



Introduction

It was brought to my attention that I have forsaken the regular writing of the newsletter. This is an epic failure on my part, and something I will strive to correct. I would use the excuse that I have been busy since the last writing (which is true), but I'm not in the habit of excusing behavior, but rather justifying it, and I don't have a proper justification, so I must accept that I have been derelict in my duty.

I don't have any particular axe to grind at this point, but I do think a discussion on automation and the general invasion of computers into our everyday lives warrants some time. It was one of the potential future subjects, and addressing it now seems as good a chance as ever.

Demetri's Corner

I have just completed a year as an independent company, and up to the year, it was looking very good. Then my active contract got put on hold, so my fortunes changes from "lots to do" back to "nothing to do". A subject for a future newsletter may be how to manage this epic whiplash effect when you are so small. I might wait until I figure out an answer – hopefully sooner than later.

I'm starting to contact engineering companies locally so I can expand my client base but haven't gotten any traction. It's still early and I think there are real opportunities. I've also decided on the first "divergent" market I want to work with: residential design and construction. I've always been interested in home design since my father designed and I helped him build a passive solar house through the present day where I'm designing and building a rather ridiculous play structure for my children. I am constantly surprised by how outdated the construction systems are relative to the state of modern design concepts and materials. There is clearly room for improvement which could build better, cheaper, more sustainable housing leveraging engineering approaches from other industries.

My approach to residential design, and how it varies from the current industry practice will be subject of a future newsletter, or perhaps a white paper – I can't decide which. But for now, this newsletter will focus on how computers are taking over the world and what we can do to prevent the rise of SkyNet.

Today's Subject – Automation in our Lives

I use computers a lot. I sit at one for longer than is healthy for anyone, but I am not an anomaly. This alone would be of concern, but all I do at the computer is type, do research, perform modeling, etc. These are all functions under my direct control and supervision. There are certainly levels of automation involved (such as spell-check, backups, etc.) but this is not about that. It's about the "bots" of our world that make decisions and take actions on our behalf without direct control and supervision.

Bots span a wide range of areas, from controlling machines that build cars (industrial robots) to curating the news feed that informs our world view. In both extremes they are consequential and have an impact (good and bad). I initially wrote this newsletter with the intent of covering



“robots” and the positive and negative attributes. I tried to categorize them broadly and cover all applications. This blew up in my face, and I’ve come to realize I could write several books on the subject (after significantly more research). I then tried to focus on just how we automate our actions, focused on robots. I included detailed examples of good and bad implementation. It was too clinical and didn’t really meet the intent of this forum and was frankly too hard to read. So I rewrote again...and again. I ended up cutting my words down to what I would consider a bare minimum discussion of automation focusing on two applications of automation as illustrative that span extremes: Industrial robots and home automation. For these applications I’ll cover a few areas that I think warrant some additional discussion and then summarize my feelings on the use of automation. This is at best a shallow dive into this very narrow scope.

The Question of Privacy

I want to start off by getting the elephant out of the room. When you think automation, you often don’t think about privacy considerations, but modern implementation of bots gather a great deal of information for various reasons. In many cases, this information is relayed back to the creator of the automation system. This data can be used to pre-emptively address issues, improve performance, and increase functionality. These are all very positive aspects of this data gathering, but there is a dark side. Either intentionally or unintentionally, this data can also be used to create a “profile” of users to determine preferences, provide a revenue stream to third parties selling valuable personal information, or maliciously attack the automation systems or connected environments.

Both types of automation discussed here are vulnerable to the privacy concerns, but in vastly different ways. Industrial robots harness a great deal of physical power and operate large facilities, so a data breach could have vast economic and safety consequences to the company, or the population as a whole. Home automation rarely has the potential for physical damage but could cause significant personal damage to users. This includes stealing of personal information for use in identity theft, to less overtly malicious acts such as shaping the preferences of the household towards a certain brand of toilet paper. In both cases, even with the best of intentions, automatic updates or perceived improvements pushed by external entities could harm operation of systems, create additional security concerns, or simply confuse users.

This is by no means a reason to eschew automation, but considerations of privacy should be made whenever implementing an automated system. This includes the types of data that is accessible, how that data is used, and the potential damage that could result from loss of control over data security. Being able to make that decision includes having a thorough understanding of what information is transmitted to where and by what means. The vulnerability of data security is also a consideration. This can be fairly straightforward for industrial robots, as they are controlled and designed to a specification that can be investigated. This process is far more complex for home automation where systems are generally serviced by cloud connected third party companies where information control is opaque at best.



The Question of Safety

As with all engineered products, safety should be a principle aspect of the design process. At some level this overlaps with protection of personal information, but as this was covered under privacy, this section is more interested in the physical safety of users or end consumers. The standards used to evaluate safety are far from uniform throughout industries, so determining “safe enough” is a moving target as technology advances faster than regulations.

During development of industrial robots, a conscious effort is put into defining safety and defining the qualifications that certify how the automation interacts and protects users. This type of intentional safety in design is not as obvious in home automation products. For certain, it's part of the design philosophy for larger items such as appliances, but digital assistants, security systems, smart thermostats and the like are more regularly some amalgamation of legacy hardware and consumer electronics. This means that controls over their development are much less intentional which can lead to unanticipated consequences.

It is therefore likely that industrial robots are “safer” in terms of design philosophy, but their potential for causing damage are much higher, therefore the additional scrutiny is appropriate. For home automation, it is unclear whether the proper balance of safety is inherent, even factoring in the low potential for physical damage. It would generally be beyond the scope of any home automation design to consider all potential environments where the automation could be deployed, allowing for that sort of assessment.

Application of Automation in Different Environments

There are certain types of tasks that lend themselves to automation, and those that do not. Any repetitive, well defined tasks in controlled environments with little potential for safety considerations is a slam dunk example of where automation should be pursued. On the other extreme, tasks that require interaction with varying environments and operate under a loose definition of the required end product are a poor fits for automation in its current guise.

In most cases, industrial robots perform repetitive, well-defined tasks. The level of safety afforded by the system is highly variable, but the controlled environment allows for tailoring these considerations in most cases. It is therefore not surprising that there has been such an increase in industrial automation. In the long run it makes a lot of sense, and due to economic advantages, effort is regularly put into optimizing safety and efficiency. As the capability of automation systems improve, migration of these systems into more “fuzzy logic” situations will be seen, but the progression will be slow and controlled, based on the high expense of automation development for industrial facilities, and the difficulty in changing manufacturing environments to incorporate new technology. In most cases this will result in a conservative application of automation that will be slow to implement changes, but when implemented will increase productivity and minimize safety consideration.

Home automation encounters a different set of challenges. Typically, it consists of a variety of products that are trying to be controlled by some central system. The automation products used can vary widely in terms of hardware, application, level of capability, etc. Therefore, it is



unsurprising that communication conflicts and instability occur. It would be difficult to remedy this problem with anything other than the homeowners giving up complete control and only buying products from a single manufacturer. That is unlikely to happen for the practical purpose that rarely does one manufacturer provide everything needed and for the psychological reason that people like choices.

As home automation is essentially a marriage of standard hardware solutions automated with consumer electronics, the underlying technologies are fairly mature. What is less mature is its implementation in a constantly changing and variable environment. There are certainly instances where home automation is only asked to do simple, repetitive tasks where the environment can be closely controlled. But in many cases we are asking fairly straightforward technology to operate in a highly variable and unpredictable environment. But there is more freedom for implementing this type of technology in the home environment than for industrial settings as the potential for physical safety considerations is significantly lower, assuming privacy concerns are taken into account.

The environment where automation is to be implemented is a primary consideration when defining the system requirements. The way environment defines requirements for safety, privacy, capability, efficiency, accuracy, etc. will drive the decision on how automation should be implemented.

Conclusions

Automation clearly has a place in our modern environment. It has the potential to greatly reduce workload, improve products, increase safety, and generally elevate our quality of life. These very positive attributes must be balanced with a recognition of the negative potentials which include a loss of privacy, remote takeover of functions, provision of incorrect or time-wasting information, etc. At the current state of technology, automation is still in relative infancy, and effective implementation leans towards simple, repetitive tasks with low safety consequences. As the technology improves and we learn to manage the potential negative consequences, we should expect and demand that automation grows to provide the greatest value.

The decision on how to move forward is based on consideration of the factors discussed here, as well as many others, including economics, quality of life, marketing, development of new capabilities, etc. A full consideration of these factors will determine the appropriate time to implement new automation technologies. These are complex considerations that require tailoring to each specific situation, be it an industrial setting or consumer electronics.

Engineers can provide a valuable service by ensuring that the potential for automation is achieved while minimizing the negative consequences. Defining requirements for the automation, developing solutions that meet those requirements, and ensuring that the requirements are met prior to implementation are going to be critical functions if we are to implement automation in an effective, safe, and sustainable manner. It is the necessary work to start determining the correct balance so that we move forward safely without overly restricting progress.



Your Dose of Aphorisms

I don't have a great aphorism for automation, but there is a general engineering theme that fits with the concept that we must balance risk with the capabilities of our systems. This is abundantly clear when making some decision on whether automation is warranted. On that note I leave you with:

Engineering is balancing resources against risk to deliver solutions to problems we don't fully understand.

The Future

Any comments or suggestions on the discussion in this newsletter or for future newsletters will be welcomed at newsletter@sigmaexpertsolutions.com. The following list of topics is being considered for the future, and any strong opinions on any of the below or additions can also be expressed to the same address.

- Engineering Ethics
- The Role of Automation – Additional Subjects
- Managing Technical Teams
- Software development
- The Role of Rapid Prototyping
- Commercial Grade Dedication