

Object Oriented Software Engineering

Case studies

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Agenda

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Introduction



An embedded system



An information system



A sensor-based data collection system

Introduction

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- To illustrate software engineering concepts, We use examples from three different types of systems.
- **Why?**
- software engineering practice depends on the type of systems being produced.
- This mean; we choose an appropriate example according to the concept that we want to discuss .

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An embedded system

An embedded system

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What?	This is a system where the software controls a hardware device and is embedded in that device.
Issues?	Physical size, responsiveness, power management, etc.
Example	A software system to control a medical device.

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An information system

An information system

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What?	This is a system whose primary purpose is to manage and provide access to a database of information.
Issues?	security, usability, privacy, and maintaining data integrity.
Example	a medical records system.

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A sensor-based data collection system

A sensor-based data collection system

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What?	This is a system whose primary purpose is to collect data from a set of sensors and process that data in some way.
Issues?	The key requirements of such systems are reliability, even in hostile environmental conditions, and maintainability.
Example	A wilderness weather station.

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An insulin pump control system

An insulin pump control system

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An insulin pump is a medical system that simulates the operation of the pancreas .

The software controlling this system is an embedded system, which collects information from a sensor and controls a pump that delivers a controlled dose of insulin to a user.

People who suffer from diabetes use the system.

Diabetes is a relatively common condition where the human pancreas is unable to produce sufficient quantities of a hormone called insulin.

The conventional treatment of diabetes involves regular injections of genetically engineered insulin. Diabetics measure their blood sugar levels using an external meter and then calculate the dose of insulin that they should inject.

An insulin pump control system

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The problem with this treatment is that the level of insulin required does not just depend on the blood glucose level but also on the time of the last insulin injection.

This can lead to very low levels of blood glucose (if there is too much insulin) or very high levels of blood sugar (if there is too little insulin).

Current advances in developing miniaturized sensors have meant that it is now possible to develop automated insulin delivery systems.

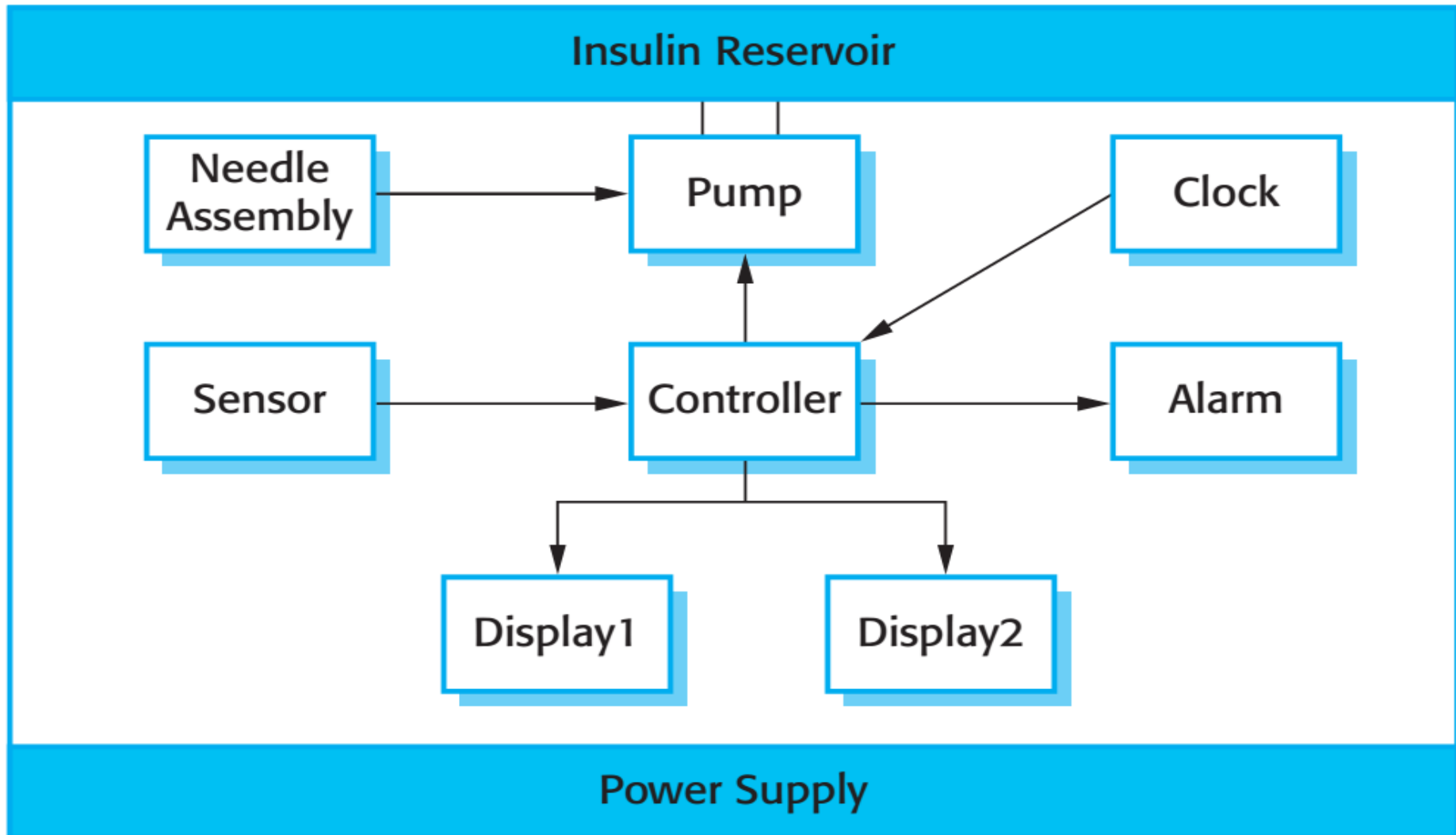
These systems monitor blood sugar levels and deliver an appropriate dose of insulin when required.

Insulin delivery systems like this already exist for the treatment of hospital patients.

In the future, it may be possible for many diabetics to have such systems permanently attached to their bodies.

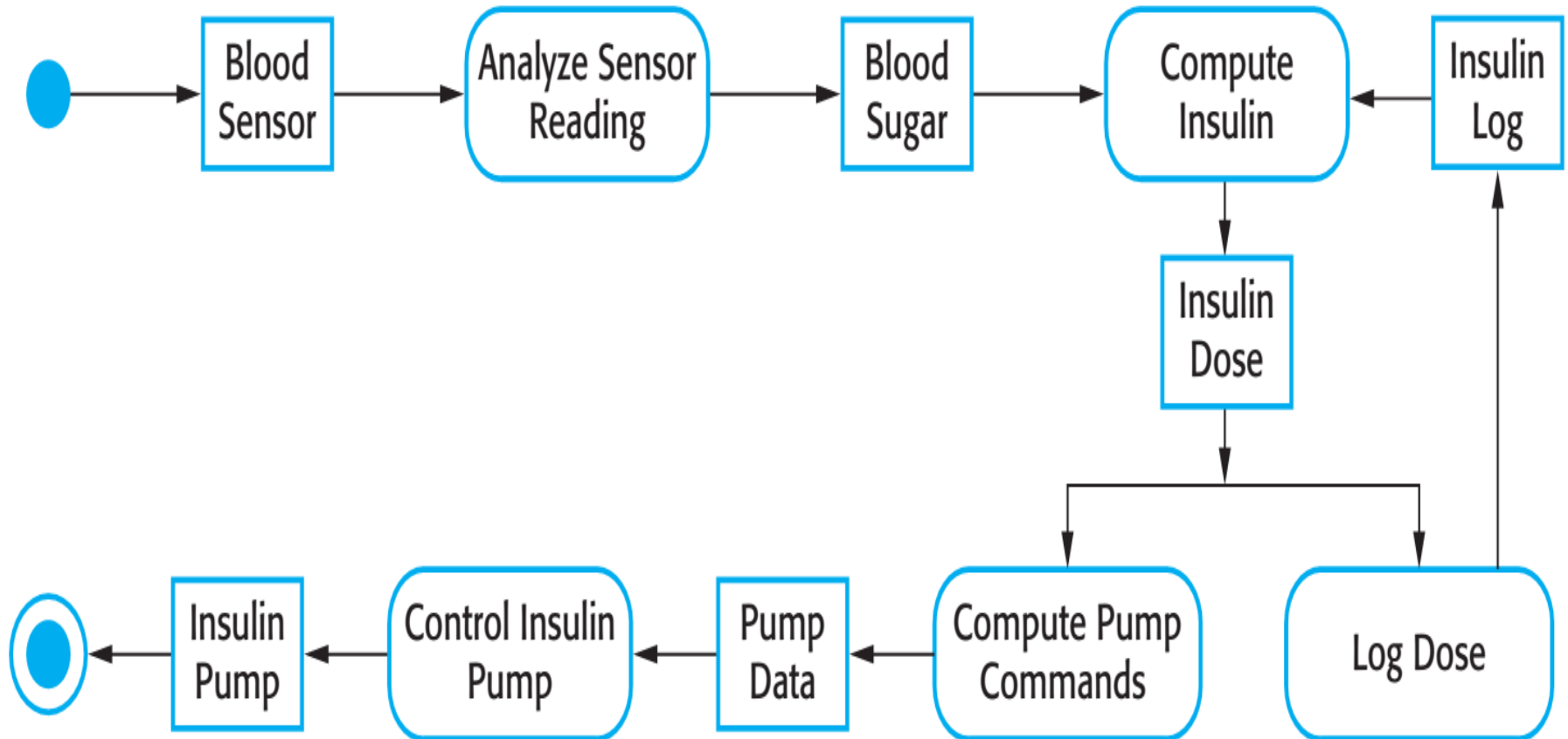
Insulin pump hardware

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Activity model of the insulin pump

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Insulin pump is a safety-critical system

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- If the pump fails to operate or does not operate correctly, then the user's health may be damaged or they may fall into a coma because their blood sugar levels are too high or too low.
- **There are, therefore, two essential high-level requirements that this system must meet:**
 1. The system shall be available to deliver insulin when required.
 2. The system shall perform reliably and deliver the correct amount of insulin to counteract the current level of blood sugar.

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A patient information system for mental health care

A patient information system for mental health care

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A patient information system to support mental health care is a medical information system that maintains information about patients suffering from mental health problems and the treatments that they have received.

Most mental health patients do not require dedicated hospital treatment but need to attend specialist clinics regularly where they can meet a doctor who has detailed knowledge of their problems.

It is an information system that is intended for use in clinics.

It makes use of a centralized database of patient information but has also been designed to run on a PC, so that it may be accessed and used from sites that do not have secure network connectivity.. .

A patient information system for mental health care

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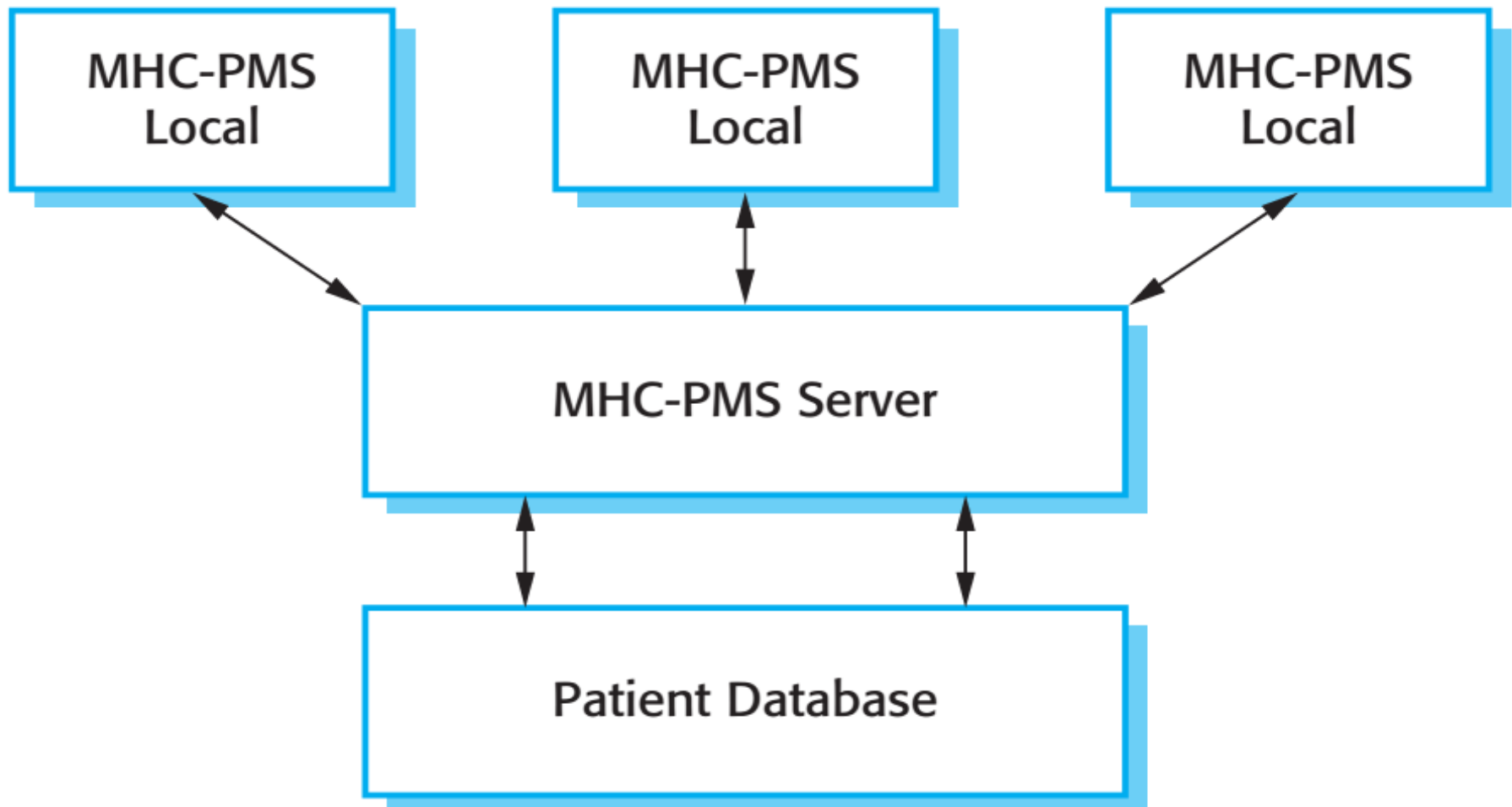
When the local systems have secure network access, they use patient information in the database but they can download and use local copies of patient records when they are disconnected.

The MHC-PMS has two overall goals:

1. To generate management information that allows health service managers to assess performance against local and government targets.
2. To provide medical staff with timely information to support the treatment of patients.


The organization of the MHC-PMS

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Mental health problems

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patients are often disorganized so may miss appointments, deliberately or accidentally lose prescriptions and medication, forget instructions, and make unreasonable demands on medical staff.

They may drop in on clinics unexpectedly. In a minority of cases, they may be a danger to themselves or to other people.

They may regularly change address or may be homeless on a long-term or short-term basis.

Where patients are dangerous, they may need to be 'sectioned' confined to a secure hospital for treatment and observation.

A patient information system for mental health care

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- Users of the system include **clinical staff** such as doctors, nurses, and health visitors (nurses who visit people at home to check on their treatment).
- **Nonmedical users** include
 - Receptionists who make appointments,
 - Medical records staff who maintain the records system,
 - And administrative staff who generate reports.

A patient information system for mental health care

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- The system is used to record information about
 - Patients (name, address, age, next of kin, etc.),
 - Consultations (date, doctor seen, subjective impressions of the patient, etc.),
 - Conditions, and treatments.

A patient information system for mental health care

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- Reports are generated at regular intervals for medical staff and health authority managers.

reports for medical staff

- focus on information about individual patients

management reports

- are anonymized and are concerned with conditions, costs of treatment, etc.

The key features of the system are:

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Individual care management

- Clinicians can create records for patients, edit the information in the system, view patient history, etc
- The system supports data summaries so that doctors who have not previously met a patient can quickly learn about the key problems and treatments that have been prescribed.

The key features of the system are:

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Patient monitoring

- The system regularly monitors the records of patients that are involved in treatment and issues warnings if possible problems are detected.
- Therefore, if a patient has not seen a doctor for some time, a warning may be issued.
- One of the most important elements of the monitoring system is to keep track of patients who have been sectioned and to ensure that the legally required checks are carried out at the right time.

The key features of the system are:

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Administrative reporting

- The system generates monthly management reports showing
 - the number of patients treated at each clinic,
 - the number of patients who have entered and left the care system,
 - number of patients sectioned,
 - The drugs prescribed and their costs, etc.

Privacy and safety-critical in MHC-PMS

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privacy

- It is essential that patient information is confidential and is never disclosed to anyone apart from authorized medical staff and the patient themselves.

Safety

- Some mental illnesses cause patients to become suicidal or a danger to other people. Wherever possible, the system should warn medical staff about potentially suicidal or dangerous patients.

Privacy and availability conflict

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- There is a potential conflict because of:

Privacy is easiest to maintain when there is only a single copy of the system data.

However, to ensure availability in the event of server failure or when disconnected from a network, multiple copies of the data should be maintained.

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A wilderness weather station

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- SOFTWARE ENGINEERING,
ninth edition, Ian Sommerville

Assignment #2

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- Complete chapter 2 in your SRS.
- Send it

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Thanks