**Project Name**

**Final Report**

The report title should be short but informative, for example 'Design of a bicycle attachment' is short but doesn't tell you much, while 'The design of a prosthetic arm add-on to allow an upper limb amputee cyclist to stand while starting, but then sit down again' is overly wordy. A fine balance is needed.

DAPP2 Final Report Template

**Team Members**

Susie Q

John Smith

**Supervisor:** Edward Scissorhands

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision** | **Date** | **Author** | **Description** |
| A |  |  | First release |

The revision tracker allows you to keep up to date with which release of the report you are working on, you while find that programs like google docs will track the changes automatically.

19 March 2025

Word Count: The word count should cover the main body and does not include references or appendices, but this may not be true for all future assessments so be sure to enquire.

ABSTRACT

The abstract is a short summary of the entire project. It should inform the person reading it on every important aspect of the project, why it was undertaken and its objectives, what was undertaken and the final conclusions. The abstract is the entire project in miniature; the reader should be able to understand enough of the project from the abstract to determine if they will invest the effort to read the whole report. The abstract may be the only bit the reader ever reads, so it should able to stand alone.

It should be ½ to ¾ of a page in length (250 – 500 words).

Write the abstract last, once you have completed everything, it is much easier that way.

Acknowledgements

Any acknowledgements of assistance, advice or aid provided should be made here. This may be thanking your supervisor and the technicians who helped you in your project, it may even be thanking your flat mates for making you tea and pancakes while you wrote your thesis.

Contents

[ABSTRACT 2](#_Toc32496686)

[Acknowledgements 3](#_Toc32496687)

[1 Introduction 5](#_Toc32496688)

[2 Requirements Definition 6](#_Toc32496689)

[3 Final Design 7](#_Toc32496690)

[4 Discussion 8](#_Toc32496691)

[References 9](#_Toc32496692)

[Appendices 10](#_Toc32496693)

[Appendix A – Project Management 11](#_Toc32496694)

[Appendix B – Risk Management 12](#_Toc32496695)

[Appendix C – Ethics 16](#_Toc32496696)

[Appendix D – Bill of Materials 17](#_Toc32496697)

[Appendix E – Nomenclature 18](#_Toc32496698)

**(Survey result)**

**(Details of the algorithm)**

**(Repositories)**

The table of contents shows where everything is in the report, this can be automatically generated by Word (as this one is) you can also include a table of figures or a table of tables.

# Introduction

A brief introduction is required to set the scene for the report so the reader understands why this work was undertaken. The motivation for the work should be clear and the intended outcome or the aim of the project should be made clear here.

In some Technical Reports you may set out specific objectives of the project. If the aim is the overall outcome that you want to achieve, it is broad and largely without specific detail. The objectives however are the detailed steps you need to take in order to achieve the aim, they should follow the SMART guidelines, being Specific, Measurable, Achievable, Realistic and Timebound. For the purposes of this report, we will not include objectives as it ends up begin an unnecessary duplication of the project plan and we have a limited page count.

In a typical Technical Report there would be a separate section detailed the background of the project and demonstrating how this work fits within the field with relevant papers and standards. As this has been largely covered in your group presentation it is advisable to include a summary of some of the background research in the introduction such as existing solutions to explain the current state of the art in the field.

# Requirements Definition

This section should be centered on the user requirements along with a selection of the quantitative requirements. This should be a very top-level summary of the information covered in the PSD. Focus on the key elements and be sure to include the items that will come up again in the explanation of the design and the testing and evaluation.

# Final Design

The final design should start with an overall view of the assembly and then detail the smaller sub-assemblies and component details. It is not a manufacturing guide and should not detail all the design steps that were taken to get to the final version, it is simply an explanation of the final design and its function.

Remember to make good use of diagrams to clarify the design (the detail drawings can be placed within an appendix). Whether your project is Electrical, Molecular, Computational or Mechanical there are appropriate images, schematics and flow charts than can explain the processes, function and use of the design.

Don’t forget to label all figures (Figure 1 and Figure 2) and tables (see Table 1) and refer to each in the text. Handy hint – a tidy way to organize figures and captions is to position them within a table and then make the table border invisible (see below).

Table 1 – Item details and dimensions

|  |  |  |  |
| --- | --- | --- | --- |
|  | Item 1 | Item 2 | Item 3 |
| Height (mm) | 150 | 75 | 125 |
| Length (mm) | 60 | 300 | 75 |
| Width (mm) | 50 | 20 | 60 |
| Mass (kg) | 0.75 | 1.2 | 1.1 |

|  |  |
| --- | --- |
| http://www.abc.net.au/news/image/7342970-3x2-700x467.jpg | exo 3 printed leg prosthesis in action |
| Figure 1 – Prosthesis development since 1916 (www.abc.net.au) | Figure 2 – 3D printed Prosthesis (behance.net) |

# Discussion

The discussion should consist of two distinct parts.

The first part of the discussion should provide an evaluation of the design against the requirements specification. This can be done in a number of ways, through physical testing, practical testing, computational analysis, user trials. The section should provide some detailing on the testing undertaken and their results. A balanced evaluation is needed as to whether or not the design meets the requirements and what steps could be taken to improve it in the future.

In a conventional Technical Report, there would be:

* a Methods section highlighting the techniques used in testing,
* a Results section relaying the data collected and
* a Discussion offering an opinion based on the results.

You may want to consider including sub-sections that follow this structure, it should be noted that the results section contains the facts whilst the discussion contains the opinion and these would be kept separate.

The second part of the discussion should focus on the group dynamic, how well the team worked together, how meetings and design decisions were organized and what would be changed if you went through the process again. This section should be reflective by nature and balanced, the aim of DAPP2 is not to create an amazing device but to experience the process of designing something, by reflecting on the process you assimilate the knowledge you have gained during the module and hopefully build on it in the future.

End the discussion with a single paragraph of conclusions as a final summary of the project, was the aim met and how does the result fit within the big picture?

References

Details should be provided here of any source material that is referenced in the main text, this allows the reader to follow up on your work and it acknowledges the work of others which you have used (failure to properly reference and cite can results in charges of plagiarism).

Referencing is not a way to convince the reader that you have read a lot, only reference the papers that are relevant to your own argument and only cite papers that you have actually read.

References should contain papers explicitly cited in the text, while a bibliography may contain books that have been read but not explicitly cited in the work.

One method of referencing a variety of materials is to use a number based system such as IEEE or Vancouver; this can be achieved using the insert citation feature within Word. For example:

Previous studies into the composite structure of moon rock suggest that it comprises on 67% cheese [1].

[1] Wallace et al. “A study of moon cheese following a grand day out” Journal of Aardman 2015,4, pages 12-16.

Scientific reports that reference purely scientific journal papers may use Harvard or Chicago style referencing that use the lead author as the citation (e.g.: Previous studies into the composite structure of moon rock suggest that it comprises on 67% cheese (Wallace 2015)); however, this can be more difficult if you are also to reference websites, technical guides etc.

For more information on referencing go to:

<https://www.imperial.ac.uk/admin-services/library/learning-support/reference-management/what-is-referencing/>

Appendices

The appendices are used to locate information to which the main text may refer, but which would prove unwieldy if it were to be included in its entirety in the main body. Such items included in the section should be:

* A breakdown of the project management structure
* An analysis of the risks associated with the design
* Ethical considerations
* Bill of Materials
* Nomenclature

Other elements that can be included in the appendices include:

* Detail design drawing
* Electrical schematics
* Manufacturing plan
* (Code repositories)

This is not an exhaustive list, just some of the aspects that may be included.

Items in the Appendix should be referenced in the main text at some point, to justify including them in the document at all.

Appendix A – Project Management

This should contain a general description of the team structure, the distribution of responsibilities and a Gantt chart of the project plan.

Appendix B – Risk Management

This should focus on the foreseeable risks associated with the design of the device. An example is given below.

Each risk/failure should be listed in the “Detailed Risk Analysis” below. Describe the failure and possible resulting effects; rate the probability of its occurrence, the severity, and the probability to detect the failure. Describe preventing measures and rate the failure again.

Examples of possible hazards are listed below (based on ISO14971):

|  |  |  |  |
| --- | --- | --- | --- |
| **Examples of energy hazards** | **Examples of biological and chemical hazards** | **Examples of operational hazards** | **Examples of information hazards** |
| **Electromagnetic energy**  Line voltage  Leakage current  enclosure leakage current  earth leakage current  patient leakage current  Electric fields  Magnetic fields  **Radiation energy**  Ionizing radiation  Non-ionizing radiation  **Thermal energy**  High temperature  Low temperature  **Mechanical energy**  Gravity  falling  suspended masses  Vibration  Stored energy  Moving parts  Torsion, shear and tensile  Force  Moving and positioning of pilot  **Acoustic energy**  ultrasonic energy  infrasound energy  sound | **Biological**  Bacteria  Viruses  Other agents (e.g. prions)  Re- or cross-infection  **Chemical**  Exposure of airway, tissues, environment or property, e.g. to foreign materials:  acids or alkalis  residues  contaminates  additives or processing aids  cleaning, disinfecting or testing agents  degradation products  medical gasses  anaesthetic products  **Biocompatibility**  Toxicity of chemical constituents, e.g.:  allergenicity/irritancy  pyrogenicity | **Function**  Incorrect or inappropriate  output or functionality  Incorrect measurement  Erroneous data transfer  Loss or deterioration of function  **Use error**  Attentional failure  Memory failure  Rule-based failure  Knowledge-based failure  Routine violation | **Labelling**  Incomplete instructions for use  Inadequate description of performance characteristics  Inadequate specification of intended use  Inadequate disclosure of limitations  **Operating instructions**  Inadequate specification of accessories to be used with the device  Inadequate specification of pre-use checks  Over-complicated operating  Instructions  **Warnings**  of side effects  of hazards likely with re-useof single-use medicaldevices  **Specification of service and maintenance** |

**Critical Risk Priority Number**

During the risk analysis, each risk or failure is analysed and rated with respect to its severity (S), probability of occurrence (O), and detection rate (D). The rating for each of the three aspects ranges from 1 (low security risk/failure, low probability of occurrence, high detection probability) to 10 (severe injuries or death, high probability of occurrence, no/low probability for detection). The product out of these three ratings is called Risk Priority Number (RPN). In case, the RPN is greater than a critical threshold, preventing measures are required in order to reach a final RPN below or equal to the critical threshold by means of reasonable and justifiable security measures.

Define a critical threshold in this section here – we recommend a critical **RPN threshold of 75**.

In case, the risk is greater than the critical threshold the risk **must clearly be mentioned** in the “declaration of agreement” signed by the pilot and involved staff.

**Factors of the Risk Priority Number (RPN)**

Find below a recommendation how to rate occurrence, severity, and detection. The “Risk Priority Number before ”is a mathematical product of the numerical Severity- (S), Occurrence- (O), and Detection-Ratings (D) obtained before applying any preventing measures to reduce the likelihood for dangerous incidents, thus: **RPN before = (S1) x (O1) x (D1)**. This “RPN before” should be set to prioritize items that require additional quality planning or action.

The “RPN after” is a mathematical product of the numerical Severity- (S), Occurrence- (O), and Detection-Ratings (D) obtained after applying the preventing measures to reduce the likelihood for dangerous incidents, i.e. **RPN after = (S2) x (O2) x (D2)**. The “RPN after” has to be equal or below the predefined threshold in order to guarantee safe use of the part/element/device.

Preventing measures are mechanisms that prevent the cause of the failure mode from occurring or that detect the failure and stop the application before an incident can happen. It could also reduce the severity by e.g. designing softer and rounder edges. Preventing measures could include specific inspection, testing or quality assurance procedures; selection of other components or materials; de-rating; limiting environmental stresses or operating ranges; redesign of the item to avoid the failure mode; monitoring mechanisms; performing preventative maintenance; or inclusion of back-up systems or redundancy.

*S – Severity*

|  |  |  |  |
| --- | --- | --- | --- |
| **Rating S** | **Criteria: Severity of effect** | **Consequence** | **Treatment** |
| 10 | Death | - | - |
| 9 | Quadriplegia | Life-long medical care necessary / coma / permanent damage | Hospital stay |
| 8 | Amputations, paraplegia, blindness, deafness, traumatic brain injury (severe), fourth-degree burns | Life-long medical care necessary / coma / permanent damage | Hospital stay |
| 7 | Complex fractures, open fracture, inner injuries, traumatic brain injury (severe), third-degree burns | Permanent damage possible | Hospital stay |
| 6 | Gash, fractures, torn muscles, articular cartilage injury, traumatic brain injury (moderate), second-degree burns | Permanent damage possible | Hospital stay |
| 5 | Gash, fractures, torn muscles, articular cartilage injury, traumatic brain injury (mild), second-degree burns | Reversible injury | Hospital stay or ambulant treatment |
| 4 | Severe cuts, severe scratches, severe contusions, strains, first-degree burns | Reversible injury | Ambulant treatment or self-treatment |
| 3 | Minor cuts, minor scratches, minor contusions, stiff muscles, tension, blisters, excoriations, sickness, first-degree burns | Discomfort during application up to three days after application | Self-treatment |
| 2 | Slight sickness, pressure marks | Discomfort | - |
| 1 | No harm | - | - |

*O – Occurance*

|  |  |
| --- | --- |
| **Rating O** | **Criteria: Probability of occurrence** |
| 10 | Occurs or may occur very likely during every use of the session |
| 9 | Occurs or may occur likely during every use of the session |
| 8 | Occurs in 1 of 5 sessions (less than once a day) |
| 7 | Occurs in 1 of 10 sessions (less than once a day) |
| 6 | Occurs in 1 of 50 sessions (less than once half a month) |
| 5 | Occurs in 1 of 100 sessions (less than once a month) |
| 4 | Occurs in 1 of 500 sessions (less than once half a year) |
| 3 | Occurs in 1 of 1000 sessions (less than once per year) |
| 2 | Occurrence very unlikely |
| 1 | Occurrence nearly impossible |

*D – Detection*

|  |  |
| --- | --- |
| **Rating D** | **Criteria: Likelihood of detection by design control** |
| 10 | No chance of detection |
| 9 | Very remote chance of detection |
| 8 | Remote chance of detection |
| 7 | Very low chance of detection by indirect methods (hardware or software) |
| 6 | Low chance of detection by indirect methods (hardware or software) |
| 5 | Moderate chance of detection by indirect methods (hardware or software) |
| 4 | High chance of detection by indirect methods (hardware or software) |
| 3 | High chance of detection by direct or indirect methods (hardware/software) |
| 2 | Direct and indirect detection: Hardware or software |
| 1 | Direct detection: Hardware or safe software (category 4, performance level e) |

**Risk Analysis**

| **Assembly** | **Failure & Effect** | S1 | O1 | D1 | **RPN before** | **Preventing measures** | S2 | O2 | D2 | **RPN after** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

Appendix C – Ethics

Ethics can be considered as the standards of conduct which provide guidelines for research and analysis of complex issues. These standards help researchers coordinate their work to ensure there is trust in their aims and output, that there is value in collaborative developments and accountability to both the public and general moral values.

Codes of ethics will typically address the following aspects:

* Honesty
* Objectivity
* Integrity
* Carefulness (preventing errors or negligence)
* Openness (sharing information)
* Respecting Intellectual Property
* Confidentiality
* Responsible publication
* Responsible mentoring
* Respect for colleagues
* Social responsibilities
* Non-discrimination
* Competence
* Legality
* Animal Care
* Human Subjects Protection

It may not be necessary for your ethical considerations to contain all if these, but some will come into the assessment of your work, particularly if it involves user trials.

Appendix D – Bill of Materials

A breakdown of the costs of the final product.

Appendix E – Nomenclature

This is a list of the terminology and abbreviations that may need explaining to the reader.