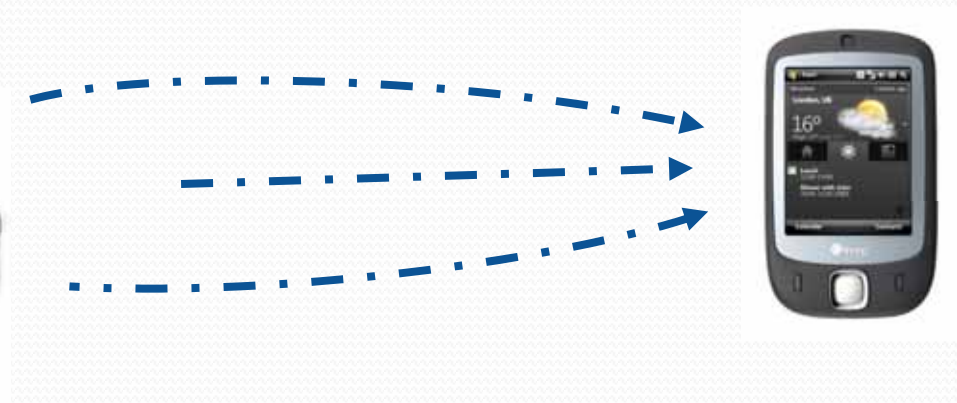




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AN INVESTIGATION OF DATA COMMUNICATION PROTOCOLS FOR TRANSFERRING READINGS FROM MEASURING DEVICES TO MOBILE PHONES IN A MOBILE TELEMEDICINE SYSTEM

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Agenda

- Background
- Objective
- Methodology
- Results
- Conclusion
- Learning Objectives
- Summary



Background: The MediNet Project

External Research Initiative

Supported by **Microsoft[®]
Research**

External Research





Background (1)

- World Health Organization (WHO) estimated the worldwide prevalence of diabetes in adults to be around 173 million in 2002 and predicted that there will be at least 350 million people with Type 2 diabetes by 2030
- Two-thirds of persons with diabetes live in developing countries and the majority of new cases are expected to originate from these areas



Background (2)

- Interesting Find:
 - “Developing countries may be experiencing the greatest cell phone impact.....In some countries the number of cell phones in use is greater than the number of people in the country.”

- **Ihealth** reports, November 2007
- Proposed solution:
 - Mobile Health (mHealth) - includes the use of mobile devices in collecting aggregate and patient level health data, providing healthcare information to practitioners, researchers, and patients, real-time monitoring of patient vitals, and direct provision of care (via mobile telemedicine)

MediNet Architecture





Objective:

Selecting the most appropriate healthcare meter interface in a mobile telemedicine system from a technical and usability perspective



Methodology

- We selected existing healthcare meters that provided a communications interface.
- We evaluated popular protocols used by these meters to transfer readings to a computer.
- We conducted several experiments to determine the viability of using these protocols to transfer the readings to a mobile phone and select possible candidates based on the results.
- Finally, we conducted usability studies to determine which approach for data transfer would be most effective for patients.

Healthcare Meters' Existing Interfaces

- RS232



- USB



- Bluetooth



RS-232



- Telecommunications standard for serial binary data signals connecting between DTE and DCE
- Computer serial ports
- Simple hardware implementation
- No support in Mobile devices or PDAs
- Conclusion:
 - Not suitable for health care monitoring systems that use PDA or mobile phone as data access point

USB



- Widely acceptable standard in computer-peripheral devices communication
- Healthcare meters provide USB Slave port
- Only compatible with a PC USB port
- PDA or mobiles phones also provide USB Slave or USB OTG port
- Conclusion:
 - Not suitable for health care monitoring systems that use PDA or mobile phone as data access point



Bluetooth

- Popular short-range and low-power communication protocol
- Adopted by some healthcare meter vendors for communication
- Also popular in mobile phone communication
- An ideal candidate for healthcare – mobile phone communication
- User friendly → No wires



Bluetooth

Option 1: Master healthcare meter + Slave mobile phone

- *Application on mobile phone opens a socket over Bluetooth and waits for healthcare meter to initiate connection after it takes a reading*

Option 2: Slave healthcare meter + Master mobile phone

- *Meter opens a socket over Bluetooth and waits for application on mobile phone to make connection and request readings stored on meter*



Existing Bluetooth enabled Healthcare Meters

Bluetooth: Glucometers (1)

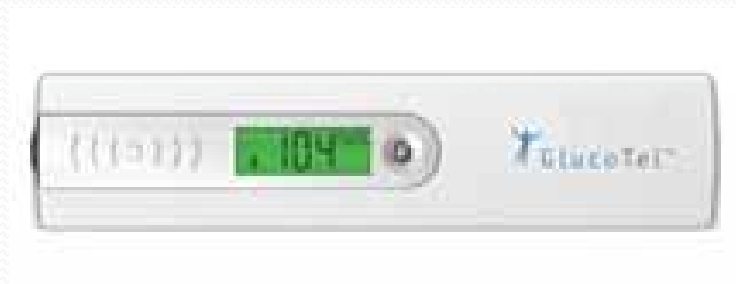
Home-made solution: Final Year Student
Project at University of Birmingham



OneTouch with eLink Adapter by eHIT
Limited

Bluetooth: Glucometers (2)

Entra Health Systems: myGlucoHealth



BodyTel: GlucoTel

Bluetooth: Glucometers (3)

OneTouch with PolyMap Glucose Meter
Accessory (GMA)



OneTouch with t+ Medical Cradle

Bluetooth: Blood Pressure Meters



A & D UA-767PBT Blood Pressure Meter

Corscience Promedia Omron 710IT
Blood Pressure Meter





Results: Protocol Selection

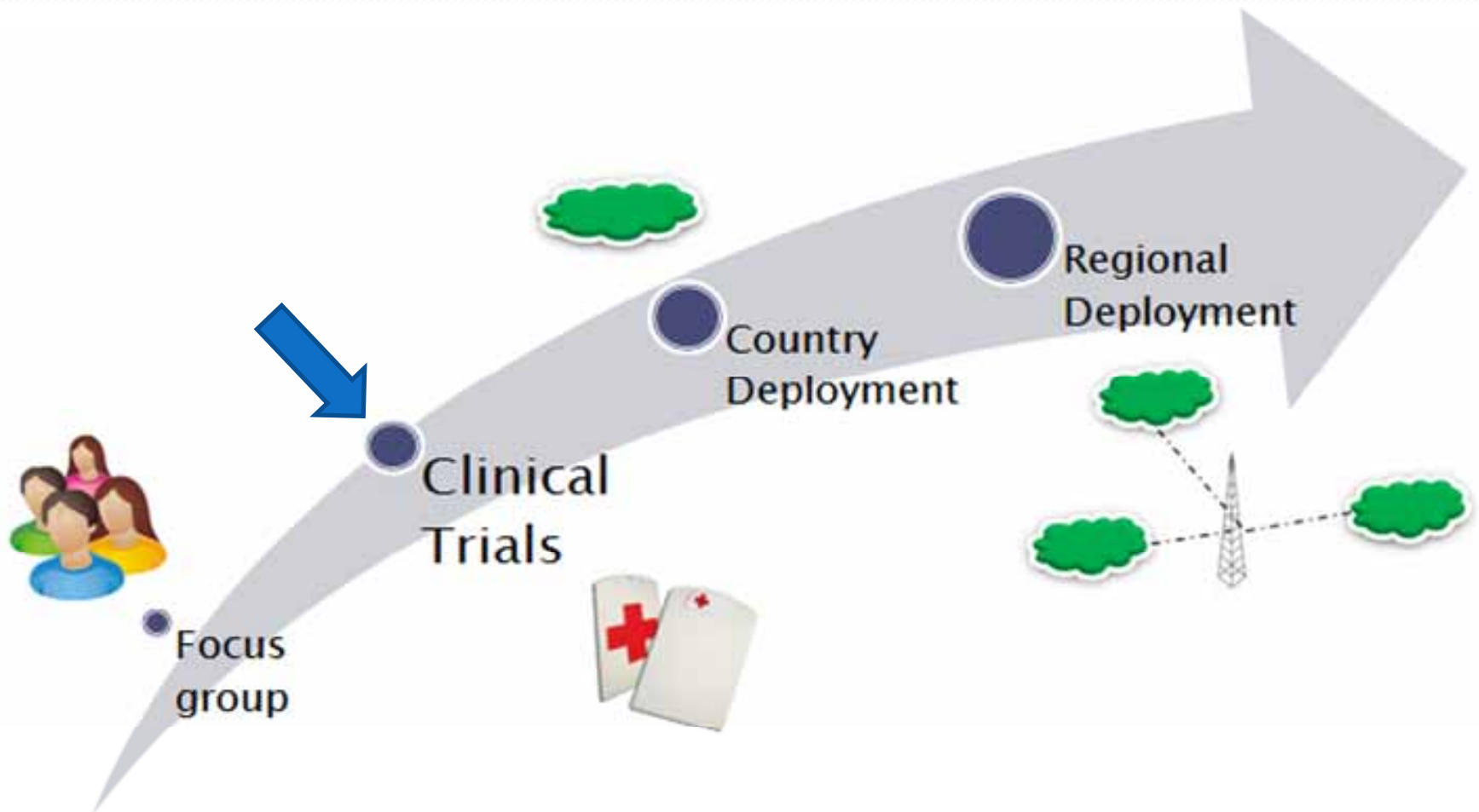
- RS-232 and USB protocols are not suitable because of hardware incompatibility and usability issues
- Bluetooth is widely available on mobile phones and because our usability studies indicate that wireless data transfer is preferred over wired communications.
- However, measuring devices with Bluetooth are rare and there are several inherent complexities that must be surmounted in order to use Bluetooth successfully in a mobile telemedicine system.



Results: Usability Study

- ISO 9241-11 measures:
 - Efficiency of the system
 - Simplicity of the system
 - User satisfaction
- Patient Feedback (16 participants):
 - 66.67% perceived the Bluetooth interface very easy to use
 - 93.33% perceived the Bluetooth interface to be a fast means of transfer in the results from the meters
 - Most popular reasons for preferring the selected interface: “less recording on the part of the patient” and “minimizes errors when recording”

Future Work





Learning Objectives

- Understand how to evaluate data communication protocols for transferring readings from measuring devices to cellular phones in a mobile telemedicine system
- Appreciate the technical issues involved in using Bluetooth as the data communication protocol for transferring readings



Summary

- mHealth has a promising future as an alternative solution to address many of the healthcare challenges of the developing world
- There exists different interfaces between healthcare meters and mobile telephony devices, with Bluetooth being the prevailing technology and is a proposed candidate for standardization
- When selecting a suitable meter for deployment in a mHealth solution many factors must be taken into consideration: usability, system integration and availability in the market



Thank You!

For more information on the MediNet project check out the following URL:

www.pmohan.org/medinet