Providing Patient Home Clinical Decision Support using Off-the-shelf Cloud-based Smart Voice Recognition

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Collaboration

- Providing Patient Home Clinical Decision Support using Off-the-shelf Cloud-based Smart Voice Recognition [Technical Proof of Concept]
Case study in mental health

- Some adults with enduring mental health conditions need ongoing social and clinical support
  - Monitoring of their mental and physical health
  - Prompting to adhere to medication regimes
- 30-50% of patients do not adhere to their prescribed medication regimes increasing risk of relapse
- Comfort Care experience shows that timely, person-centred, support improves adherence to medication
- Human intervention (and interaction) is effective but expensive
- Customisable and engaging technology offers an alternative for some patients
Self-management and technology

• Self management offers advantages
  • Independence for the patient
  • Patient outcomes are improved
  • Cost reduction to the healthcare system

• Ability of the patients to directly interact with an extended healthcare system
  • Enabled by technology advances in human computer interaction
    • Gestures, natural language voice, video, sensors

• Variable modes of interactions
  • Reminders
  • Data collection and storage
  • Assessments and data analysis
  • Clinical decision support
Off the shelf technology: £50-150

Amazon Echo

Volume ring

Reflex port
Enhances the woofer's output for deeper sounds without distortion

2.5 inch woofer
Delivers deep bass response

2.0 inch tweeter
Crisply hits the high notes

Echo Dot

Front
83.5 mm

32 mm

Volume up
Microphone off button
Volume down
Light ring
Action button

Back

7-microphone array
Micro-USB power

3.5 mm audio output
Overview of the technology

Patient
- Patient gives a voice command or information
- Patient hears response using Echo’s voice
- Data visualisation

Echo
- Identifies patient’s request and converts command or data to a structured computer-interpretable format
- Echo converts text to speech and streams it to patient’s device
- Graphical rendering

Application
- Application collects and structures information for storage and processing
- CDS algorithm provides output
- Storage
- Action decision (patient feedback or intervention)

Healthcare professional
- Intervention trigger
- Data visualisation
Functions

- Self assessment of well being
  - Conversion of response to quantitative data
  - Trend monitoring
  - Customisable thresholds
  - Triggers based on keywords and quantitative analysis

- Clinical Decision Support (CDS) algorithms
  - BMI, diabetes risk
  - Algorithms based on measurements
  - Provides warning and advice
Functions 2

- Self-quantification
  - Collection of data sourced from the patient
  - Various measurements
    - Weight, mood, BP, sleep, exercise
- Medication adherence
  - Customised prompts by the system
  - Recording patient declared adherence (type, quantity and time)
  - Advice based on patient care needs and history
  - Notification for medication replenishment
Way forward

• Increase clinical complexity
  • Protocols implemented
  • CDS
• Integration with other sources and storage
  • Source and provide data to HER
  • eHRM (electronic staff HR system)
  • Wearable, environmental and IoT sensors
• Actions based on protocol
  • Alerts, guidance and instructions given to patent care givers
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  • Integration with healthcare system
Conclusion

• Motivated by the healthcare triple A challenge: improved safety, quality and efficiency
• Motivated by healthcare literature in self-management
• Goal: Technical proof of concept
• Successful implementation
  • Easy natural language interface
  • Ability to collect and process data
  • Ability to customise backend algorithms
  • Deliver clinical and social decision support
• Further development required
  • Backend algorithms
  • Integration with other healthcare systems, sensors and IoT
  • Predictive analytics
  • Improved CDS