A Secure Wireless Telehealthcare Monitoring System and its Web Application
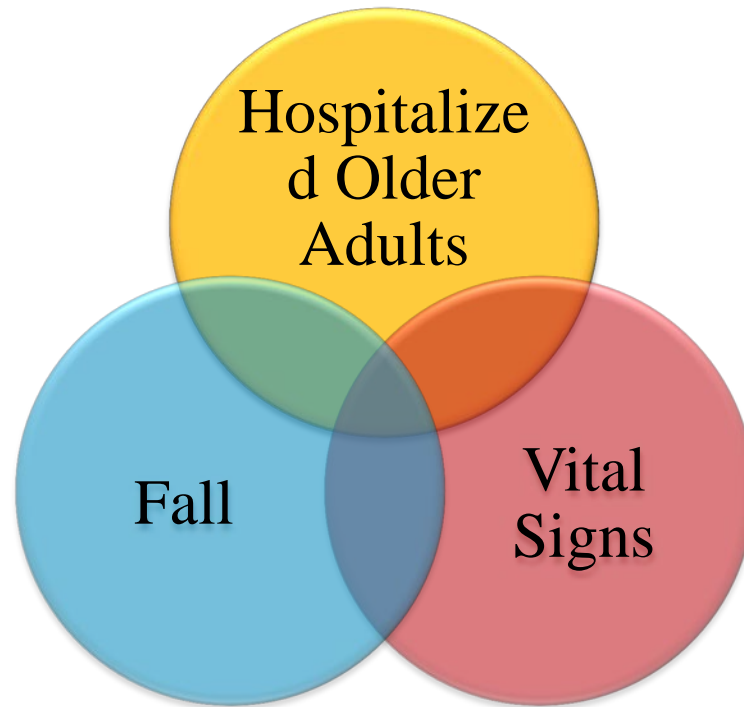
Mirza Mansoor Baig[1],
Hamid GholamHosseini[1] and Dehan Luo[2]

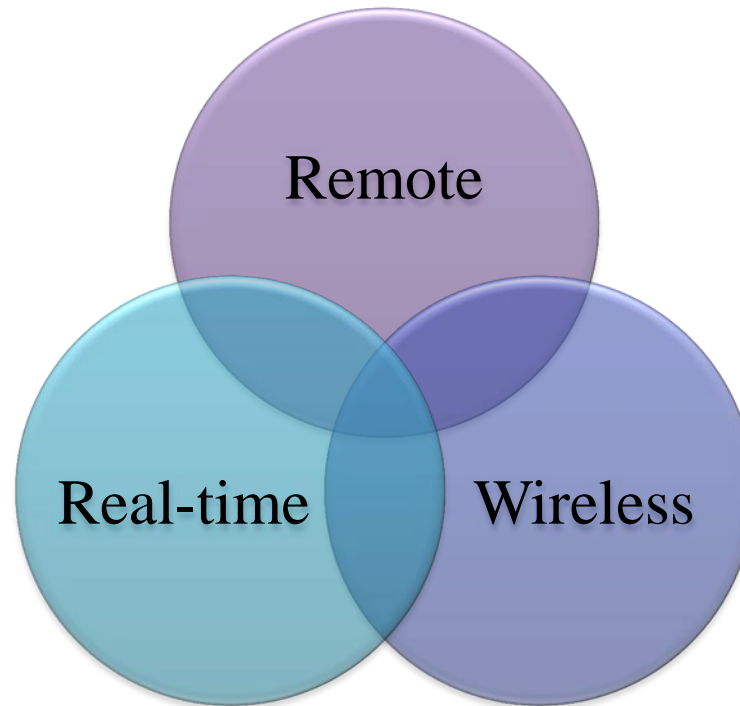[1]School of Engineering, Auckland University of Technology, Auckland-1142, New Zealand

[2]School of Information Engineering, Guangdong University of Technology, Guangzhou 510006, China

RESEARCH SPACE

RESEARCH SCOPE

Work Overview

- Research focuses on two important areas of healthcare; real-time remote patient monitoring and wireless medical device connectivity.

- Advanced real-time, wireless patient monitoring system with two-way audio/video transmission as well as vital signs.

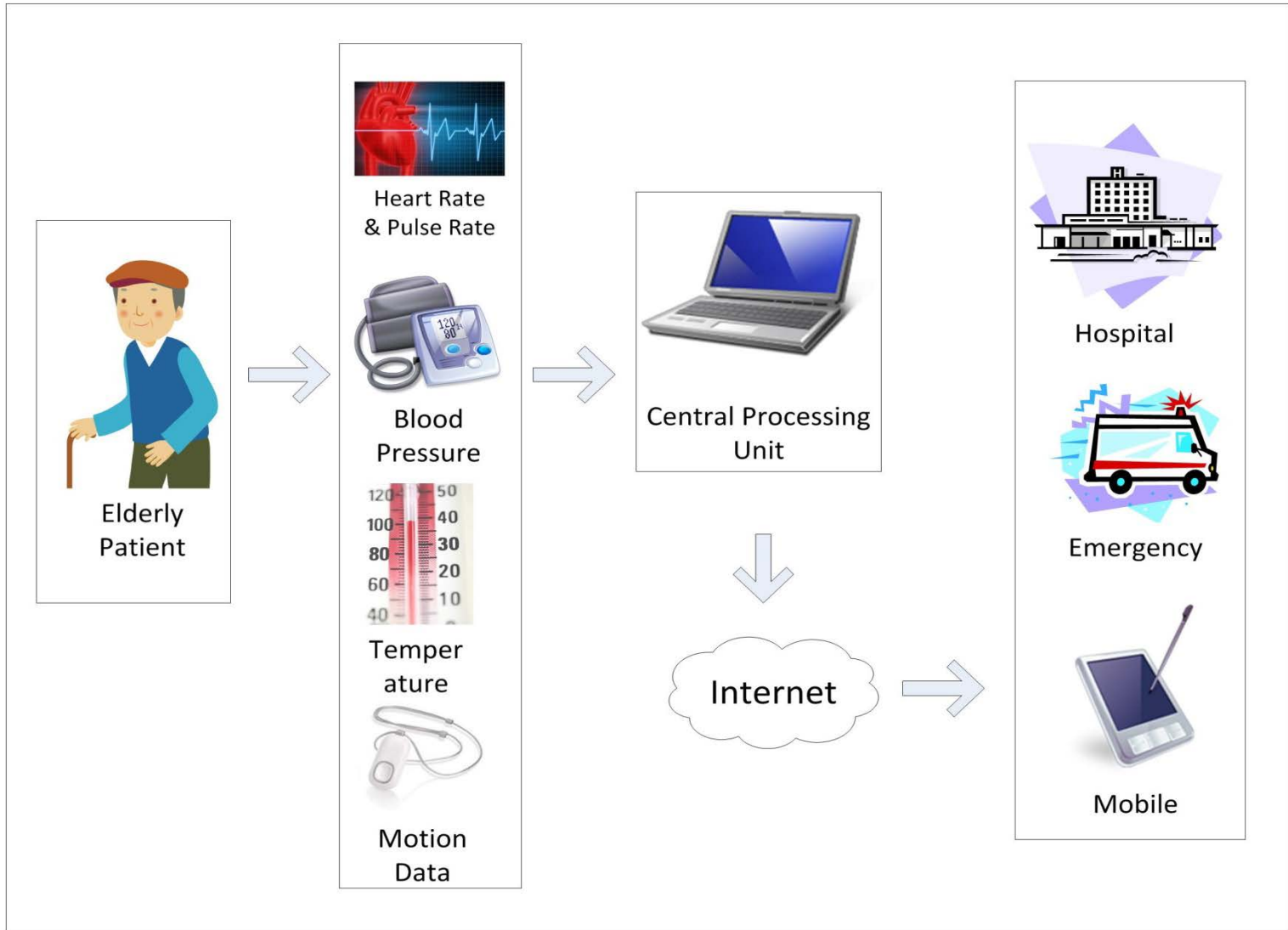- Real-time testing is underway at New Zealand Hospitals.

Blood Pressure Monitor

Limitations and Challenges
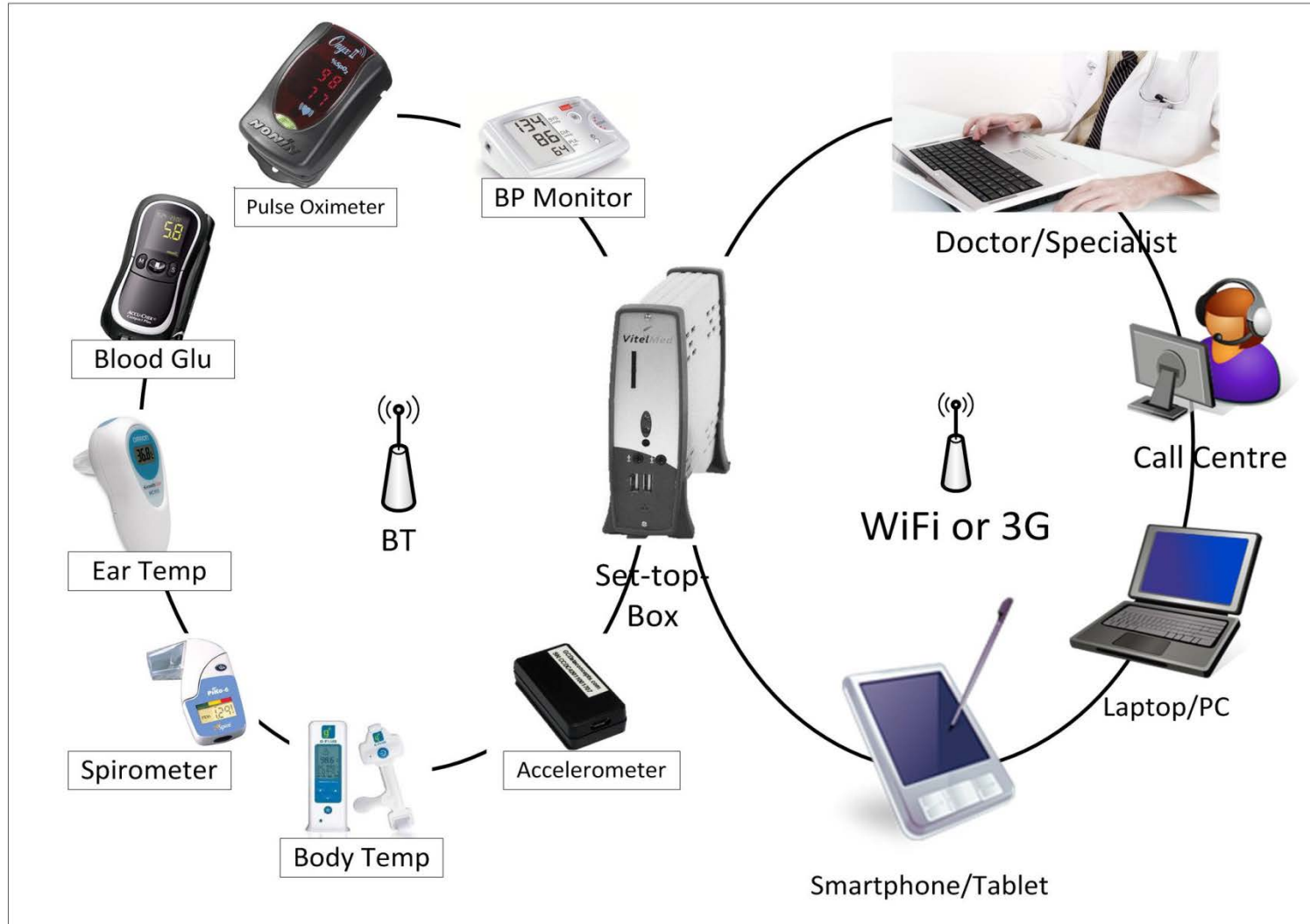
- Delay in alert/warning due to data transmission or real-time data processing

- Security and privacy of patient's medical data and personal identification

- Rate of false alarms generating by diagnosis systems

Block Diagram

Elderly Patient → Heart Rate & Pulse Rate / Blood Pressure / Temperature / Motion Data → Central Processing Unit → Internet → Hospital / Emergency / Mobile

Logic Diagram

Pulse Oximeter

BP Monitor

Doctor/Specialist

Blood Glu

Call Centre

Ear Temp

BT

Set-top Box

WiFi or 3G

Laptop/PC

Spirometer

Accelerometer

Body Temp

Smartphone/Tablet

Key Functionalities

- Set-top-box-data collection and transmission

- Vital signs-ECG, heart rate monitor, blood pressure, pulse and blood glucose meter

- Two way audio-video transmission

- Secure and user friendly

The System

Doctor-Patient Consultation

Remote patient monitoring

The Devices

1. Data receiver box - Set-top-box

2. Boso-medicus prestige BP Monitor

3. Nonin's Onyx II finger clip oximeter

4. Accu-Chek Compact plus B Glu. Monitor

5. Omron's Ear Thermometer

6. G-plus wireless remote thermometer

7. nSpire's Piko-6 spirometer

8. Gulf Coasts Data Concept's accelerometer X8M-3mini

Results

- The proposed system is tested offline using approximately 200 hours of patient data.

- The performance was measured using; true positive (TP), true negative (TN), false positive (FP) and false negative (FN).

- System has achieved an accuracy of 92.60%, sensitivity of 94.35%, specificity of 91.92 % and predictability of 81.81%.

Results Summary

Alarms	PROPOSED SYSTEM		Oberli et al.#	
	Diagnostic module	Datex-Ohmeda S/5 monitor	Expert System	Space Labs™ monitor
TP	117	104	169	149
TN	296	327	112	181
FP	26	82	8	737
FN	7	35	24	88
Total Alarms	446	548	289	1067
Accuracy (%)	92.60	78.64	89.77	28.57
Sensitivity (%)	94.35	74.82	87.56*	62.86*
Specificity (%)	91.92	79.95	93.33	19.71
Predictability (%)	81.81	55.91	95.48*	16.81*

Where TP is true positive, TN is true negative, FP is false positive, FN is false negative. The authors used TP and TN to calculate the sensitivity and predictability.

- C. Oberli, *et al.*, "An expert system for monitor alarm integration," *Journal of Clinical Monitoring and Computing,* vol. 15, pp. 29-35, 1999.

Conclusion & Future Work

- Our aim is to minimize current challenges and limitations, by using a remote patient monitoring system.

- Add more physiological parameters and devices.

- Currently, the proposed system is on-going clinical trial with more than 30 patient at New Zealand Hospitals.

Thank You