iSpondylitis

Using Gamification App Design & Remote Wearable Sensors to Attain Ankylosing Spondylitis Patient's Participation Engagement

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WEARABLE SENSOR TECHNOLOGIES SENDoc

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CONCEPT / OBJECTIVES

iSpondylitis is an application design for remote monitoring of Ankylosing Spondylitis using IMU sensor technology. iSpondylitis uses gamification in its design to engage and retain patients to perform regular monitoring of their condition, treatment process and offer remote feedback regarding their spinal mobility.

The project is part on the on-going clinical evaluation being undertaken in L'Derry, N.Ireland, Dublin, Ireland and Cordoba, Spain to examine the accuracy of sensors in measuring spinal movement.

The overall purpose of the research is to replace conventional metrology (e.g. BASMI test) with a new validated outcome measure based on IMU sensor technology and offer patients a mobile solution as part of their treatment process.

PROBLEM

Spinal mobility is assessed in patients with AS/axial SpA using the BASMI to provide baseline measurement and monitor change over time. The BASMI test is usually undertaken on a yearly basis with varying degrees of accuracy.

1 : Can wearable sensors and mobile technology be used to replace the BASMI test and construct an accurate picture of the patients condition through regular monitoring?

2 : Can we leverage technology to engage and motivate the patient to perform condition monitoring remotely?

CLINICAL DEMONSTRATIONS

PHASE 1 STUDIES

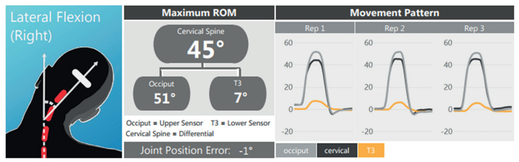
Derry / Londonderry, N.Ireland
Examining the accuracy of sensors in measuring movement in axSpA

Dublin, Ireland
Examining the performance of standardised functional tests while wearing the spinal sensors (e.g. sit to stand).

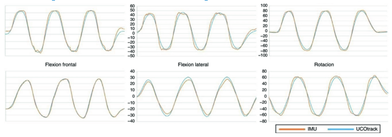
Cordoba, Spain
Comparing sensor outputs to data obtained from optical motion capture (UCOTrack).

IMU Sensor Calibration & Data Output Example

Max	0.625922024	9.740689278	1.545520306	10.01040363	1.731065631	1.184652209
Min	-4.416422367	-26.5758667	-5.13936758	-31.92823982	-1.781682014	-5.956914902
ROM	5.042344391	36.31655598	6.684887886	41.93864346	3.512747645	7.141567111
Stc	**Cervical F (IG)**	**Cervical L (IG)**	**Occiput F (IG)**	**Occiput L (IG)**	**T3 F (IG)**	**T3 L (IG)**
11:43:40:84	-0.0348465	4.489578247	0.954510033	4.638955116	0.989024997	0.154398218
11:43:40:889	-0.068415008	4.518737793	0.979437232	4.625243664	1.007095814	0.147380099



IMU Sensor vs Optical Motion Capture (UCOTrack)

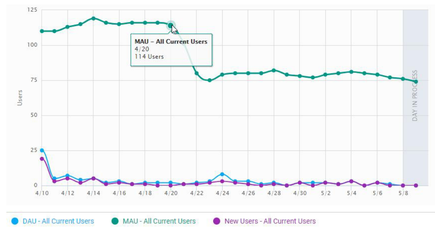


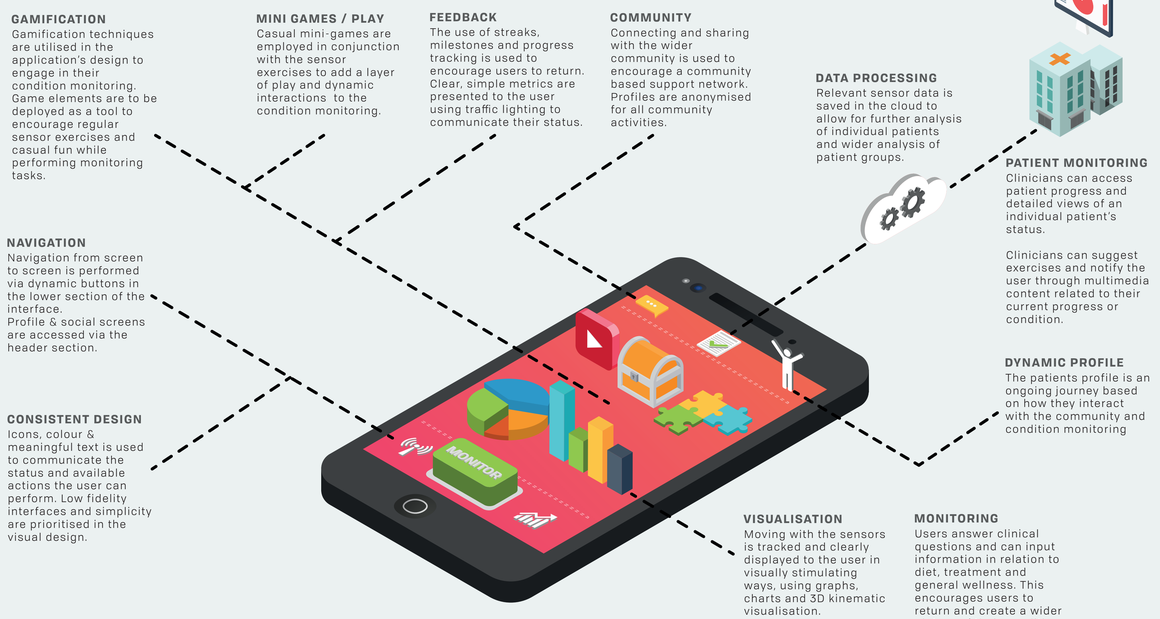
METHODOLOGY

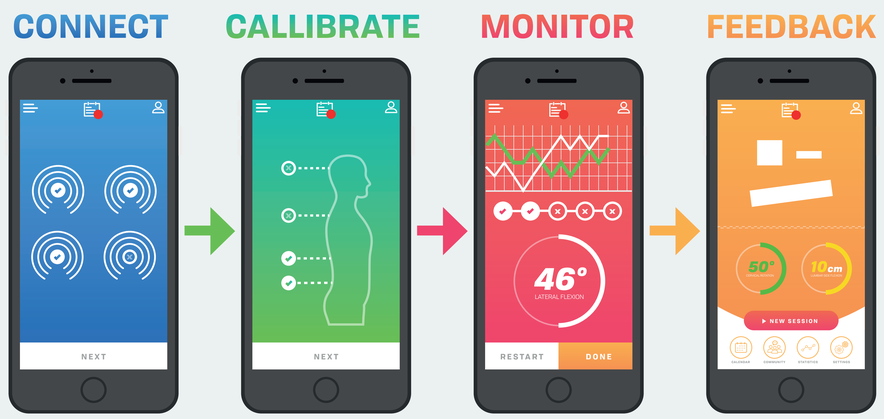
1 : USABILITY FEEDBACK
The application is tested with user groups and qualitative feedback is gathered via surveys and questionnaires

2 : APP / DATA ANALYTICS
Analytics are used to gain insight in user retention cycles and sticky factor.

We can directly measure how users interact with the application and use this information to make usability, feature and functional improvements







FRAMEWORK / DESIGN

PATIENT VIEW

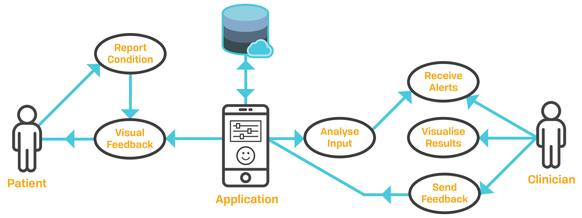
Monitoring :
-- Patients regularly input information and condition status through questionnaires and sliders. Patients are encouraged to document how they feel each time they use the app or during condition 'flare ups' to create a detailed picture of their progress over longer periods of time.
-- The app assists in sensor setup and guides patients through movement routines while recording the relevant data for feedback and analysis.

Feedback :
-- Patients are presented with simplified meaningful feedback. Traffic lighting is used to quickly inform the patient of their condition status.
-- Links to relevant exercises and information based on their current status is available to view in the app.

Visualisation & Play :
-- Sensor input is visualised using 3D kinematics, charts and graphs. Interactive exercises and casual mini-games are built into the app to add a layer of fun to the monitoring process.

Profiles & Progression :
-- Condition monitoring is presented as a journey with a sense of progression at the core of the experience. Achievements, milestones and streaks are used to encourage long term engagement with the app.

Community:
-- App users are part of a wider community to share information and build a support network.



CLINICIAN VIEW

Profile :
-- Clinicians are setup with an ID to monitor groups of patients and provide individual monitoring and management.

Visualisation :
-- Clinicians have access to detailed data visualisation and patient monitoring history to support their analysis and improve patient care.

Feedback :
-- Clinicians can be alerted by the patient or through an automated process. They can recommend exercises and link relevant information on an individual patient basis

OUTCOMES

Over the course of the project we will develop a set of gamification principles to use within the application design.

The app development will support the clinical demonstrations for the IMU sensors to test the remote monitoring and practical application of patients using the hardware in a home or work environment.

KEY OUTCOMES

1. We can engage users within the app environment to perform regular monitoring and measure their engagement in the process using data analytics.
2. We can gain positive patient feedback in regards to the gamification and community focused design of the application compared to traditional monitoring using intermittent BASMI tests.
3. We can determine a correlation in improvement to patient condition and regular use of the sensors and application.