What we are looking for in each paper:

1. Background info on IoT
2. Background info on any domain of IoT
3. Generic IoT patterns
4. Domain Specific IoT patters
5. Usages of non-IoT patterns in IoT

Add a commend on any line that is one of these saying which it is and any pertinent information.

Use <https://www.naturalreaders.com/online/> to read the articles aloud while following along.

Add at least one diagram for each of the subdomains.

Domains that I will write about:

Smart Water Management System

BCI

Health Care

-

Smart Metering

Smart Grids

Industrial IoT (such as Smart Cities)

Notes on the articles:

nf

Design Patterns for the Industrial Internet of Things:

* lots of general information about IoT and it’s structure
* several design patterns used in some domains

Fog and IoT- An Overview of Research Opportunities

* networking architecture pattern and reasons for it
* also includes information about general needs of IoT as it grows and limitations of current IoT

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An Integrated IoT Architecture for Smart Metering:

* information Smart meters (electricity, water, gas)
* the articles proposition on a system for it (including benefits for the utilities and customers)

IoT Architecture for Smart Grids:

* talks about why we need smart grids (benefits)
* lists lots of types of energy sources and how they connect to IoT (like distribution to local areas, micrograms, smart cities, building, etc.)
* ^as well as storing energy to fix the fluctuations in these energy generation types

Study of IoT - Understanding IoT Architecture, Applications, Issues and Challenges:

* has a lot of domains of IoT (also divided into sub-domains)
* general information about IoT
* pros and cons of IoT
* challenges of IoT

Decentralised IoT Architecture for Efficient Resources Utilisation:

* like the Fog one it talks about removing some of the work from the could due to the increasing work load on them
* ^offers solutions for that issue (such as a more intelligent edge device and more)

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Dependable design for elderly health care

* Healthcare of the elderly, trustworthiness
* (check the main one to see what patterns are in it)

A simple security architecture for smart water management system:

* Issues with security regarding smart water (for instance the option of physically accessing the devices and not just hack into it computing)
* some general architectural patterns regarding their solution
* security solutions

BCI ontology- A context-based sense and actuation model for brain-computer interactions:

* general info on BCI
* design patterns for BCI
* ontology stuff… (conforming to existing things and so on …)
* integration with AI

Cataloging design patterns for Internet of Things artifact integration:

* a lot of design patterns in general and how they made IoT patterns from existing things
* (I think these can go in the general IoT category)

IoT design patterns- Computational constructs to design, build and engineer edge applications:

* several of general IoT patterns

BCI –

BCI, that is Brain-Computer Interfaces, is quite an interesting domain of IoT connecting neurology, electrical engineering, machine learning in addition to some of the more standard aspect of IoT such as networking connectivity.

Using various devices for sensing electromagnetic waves the body, and specifically the brain (emitting brain-waves), sends out, such as and electroencephalogram (EEG), it analyzes these electromagnetic waves and classifies them using machine learning algorithms to train the associated software making it “understand” the intention behind those waves. This is usually done by a device such as an EEG coming into physical or near physical contact with the body. After classification by the machine learning (generally deep learning) software actuation is required.

Although this may seem like a futurist idea, perhaps something out of a science fiction novel, real world examples have already been developed. They range in purpose and field, from military to healthcare, not to mention entertainment.

Although we will mainly talk about healthcare in the remainder of this paper, we will deviate from that for one example to solidify an image of what BCI can do. This example may cause and upset in the world of gaming. The NextMind device with its SDK for the Unity game engine allows users, when wearing the device, to control certain aspects of project created with then Unity game engine simply by concentrating. It works by analyzing the brainwaves of the wearer when concentrating on special graphics displayed on the screen and with integrating the software this can be used to cause a myriad of effects, simplest of which would be perhaps movement in a game. This is not limited to a simple trigger of is the user is concentrating on the visual queue either, it can analyze the intensity of the concentration. Via software interface any effect can be given to the values read from the brain.

Now that we understand some of the capabilities of BCI we will see in the field of healthcare that the same type of technology isn’t limited to video games. It can be used for instance to move around a wheelchair of a patient who does not have the ability to walk. Once the software is trained for the patient and a classifier is created, it can be used to analyze the patient’s brainwaves and interpret how to actuate and move the wheelchair. Here the IoT technology is allowing all the various parts to communicate with each other such as the EEG device, the actuated device (the wheelchair) and the processing unit which may be on a separate device.

To more efficiently work with BCI as a subdomain of IoT ontology design patterns were developed. Here we will look at a couple, both targeting compatibility and maintainability as ontology patterns.

* Actuation-Actuator-Effect Ontology Design
* Stimulus-Sensor-Observer Ontology Design

Without going into detail of the tagging and models of the ontology itself, these two patterns work hand in hand cataloging the full picture of BCI model, that is the connection between the Sense Model (described by the Stimulus-Sensor-Observer Ontology Pattern) and the Actuation Model (described by the Actuation-Actuator-Effect Ontology Design). Each pattern is aligned to and expands upon existing ontologies in the relevant fields including, of course, the field of IoT.

In the Figure below we can see the relationship between the two patterns:



Figure [fill in citation probably since this is copying the image exactly]

The subject of this paper, the Internet of Things or IoT put simply is the technological field dealing with interconnected devices over a network. These devices range from a common electric kettle to the cutting edge of green energy wind turbine and everything in between. In fact, it is no exaggeration that the limits of IoT aren’t bound to the Earth itself and has taken flight to the bounds of spaces.

IoT is often thought of as a new up and coming technology and although it certainly has experienced growth spurt in the last decade or so, it can be seen as far back as the 1980’s, from before the term was even coined, in old vending machines. What most see and an internet buzz word some hail as a major component of the fourth Industrial Revolution. As such I would like to discuss why IoT is such an important in today’s world and even more so in the world of tomorrow. What can it do to further society, what fields does it progress?

Like any field especially one so large and diverse there many ways to get a job done, some efficient than others. We learn from our experiences and device better mays to design and develop in the field.

IoT hardware and software component and I would like to focus on the software side. Software design or soft architecture is a vast and highly discussed field in and of itself. It is imperative model our software in a way that is robust, easy to maintain and flexible among many other traits. Software as a general field has much experience with this since the Gang of Four and the original wide spread design patterns became well known. The job of these design patterns was to allow software to be built in such a way that would counter problems that has come up in somewhere to that point, improving the quality and maintainability by a significant margin, but it didn’t stop there. More and more patterns were recognized and as spread of software engineer spread specialized patterns showed up, that is to say, ways of designing software that fit a specific field or sub-field.

IoT is no stranger to this. As the field of IoT developed, software patterns that were specific to IoT appeared one after another, furthermore, patterns for the fields or domains within IoT developed patterns specific to themselves.

Note the term “pattern” that I have been using has been used somewhat ambiguously. Here I am using it to mean an identified design rather than specifically an architectural pattern or design pattern. The difference between the two being their level of abstraction. In fact, some go so far as to include architectural styles under the same umbrella. The difference between a pattern and a style is that a pattern is meant to solves a specific problem while a style is simply a preference for how to compose software. As both deal with software design they may be lumped together as long as it is understood what “pattern” may be referring to. As such there are three levels of abstraction of patterns where architectural styles are the most abstract deal with the general idea of the software but no specifics, architectural patterns are in the middle, dealing with the specific design of the larger systems of the software and design patterns the least abstract specifying the design of individual components.