ECEN 5623

Homework set 1
Due 2019/01/23

1. **Provide examples of real-time embedded systems you are familiar with and describe how these systems meet the common definition of real-time and embedded.**

   An embedded system is basically a combination of hardware and software that is dedicated to perform a particular function. A real time system is a system that is bound by time i.e. it is time critical and must perform the specified tasks within the required deadline. An example of a real time embedded system that comes to mind is that of an airplane. It is an embedded system as it requires a processor for performing several operations like flight control, opening and closing of the airplane door, indoor entertainment system etc. It is also a real-time system because if the direction of the plane is not correctly maintained by steering the wings in the right direction, it could result in a crash which would be a catastrophic result. Hence, in an airplane, the tasks performed have time constraints. Other examples of real time embedded system include medical systems, military weapons, traffic control etc.

2. **Find the Liu and Layland paper and read through Section 3. Why do they make the assumption that all requests for services are periodic? Why might this be a problem with a real application?**

   In real world applications, most of the requests for services are periodic in nature. This is because it best fits majority of the implementation of various applications. For example, if we have an automatic irrigation system, the sensor data will be analyzed periodically, and the water will be supplied to the crops, according to the requirement. This is the scenario in most of the applications. Hence, in the paper, a general assumption is made that all requests for services are periodic. However, this is not always applicable to all situations especially to the ones pertaining to emergencies and sudden occurrences. For example, in a fire extinguishing system, the services are not required periodically as it involves a sudden occurrence i.e. a fire critical condition. Hence, we can say that periodic requests of services are not always applicable.

3. **Define hard and soft real-time services and describe why and how they are different.**

   A soft real time system is one in which if the deadlines are not met, it gives a result with deteriorated utility, but the outcome is not catastrophic and does not include a fatal ramification. An example would be an entertainment system which, in case, fails to function correctly, will give poor performance but it will not have a catastrophic consequence.

   A hard real time system is one, in which, if the deadlines are not met, it will result in a catastrophic outcome. An example of a hard real time system would be a flight control system. If the direction of the airplane is not correctly maintained by steering the wings in the right direction, it could result in a crash which would result in loss of lives.

   To sum it up, the difference between soft and hard real time services is as follows:

SOFT REAL TIME SERVICE	HARD REAL TIME SERVICE
• It is not time critical.	• It is time critical.
• If the deadlines are not met, it will not result in fatal consequences.	• If the deadlines are not met, it will result in fatal consequences.
• If there is no performance, then the utility of the service decreases over time.	• If there is no performance, then the utility of the service is zero or negative.
• Example: Entertainment System	• Example: Flight Control System