SCC.205 Term Assignment

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I'll start with the positive. As 'Berkeley boffins build cut-price robo-crutches, er, sci-fi exoskeleton' and 'Boffins give amputee the finger – a bionic touch-sensitive fingertip' show, wonderful advances have been made in recent years in the fields of medical technology – specifically, medical prostheses. These aim to graft man and machine in order to assist people with conditions or injuries that impair them, from not being able to walk to not being able to see, and are a fascinating field.

Since someone first stuck a glass lens in front of their face to alleviate their astigmatism, inventing the glasses, or stuck a guy who couldn't walk on a chair with wheels rather than legs so he could get around, we've used technology to repair the bits of our fleshy bodies that fail as often as, if not more so, we've used it to advance our abilities beyond what those fleshy bits could ever hope to achieve, even in their prime. This is just the latest manifestation of this impulse, and I think it's an incredibly positive thing that many things we consider debilitating conditions now may not be in only a few years.

Obviously it's thinking way too far ahead, but this sort of thing, combined with research into AI systems that mimic the human brain and so could theoretically be used to store a human consciousness, raises thrilling sci-fi thoughts of immortality. Even more realistically, it would certainly seem to offer advances in human longetivity and durability, which could drastically change our outlook as a species – if we can replace bits as they fail and live for centuries, who would bat an eye at the thought of a trip to Alpha Centauri?

However, it's not all unbridled optimism. There is the risk of the likely prices of such technology serving to create (or rather, exacerbate the current existence of) two classes – the haves and the have-nots. Whether this happens or not is hard to predict, as there is no hard-and-fast Moores' Law equivalent in robotics (yet), but the fact that the Berkley boffins' exoskeleton is “about half the cost of the nearest competitor” is heartening news. What is less heartening, however, is the other major potential dark side of this industry, which is evidenced by a number of my chosen 'negative' articles.

'Hotel light control hack illuminates lamentable state of IoT security' and 'Your unpatchable, insecure Android mobe will feel right at home in the Internet of Stuff era' are but two of the seemingly unending flood of articles and demonstrations about the dodgy security in the much-touted 'Internet of Things'. Software vulnerabilities are bad enough, but when every facet of everyday life is running some sort of vulnerable software, and some can't even be patched when said vulnerabilities are discovered, this problem is massively intensified.

What does that have to do with prostheses? Hopefully I'll be allowed to bring up an event from far outside the time window of this coursework. In 2013, late hacker Barnaby Jack demonstrated the ability to hack a pacemaker and output a fatal voltage. If we continue to play so fast-and-loose with embedded system security, and then start embedding those systems in lovely soft squishy vulnerable bodies, we are opening ourselves up to the possibility of huge, potentially fatal problems.

As these devices get more advanced, they will need more advanced software. As the number of lines per program increases, so to do the number of vulnerabilities. If the current embedded systems are difficult to impossible to patch, imagine how it'll be for future ones that require surgery and anaesthetic just to implant. Having some sort of wireless connectivity would seem to be an answer, but that also brings in countless additional approaches for malicious entry.

It could only take one high-profile failure of the security of embedded systems in general (e.g. “car crash kills two as hackers disable brakes”), or of embedded prosthetic systems in particular (e.g.

“man shot by police after hackers forced him to attack”) to swiftly turn public opinion against this fruitful avenue of research, which could set it back for years or even decades.

If we are to start embedding systems inside human beings, we have to focus heavily on how to make these devices secure. If I can't even trust that my fridge can't be abused, why am I going to trust anything more advanced like a bionic arm?