Utilising Blockchain to Coordinate IoT Devices

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1. Question:

How effective is the blockchain at coordinating IoT devices in the context of a smart home environment?

2. Aims:

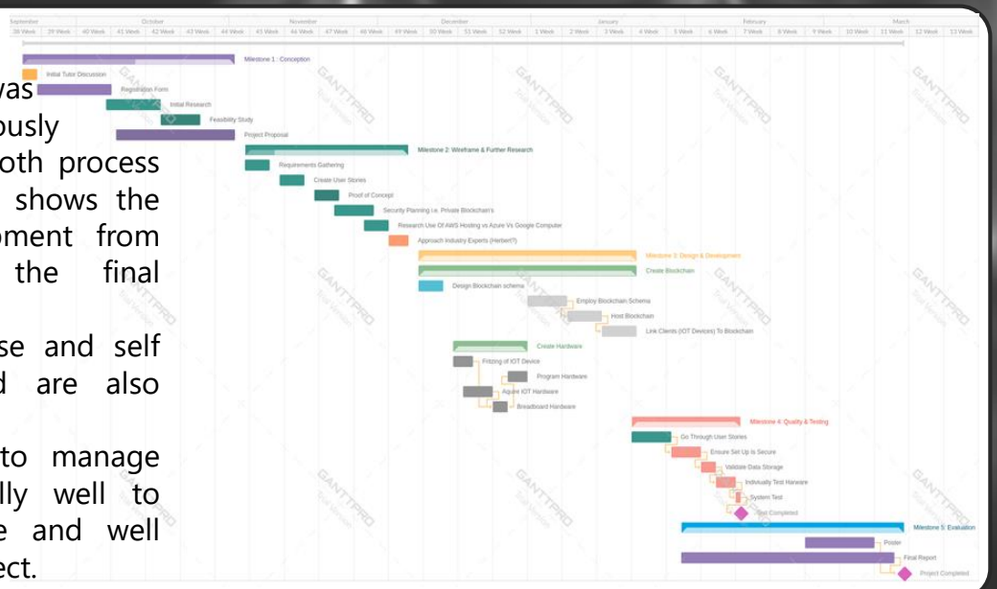
- Investigate the security of IoT devices.
- Develop a private blockchain prototype.
- Compare the costs and benefits of a blockchain based IoT system to conventional products.

3. Planning

The Gantt chart was followed meticulously to ensure a smooth process of creation. This shows the flow of development from inception, to the final product.

The testing phase and self reflection period are also included.

It allowed me to manage time exceptionally well to create a mature and well thought out project.



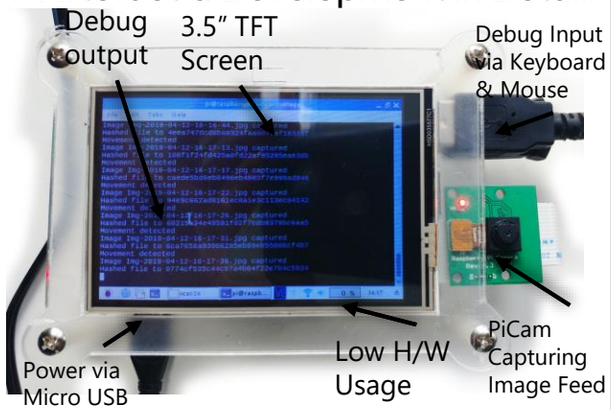
3. Background:

IoT is utilised in almost every facet of our lives, to improve efficiency, add value and to smoothen our daily experiences (Lasse Lueth, 2018). Despite this it runs on decadent and ancient platforms and remains power hungry, and insecure (Bai et al , 2011).

Comparatively, the Blockchain is a new technology, heralded by tech-evangelicals as the height of security protocols with features such as SegWit & fault tolerance (Dorri et al, 2017).

Seeing the intersection of these technologies, this project aims to measure the benefit that the Blockchain could have to an IoT system.

4. Artefact & Development in Detail:



The hardware was developed with several key features in mind; notably low power use, blockchain backed secure storage and scalability.

The chosen hardware included a Raspberry Pi 3b+ with ensured that it was scalable and supported the Hyperledger framework which serves as the backbone for the blockchain technology (O'Dowd, 2019). They work with the PiCam to capture images once motion is detected, before writing the image's unique hash to the blockchain as a transaction.

5. Goals:

- Research current applications of the blockchain in the consumer field and home environment.
- Test usability and functions of a blockchain based IoT backend.
- Define the pro's and con's concerning the use of blockchain and IoT.

6. Testing:

The artefact is measured in 4 areas.

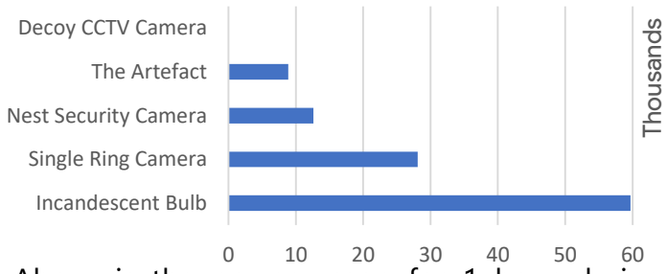
Power Usage, via external monitor.

Speed as time taken to add a record.

Scalability is measured as speed over over clients.

Security was gauged as how secure the system is.

7. Power Usage for 1 Hour (Watt Hour)

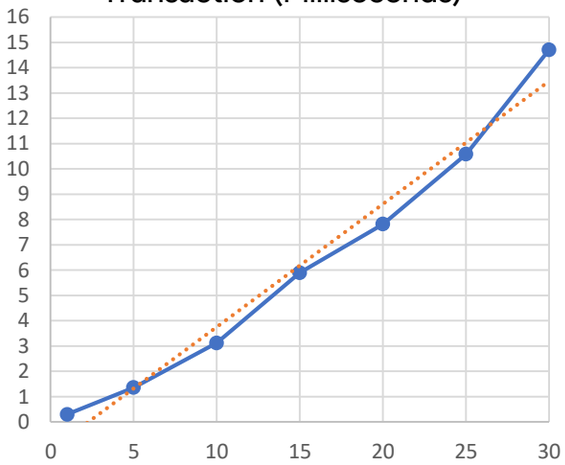


Above is the power usage for 1 hour during video recording. A decoy CCTV camera and a lightbulb are included for electrical scale purposes.

As you can see our artefact offers a very energy efficient solution, half that of the Ring Camera. This is due to it not capturing images until motion is detected.

The time taken to add a single record to a single client was repeated 100 times and came to an average of 300 milliseconds.

8. Time Taken To Process Transaction (Milliseconds)



Above you can see that as the amount of clients increased, so does the time taken to process the transaction across clients. The addition of 5 clients doubles the time taken.

9. Conclusion & Self-Evaluation:

The artefact shows the promising use of a new technology in a field not yet explored. The results presented above show that performance (speed, scalability) were favourable whilst the low power usage was encouraging. The artefact was very effective and as such the endeavour could be considered a success.

In terms of research and product created. Although future iterations could use even lower powered hardware, such as an Arduino micro-controller.

10. References:

Bai, Yw et al. (2011) Design and Implementation of a Home Embedded Surveillance System with Ultra-Low Alert Power. Ieee Transactions On Consumer Electronics. 57 (1), 153–159.

Dorri, A., Kanhere, S., Jurdak, R. and Gauravaram, P. (2017). Blockchain for IoT security and privacy: The case study of a smart home. 2017 IEEE International Conference on Pervasive Computing and Communications Workshops (PerCom Workshops).

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O'Dowd, A. (2019) A Blockchain Platform for the Enterprise — hyperledger-fabricdocs master documentation, Hyperledger-fabric.readthedocs.io. Available at: https://hyperledger-fabric.readthedocs.io/en/release-1.4/ (Accessed: 2 April 2019).