The Everchanging Interaction Between Humans and Robots

Sonia Halabi

Technology has been making an immense impact on many people's lives and is only increasing the amount of influence. Each day, new ideas, innovations, developments, and advancements arise in technology. It is no doubt we all use technology in some way or the other on a regular basis. Something more recent that is starting to impact people's lives are robots. They are being developed and programmed to go out into human environments and interact with humans to the best of their ability. Robots are considered as a friend to look up to for any emotional support, which is one of the benefits too. Opinions vary as to how much humans are willing to accept robots being around them often on a daily basis, such as that some people think robots cause challenges to adjust them to human situations, are replacing human jobs, and ruining the value of human friendships. The benefits of humans and robots working together outweigh the challenges in the long run, since it leads to a peaceful coexistence amongst humans and robots and relieves humans of all the pressure and stress from the duties they need to get done. Humans and robots can have meaningful connections by working together as a team to accomplish tasks.

To first understand robots, knowing how robots are built and developed, how they are programmed, how their functions work, and the details of their artificial intelligence, is essential. According to Piyush Khandelwal, who works in the field of technology and has a Ph.D. from the University of Texas at Austin, declares that the recent progress in the hardware robustness and software sophistication of mobile robots has enabled the integration of new AI planning, sensing, reasoning, and acting, are able to have autonomy for a long amount of time in human-inhabited environments that are dynamic (Khandelwal et al. 635). Previously, robots were more limited in

their ability as they would just perform small sets of actions in more confined places for short amounts of time. Features of robots include the BWIBot platform, which has been of great use in the design of robots. BWIBot is a custom designed multi-robot platform for research for the integration of robotics and AI (Khandelwal et al. 635). BWI is an acronym for Building-Wide Intelligence. Besides the way robots are designed, knowing how they analyze everything around them is also critical to apprehend.

Robots have sensors that help them navigate their way around; "The sensors should have a sufficiently large horizontal field of view for robust robot localization, and some vertical field of view is also necessary to prevent the robot from crashing into concavely shaped objects," according to Khandelwal (Khandelwal et al. 638). These are definite requirements that the sensor suite needs to have. There are even extra parts being considered to add to it; "... it is useful to have a sensor resistant to being affected by sunlight for robust operation near glass windows" (Khandelwal et al. 638). These improvements and additions all constitute the preparation of making robots adequate at functioning skillfully and professionally, which leads to being able to have communication with humans at a surpassing level. When robots have the ability to perceive things in a useful way by having sensors, it is a resourceful idea to put it to more use by considering having another significant aspect of robots. One of the ways sensors can be put to use is by making sure robots can walk around places in a safe manner.

An important factor of having a helpful robot is to ensure that they can navigate around spaces in a safe process and avoid obstacles that they could potentially crash into. Wenyong Gong, who is a senior algorithm engineer, explains about how robots are being made to navigate safely; "Specifically, we build a speed field in accordance with several human driving experiences, like slowing down or detouring at a narrow aisle, and keeping a safe distance to the

obstacles" (Gong et al. 1). Similarly, having a smooth and clear path is key to making this process sufficient; "The path planning, which refers to designing a path for navigating an agent toward a desired location from a start position, has been widely applied in robotics community and other real application fields, such as window cleaning, exploration of Mars, and video game" (Gong et al. 1). This shows that it has already been used in certain settings and has been working out well along with continuing to make any necessary enhancements. There are even specific types of robots, such as the humanoid robot, which have been proven competent at working in human situations.

The humanoid robot is a robot that is shaped like a human. These robots are being made to prevent damage when falling as that is critical to have them continue being productive in helping humans with chores. According to Li Quingquing, who has a B.S. in exploration technology and engineering and a M.S. and a Ph.D. in geophysics, "In order to better adapt to human living environment for improving the ability of serving people on various occasions, humanoid robots need to prevent themselves from being severely damaged during falling backward" (Quingquing et al. 1). Having certain robots being refined with exceptional increments upgrades the capability of having them attain their duties in a reasonable amount of time. The humanoid robot does have advantages over wheeled mobile robots like being able to step over objects and going on staircases (Quingquing et al. 1). This validates how satisfactory the humanoid robot has been made in a more practical procedure throughout time. A way that robots have made practical use is by communicating with humans.

Possessing the insight of the way robots are and how they function, causes it to generate more sense as to how it is applied to make effective communication with humans to socialize and accomplish chores. Getting chores done with a robot gives a significant amount of stress relief

for humans, according to Kai Zhang and Li Xiaobo, who work in this type of career and have experience from researching topics related to it. They convey that "...humans can become highly stressed due to fatigue, resulting in decreased efficiency" (Zhang and Xiaobo 1). That is why Zhang and Xiaobo claim, "Many applications for robots require them to work alongside people as capable members of human-robot teams and to collaborate in order to perform tasks and achieve common goals" (Zhang and Xiaobo 1). A crucial aspect of that is humans and robots should treat and respect each other as equals instead of one or the other acting superior. Even though robots are machines that are built by humans, it is for the better if humans and robots coexist peacefully and do their best to get along since it will create more happiness and put everyone at ease rather than fighting and always being tense. After all, humans had the intelligence to invent such amazing and useful technology that can act similar to humans and make use of helping out with different forms of work, such as in the military.

Examples of where robots and humans have made magnificent collaboration are in the military, space, and medical industries; "These tasks are often performed under strain due to time constraints" (Zhang and Xiaobo 1). Humans are already feeling very fatigued from the amount of work they need to do, so why not have a robot to complete it with? It is a good opportunity to be able to create connections with them since they can act a lot like humans. It is a distinct style of having company to socialize with that many humans can find happiness in. "Existing approaches to human-robot team collaboration can be assigned according to three categories: fully centralized approaches, completely distributed approaches, and auction algorithms" (Zhang and Xiaobo 2). Having something, like robots, where people can be in a team with, makes life easier since common goals can be achieved in decisive interactions and establishes valuable bonds

between robots and humans. Specific types of robots, such as robot swarms, are helping to make that possible.

Robot swarms are a kind of robot where they have exhibited that they cooperate with humans and work together as equals in a team rather than one or the other acting like a supervisor. According to Jonas Hasbach and Maren Bennewtiz, who are in the technology career, "Human-swarm interaction is a frontier in the realms of swarm robotics and human-factors engineering" (Hasbach and Bennewitz 1). This is fairly new and has been successful so far. Robots swarm make good utility in certain areas such as search and rescue, military operations, pollution control and space exploration. Robot swarms are unique from other multi-robot systems because they "...are designed to solve tasks by local robot interactions only, resulting in robustness against node failures and scalability of swarms" (Hasbach and Bennewitz 1). Having a new type of robot that has been prosperous in accomplishing tasks in imperative professions, cooperating with people by having meaningful interactions, and are designed in a different measure, gives many vast ways for humans and robots to build a bond and work together as a team. It is acceptable to expect humans and robots to get used to having each other around, learn to be a team, and problem-solve together.

Robots are gradually shifting to going out to human environments on a daily basis. That makes it even more vital to ensure that humans and robots can accept each other and can socialize in a friendly and kind manner. According to Mikael Svenstrup, who has an M.Sc. degree in electrical engineering and a Ph.D. in robot navigation, robots must be able to act in a natural way in order to coexist with humans in future everyday human environments (Svenstrup et al. 7). That makes interactions between robots and humans a lot more straightforward to comprehend and act, especially since robots are moving out to public spaces and private homes.

In order to make that shift successful it "...relies on the robots' abilities to be responsive to, and interact with, people in a sociable, natural and intuitive manner" (Svenstrup et al. 7). Elaborating on that, "The focus is often on close interaction tasks like gestures, object recognition, manipulation, face expressions or speech" (Svenstrup et al. 7). The more robots are able to act similar to humans in open-ended environments, the better humans and robots can be a team to accomplish tasks and learn to coexist together. Humans will have less pressure and stress on themselves from so many chores to do as the robots can assist them with it. The robots will know how to interact with humans as they will be programmed and designed to get used to human environments and have a clearer perception of what humans need.

An everyday human to robot interaction example is at a shopping center, where the robot is working in customer service; "The service person will try to determine their interest or need for help and adjust actions accordingly" (Svenstrup et al. 7). The service person will learn over time to adjust to human needs and environments of knowing how to assist. It takes enough experience to be able to do that. That helps contribute to building a solid friendship between robots and humans. There is a specific type of robot that can lend a helping hand towards humans for certain things, which is the upper-limb wearable robot. It is used to help humans lift heavy objects. Lina Hao, who has a Ph.D. in control theory and control engineering, asserts that people who work in jobs where there is heavy lifting have a hard time doing that and it leads to musculoskeletal problems, fatigue, and muscle pain. "For repetitive movements in high-frequency operations, the manual lifting of objects consumes a large amount of body energy and has low efficiency" (Hao et al. 1). The concern is the continuous motion of arm movements without long-term recovery because it "...is biomechanically challenging and is associated with a risk of musculoskeletal disorders" (Hao et al. 1). Hence, the upper-limb robot was invented and,

"At present, the assistance provided by these devices can be exploited to augment the performance of workers in production facilities, enhancing their endurance or strength and reducing their muscle activity" (Hao et al. 2). This clearly illustrates that upper-limb robots have been proven helpful in reducing the risks humans have from continual arm movement from lifting heavy loads. Aside from helping humans out with work, robots are more than just something to work alongside with as they can make a good friend to look up to when people feel they need a friend to talk to, which deepens and brings meaning to human and robot connections.

Robots make a wonderful friend to turn to when humans need emotional support. It is an alternative method to go to for support, that many humans could find themselves more relaxed and at ease. It is helpful to have various solutions to find something that will help make people feel better and to give advice to people. People used to just go to each other when they needed a friend to talk to, but now there are other options such as robots, which many people may favor. Robots also help people with physical treatment when people are in pain or suffering from a condition. Robots are a good source of providing rehabilitation, according to Guo Bingjing, who works in the field of science and technology; "Robot-assisted gait rehabilitation solutions, as therapeutic adjuncts to facilitate clinical practice, have been demonstrated the effectiveness for patients suffering from neurological impairments such as stroke and spinal cord injuries" (Bingjing et al. 1). This proves that robots are therapeutic and do a sufficient job in providing rehabilitation for patients who are in physical pain.

The robots put as much effort into providing rehabilitation as much as the patients' willingness to participate. Even though robots are machines providing physical treatment for people, "There is energy transfer between patients and rehabilitation robots in the interactive system, which is represented by the dynamic coordination of position and force" (Bingjing et al.

2). It is truly impressive how similar robots can be to humans, especially since there is energy transfer. It is satisfactory that there are numerous options of the source where humans can get rehabilitation from for physical conditions, since going to humans may not necessarily be the first choice. Many people find relaxation and comfort from getting treatment from robots, which contributes to making positive interactions among them and building their connections with each other.

Not everyone thinks that robots and humans should form connections, look up to each other as friends, and be a team to accomplish tasks. Many people believe that since robots are just machines, they do not equate to the value of human friendships and connections, and think that robots should just be used to do tasks. They believe to not rely on robots as a friend and to not socialize with them, as they think it is silly and tarnishes the real and meaningful relations amongst humans. They do not want so many people to forget the importance of human-to-human support and connections by turning to robots instead. Others take a more neutral stance where robots' main duties are to help humans and that humans and robots can get along by showing basic respect and treatment as acquaintances. However, they do not think that humans should consider robots as their equals when working together and acting like friends to socialize with, as they want to preserve the value of human friendships instead of falling down the path of using machines for friendships, emotional support, and teamwork. People also worry that robots will be taking over people's jobs, which would make it harder for humans to find jobs; "Nonetheless, they are simultaneously threatening human jobs and creating ethical and societal challenges that might lead to public distrust," states Fraser McLeay, who is a professor at Sheffield University Management School (McLeay et al. 105). This is a concern that McLeay and many others have about robots not being able to gain trust from humans to be reliable at doing their jobs and are

concerned about robots replacing humans for jobs. However, with productive and sufficient training for robots to conquer societal challenges and to know what is ethical in order to prove they are trustworthy towards humans, it will be worthwhile to have robots work with humans to be there to help, without fully replacing human jobs. This ensures that humans can be financially secure. Robots still need to be looked after by humans to make sure they know what to do and are functioning properly, so humans and robots working together for a job ensures that robots will be informed by humans of what the tasks are and that humans can watch over the robots in case if the robots need assistance. Humans will have robots to help them with their jobs to make it easier and less overwhelming. It is extremely useful to implement having robots working in jobs with humans when it is being done the right way, which is by maintaining jobs for humans and keeping humans in a good financial situation.

With the growing shift of technology today being used for many imperative entities and in divergent modes, it is exemplary to provide humans with other options for finding teamwork and friendships as many humans have liked that. John Leland, who is a reporter at The New York Times, expresses that "Robots are going to play a major role in reminding us to take our medications, keeping us socially engaged, helping us if we fall and can't get up, navigating getting food delivered to the home" (Leland). This reminds people that robots will start to play a bigger part in our lives and are a valid option to have for many things, so it is best to do what is according to people's preferences, so that way there can be a variety of options to choose from for what is best for humans instead of everything being just one way or the other. It is still possible to maintain the value and meaning of human relations, while forming new ones with robots. Many people find relief and happiness by having connections with robots when working together as a team to achieve goals, because "...unlike human workers, robots never get in a bad

mood or tire of having to repeat themselves" (Leland). That is a strong advantage of having a robot to do duties. The use of robots around humans to do work is only growing and will continue to in the future, as a lot of new ideas for developing and programming robots are going on currently. It would make everyone happier in the long-term for robots and humans to coexist together. Although it may take time, it will be worth the effort.

There have been many advancements and new ideas to make robots strive high to function to the best of their ability. Afterall, it is taking off tons of pressure and stress from humans to have something else to help out with for tasks. It is beneficial to have robots as they can act closely like humans because that broadens opportunities for humans and robots to build a vigorous team together, socialize, and make connections, since there is happiness and peace by doing that. Humans and robots truly can have meaningful connections by working together as a team to accomplish tasks. They just need to stay motivated by trying and learning to understand each other. It is all about adjustment to this new technology, which is currently being used and will keep expanding for many years. Interactions with robots could possibly become normal and easy to do in the future. The world is changing and advancing all the time, so it is best to adapt and get used to the new ideas, inventions, and innovations that are thoughtfully and creatively modern.

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