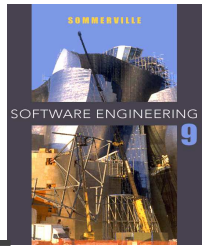
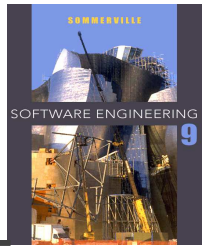


3 Case Studies

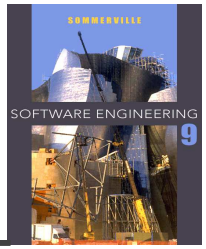
Case studies



- A personal insulin pump
  - An embedded system in an insulin pump used by diabetics to maintain blood glucose control.
- A mental health care patient management system
  - An information system used to maintain records of people receiving care for mental health problems.

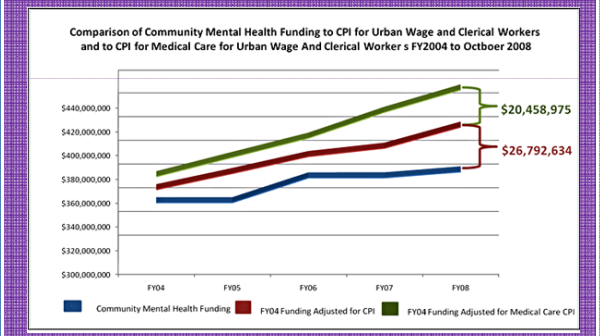
    (Transaction Processing System, Decision Support System, Management Information System)
- A wilderness weather station
  - A data collection system that collects data about weather conditions in remote areas.

3 Case Studies



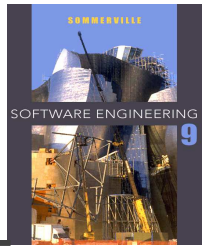
Insuline Pump

Mental Health Care Patient Management System



Wilderness Weather Station

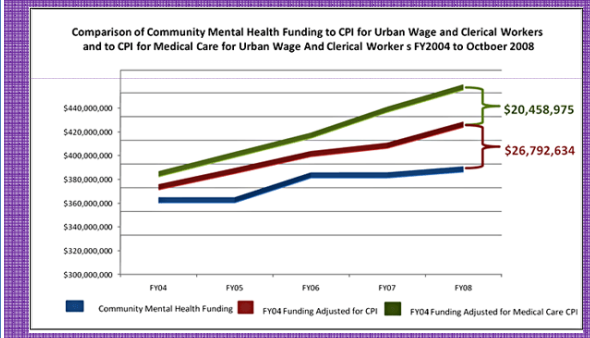
3 Case Studies



Insuline Pump

Embedded System

Mental Health Care Patient Management System

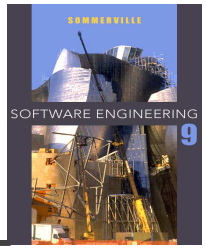


Information System

Wilderness Weather Station

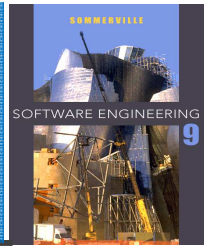
Data Collection System

CASE STUDY 1: Insulin pump control system



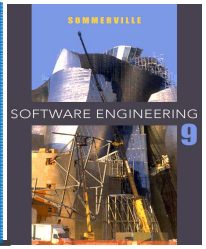
- Collects data from a blood sugar sensor and calculates the amount of insulin required to be injected.
- Calculation based on the rate of change of blood sugar levels.
- Sends signals to a micro-pump to deliver the correct dose of insulin.
- Safety-critical system as low blood sugars can lead to brain malfunctioning, coma and death; high-blood sugar levels have long-term consequences such as eye and kidney damage.

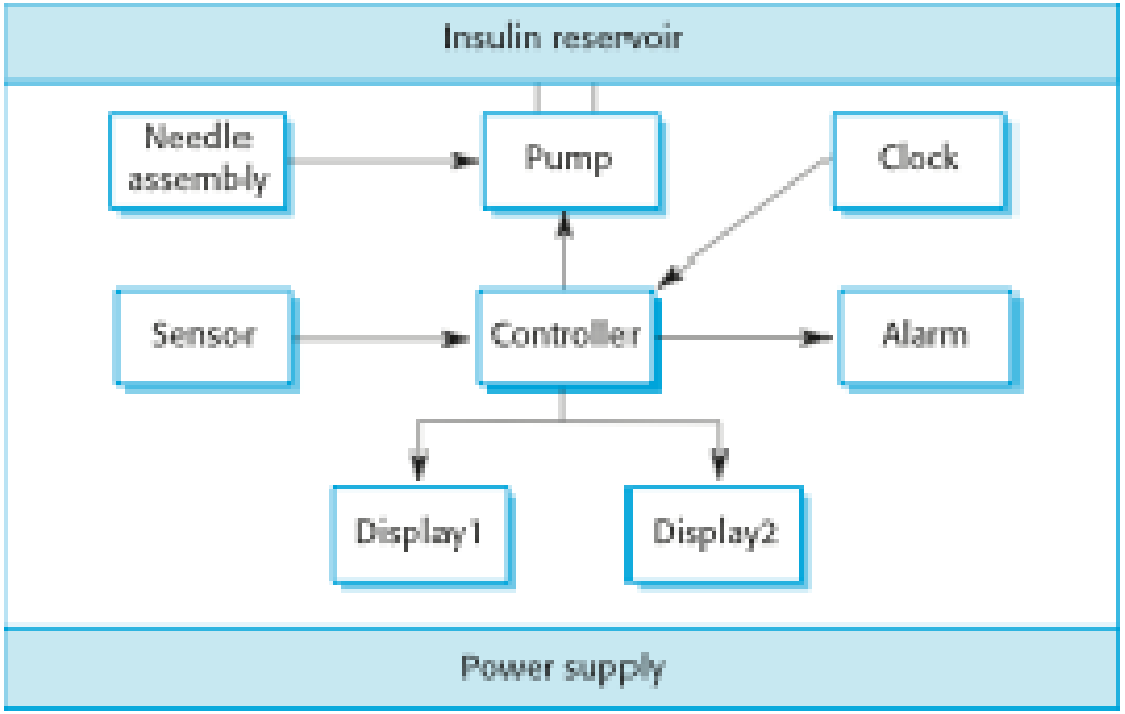
CASE STUDY 1: Insulin pump control system



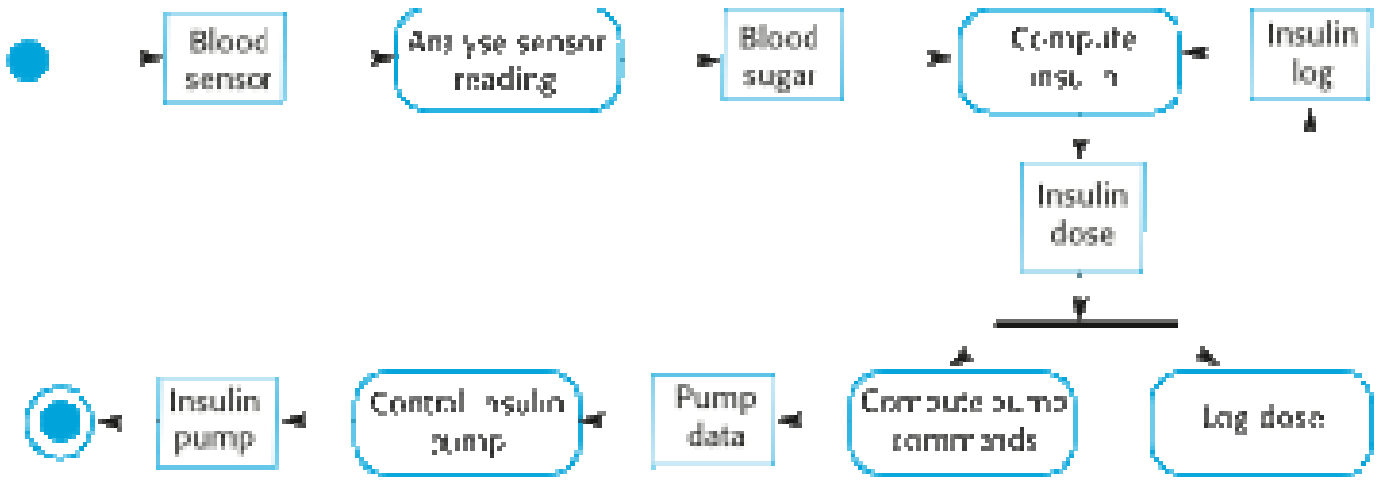
An embedded system used by diabetics to maintain blood glucose control.

Insulin pump hardware architecture

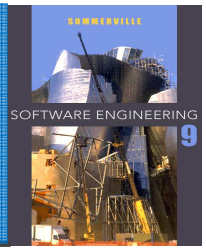




Activity model of the insulin pump

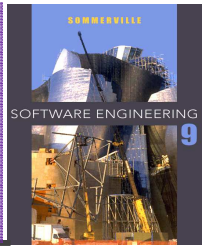


Essential high-level requirements

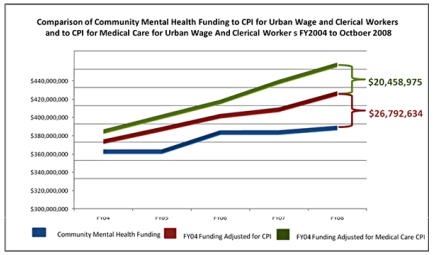


- Safety critical system
- Essential high-level requirements:
  - Availability
  - Reliability / Accuracy

CASE STUDY 2: MHC-PMS



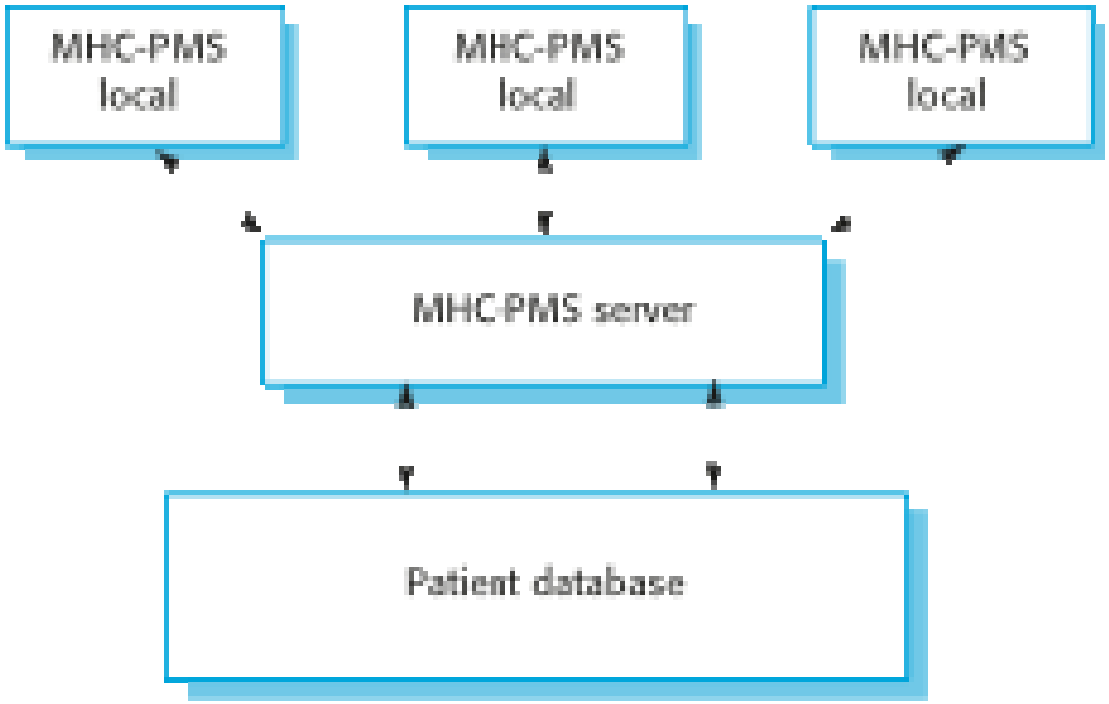
- **M**ental **H**ealth **C**are-**P**atient **M**anagement **S**ystem
- Information system for use in clinics.



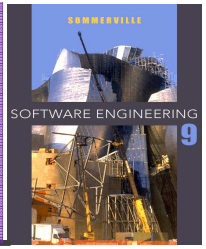
- Centralized database

  (patient info, medication, treatment received)
- PC for easy accessibility
- DB when secure network access, local copies otherwise

The organization of the MHC-PMS



3 Key Features:



- ✧ Individual Care Management

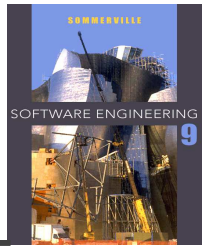
  CRUD, data summary

- ✧ Patient Monitoring

  e.g. warning if formerly scheduled patient misses check

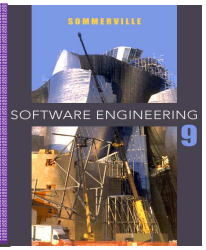
- ✧ Administrative Reporting

MHC-PMS key features



- Individual care management
  - create, edit and view patient records
  - data summaries
- Patient monitoring
  - Monitors records
  - issues warnings
- Administrative reporting (monthly management reports)
  - number of patients treated per clinic,
  - number of patients who entered / left system
  - drugs prescribed and costs

Essential High-level Requirements:

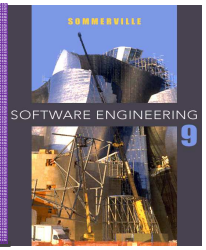


There are laws about privacy and compulsory detention

Essential requirements:

- ✧ Privacy (Security)
- ✧ Safety (through reliability and availability)

Essential High-level Requirements:



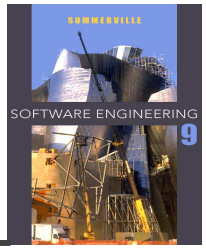
There are laws about privacy and compulsory detention

Essential requirements:

- ✧ Privacy (Security)
- ✧ Safety (through reliability and availability)

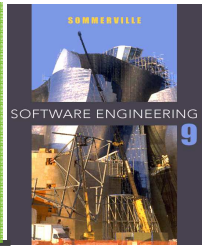
security vs availability

MHC-PMS concerns



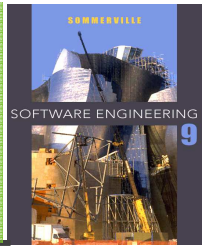
- Privacy
  - It is essential that patient information is confidential and is never disclosed to anyone apart from authorised medical staff and the patient themselves.
- Safety
  - Some mental illnesses cause patients to become suicidal or a danger to other people. Wherever possible, the system should warn medical staff about potentially suicidal or dangerous patients.
  - The system must be available when needed otherwise safety may be compromised and it may be impossible to prescribe the correct medication to patients.

CASE STUDY 3: Wilderness weather station

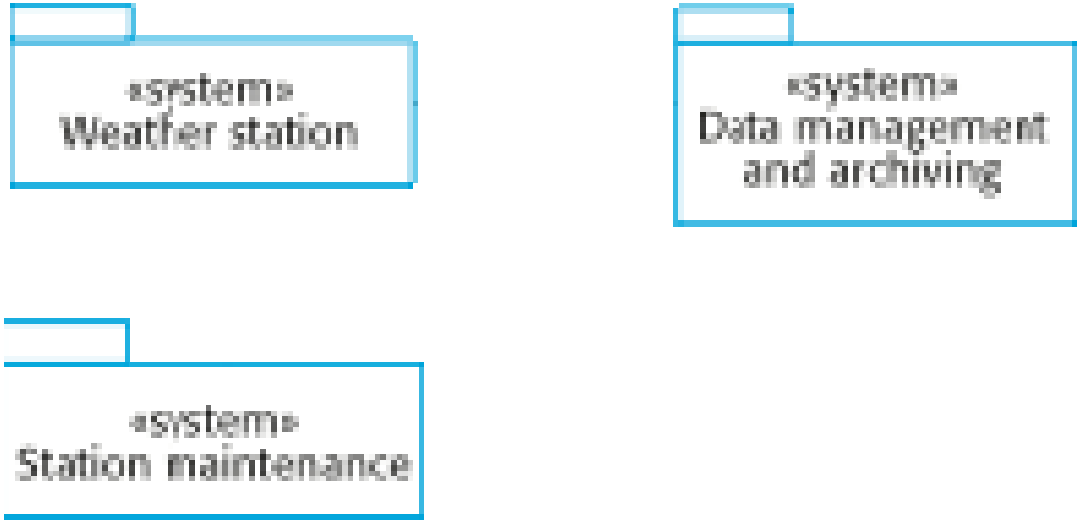


- Hundreds of weather stations in remote area
- Weather stations collect data from instruments that measure temperature, pressure, sunshine, rainfall, wind speed and wind direction.

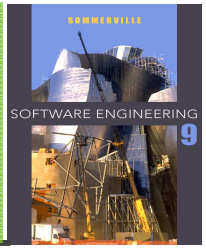
The weather station's environment



Part of a larger system



The weather station's environment



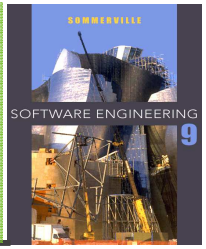
*) Collects weather data
*) Initial data processing
*) Transmits data

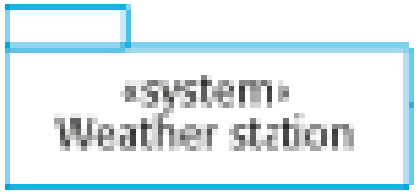
«system»
Weather station

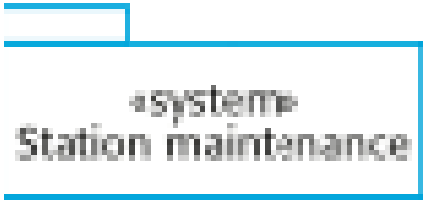
«system»
Data management and archiving

«system»
Station maintenance

The weather station's environment

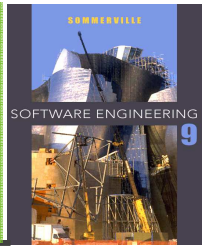


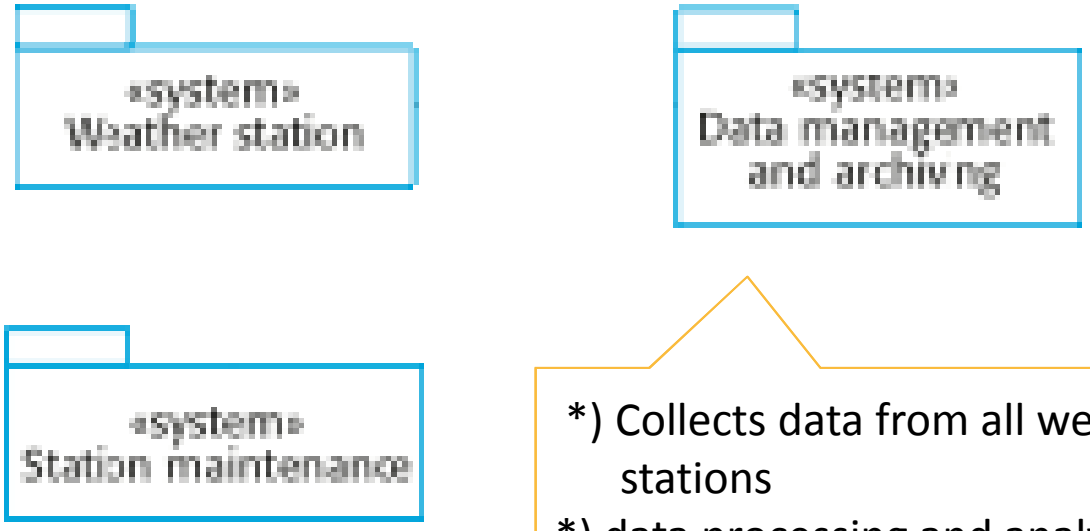




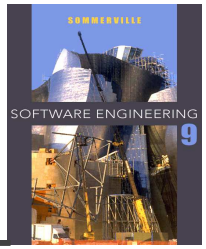
*) Monitors weather stations via satellite and provides reports
*) Update embedded software
*) Can remotely control weather stations

The weather station's environment





Functionality required from software:



- Data Collection
- Monitor the instruments, power and communication hardware and report faults to the management system.
- Manage the system power,
  ensuring that batteries are charged,
  that generators are shut down in bad weather
- Support dynamic reconfiguration
  parts of software replaceable with new versions
  backup instruments switched into system when needed