Initial Plan

The Internet of Things Era and its Applications

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Initial Plan – The Internet of Things Era and its Applications

CM3203 – One Semester Individual Project, 40 Credits

Author: Vikas Bhatia

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Roles of Supervisor

- 1. Providing advice on the Internet of Things (IoT) and emerging technology fields.
- 2. Providing advice on the commercial and some technical aspects of the project.
- 3. General project guidance.
- 4. Support on testing the IoT hardware deliverable.
- 5. Supervising progress through weekly meetings.

Project Description

The Internet of Things (IoT) has become a vibrant part of the IT landscape. IoT means many things to different people, from smart homes to wearables to connected cars, with different developer ecosystems built up around each IoT pillar. As a megatrend in 2016, it is going well beyond a hobbyist developer's next fun project, to becoming a space where technology vendors and 4.5 million IoT developers are gearing up to invest their time (VisionMobile, 2015).

The Internet of Things revolves around increased device communication; it's foundation is built on cloud computing and (networks of) data-gathering sensors. It is mobile, virtual and instantaneous, with the promise of making our everyday devices "smart". However, it is also a relatively nascent field with challenges. With these in mind, in this project, I aim to create an addon hardware module that internet-enables a device, and with it, demonstrate the benefits of bringing a previously-disconnected device into the IoT domain. I intend to analyse the impact of adding such capabilities, and show the problem-solving potential of making a device smart, from a business (social/economic) and technology perspective. The devices that can benefit from such a conversion have some common problems. They are often complex and expensive. There are competing standards and approaches for adding smart capabilities to them, which may be expensive themselves. They are placed in off-site/remote locations, and maintaining them may be a challenge. If the device becomes defective, service engineers may take a long time to diagnose issues because they lack the context of the machine's recent operation, and what spares may be required. These devices may even perform poorly since there is no established way to collect data from them or centrally monitor them.

This project shall focus on enhancing an existing device with Internet/network capabilities, logging data from it, and showing that the real value that the Internet of Things creates is at the intersection of gathering data and leveraging it to solve these problems. A use-case for this is with a vending machine. Through small modifications to the electronic control system of such a device at a very low cost, implementing an IoT solution will allow the collection of data such as sales patterns, total revenue generated, usage statistics, and more. This data may then be

transmitted to a central server. With this information, the potential benefits are (including but not limited to) remote diagnosis and monitoring, reduced turnaround time to repair the device, increase in revenue and uptime, and a reduction in wastage of resources.

Project Aims and Objectives

- 1. Discuss IoT as a developing field and the implications to consumers.
- 2. Create a hardware add-on unit that allows a target device to connect to the network/Internet.
 - a. Evaluate a commercially available Wi-Fi module for this use.
 - b. Evaluate alternate modules/methods of connecting to the network.
 - c. Compare the benefits of using an independent Wi-Fi module vs. an out-of-thebox IoT board such as the Raspberry Pi (including costs and business implications).
 - d. The solution will ideally be simple, economical, and use-industry standard interfaces.
- 3. Adapt the module to internet-enable a target device.
 - a. Deploying on an actual real-world target device is unnecessary given time/resource constraints. A sample representative piece of hardware will be acquired and connected.
- 4. Program the microcontroller and log data from the device.
 - a. Environment and programming will be in C, using a suitable IDE. The language and environment will be evaluated and justified.
 - b. Evaluate events to log (such as button presses on the device).
 - c. Log the data.
- 5. Interpret the collected data and its usefulness.
 - a. Show sample use cases.
- 6. Evaluate the impact of IoT in context, including business, social and economic effects.

Out of scope: due to time and resource constraints, the following will not be implemented, or will be implemented in a limited manner:

- 1. Creating a central server/server infrastructure to receive data from the IoT device.
- 2. Transmitting the logged data to the server/over the internet.

The aim of the project will have been considered achieved if the data is deposited in a specified location in a usable, standard format (such as for a software developer creating an interface to monitor this data).

<u>Ethics</u>

Currently, I do not foresee a need for an ethical review as the proposal does not meet the requirements for an ethical review to be made. No sensitive or personal data will be collected and testing will be done in a controlled environment. If this changes at any point during the project, the ethics approval will be requested with support and co-ordination from the supervisor.

<u>Work Plan</u>

- 1. Complete **initial plan** and set timelines. Subject to change based on progress of project and supervisor feedback.
- 2. Research phase.
 - 2.1. Research on the IoT field. Current standards, practices and solutions + evaluation.
 - 2.2. Hardware solutions and available Wi-Fi boards + choosing best solution.
 - 2.3. Acquiring external support and advice where personal experience is low.
- 3. Design phase.
 - 3.1. Freezing project requirements to implement and scope to avoid scope creep.
 - 3.2. Ordering/acquiring parts, familiarising with target device, events to log.
- 4. **Environment setup** phase. Setting up programming and testing tools, familiarising and adapting to C syntax as needed.
- 5. Implementation phase.
 - 5.1. **Building stable core**. The main features as agreed upon with the supervisor will be focused on.
 - 5.2. **Building peripheral features**. Including code review, refactoring if necessary, setting up testing tools.
- 6. **Testing**. Conformance to original requirements, expected vs. real-world performance, suitability vs. other solutions.
- 7. Complete **final report**. Extensive documentation of the entire development and testing process.

Please see the Gantt chart below for the estimated project timeline.

Project Meetings

Meetings with the supervisor will be held weekly at a mutually agreed-upon time. Each meeting will have a clear agenda and a meeting log will be maintained which will track attended meetings and summarise the discussions. Deviations from the schedule will be noted and compensated for, as will any major deviations to the project based on supervisor feedback.

Deliverables

- 1. IoT module that interfaces with hardware and enables Wi-Fi connectivity.
- 2. Final report.

The deliverables will be submitted by the deadline for the project: 6 May 2016.

Gantt Chart

| | Jan 2016 | | | | | Feb 2016 | | | | Mar 2016 | | | | Apr 2016 | | | | May 2016 | | | | |
|------------------------------|----------|----|----|----|---|----------|----|-----|----|----------|----|----|----|----------|----|----|----|----------|---|----|----|----|
| Internet of Things Project | 4 | 11 | 18 | 25 | 1 | 8 | 15 | 22 | 29 | 7 | 14 | 21 | 28 | 4 | 11 | 18 | 25 | 2 | 9 | 16 | 23 | 30 |
| Initial Plan | | | | | | | | | | | | | | | | | | | | | | |
| Research | | | | | | | | | | | | | | | | | | | | | | |
| IoT background research | | | | | | | | | | | | | | | | | | | | | | |
| Hardware solutions | | | | | | | | | | | | | | | | | | | | | | |
| External resources + support | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | _ | | | | | | | | | | | | | | | |
| Design | | | | | | | | | | | | | | | | | | | | | | |
| Freeze scope, requirements | | | | | | | 0 | | | | | | | | | | | | | | | |
| Acquire, familiarise parts | | | | | | | | | | | | | | | | | | | | | | |
| Environment Setur | | | | | | | | | | | | | | | | | | | | | | |
| Environment Setup | | | | | | | | | | | | | | | | | | | | | | |
| Set up programming IDE | | | | | | | | | | | | | | | | | | | | | | |
| Implementation | | | | | | | | i p | | | | | | | | | | | | | | |
| Core + review | | | | | | | | | | | | | | | | | | | | | | |
| Code/implementation frozen | | | | | | | | | | | | | 0 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | |
| Testing | | | | | | | | | | | | | | | | | | | | | | |
| Conformity, corrections | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | |
| Final Report | | | | | | | | | | | | | | | | | | | | | | |
| Documentation | | | | | | | | | | | | | | | | | | | | | | |

The project timeline is adjusted to allow sufficient time to remain before the deadline to compensate for unforeseen circumstances/delays. More/less time may be assigned to any phase based on supervisor feedback and changing needs felt with the progress of the project.

<u>Bibliography</u>

VisionMobile. (2015, December). *IoT Megatrends 2016 - VisionMobile*. Retrieved from VisionMobile: http://www.visionmobile.com/product/iot-megatrends-2016/