# A Study on Internet of Things (IoT)

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## Abstract

This essay presents a Human-Computer Interaction (HCI) perspective on the Internet of Things' evolving architecture (IoT). The idea is to share knowledge and examples of how HCI could work well with the IoT strategy at this early stage of development. We gathered 21 research articles for analysis and exploration of IoT business outcomes and writing linked to human-computer interaction. This gives us the ability to describe the types, scope, and focuses of both research and commercial operations. Additionally, it has revealed trends and chances for HCI to advance when collaborating with the IoT. Finally, this research offers HCI-related insights, suggesting tactics and viable techniques that could assist ensure an IoT that is human-focused.

#### *Keywords:* Internet of Things (IoT), Raspberry pi, Human–computer interaction, IoT scope besides applications.

#### I. INTRODUCTION

The term, Internet of Things (IoT) refers to a wide vision in which "things" such as the everyday objects, places and environments which can be interconnected with one another via the Internet. A simple example of an IoT object which is now available in some of the homes is a thermostat which can be used to determine as to when an individual occupy certain rooms and alter the levels of heating, lighting and various other functions in the house accordingly. By broadening the Internet from "a network of interconnected computers to a network of interconnected objects (Commission of the European Communities 2009), the Internet of Things (IoT) will include a diverse and vast network of interconnected devices. These devices will include various sensors to measure the environment around them and the actuators which can physically act back into their environment such as opening a door, switching of devices and storing of the vast data generated, nodes to relay the information and also coordinators to help manage sets of these components.

Through this, it can possibly altogether broaden, improve and even move the relationship in the middle of individuals and their general surroundings. Actually, numerous are trusting that the IoT will play an important part in tending to a considerable lot of today's societal difficulties, for example, a maturing society, deforestation and recyclability.

This interconnection of physical articles is relied upon to intensify the significant impacts that vast scale organized interchanges are having on our society.

The Internet of Things portrays a world in which the everyday objects are joined with a system so that the information can be shared and used accordingly. Yet it is truly as much about individuals as the spiritless items. Today everyone uses the smartphones but are these phones really smart? Cell phones are just the starting. Later on we will convey sensors that measure our wellbeing and how It is critical that the researchers, software engineers and business people who are driving the research, improvement and formation of the new organizations actualize the innovation capably. Just as, strategy creators can help dependable advancement and choose whether and how to administer or manage as fundamental.

Everybody included in the Internet of Things ought to be always filtering the skyline to suspect, as opposed to manage unforeseen outcomes by and large. We move around nature in which we live. These will help us to standardize and explore the world in ways that we canhardly imagine.



HCI has engaged with the technologies that bear some of the characteristics of those proposed for the IoT. In particular many efforts around ubiquitous and pervasive computing include various internet technologies for sensing, tracking and monitoring.

The key vision of the technologies like ubiquitous and pervasive computing is comparatively similar to that of theIoT, in which both the technologies seek to design the computers in a way that they can be a part of the environment, embedded in a variety of everyday objects, devices and displays (Sharp et al. 2007 p218). We would also say that wearable computing (Ishii 2008; Reichl et al. 2007), which focuses on embedding computing into the everyday objects also share many attributes of the IoT.

However, the primary distinction between these explorations of technology and the Internet of things is the notion of interconnectivity. By interconnectivity, we mean the potential for multiple connections to be made, and datashared, between all objects of the IoT.

Efforts within pervasive, ubiquitous and wearable computing till today often consist of a single device connecting to the corresponding one data source, whereas in case of IoT, the concept of an ecosystem in which one device communicated to many things is there (Berzowska 2005).

To date, HCI has captivated with advancements that bear a few attributes of those proposed for the IoT. Specifically numerous endeavors around ubiquitous and pervasive processing incorporate Internet advances for sensing, checking, following and monitoring.

The essential vision of universal and pervasive processing is like that of the IoT, in that they try to plan PCs which are "a part of the environment, inserted in a mixture of ordinary gadgets and displays" (Sharp et al. 2007).

We would say that the technology of wearable computing (Ishii 2008; Reichl et al. 2007), which concentrate on embedding computers into regular items also impart numerous characteristics of the IoT. In any case, the key refinement between these investigations of innovation and the IoT is the thought of interconnectivity.

What we mean by interconnectivity is the potential various interconnections that can be made and the information can be imparted between all objects of the IoT. Efforts within pervasive, ubiquitous and wearable computing registering to date often comprise of standout gadget interfacing with one information source, while the IoT advances the idea of a system where one gadget is addressing numerous things (Berzowska 2005)

In this paper, we review the latest HCI-related writing and business items connected with the IoT vision. One point is to give an asset to the general HCI crowd to comprehend the flow condition of research connected with the rising IoT motivation.

A second point is to highlight ways whereby HCI can advance into captivating all the more gainfully with endeavors of the IoT. This is accomplished through empowering a dialog between the discoveries of our literature review and the business offerings, uncovering the opportunities and the future methodologies for HCI as it captivates completely with the IoT. Next, we will portray how we led our survey.

Taking after this we will exhibit the discoveries, including two tables that classify late research and business endeavors identified with the IoT. We then utilize these as the premise for talking about how the HCI group can captivate with the creating vision of the IoT.

#### II. METHODOLOGY

Both HCI-related literatures as well as commercial offerings related to the Internet of Things were explored and with HCI-related literature, we used keyword searches like, Internet of Things, sensors, connectivity, etc. Considering the close relationship between efforts such as ubiquitous computing and the IoT, we also surveyed articles from the journal of Personal and Ubiquitous Computing (PUC).

Given the way that the IoT is still a moderately new research field, we constrained our pursuit to the most recent four years. An alternate purpose behind this confinement was the sheer number of articles accessible every year from these productions (from CHI and PUC alone there was a consolidated 1,793 papers).

We then extended our hunt to yield articles from the ACM Ubicomp Conference, European IOT examination groups, and specialized reports. We found that not very many papers specified the expression "IoT" unequivocally.

Thus we extended our pursuit criteria to incorporate papers which managed gadgets that could both screen and track their surroundings through sensors, and had the capacity to transmit that information – basic components of the IoT. This prompted an aggregate of 43 papers from CHI and 46 papers from PU

The Internet of Things is not a new idea. The term was instituted in the late 1990s, and huge numbers of the key parts like semiconductors and remote systems have existed for quite a long time.

The Internet of Things is comprised of equipment and programming advancements. The equipment comprises of the joined gadgets – which run from straightforward sensors to cell phones and wearable gadgets – and the systems that connection them, for example, 4G Long-Term Evolution, Wi-Fi and Bluetooth. Programming segments incorporate information stockpiling stages and examination programs that present data to clients. Notwithstanding, it is the point at which these segments are joined to give benefits that genuine worth is made for organizations, shoppers and government.

We then looked into each of these papers, arranging them into diverse classifications in light of the principle center of their contribution(s). Utilizing an iterative partiality sorting methodology, we arrived at a last set of three classifications, sub-separated into area particular, movement related, and framework driven interests.

Other than HCI-related writing, we additionally reviewed over numerous business items. These items were assembled from late shopper gadgets show transactions, pro destinations (e.g. postscapes.com) and online pursuits.

We restricted our review to essentially daily items, instead of mechanical arrangements, for example, RFID package following. Taking after the same criteria utilized for selecting applicable writing, we picked items that had the capacity both assemble and transmit sensor information. It is important that the greater part of items picked do show some feeling of interconnectivity, for instance home lighting that has the capacity reflect natural and social occasions.

We then categorized these products according to the tasks they are primarily used for or the domain for which they are primarily focused on, for example home security or fitness tracking devices.

We investigated both HCI-related literature and business offerings identified with the IoT. With HCIrelated writing, we utilized keyword searches (e.g., Internet of Things, sensors and so on), drawing from the ACM SIGCHI Conference on Human Factors in Computing Systems (CHI) processes as this is the head HCI gathering. Considering the nearby relationship recognized between ubiquitous computing and the IoT", we additionally reviewed articles from the diary of Personal and UbiquitousComputing (PUC). "Given the way that the IoT is still a moderately new research area, we restricted our pursuit to the most recent four years. An alternate purpose behind this constraint was the sheer number of articles accessible yearly from these productions (from CHI and PUC alone there were a joined 1,793 papers). We then extended our pursuit to yield articles from the ACM Ubicomp Conference, European IOT examination groups, and specialized reports.

Other than HCI-related writing, we likewise overviewed more than 300 business items. These items were assembled from late purchaser hardware show processes, expert locales (e.g. postscapes.com) and online pursuits.

We constrained our inquiry to essentially daily items for example, RFID parcel tracking. Emulating the same criteria utilized for selecting significant writing, we picked items that had the capacity to both assemble and transmit sensor information. We then sorted these items as indicated by the assignments they are principally utilized for or area they are fundamentally centered around, for instance home security. An IoT system comprises of a huge number of devices and sensors that communicates with each other. With the extensive growth and expansion of IoT network, the number of these sensors and devices are increasing rapidly. These devices communicate with each other and transfer a massive amount of data over internet. This data is very huge and streaming every second and thus qualified to be called as big data. Continuous expansion of IoT based networks gives rise to complex issue such as management and collection of data, storage and processing and analytics. The IoT dataframe for smart buildings is useful to solve several smart building problems such as oxygen level management, smoke/hazardous gas measurement, and brightness. One such framework is capable of collecting data from sensors installed in buildings and performing data analysis for decision making. Furthermore, industrial production can be enhanced by using an IoT-based network-physical system equipped with information analysis and knowledge acquisition techniques . Traffic congestion is a serious problem for smart cities. Real-time traffic information can be collected through IoT devices and sensors installed in traffic lights and this information can be analyzed in an IoT based traffic management system. sixty one]. In healthcare analytics, IoT sensors used with patients generate a wealth of information about the patient's health status every second.

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#### III. REVIEWING LITERATURE OF THE IOT

The review of HCI-related writing recognized three classes of research efforts that reflect distinctive methodologies taken within the design research. They are: i) assessing for configuration thoughts, ii) investigating frameworks through outline and iii) investigating specialized segments through configuration.

## **Class 1: Evaluating for configuration thoughts**

One zone of HCI exploration is concerned with assessing existing frameworks for thoughts that can be utilized as a part of future outlines. The primary area, Utilities, was fundamentally concerned with assessing home power practices with a perspective to bringing down the usage (e.g. Puncture and Paulos 2012). Other home utilities were additionally investigated, for example, Internet data transfer capacity (e.g. Erickson et al. 2013). Individual information, security and protection are conspicuous worries that underlie numerous assessments of IoT innovations.

## Class 2: Exploring frameworks

These researches investigated (i) domain specific investigations, for example, wellbeing and self-awareness, (ii) activity related investigations for example, tracking individuals, computerizing and making the invisible visible.

## **Class 3: Exploring specialized segments**

Efforts inside the third classification are those which investigate singular specialized segments through configuration. These fundamentally comprised of (i) framework driven investigations, for example, new inputs, systems and data processing and (ii) domain specific investigations, for example, protection and utility utilization. IoT Key Issues and Challenges

The involvement of IoT-based systems in all aspects of human life and various technologies related to data transmission between devices Embedding made it complicated and led to a number of problems and challenges. These issues are also a challenge for IoT developers in the advanced smart technology society. As technology evolves, so do the challenges and needs in for an advanced IoT system. Therefore, IoT developers should think about the emerging problems and should provide solutions to them.

Security and Privacy Issues: One of the biggest and most challenging issues in IoT is security and privacy due to a number of threats, cyber attacks, security risks and vulnerabilities secret Issues that give rise to device-level privacy are insufficient authorization and authentication, insecure software, firmware, web interface, and poor transport layer encryption. Security and privacy issues are very important parameters for developing trust in IoT systems regarding various aspects .Security mechanisms should be built into every layer of the IoT architecture to prevent security threats and attacks. Several protocols are effectively developed and implemented on each communication channel layer to provide security and privacy in IoT-based systems.

# IV. REVIEWING PRODUCTS OF THE IOT

A person-centric item is one that is basically intended to accumulate information about the human body, usually by being worn or persistently conveyed. We discovered such concerns to concentrate predominantly around tracking, for example, tracking sleep, body, wellness and weight. Additionally, EEG tracking gadgets is utilized to always measure brainwave movement utilizing little headmounted gadgets with the objective of seeing how concentration levels may be influenced by action.

Connected devices fundamentally expand the possibility to accumulate more sophisticated information for utilization in epidemiological studies. Case in point, information taken from wearable gadgets could help reveal whether certain way of life examples consolidated with specific hereditary qualities lead to inclinations or resistances to specific illnesses.

Wearable gadgets could gather an expansive scope of information: eating methodology; exercise; introduction natural elements, (for example, allergens, to contamination and daylight); and markers for psychological wellness, for example, social association. Such information will give general advantages and empower more customized social insurance from a deeper understanding of the persistent's extraordinary way of life and history.

Smart data have effectively made it simpler for individuals to track their action and conduct. These devices embrace a healthier way of life with information on the quantity of steps strolled or calories burned. By connecting eating methodology and work out, and showing the information, the client is incentivized to enhance their wellbeing.

A few specialists contend that applications and savvy wearable gadgets will be a main thrust for a healthier society. However, it stays early days for these gadgets, and the confirmation supporting the effect of wearable gadgets on way of life practices is still constrained.

These advances are not without danger. The Internet of Things makes three noteworthy dangers in social insurance: information security and possession, equipment security and interoperability, and change administration.

#### A. Home-centric

Home-driven items were discovered to be intended to remain and function in the home. They basically accumulate information about their surroundings, which might incorporate individuals, objects inside the house or even the house itself.

A sample of an application that is focused on individuals is a home security framework that monitors for intruders. While home-driven items were essentially planned (and promoted) to be utilized inside the household setting, it must to be noticed that numerous could likewise be repurposed in other situations, for example, an office space.A great transformation can be observed in our daily routine life along with the increasing involvement of IoT devices and technology. One such development of IoT is the concept of Smart Home Systems (SHS) and appliances that consist of internet based devices, automation system for homes and reliable energy management system . Besides, another important achievement of

#### V. CONCLUSION

There Evidence of HCI's growing engagement with both the IoT vision is available. This is demonstrated by recent HCI meeting topics on the IoT (such as the British Computer Society's HCI meeting in 2013), extraordinary diary issues on the IoT (Carretero & Garca 2013), and other gathering workshops (such as OzCHI 2012) on this topic. This paper's motivation is to foster and promote this interaction.

IoT is Smart Health Sensing system SHSS incorporates small intelligent equipment and devices to support the health of the human being. These devices can be used both indoors and outdoors to check and monitor the different health issues and fitness level or the amount of calories burned in the fitness center etc. In addition, it is also used to monitor vital health conditions in hospitals and trauma centers. Thus, it changed the whole scenario of the medical field by facilitating it with high technology and smart devices. In addition, IoT developers and researchers are actively involved in improving the lifestyles of people with disabilities and the elderly.

IoT has shown a strong performance in this field and given a new direction to the ordinary life of these people. Since these devices and devices are very cost effective to develop and are available in the normal price range, most people use them . Thanks to IoT, because they can live a normal life. Another important aspect of our lives is transportation. IoT has brought new advancements to make it more efficient", comfortable also reliable. Smart sensors and drones now monitor traffic at differently beckoned crossings in major eitige





This paper provides a record of the flow condition of research within HCI and offers nuggets of knowledge inside the matter of how we can strengthen HCI's engagement with the IoT by reviewing a portion of recent HCI research that deals with the technologies closely related to those of the IoT and additionally IoT business items.

We have increased the value of scholarly research by taking contractual obligations into account. In order to ensure that the HCI group's appointment through the IoT

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incentive is human-focused, this has allowed us to open a dialogue between these two undertakings, revealing the potential and practises aimed at the HCI group.

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