

# JOB POSTING

## Auto-ID Centre Europe

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**TO:** Public

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### BACKGROUND

#### Cambridge University Engineering Department

Cambridge University Engineering Department is the top ranked Engineering Department in the UK and one of the strongest in Europe. The Engineering Department teaches and conducts research in all the main branches of engineering except for Chemical Engineering, which is a separate department. All undergraduate students take the same courses in their first two years, before specialising in their third and fourth years. The four-year course leads to the degrees B.A., M.Eng. for all branches of engineering. There are more than 1,000 undergraduate and 300 postgraduate students in the Department; the standard of both undergraduate and graduate entry is exceptionally high. For administrative purposes, the Department has a divisional structure. Division A covers acoustics, fluid mechanics, turbomachinery and thermodynamics; Division B covers electrical engineering; Division C covers mechanics and materials; Division D covers civil, structural and environmental engineering; Division E covers manufacturing and management; Division F covers information engineering, i.e. control, communications and computing.

#### Institute for Manufacturing

The Institute for Manufacturing brings together the established activities of the Manufacturing & Management Division of the Cambridge University Engineering Department, with the expertise in economic and policy issues of the former Foundation for Manufacturing & Industry in London. The Institute's aims are:

[Education](#) - Increasing the number of able people choosing manufacturing as a career through innovative education programmes.

[Research](#) - Influencing a shift towards high value-added manufacturing activity through collaborative research with industry.

[Networking and Dissemination](#) - Enhancing the economic and public profile of manufacturing through targeted networking and dissemination.

The Institute's research programmes cover the full cycle of manufacturing issues from technology and operations to strategy and public policy. Much of the work is carried out with Industry through the

Centres and Groups each of which has its own industrial and academic community. The research activity is very well connected internationally. The Centres and Groups pay particular attention to networking and dissemination and to the interpretation and preparation of their research for a range of industrial and commercial as well as academic communities.

- Manufacturing Strategy and Operations
- Business Performance
- International Manufacturing
- Technology Management
- Manufacturing Automation and Control
- Production Processes

The Division is able to draw on excellent discipline based groups in engineering, management, economics and science complementing their specialist expertise. Research programmes are invariably industrially supported and designed to deliver practical outputs often in the form of new processes and methodologies for immediate use by industry. Through its extensive national and international networks in manufacturing industry and academia the Division is uniquely well placed to draw together Research, Practice and Education in a traditionally neglected area providing interfaces between Engineering and Management, Research and Practice, Education and Application. All members of the division have strong industrial links and strong enthusiasm for industry. Industrialists find the style and priorities of the group recognisable and relevant allowing some of the strengths of the academic approach including breadth, novelty, rigour and awareness of emerging trends to be applied for the benefit of manufacturing industry.

### **Manufacturing Automation and Control Group**

Successful candidates will be part of the Manufacturing Automation and Control Group. The main business focus of the Manufacturing Automation and Control Group's activities is in understanding and improving the ability of manufacturing production to respond in the face of unpredictable disturbances & increasing change. Traditionally production performance has been assessed in terms of output under steady-state operation conditions. However, greater product variety, smaller batch sizes and frequent new product introductions, coupled with tighter delivery requirements, demand operations that are capable of performing consistently under continually changing conditions.

The technological focus of the group involves research into *co-operative* control algorithms and distributed, *reconfigurable* control systems architectures for the development of *holonic* manufacturing systems. The main rationale for this approach is that by combining more flexible algorithms for disturbance handling and more adaptable control architectures for responding to change will deliver production system support for a responsive business.

More recently the group has extended its activities into the areas of intelligent systems applications across the supply chain, examining internet based order fulfilment and the deployment of intelligent products and devices as a means of supporting a more flexible and reconfigurable means of moving and processing manufactured goods.

Applicants are referred to [www-mmd.eng.cam.ac.uk/automation](http://www-mmd.eng.cam.ac.uk/automation) for more information.

## EUROPEAN AUTO-ID CENTRE

### Cambridge

An Auto-ID Centre was established at MIT in 1999 to investigate issues associated with developing a ubiquitous electronic product coding environment to extend the current bar coding technologies in use in many industrial, retail and commercial environments today. The Auto ID Centre is a joint project involving MIT and University of Cambridge. Industrial Sponsors include Proctor and Gamble, Walmart, Gillette, Unilever, Sun Microsystems, Invensys. The project is a highly ambitious undertaking and is aiming to establish an electronic equivalent of the Bar Code through low cost electronic tagging and through appropriate networking establishing significant advances in supply chain management, manufacturing operations and retail services. A European Auto-ID Centre was been established in Cambridge in 2001 in order to undertake activities in industrial awareness, standards development and research. Dr Duncan McFarlane is the Research Director of the Centre and Helen Duce is Associate Director of the Centre with responsibilities for the business operations of the centre. The Cambridge activity is focused on the development of suitable languages which enable products to communicate with their surrounds and distributed control algorithms which support direct (decision making) interactions between products, machines and customers.

There are five principle domains of research & development within the Auto-ID Project.:

Hardware – the development of tagging and reader infrastructure to support the implementation of a low cost, ubiquitous wireless identification system

Software – development of the software and network services required to support a pervasive environment of networked, identifiable objects

Languages – the development of a unique, item level identification code and the development of a mark up language to enable a standardised means of specifying product characteristics and instructions

Control – the development of strategies for integrating auto id based information into existing control systems as well as developing fundamentally new strategies whose existence is dependent on the availability of auto id data

Application – the demonstrated application of Auto-ID based solutions in industrial, retail and domestic situations

The research work in Cambridge is centred around the latter items and will initially be structured as in

Figure 1. The Recipes/Machine Instructions section is in fact part of the Languages Research activity, but we include it here for completeness.

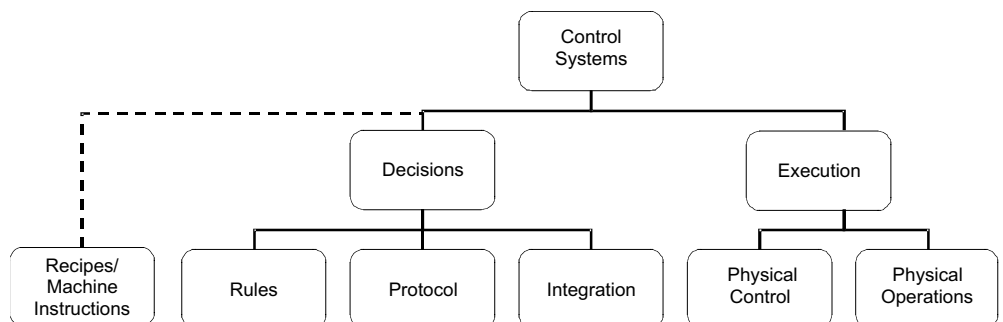


Figure 1 Auto ID Control Systems Research Structure

The activities listed in

Figure 1 are as defined as follows:

- Recipes/Machine Instructions – *the specification of a set of parameters, tasks, sequences, decision points which describes a transformation of one of more products*
- Decision - *the generation and resolution of issues encountered by auto-id based products in their manufacture, distribution, retail, use and disposal*
- Rules – *Underlying criteria used to guide and resolve automated decisions which use auto-id and other information*
- Protocol - *Mechanisms for managing distributed communications such that application of the rules can provide a distributed solution.*
- Integration - *Alignment of auto-id based information with industrial decision making and information systems*
- Execution - *methodologies for the carrying out of auto-id based decision outcomes e.g. execution of schedules, inv. Management, distribution policies*
- Physical Control – *Guidelines for the development and implementation of Auto ID Driven Control System Hardware/Software, coupled with suitable demonstration.*
- Physical Operations – *Guidelines for the design and operation of physical systems so that they best exploit advantages provided by auto-id capabilities*

As a means of illustrating the results of these developments, A 3 phased demonstration system will also be developed within the Cambridge Laboratory:

*Phase 1: Simple Auto ID driven packing and storage (conventional control)*

*Phase 2: Intelligent Auto ID driven packing and storage (enhanced control)*

*Phase 3: Intelligent Auto ID driven mini supply chain (enhanced control)*

## THE ROLE OF THE APPLICANT

### Research Associates (Senior Research Associate)

Research Associates will be given specific responsibilities for research deliverables in the above areas as well as contributing more broadly to a growing research team at Cambridge. A significant part of the role would involve collaborating with the MIT research team and interacting with industrial partners. A suitable background would include a PhD in Artificial Intelligence (esp Multi Agent Systems), Control Systems or Software Engineering along with 2-3 years industrial experience, but other relevant backgrounds would also be considered. Experience with Java programming and object oriented methods in general would be a significant advantage, as would be experience with both theoretical and applied aspects of distributed control systems. Demonstrated project management skills are highly desirable and the ability to undertake and deliver self directed work essential.

One to two appointments are currently being sought.

- One candidate will be responsible for the interfacing of Auto ID systems with new and existing industrial information systems. The candidate will lead research activities in the area of recipes and machine instructions (see Section 2) and will also be responsible for maintaining and developing the Auto ID software systems in the demonstration environments at the European centre. This candidate will be expected to interface regularly with the languages research group at MIT and with sponsoring partners such as Sun and Unilever.

- One candidate will be responsible for development and analysis of distributed intelligent control solutions which are compatible with Auto ID based data environments. The candidate will lead research activities in the application of software agents and in the development of multi agent based or holonic control environments. Prediction and analysis of performance of these environments would be undertaken and the candidate would be expected to develop software in a java based agent development environment as well as interfacing this to an industrial control network

Both appointees would report directly to Dr Duncan McFarlane and would be expected to play a role in the day to day supervision and management of members of the project as well as occasional administrative tasks

### **PhD Candidates**

PhD candidates are sought to work on theoretical issues linked to the language and distributed decision making needs associated with developing Auto ID based control systems. Candidates will also have access to state of the art laboratory and industrial automation facilities to illustrate the scope of these development, and will work closely with industrial sponsors in these demonstrations. The candidates should have a strong undergraduate degree in Industrial, Electrical, Electronic or Control Engineering or Computer Science with ideally either a Masters degree or suitable industrial experience. It is expected that successful candidates will have some of the following skills:

- Control systems: feedback systems, PLC, CNC, robot programming, discrete event systems, system modelling
- Communications: signal analysis, information filtering, sensor fusion
- Computing: object oriented methods, java programming, Linux operating systems
- Industrial engineering: factory layout, machine design

Additionally, some familiarity with Artificial Intelligence methods would be of great benefit