Electronics and Computer Science

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Technical Writing: Background & Theory

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Background and/or Theory

The first core section of a piece of technical writing.

Notes are taken for this section throughout the course of carrying out your work.

Final version is written after all sections pertaining to your contributions and before Introduction and Conclusions

What is this section for?

This section can be a review of the technical field in which your work fits, a general literature review for high level projects and/or a review of theory necessary to understand your work.

Might be multiple sections depending on the best way to compartmentalise the information you ***need*** to present.

As such there are three key features:

- Reviews the field in detail (not necessarily exhaustively)
- Contains all information necessary to understand the work presented in the report
- Also contains references to all material necessary to understand the information presented in this section

As a result, this is the section that contains citations to the majority of the reference material.

What purpose does it serve? #1

A demonstration that you have considered and understand all relevant practical and/or theoretical aspects of the field of work.

This are several important aspects to this:

- It provides adequate information for the reader to educate themselves in the field of the work with a guide to the reference material. It is in this case an expansion of the context in the Introduction or rather the Introduction is a distillation of this section.
- It provides a baseline state-of-the-art statement – when read at a later date, when the field has moved on with new contributions, your work can be seen in the correct light.
- It is a demonstration of scholarship on your part – i.e the first situation where you can demonstrate CRITICAL ANALYSIS. This is where you make value judgements rather than just accept what you are told.
- These value judgements are an important part of enabling the reader to understand your work, example…

What purpose does it serve? #1

Let's say that you are designing a new low power signal processing circuit, you will want to say that yours is better (ideally).

In order for you to make this statement (which occurs later in your report), you will have to JUSTIFY or PROVE it:

- This requires knowledge (given by you to the reader) of the state of the art
- You must collect all relevant references
- Compare, standardise and tabulate data (for easy reader access)
- Make critical statements of the capabilities of previous designs and why they are not adequate

This critical judgement is a valuable (possibly essential) skill in engineering and/or industry in general. It develops with practice.

What purpose does it serve? #2

This section also presents all the background material immediately relevant to your work, such as:

- Reasons for design decisions and the establishment of requirements
- Formulas or theorems used in the design or analysis stages of your work
- The information necessary to establish performance indicators
- Technical outlines of experimental methods

This second aspect gives the reader a quick reference to necessary material immediately.

The corollary of this is (of course) there should be no UNNECESSARY material.

Example

means of objectively measuring and receiving feedback on the weight being exerted through their affected limb. Such an instrumented crutch differs from those previously researched and developed for PWB by being less invasive (no additional equipment is required to be attached to the patient or their footwear, as all electronics is contained within the crutch), and being used for both clinical training and long-term in-home monitoring.

2. Concept and system architecture

Through consultation with clinicians at Southampton General Hospital, it was specified that the primary aim of an instrumented crutch would be to assist in both training and long-term monitoring of a patient's PWB programme. The secondary aim was to infer information about how the patient is using the crutch. The system should augment a standard low-cost pair of forearm crutches, thus dictating the use of off-the-shelf components. The low-cost requirement also typically infers a low level of accuracy. However, in this application the required level of accuracy was identified to be <5%, a level which would provide a significant patient benefit over existing methods and systems. Any improvement in this accuracy is likely to be unnecessary, as alternative measurement errors are likely to become predominant as a result of the force distribution through the bones and soft tissues. It was also stressed however that the system needed to be easy to use and simple to configure in order for it to achieve acceptance by both patients and clinicians alike. Figure 1 shows the uses of the crutch, including real-time observation of data by the clinician (to train patients how to use the crutch) and to provide real-time biofeedback to the patient (encouraging them to consistently put the recommended weight through the limb). Clearly, a wireless, low-power, small and lightweight system is essential for such an application.

To achieve the primary aims (monitoring PWB), it was realized that the crutch should monitor the magnitude of the force translated through the axis of the crutch ($|F_c|$ in figure 1) thus allowing the weight-bearing of the affected limb to be estimated. The secondary aims of the system require the measurement of the crutch tilt (the angles between the crutch and the ground parallel and perpendicular to the walking direction, i.e. the pitch, θ, and roll, φ, components of the unit vector $\hat{F}_c$), and an indicative measurement of the patient's grip pattern—implemented through identifying the position (d) at which the grip force (F_h) is applied to the handle.

3. The instrumented crutch

This section describes the various hardware and software components of the instrumented crutches. One crutch acts as a master; the master crutch receives data from the other crutch, referred to as the slave, and processes the data to provide biofeedback to the patient via an audible buzzer.

3.1. Hardware architecture

The hardware consists of low-cost sensors integrated into the crutch for measuring $|F_c|$, θ, φ and d, and a low power embedded microcontroller and radio transceiver to sample, process and communicate data between the crutches and back to the host computer. The crutches were developed using commercial off-the-shelf (COTS) components in order to minimize the potential cost. As is visible in figure 2, the crutch hardware is currently in prototype; it is envisaged that all hardware (batteries, cabling, sensors and circuitry) can all

Reference style

Just as a note, the reference style that you use in your technical writing is often heavily influenced by this section.

Whether or not you use numbers (Vancouver) or names (Harvard) largely depends on the material that you are conveying in this section and whether there are many many references or just a small number of key players.