



## The Internet of Things – The future or the end of mechatronics



David Bradley<sup>a,\*</sup>, David Russell<sup>b</sup>, Ian Ferguson<sup>a</sup>, John Isaacs<sup>c</sup>, Allan MacLeod<sup>a</sup>, Roger White<sup>d</sup>

<sup>a</sup> Abertay University, Bell Street, Dundee DD1 1HG, UK

<sup>b</sup> Penn State Great Valley, 30 E Swedesford Rd, Malvern, PA 19355, USA

<sup>c</sup> Robert Gordon University, Garthdee House, Aberdeen AB10 7QB, UK

<sup>d</sup> RC2 Inc., Ridgeway, Ontario, Canada

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### ABSTRACT

The advent and increasing implementation of user configured and user oriented systems structured around the use of cloud configured information and the *Internet of Things* is presenting a new range and class of challenges to the underlying concepts of integration and transfer of functionality around which mechatronics is structured. It is suggested that the ways in which system designers and educators in particular respond to and manage these changes and challenges is going to have a significant impact on the way in which both the *Internet of Things* and mechatronics develop over time. The paper places the relationship between the *Internet of Things* and mechatronics into perspective and considers the issues and challenges facing systems designers and implementers in relation to managing the dynamics of the changes required.

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### 1. Introduction

The concept of mechatronics was introduced nearly 50 years ago in order to express and reflect the increasing use of computers such as the PDP series for the control of a range of essentially mechanical processes and systems [1–3]. Further, the introduction and increasing availability at reducing cost of integrated circuit technologies, and the advent of the first microprocessors, offered the potential to create new forms of integrated electronics which would form the core of new and novel systems in applications such as manufacturing and vehicle technologies and result in new ranges and types of consumer goods such as the Sony Walkman [4].

Fig. 1 shows the results of a simple search on Google Scholar for the number of articles incorporating either or both of ‘mechatronic’ or ‘mechatronics’ in their title in the period from 1969 to 2013. Fig. 2 shows the results of a similar but more sophisticated search using *Web of Knowledge* and *IEEE Xplore*. Taken together, these figures clearly show that the development of the mechatronics concept as an integrating theme or philosophy within product and system design did not really come to the fore until the early 1980s. Around the same time more sophisticated microprocessors, along with other electronic components such as Field

Programmable Gate Arrays (FPGAs), became available and enabled the development of increasingly complex and powerful mechatronic systems, facilitating their introduction into a range of consumer goods, vehicles and manufacturing technologies.

It was also around this time that academic programs and courses, at both the masters and undergraduate levels, in mechatronics began to be introduced on a significant, and worldwide, basis.

Thus, by the end of the 1980s, the underlying concepts of mechatronics were perhaps felt to have been defined, and that it was then more a matter of establishing rather than developing the discipline [1,5–10].

Subsequent years, and in particular developments in information technology and electronics, have suggested that this view was misplaced and that instead of consolidating around a specific expression of the mechatronics concept, there has been an increasing diversification of both content and concept. This can be seen by reference to Fig. 3 which shows the spread of topics identified as mechatronic in a keyword search using *Web of Knowledge* and *IEEE Xplore*.

The differential rate of development in the core mechatronic subjects of information technology, electronics & computing and mechanical engineering is then suggested by Fig. 4. Though this figure is highly subjective, and indeed personal, in nature, the extent of development since the inception of the mechatronics ideology can perhaps best be illustrated by the comparison of

\* Corresponding author.

E-mail addresses: [dabonipad@gmail.com](mailto:dabonipad@gmail.com), [d.bradley@abertay.ac.uk](mailto:d.bradley@abertay.ac.uk) (D. Bradley).

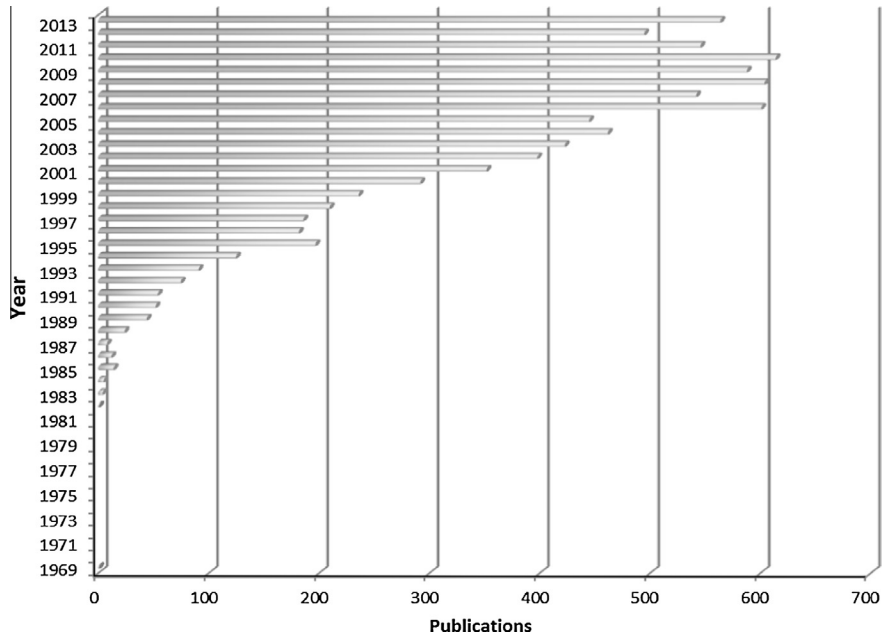


Fig. 1. The results of a search on *Google Scholar* for articles with either or both of 'mechatronic' or 'mechatronics' in their title in the period 1969–2013.

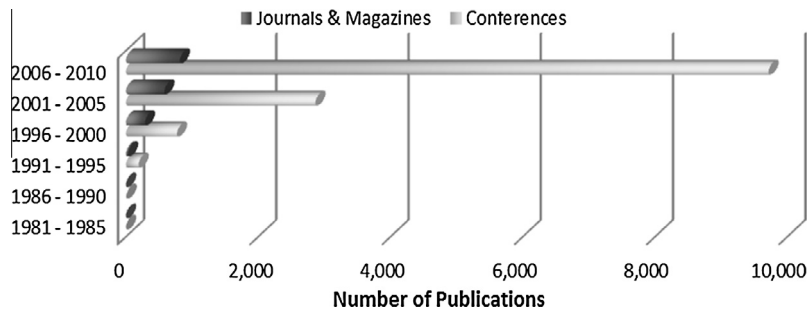


Fig. 2. The results of a search using *Web of Knowledge* and *IEEE Xplore* for articles with either or both of 'mechatronic' or 'mechatronics' as a keyword in the abstract in the period 1981–2010.

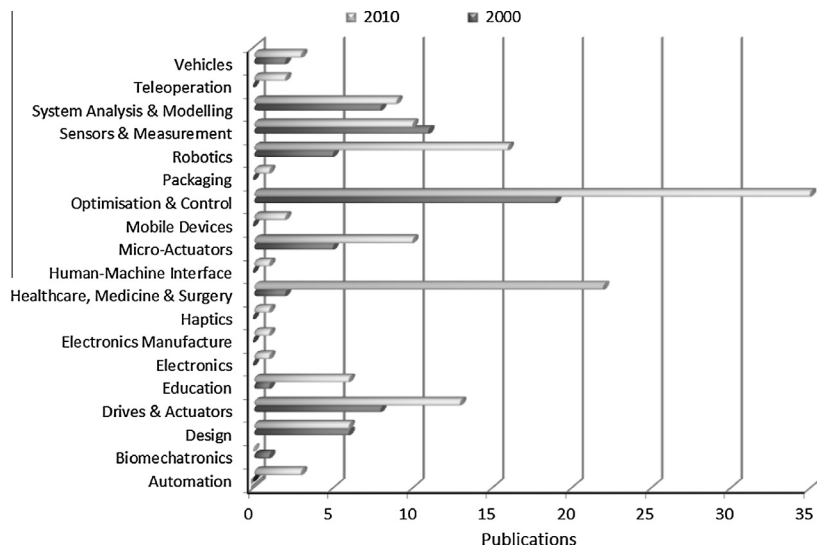


Fig. 3. Mechatronics subject areas derived from a keyword search using *Web of Knowledge* and *IEEE Xplore* for the years 2000 and 2010.

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