



U. S. Department of
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Diabetes Management in Home Environment

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Diabetes and Insulin Pumps



- ◆ Type-1 Diabetes
 - ◆ Pancreas cannot produce insulin to control blood glucose
 - ◆ 3 million patients in US, 300K of them use insulin pumps (2009).
- ◆ Continuous subcutaneous insulin pumps
 - ◆ Provide continuous insulin replacement
 - ◆ Basal (low rate continuous insulin delivery)
 - ◆ Provide corrective insulin delivery
 - ◆ Correction bolus: bring high BG to normal
 - ◆ Food bolus: cover carbohydrates in meal
 - ◆ Limitations:
 - ◆ Patients operate pumps without supervisions
 - Over-infusion / Under-infusion
 - ◆ Regular fingerstick tests required to detect BG levels

Insulin Pump and Glucose Sensor



◆ Glucose sensors

- ◆ Subcutaneous / Implantable
- ◆ Support continuous BG monitoring
- ◆ Save the trouble of fingerstick tests
- ◆ Some can directly *talk* to insulin pumps



◆ Insulin pump calculates bolus dose based on BG readings from the sensor

◆ Multiple glucose sensors

- ◆ Single sensor guarantees only 85% accuracy
- ◆ Clinical studies show that using multiple glucose sensors can significantly improve sensor data accuracy

Safety Concerns



◆ Communication Failures

- ◆ One sensor: how to decide BG readings when the communication with the sensor fails?
- ◆ Multiple sensors: how to decide the average BG readings if the communication with one/more sensors fails?

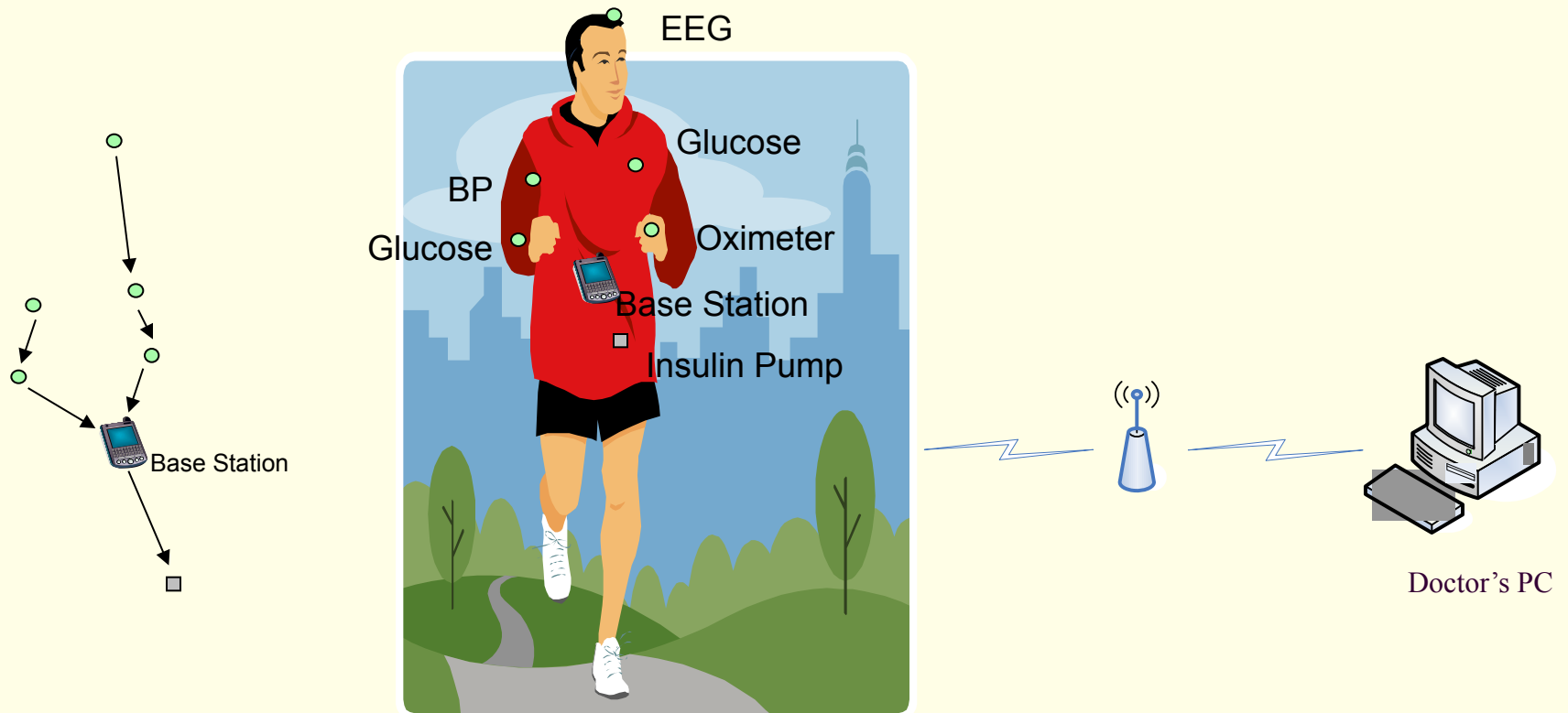
◆ Electromagnetic Compatibility Issues

- ◆ Open to various radiation sources
 - Device Performance, Interaction between pump and sensor
- ◆ Upset other devices worn by the user

◆ Other Environmental Issues

Humidity, temperature, vibration, dust ...

Interoperable Diabetes Management System



○ Physiological sensors

□ Actuators

◆ Introduce physiological sensors:

Detect severe hypoglycemia, decision support

◆ Telemedicine via wireless communications

Thank You !