Project Brief

**Audio Spectrum Analyser**

Version information

|  |  |
| --- | --- |
| Draft/Version | Draft 0.1 |
| Release Date | 30 March 2017 |
| Author | Samuel Simpson |
| Document Owner | Samuel Simpson |

Confidentiality

|  |  |
| --- | --- |
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# Document control

## Version history

| **Version** | **Date** | **Change Description** | **Author** |
| --- | --- | --- | --- |
| 0.1 | 28/10/2017 | First Draft | Samuel Simpson |
|  |  |  |  |
|  |  |  |  |

## Approvals

| Name | Role | Version | Date |
| --- | --- | --- | --- |
| Steve Phillippo | Electronics Teacher |  |  |
| Jose Almeida | Solution Architect |  |  |

## Distribution list

| Name | Role | Version | Date |
| --- | --- | --- | --- |
| Steve Phillippo | Electronics Teacher |  |  |
| Jose Almeida | Solution Architect |  |  |

## Related documents

| Document | Location |
| --- | --- |
| Webpage | <https://www.quora.com/How-many-recording-studios-are-there-in-London>  Number of recording studios in London |
| Webpage | <https://www.quora.com/How-many-nightclubs-are-there-in-London-England>  Number of nightclubs and bars in London |
| PDF | <https://www.citb.co.uk/documents/research/csn%20outputs/closer-look-construction-greater-london.pdf>  Amount of construction growth in London |
| Webpage | <http://www.hse.gov.uk/noise/statistics.htm>  Amount of hearing problems each year due to work environments |
| PDF | <http://www.atmel.com/images/doc8059.pdf>  Datasheet for Atmel ATMEGA 1284p |

# Introduction

## Purpose

The product will be an audio spectrum analyser which will be able to show information about the relevant frequencies present in an audio signal that may bring some insight on the sound quality and distortion level, that can affect the consumers’ user experience. The product will be able to have different firmware’s installed which could help target different markets requirements

It could be used to provide visual feedback for use in industries such as

* The entertainment industry
  + It could be used to give an immersive visual experience for the users of the product and it could be used to allow people to see the music they are listening to. In London alone there are a total of 337 night clubs and 2143 bars.
* The audio engineering industry
  + It could be used to give information on the quality of the audio from a new audio device and could be used to automate testing of new audio devices’ performance.
* The music industry
  + It could be used to give information on an audio signal and could be used to help master the audio signal and improve the audio dynamics. In London there are a total of 10 large recording studios and many other small studios.
* The construction industry
  + It could be used to analyse noise levels in a new development and make sure construction noise levels do not cause noise complaints. In London alone the growth of new construction projects is expected to rise by 6.6% and the growth of maintenance projects is expected to increase by 1.5%.
* The medical research industry
  + It could be used to analyse the different audio signals someone could hear so it could provide a way to easily test what audio frequencies someone could hear and diagnose common hearing problems.
* The health and safety industry
  + It could be used to monitor noise levels in different environments and make sure they do not surpass safe levels. In the UK there is an average of 21,000 hearing problem cases each year which are reported to be work related. The product could be used to detect noise hazards and help to prevent them from being a problem and so prevent businesses from being sued due to damage to employees hearing.

The product will have multiple firmwares available which will be able to display information or feed data to a computer through a serial connection where different APIs will be available to make it able to be integrated into computer systems.

# Project Definition

| Key Project Data |  |
| --- | --- |
| Project Name | Audio Spectrum Analyser |
| Project Code | TBD |
| Project Type (Capex or Opex) | Capex |
| Project Manager | Samuel Simpson |
| Start Date | May 2017 |
| Programme Area (Programme Board) | Electronics |
| UK or Ireland or Both | UK |

## Objectives & desired outcomes

The device will have a display and will be able to be a standalone unit with the option to have a computer interface to allow the use of many APIs to expand the features of the unit and allow it to integrate into existing systems

It will have a high-performance Microchip 8-bit AVR RISC-based microcontroller –

ATMEL ATMEGA 1284p

* 16MHz Clock Frequency
* 128K Bytes of In-System Self-Programmable Flash
  + Endurance: 10,000 Write/Erase Cycles
* Optional Boot Code Section with Independent Lock Bits
  + In-System Programming by On-chip Boot Program
  + True Read-While-Write Operation
* 4K Bytes EEPROM
  + Endurance: 100,000 Write/Erase Cycles
* 16K Bytes Internal SRAM
* Programming Lock for Software Security

It will have support for an SD card to store display modes and store sample data depending on what firmware it is running.

## Scope and Exclusions

**Must Have**

Ability to function without external hardware

Different APIs to allow the unit to perform multiple functions

Serial port for integration into existing systems

Ability to store settings when powered off

**Nice to Have**

Have an internal microphone to allow use without audio cables

Have an infrared remote

**Exclusions**

It will only run on UK 240V 50/60Hz power

It will only work on standard line level audio signals

It will not be able to display frequencies above 1MHz due to microcontroller speed

# Outline Business Case

## Justification

There is a huge market for spectrum analysers with some ranging as high as £100,000 and beyond. But there is still a huge gap in the market at around the £200-£300 mark where I plan to target my product at.

There is a huge demand for the spectrum analysers, for different markets; audio industry, medical industry, Industrial factories, and most of the best performance analysers can cost as up as £100,000.

What we are trying to aim is to provide to our customers an affordable product with the same level of quality as the top analysers with more support for people just starting out using spectrum analysers and more ways to easily expand its functionality.

We will provide also a support model, where we will be able to Operate and maintain the units at a very low cost. 1st line of support, upgrades,etc.

## Financial Analysis

High level benefit realisation plan: Benefits to be realised from May 2018

Estimated end to end costs: GBP £2,305

| **Description** | **Equipment**  **(GBP)** | **Professional Services**  **(GBP)** | **Total Price**  **(GBP)** |
| --- | --- | --- | --- |
| Hardware | £995 |  | £995 |
| Professional Services |  | £1,710 | £1,710 |
| SW+Licenses | £110 |  | £110 |
|  |  |  |  |
| **Total** |  |  | £2,305 |
| **Grant Total with profit** | +25% |  | **£2,881.25** |

Profit: £576 per unit

# Risks, Assumptions, Issues and Dependencies

| Description/Impact | Impact  H/M/L | Mitigation | Owner |
| --- | --- | --- | --- |
| PCB failing specifications | H | Choose the correct materials, design specification and the correct method of manufacture | Samuel Simpson |
| Software Bugs/Glitches | H | Have a process to check the validity of the software and test the software before deployment | Samuel Simpson |
| Skills | H | Train workers to reduce failed boards. | Samuel Simpson |
| Part Availability | L | Order parts in advance and get ETA of when the parts will arrive | Samuel Simpson |

## Assumptions

Further requirements gathering to take place to firm up use cases.

## Issues

None identified.

## Dependencies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| In-/Out-  bound | Dependency | Required  Date  (if known) | Project/  Programme  (if known) | Project No.  (if known) |
|  |  |  |  |  |

# Stakeholders

Electronics Teacher

## Functional Analysis

|  |  |  |  |
| --- | --- | --- | --- |
| Function | Functional Representative Name | Impact  H/M/L or None | Date reviewed |
| Brand | Samuel Simpson | H | 28/10/2017 |
| Business Analysis | Samuel Simpson | H | 28/10/2017 |
| Business Intelligence | Samuel Simpson | H | 28/10/2017 |
| Business Operations (Service Delivery Management) | Samuel Simpson | H | 28/10/2017 |
| Capital Finance | SJCR + Samuel Simpson | H | 28/10/2017 |
| Devices & Applications Team | Samuel Simpson | M | 28/10/2017 |
| Risk & Security | Samuel Simpson | L | 28/10/2017 |
| Marketing | Samuel Simpson | L | 28/10/2017 |
| ROI | Samuel Simpson | H | 28/10/2017 |
| Sales/Retail/Online | Samuel Simpson | L | 28/10/2017 |
| Supply Chain | Samuel Simpson | L | 28/10/2017 |
| Testing | Samuel Simpson | H | 28/10/2017 |
| Wholesale | Samuel Simpson | L | 28/10/2017 |

### Business Operations

Acquire full support contract with customer – this does not include customisation

Levels of support

Bronze – Basic repairs and replacement – 6 months

Silver – Advanced repairs, replacements, user support – 12 months

Gold – Expert repairs, replacements, user support, upgrades – 24 months

Platinum – Lifetime Gold support

# Architectural Impact Assessment

## Architecture Decisions and Issues Logs

### Architecture Decisions Log

| Decision # | Decision Required & Outcome | Rationale for Decision |
| --- | --- | --- |
| 1 | Chosen Microcontroller | It has one of the highest SRAM sizes and Program memory for a through-hole microcontroller |
|  |  |  |

### Architectural Issues Log

| Issue # | Issue Description | Management Approach |
| --- | --- | --- |
|  |  |  |
|  |  |  |

## Significant Architecture Principles

| Principle # | Definition | Rationale |
| --- | --- | --- |
| 1 | PCB specification | Use the correct methods and solutions to design the board correctly for PCB manufacture |

## Target Architecture Alignment

A standalone unit with the capability to connect to different units for analysis and configuration

## Gap Analysis

None

| Gap Description | Mitigation approach |
| --- | --- |
|  |  |
|  |  |

## Security, Compliance & Information Governance

|  |  |  |  |
| --- | --- | --- | --- |
| **Security Question** | **Yes** | **No** | **Don’t know** |
| Is the security lock bit on the microcontroller set | X |  |  |
| Is there any customer information on the SD card provided with the unit or the unit | X |  |  |
| Is there any internet connectivity to the box |  | X |  |
| Is the configuration port on the device secure and is the software secure | X |  |  |

## Regulatory Contractual implications

No impact.

# Glossary

| Term | Description |
| --- | --- |
|  |  |
|  |  |
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|  |  |