

Internet of Things (IoT)

Gathering Data, Evaluating Data, and Panopticon

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Welcome to the Internet of Things: An Introduction

Internet of Things (IoT) is a technological concept that has applications to everything from consumer products to military equipment. Rather than being a specific device, it is a class of device that takes many forms, and levels of complexity. At its simplest: such a device can have one or more sensors to quantify input from its surroundings, and a wired/wireless output component allowing connectivity to a local network, or the wider Internet; More complicated devices may have onboard processors, or an integrated user interface. Examples include: fitness trackers, smart assistants, traffic lights, security cameras, status sensors for manufacturing equipment, and GPS trackers for packages.

Due to the broad applications of IoT, it likewise has a broad audience; the entirety of which is divisible into consumer, commercial, industrial, infrastructure, and military segments. Though different, a commonality between all segments is for convenience, data tracking over time, and data evaluation to turn data points into actionable information. For consumer audiences, this could mean getting a notification on your smartphone from a home appliance, or, for a manufacturer-- tracking the health of critical industrial equipment. Further, IoT has made its way into infrastructure across the world in major cities. China for the purposes of surveillance, and in other parts of the world, for traffic flow control. In short: each segment of the IoT market experiences augmentations to their operations through the prudent application of this technology.

The aforementioned augmentation is rooted in the concept of automating the tracking, and evaluation of data points that inform what should be done for given trends in the real world. As technological innovations of increasing complexity are normalized, the human cognitive capacity for accounting for all these factors is, and has been outpaced by the integration of technology in all facets and levels of society living in the Information Age. As a solution for this imbalance: IoT utilizes (ironically enough) technology to increase the capabilities of digital citizens to keep track of data/information that would otherwise be difficult to keep pace with. This observation leads us to identify that the benefits of the usage of IoT comes not from the technology itself, but rather from the technology enhancing our inherent abilities as human beings to make decisions. However, it cannot be denied that IoT as a class of technology will only continue to grow and become more integrated with society as newer, and even more complicated innovations continue to emerge, and the need to cope with the increasing complexity that those innovations bring.

The Chink in the Armor: A Focus on Data Collection, Storage, and Security

IoT devices go through three phases: data collection, data storage, and data evaluation; Managing these phases for a single device is quite manageable. Yet, there are well over 7 billion IoT devices across the globe, a number that has outpaced non-IoT devices (Howarth, 2022). Future estimations put this number closer to 30 billion by 2025, with the data produced to be approximately 73.1 zettabytes (Jovanovic, 2022). This imminent prevalence raises a swath of ethical questions that warrant investigation.

We first will direct our attention to an ethical quandary on data collection, and storage in relation to security. Why this is important is as follows:

1. IoT device circuit boards and their network components have varying protections against external agents; due to inconsistent regulation/policy.
2. Collected data can only be stored locally as a subset of the whole (Ressler, 2016), and must transfer over a network to a wider system (Kaur, 2021).

By combining the above two points, IoT devices present external agents a throughway into larger systems. For a consumer, this wider system might be their mobile device; for a government institution, it could be more severe. Aside from the security risk associated with the transfer of the data providing a backdoor into such systems, we can also examine the type of data being collected, including, but not limited to: Status data, Location data, and Automation data (DIGITEUM TEAM, 2020). Accessing this data can expose vulnerabilities for exploitation, such as: Whether someone is home or not, or potential property damage if such data is altered. With so much on the line, it leads us to the question of “How secure are our IoT devices?”

Through my investigation of current regulation/policies of IoT device security, I found it to be lacking; (Maidment et al., 2021) and the pace at which current regulation is proceeding to deal with the security vulnerabilities exposed by IoT devices is likewise lacking in speed. (Maloff & Newton, 2019). With a three-times growth in device quantity projected: Dealing with the security flaws that such devices present should be our utmost concern.

Our Inner Workings: A Glance into Physiological/Psychological Metrics

Shifting our focus to data collection on a more personal level: we will address health/fitness trackers. These sorts of devices collect and contextualize physiological parameters such as heartbeat, weight, calorie-intake/output, movement statistics, and body temperature (Zhang, 2021) . While impressive, the accuracy of measurements do have discrepancies when studied closely (AV-TEST, 2015). Though, I predict such inaccuracies will likely be addressed over time as such devices grow more sophisticated, and their inner workings are improved.

Putting aside current limitations of fitness trackers, it begs the question that when such issues are addressed, what applications such data could provide us in a broader sense. Currently, it has been revealed that such data can potentially point towards early symptoms of depression (The Optimist Daily, 2022), illness (Miller, 2021), and even be utilized to support medical practitioners in carrying out vital care when looking at physiological parameters over a period of time (Johns Hopkins Medicine, 2022). The current benefits present an opportunity for the health sector to augment preventative care, saving many lives, in no small part thanks to the development and usage of IoT devices that track such fluctuations in our health.

But another, less talked about implication of physiological and psychological evaluation through such trackers is the augmentation of another sector that is seemingly disconnected from our more immediate personage: predictive marketing. The current landscape of predictive marketing focuses on data accumulated from our internet activity, and other observable behaviour; this accumulated data is then added to a profile that summates current, and potential future trends through the lens of what draws an individual's attention, and what products/services that individual may be willing to buy (SendPulse,

2022). This is a large, and profitable industry, the reach of which is far indeed– but might it reach us on a more physiological/psychological level?

As was established, such trackers can detect physiological/psychological states that we may experience from inferred information from collected data (Kyriakou et al., 2019). These states, through the lens of psychology, point towards these states as having varying side effects dependent on the individual– side-effects such as being susceptible to certain cues and stimuli. It could be postulated that these states would be of great interest to marketers who may want to deliver specific content dependent on a consumer's physiological/psychological state. Potentially delivering an advertisement that is food related when you're hungry, or inflammatory content to keep your attention when you're irritated or angry. This possibility sets an unsettling precedent for the future of society when our privacy, and indeed our most inner workings are under siege from those who would seek to take advantage of such “insider knowledge”.

Something Old, Something New: Panopticon, and the Future of IoT

IoT devices from their conception back in 1883, up to the first IoT device ever created in 1980 (Scammells, 2020), have been utilized for reasons varying from tracking the stock, and coldness of Coca-Cola in a vending machine, to getting news related to weather, or stock market changes. These humble beginnings seem quaint when compared to current applications which range from supply chain logistics when taken in the context of industrial IoT devices, or even tracking vitals such as stress, spent ammunition, and physical health of soldiers operating in remote combat zones (Segal, 2021), (Sahu, 2021). These are only the current usages and applications of this technology, it is hypothesized that many more developments will materialize in the coming years (Stetsenko, 2021), (Symanovich, 2019).

This current aggregation of IoT devices across all sectors, and industries leads us to the question: “How far off is the normalization and mass-distribution of IoT in every facet of our lives as digital citizens?”

Projections put consumer markets as being poised for active growth, and presumably this refers to the ongoing normalization of smart appliances, video entertainment, and smart speakers by early adopters (Howarth, 2022). But assuming that the before stated regulations/policies regarding IoT devices fails to catch up with the needs of consumers in this limited time frame, could we trust the washing machine to not air our dirty laundry, or Alexa to keep hush-hush about our embarrassing singing habits? All joking aside, it would be fair to assume that the other industries and sectors of society would be under the same threat, and when there is nowhere left to hide, where will that leave us as a society?

‘Panopticon’, as a concept, is symbolic of present-day society, particularly when considering social media, the attention economy, and predictive marketing (Pelzel, 2021). To answer the question from the paragraph prior: I hypothesize, along with others (Ranger, 2015) that the employment of IoT in all parts of society will magnify the current implementation of panopticon, and that as a digital citizen it will be unlawful, or met with extreme suspicion to not take part/contribute to its machinations.

Conclusion/Discussion: Putting it All Together

The Internet of Things (IoT), for all intents and purposes is simplistic in its concept, but is capable of powerful, and groundbreaking innovations when coupled with various industries and applications. But as awe-inspiring the prospective applications into medicine, smart cities, and others: we must also come to grips with the risks associated with such technologies.

The ethical dilemmas discussed in this paper are only a handful of dozens, if not more. From the lack of security in billions of IoT devices, to the benefits/risks of quantifying physiological parameters through fitness trackers, and finally the examination of where society will end up as a result of all factors.

IoT has the potential to do great things, but it is of utmost importance that we focus on developing sound legislation, and policies surrounding the implementation and design of this technology; because it, along with so many other technologies on the horizon have the potential to change society for the better, or worst; and it is our responsibility to address it without fear.

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