In this assignment, you will consider an operating system for an embedded computing application. Your task is to consider the various features of an operating system, which features you believe would be important for the embedded application, and how those features might be implemented. You are to write an essay outlining the key design decisions that you believe would be appropriate for the embedded operating system.

**Start this assignment early** as it may take some time to you to choose the device you will work with.

Embedded systems are all around us. Devices such as network routers, mobile phones, personal organisers, handheld game platforms and MP3 players are obvious examples of embedded computing – devices containing a microprocessor that runs the device. Less obvious examples include telephones, fax machines, fridges, washing machines, microwave ovens, and many other household appliances.

Firstly, you should choose an embedded system that you will discuss in this assignment. Preferably, choose a device that you own or have access to. It would probably help if you have access to the manuals for the device. Do not choose a device that is a general-purpose computing platform (such as a PC, laptop or palmtop computing device). On the other hand, do not choose a device which is too simple. A modern microwave oven, digital answering machine or DVD player is probably about the right level of complexity.

Find out as much as you can about the hardware of the embedded system that you have chosen. You are particularly interested in the interface between the embedded microcomputer and the device itself. The device will typically have hardware capabilities such as a display, input keys or buttons, specialised sensors such as the door open sensor on a microwave oven, and components controlled by the microcomputer such as the DVD drawer in a DVD player. If you can find a block diagram from the device, that would be helpful. If not, you should make some reasonable assumptions about the way the microcomputer interacts with the device. If you are unsure, you may want to choose a different device.

Here are some hints about typical hardware interfaces:

- Sensors (like a door open sensor) can be read as an input port on a microcomputer. Essentially, the microcomputer can read the status of the sensor at any point in time. There may or may not be an interrupt capability whereby the CPU can be interrupted when status of the sensor changes.
• Component controls (such as opening the DVD drawer) typically use an output port.
• The display is also an output – it may be a small LCD panel that operates as a pixel map or it may be a segment display where the microcomputer can activate the individual display elements through writing a bit pattern to an output port.

**Device selection email:** At this point, you should send Len an e-mail in which you summarise the device you have selected and what you know about it. Len can then offer you some assistance as to whether he thinks it is a suitable device for this assignment. **Note:** you should submit this request for feedback **at least two weeks prior to the due date** of the assignment; otherwise, Len may not have time to give you meaningful feedback before the due date.

Once you understand the hardware environment for the microcomputer in your embedded system, then you need to turn your attention to an OS for the embedded system. Imagine that the system designer chose to use a cut-down version of Minix or Linux as the OS in their system. What features of Minix/Linux would you retain in order to support the operations of the embedded system? You will need to think about the kinds of functionality supported by the device and what requirements that will place on the OS: issues such as memory management and processes, I/O, file system and interrupt handling. What features of Minix/Linux could you remove as unnecessary for your particular embedded system?

Write an essay, three to four pages long (typed, 11 point font, double-spaced in Word for example), discussing the design of an operating system for your embedded application. In your essay, you should first discuss the nature of your embedded system and any assumptions you are making about how it operates. You should attach a copy of the block diagram of the system (if that was available) or a sketch outlining your interpretation of how the system operates. Clearly show the CPU and how it interacts with the hardware of the system. After introducing the hardware, discuss which operating system components are important for your system, and why. Also explain which operating system components are not required and why you believe that they are unnecessary. You will need to consider the sort of tasks that your system must be able to perform and how these tasks might be implemented using the operating system features that you propose to support. Remember that a design goal of embedded systems is to minimise the complexity of the system, so you should aim for the simplest design that would make it possible to implement the system that you have chosen.

You may discover that it is unclear to you whether a certain feature of the operating system is important or not for your embedded system. If so, try to explain why that particular operating system feature may be useful but also why it may be unnecessary. For example, you maybe uncertain whether your embedded system would require the operating system to support multiple user processes. In that case, you may wish to discuss those aspects of the embedded system that may benefit from multiple user processes but also discuss how you think those same features could be implemented by a single user process.
Finally, present your essay in the usual way -- stapled in the top left-hand corner without any enclosing sleeves or folders. Don't forget to use the standard assignment cover sheet. Remember that writing style (clarity, organisation, grammar and spelling) is important in written presentation so write clearly with a good structure including a suitable introduction and conclusion. If you are drawing information from technical sources, textbooks or other information sources, remember that you must cite your sources with suitable bibliography entries; if you do not cite your sources, then that is a form of plagiarism.