the robot will be engaging to the individual with the difficulty settings. The robot will be able to play against a human in "easy mode", where it will randomly place down pieces to provide a relaxing experience for the human player by exhibiting moves that would allow the user to win without much difficulty. The robot may also play in "hard mode" where it will provide more complex strategies against the player. The robot will be able to determine the best moves to challenge the user and attempt to win using a minimax algorithm, which ensures the largest payoff for the computer based on a zero-sum game to minimize the potential score for the human and maximize the potential score for the computer (Yanovskaya, 2020, p. 1).

The final key feature of the Connect 4 robot is that it is engineered to provide an experience that is non-discriminatory and will play in an unbiased manner according to the desires and inputs of the human player. While there would be no inherent benefit for the robot to discriminate between groups of people based on their differences, it is the responsibility of the social media engineer to create algorithms that do not censor societal subgroups. Engineers must construct technology to prevent capitalizing on the addictive nature of technology, such as that of social media on the youth. A major part of this technical project's design philosophy that it is possible for the engineer to design a technology that minimizes the disproportionate negative consequences on individuals or groups. The engineer must be conscious of how their technology may affect others since the creator of technology has the power to greatly influence society.

From the outcome of this project, the Connect 4 robot was about to be made according to duty ethics and utilitarianism where the engineers ensured that the project was safe for the user while also being simple enough to not attempt to grab the user's attention constantly. This

project also ensured that it was an enjoyable product such that there would be a net positive outcome for the experience of the user to have a beneficial impact on society. The engineer is hence able to build technologies that build a better society following these ethical theories.

CONCLUSION AND FUTURE WORK

Creating a robotic algorithm to simulate a real-life game of Connect 4 with a player could offer an alternative to social media since one of the goals for this device is to minimize all possibilities of discrimination or disproportionate targeting such that social media faces. This technical project would create a way for interaction between something robotic like how using social media can be an isolating event that separates the users from others and negatively impacts them. The project has also shown that the engineer can accommodate for the end user and implement ways to ensure that the user is protected by employing duty ethics and utilitarianism. The STS analysis delivered a new insight into the disproportionate ways that social media has developed to target individuals and the moral responsibility of the engineers designing these applications. With this deliverable, marginalized groups would be able to voice their opinions to the corporations and engineers through communication such as switching to other social media platforms, and social media engineers would be able to reflect on these discoveries and move forward to developing social media that does not target or discriminate against certain groups.

Regarding future work, engineers within organizations can form special groups to persuade others towards developing technology that cares for the end user and considers what actions need to take place to prevent catastrophes such as mass addictions to social media or any other technology that would lead to problems. A future work could also be done to examine the most efficient ways to form policies and cultural shifts toward ethical responsibility for engineers to prevent problems such as with social media in the future.

REFERENCES

Abril, D. (2021, June 4). Facebook puts the final nail in Mark Zuckerberg's free speech master plan. https://fortune.com/2021/06/04/facebook-free-speech-politicians-policy-newsworthiness-hate-speech-misinformation/

Anderson, M., & Jiang, J. (2021, May 27). Teens, social media & technology 2018. https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/

Bobrowsky, M. (2022, February 4). Apple's new ad policy stings Facebook. Factiva. https://global.factiva.com/ga/default.aspx

Cobbe, J. (2020, October 7). Algorithmic censorship by social platforms: Power and resistance. https://link.springer.com/article/10.1007/s13347-020-00429-0

Cresswell. et al. (2010, November 1). Actor-Network Theory and its role in understanding the implementation of information technology developments in healthcare. https://bmcmedinformdecismak.biomedcentral.com/articles/10.1186/1472-6947-10-67

Edwards, D. (2021, February 16). Pandemic lockdowns boost consumer robotics market to $10 billion in 2020 revenues. https://roboticsandautomationnews.com/2021/02/16/pandemic-lockdowns-boost-consumer-robotics-market-to-10-billion-in-2020-revenues/40492/

Kim, C., & Feng, B. (2021, May 21). Digital inequality in online reciprocity between generations: A preliminary exploration of ability to use communication technology as a mediator. https://www.sciencedirect.com/science/article/pii/S0160791X21000841

Kuss, D., & Griffiths, M. (2011, September). Online social networking and addiction--a review of the psychological literature. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3194102/

Luqiu, L. (2017, May 3). The cost of humour: Political satire on social media and censorship in China - luwei Rose Luqiu, 2017. https://journals.sagepub.com/doi/full/10.1177/1742766517704471?casa_token=hBQTIcVYm-sAAAAA%3AE7mW0CkBi_vAzEimplD_9-fKYUniVnPdpnJrIcVjUv-KCEJICuwxyymbF5AZpC0Xaa5Xm9srlSLa

Mandal, J., Ponnambath, D. K., & Parija S. C. (2016). Utilitarian and deontological ethics in medicine. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4778182/#:~:text=In%20practical%20ethics%2C%20two%20arms,may%20not%20justify%20the%20means).

Marseille, K., & Kahn, J. (2019, April 3). Utilitarianism and the ethical foundations of cost-effectiveness analysis in resource allocation for global health. https://peh-med.biomedcentral.com/articles/10.1186/s13010-019-0074-7

Martin, M., & Schinzinger, R. (2009). Ethics and professionalism. In Introduction to Engineering Ethics (2nd ed.). McGraw-Hill Higher Education.

Montag, C., Lachmann, B., Herrlich, M., & Zweig, K. (2019, July 23). Addictive features of social media/messenger platforms and freemium games against the background of psychological and economic theories. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6679162/

Perloff, R. (2014, May 29). Social media effects on young women's body image concerns: Theoretical perspectives and an agenda for research. https://link.springer.com/article/10.1007/s11199-014-0384-6

Ramesh Masthi, N., Pruthvi, S., & Phaneendra, M. (2018). A comparative study on social media usage and health status among students studying in pre-university colleges of Urban Bengaluru. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6166494/

Tulane University (2020, December 8). Understanding the effects of social isolation on mental health. https://publichealth.tulane.edu/blog/effects-of-social-isolation-on-mental-health/

Tyranski, J. (2021a). *Sociotechnical Actor Network Model of Social Media.* [1]. *Prospectus* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.

Tyranski, J. (2021b). *Connect 4 Robot Gameplay Flowchart.* [2]. *Prospectus* (Unpublished undergraduate thesis). School of Engineering and Applied Science, University of Virginia. Charlottesville, VA.

Whiting, A., & Williams, D. (2013, August 30). Why people use social media: A uses and gratifications approach. https://www.researchgate.net/publication/237566776_Why_people_use_social_media_A_uses_and_gratifications_approach

Yang, C., Tsai, J., & Pan, S. (2020, December 14). Discrimination and well-being among asians/asian americans during COVID-19: The role of social media. https://www.liebertpub.com/doi/abs/10.1089/cyber.2020.0394?ai=su&mi=cjwv&af=R

Yanovskaya, E. B. (2020, February 14). Minimax principle. https://encyclopediaofmath.org/index.php?title=Minimax_principle