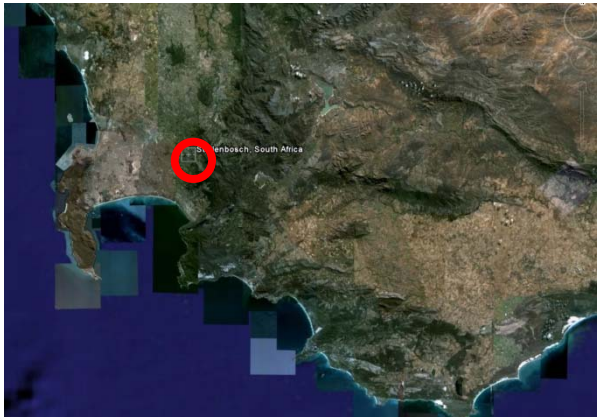
Cornie Scheffer
Biomedical Engineering
Stellenbosch University

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

Where are we?

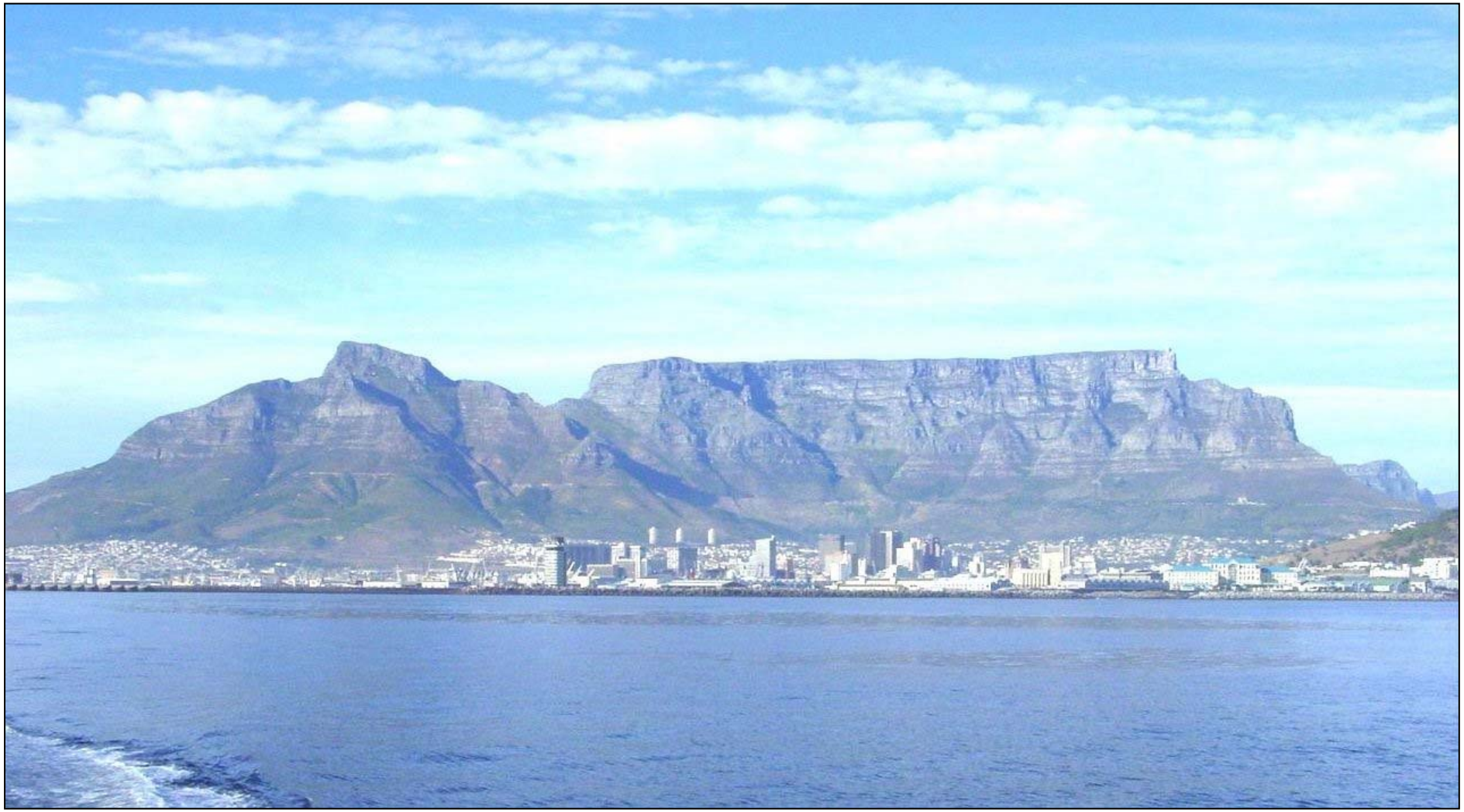


FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

Cape Town



Stellenbosch

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

South Africa

Johannesburg is the largest city in South Africa.

South Africa

Johannesburg – alternative reality! Inspired by current illegal immigrant problem in Johannesburg.

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

The healthcare need….

Billions of people are without basic healthcare.

- **3000 children die every day of treatable diseases.**
- **HIV/AIDS, TB, Malaria etc.**
- **Doctor to patient ratio unfavourable…**
- **Most African countries lack adequate medical personnel:**
  - **Europe 1 : 15 000**
  - **Africa 1 : 2 000 000**

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

P15 P8,9 P1

SATURDAY Star

SOUTH AFRICA'S BIGGEST-SELLING SATURDAY NEWSPAPER

June 10 2006

Solutions….

Train more healthcare professionals – three times the current count & force them to work in the middle of "nowhere".

Build more hospitals and clinics – at least three times the current count.

WILL THIS WORK?

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING
UNIVERSITEIT STELLENBOSCH UNIVERSITY
BERG

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

Solutions with hope

Innovation and technology are the only hope for a widespread impact on healthcare.

We need to use the time of medical professionals more efficiently.

We need more clinics functioning with “virtual” professionals.

Technology can achieve the above and one can decrease the cost and increase the access of healthcare significantly - so much so that a poor patient can pay or his own “private” healthcare.

Model is financially attractive & sustainable.

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

Automation

- How does one save the time of a professional so that he / she can see more patients – automate!

- Combine automated technology like automated medical devices with a basically trained healthcare facilitator to perform the time-consuming work (e.g. history taking).

- Automation: Examine a patient automatically, utilize auto-interpretations, automatically monitor that automated tests are performed compliantly, etc.

- Automate the time-consuming parts of healthcare!

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING
UNIVERSITEIT STELLENBOSCH UNIVERSITY
BERG

Medical tricorder

The clamshell-shaped medical tricorder is made from micromilled duranium foam.

Detachable high-resolution scanner

Touch-sensitive buttons cover the face of the unit. Tricorders also respond to voice commands.

The main body is a standard-model tricorder.

The medical peripheral device works with the tricorder interface to access all the normal functions as well as the added medical ones.

The medical tricorder contains information on many non-human races, making the instrument equally effective for treating other life forms, such as Cardassians.

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

Telemedicine

- We want to empower medical doctor to examine a patient over telecommunication wire as if he was physically present & examined the patient with his own hands.
- Automate the process of collecting data as much as possible.

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING
UNIVERSITEIT STELLENBOSCH UNIVERSITY
BERG

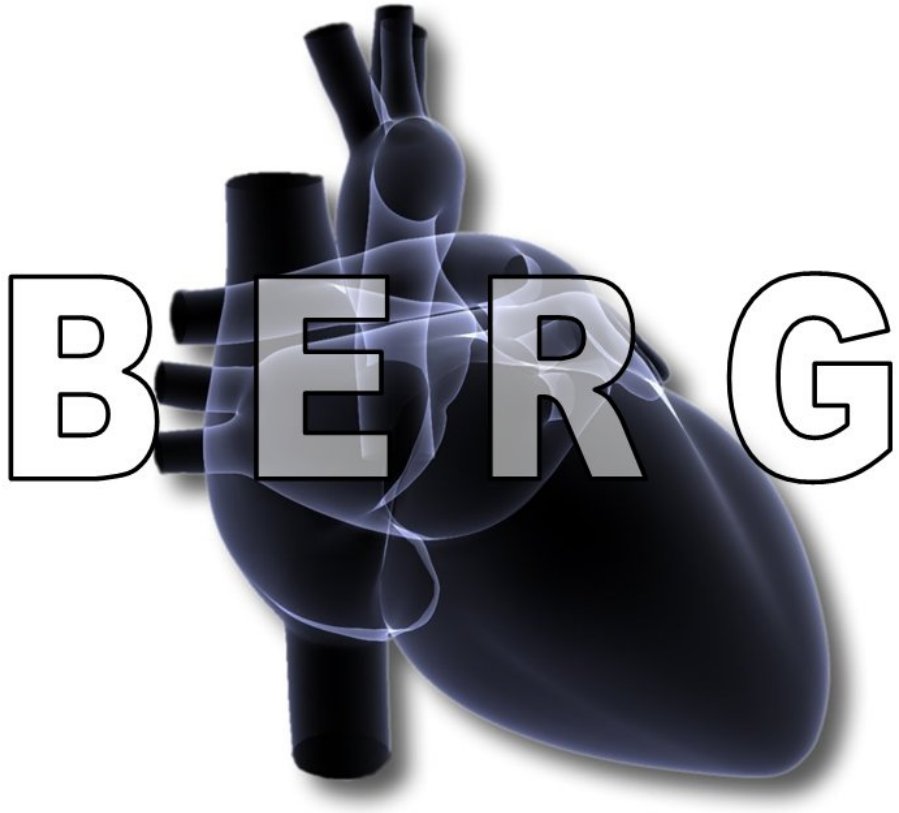
Telemedicine

- Advanced technologies applied to non-medical scenarios currently exist extensively in the world, but practical applications in the examination of patients in the primary consultation scenario lacks dramatically.

- A very basic example, for instance, is that no generally available device exists to measure a basic knee reflex without the interpretation skills of a medical doctor.

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING
UNIVERSITEIT STELLENBOSCH UNIVERSITY
BERG

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING



Brief overview of completed and current projects involving aspects of E-medicine

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

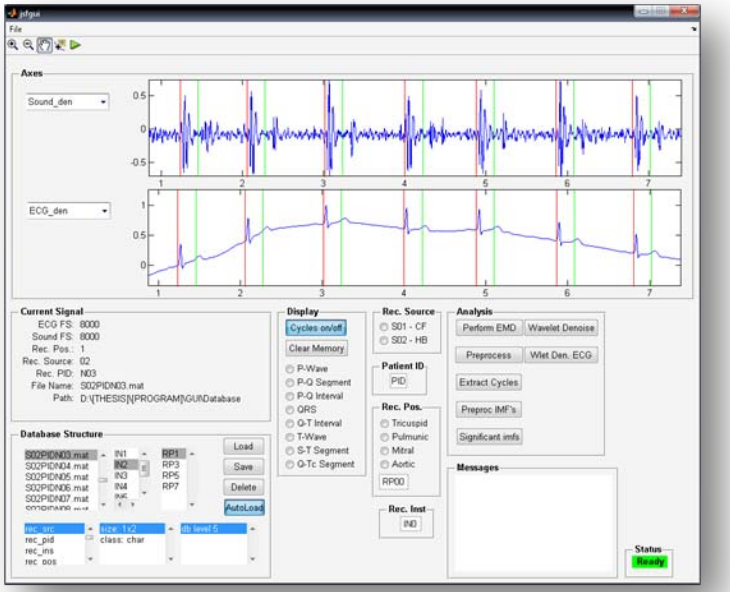
Heart & lung sounds, ECG and ICG

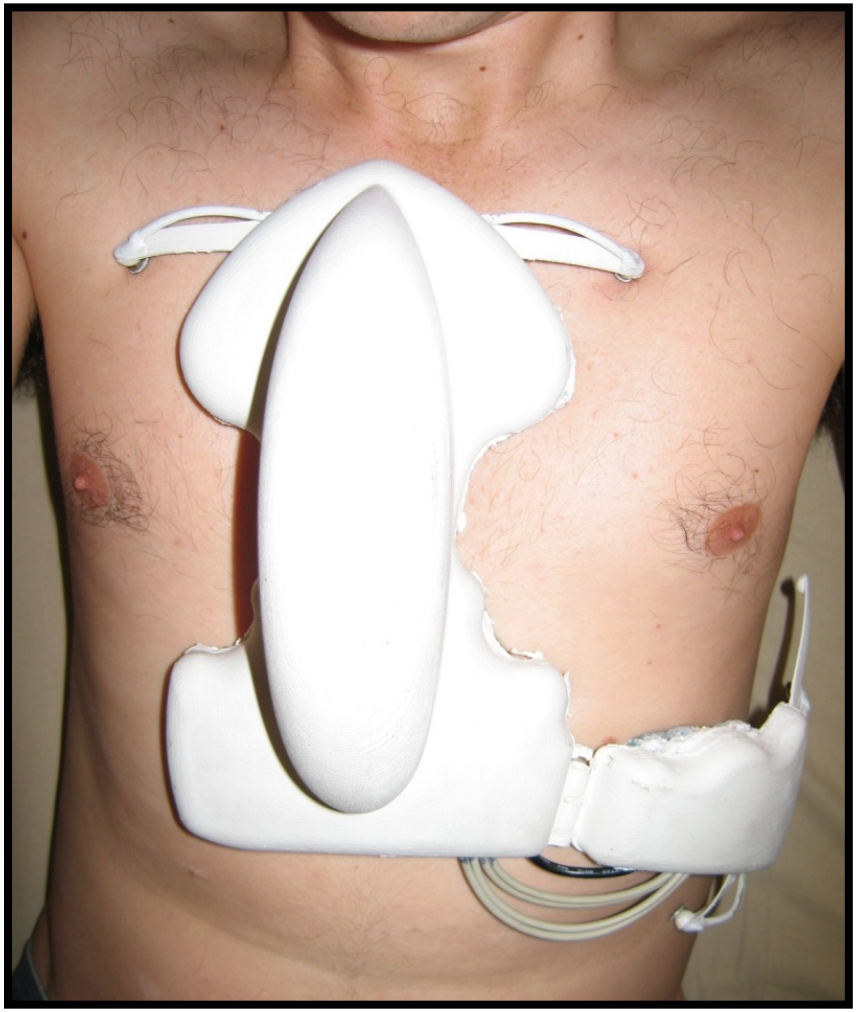
FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

Heart sounds & ECG



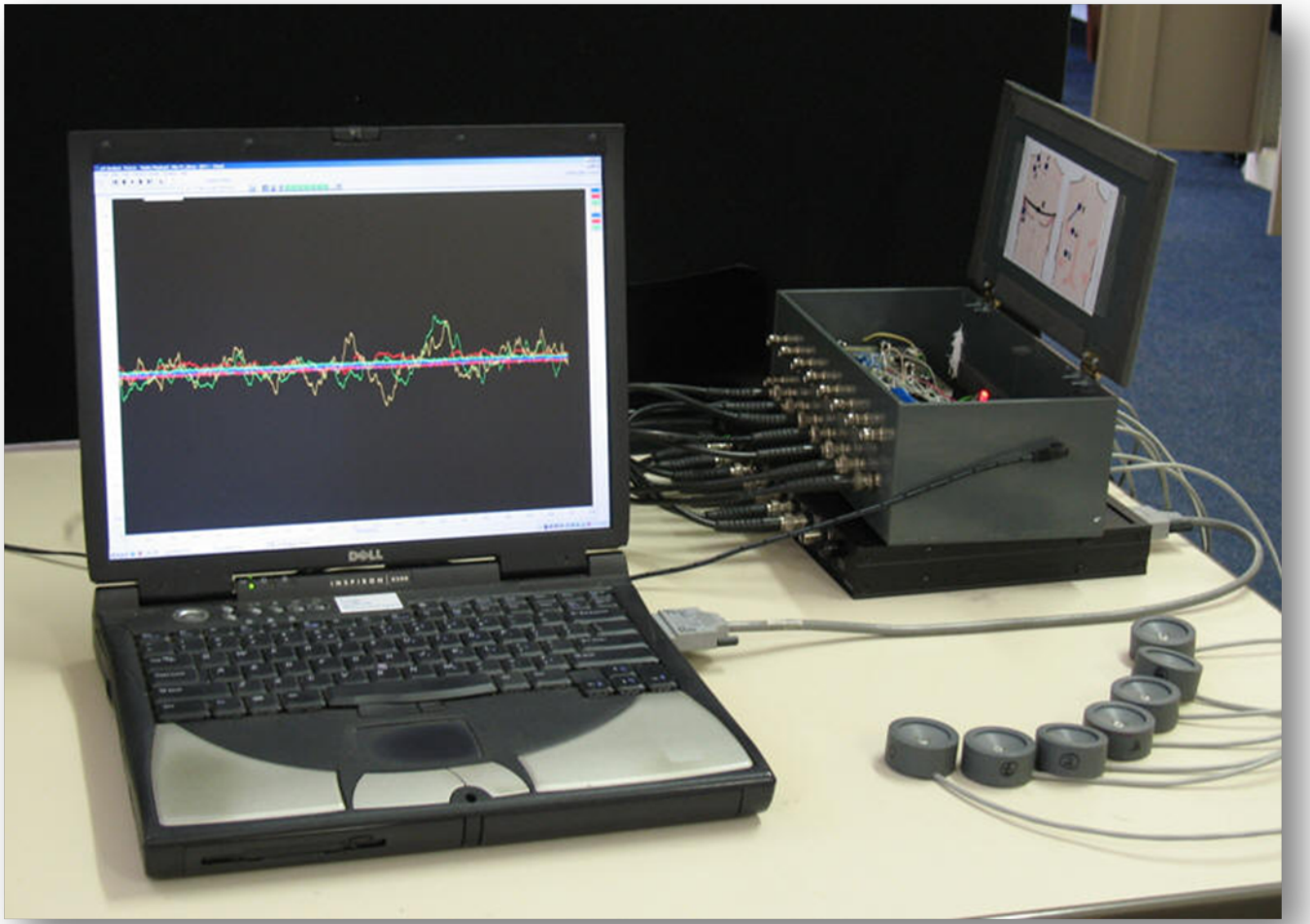


FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT STELLENBOSCH UNIVERSITY

BERG

Lung sounds



FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

Gait analysis

Inertial motion capture for clinical gait analysis via telemedicine.

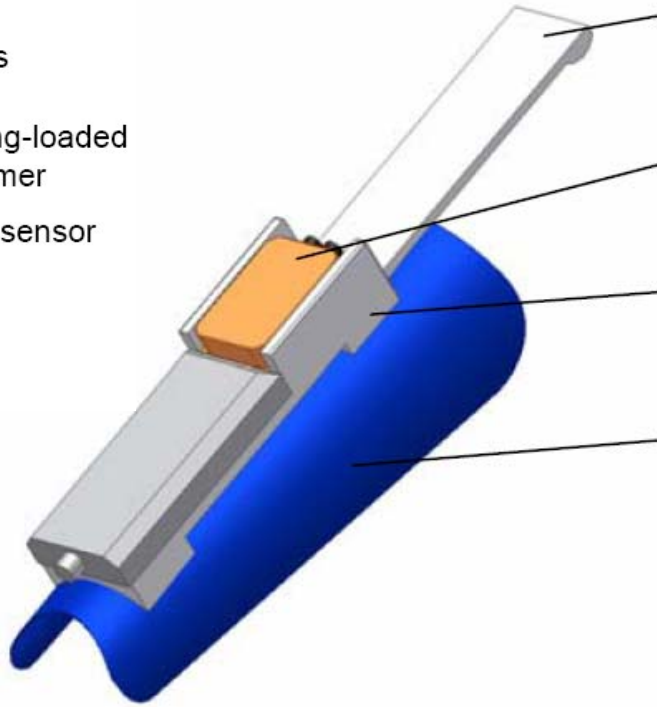
UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

Reflex sensing system

- **Semi-autonomous recording and classification of reflexes.**



UNIVERSITEIT STELLENBOSCH UNIVERSITY

BERG

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

Detecting swollen lymph nodes

“Neck palpation device”

Detecting swollen lymph nodes

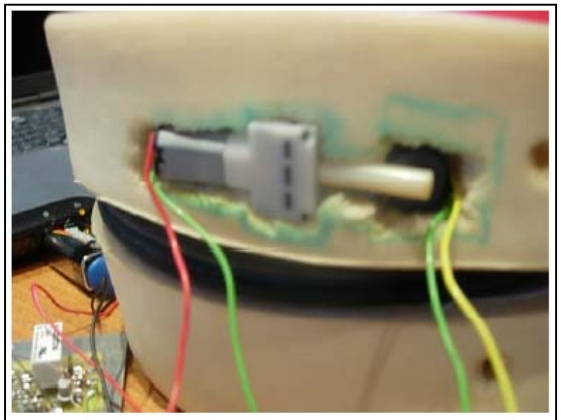


Figure 16: Location of pump and valve

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING
UNIVERSITEIT
STELLENBOSCH
UNIVERSITY
BERG

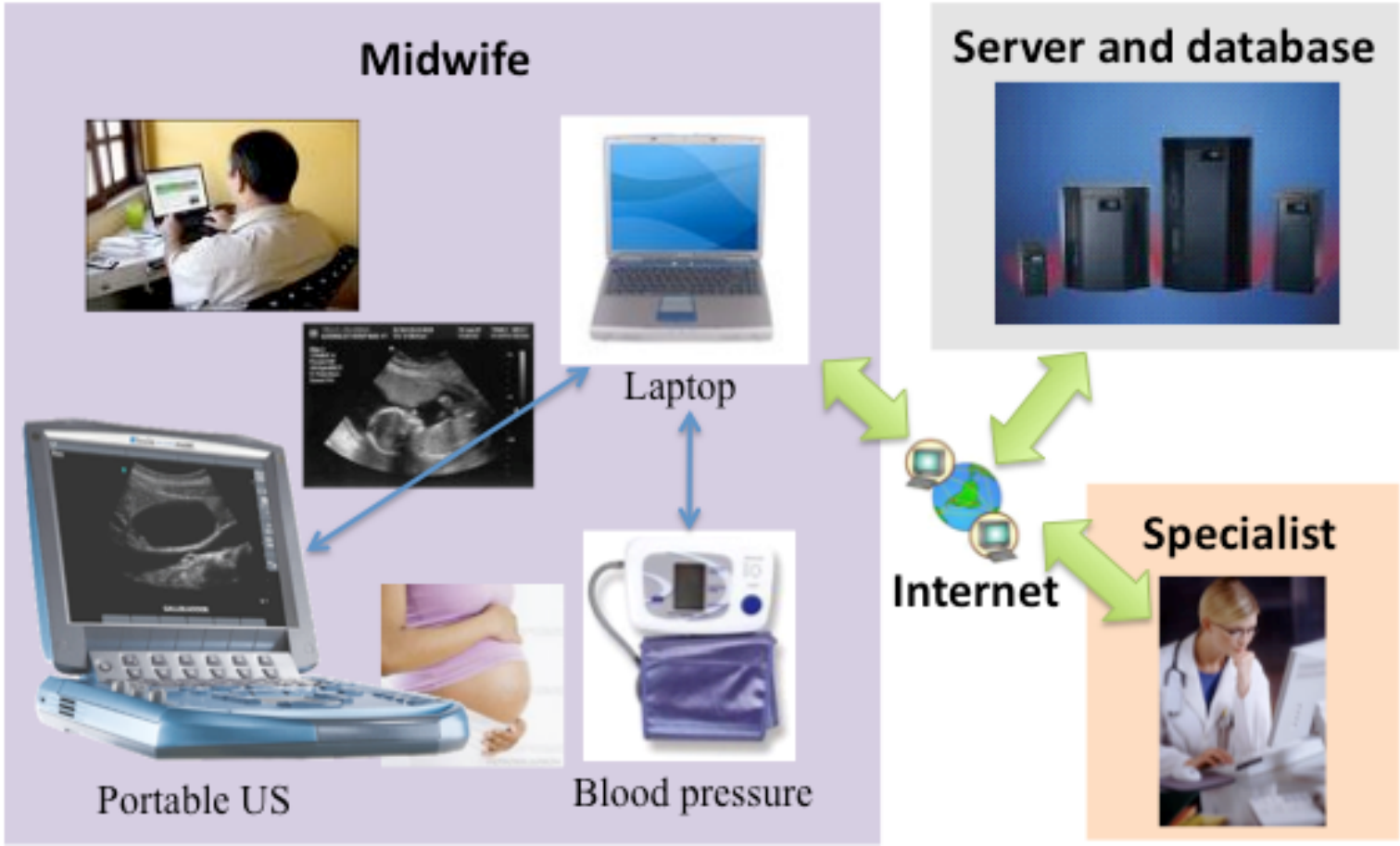
Emulate percussion of liver

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

Ultrasound E-medicine platform



FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING
UNIVERSITEIT STELLENBOSCH UNIVERSITY
BERG

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

BERG

Tele-audiology device (KuduWave)

Can perform hearing test remotely & automatically, without sound-proof booth.

Conclusion

- Significant potential if devices are reliable and at a reasonable cost.
- Can bring more work for doctor, rather than “replace” him.

FAKULTEIT INGENIEURSWESE
FACULTY OF ENGINEERING
UNIVERSITEIT STELLENBOSCH UNIVERSITY
BERG