Cyflymu Accelerate

AN INNOVATION CASE STUDY

# PERSONALISATION OF REHABILITATION FOR BODY MOTION RELATED INJURIES THROUGH WEARABLE ELECTRONICS

**PROJECT DURATION: 12 months**

**PARTNERS: Ambiquire, Cardiff and Vale University Health Board, and Cardiff University.**

**PROJECT AIM: To create a new treatment paradigm which will provide clinicians and patients with objective movement analysis data to help guide therapy for individuals with knee pain.**

## OVERVIEW

Musculoskeletal conditions are the leading contributor to chronic pain and disability, with knee pain amongst the most common patient presentations. Physiotherapy plays an important role in the rehabilitation process after injury or disease; however, the monitoring of patient progress often relies on clinical judgement, and patient feedback. Technology has the potential to provide objective data to accelerate rehabilitation, but further work is needed to translate its use from movement laboratories into patient homes and NHS clinics

The Sensor Physiotherapy Intervention (SPIN) Research Group at Cardiff University have been researching how wearable biomechanical sensors may play role in providing objective assessment and feedback on patient movement. Such technology could be used to underpin a concordant approach to guiding treatment and measuring change.

Ambiquire, a company based in South Wales, have developed a micro-wearable device (inertial measurement unit) that can acquire and wirelessly stream real time "movement "data.

This project seeks to bring movement sensor technology together with biomechanical data and embedded clinical expertise to develop a simple and affordable product to provide objective movement feedback to patients and physiotherapists. The intention is to deliver this through:

- The development of machine learning algorithms to quantify the biomechanical parameters using single or multi Ambiquire Inertial measurement units (IMUs).
- The development of a web-based interface for biomechanical clinic and home use

*"Whether you have had a sporting injury, recovering from surgery or simply getting older, movement induced joint pain can be completely debilitating. To address this growing problem, the Accelerate programme has provided an excellent mechanism to facilitate the collaboration between leading Ambiquire engineers and expert Biomechanics researchers and Active Health clinicians at Cardiff University.*

*Combining the latest Ambiquire electronic measurement devices, data analytics and AI inference techniques the partnership aims to develop a novel system to enable "patient specific" interventions to be designed and effectively monitored remotely at their home."*

Steve Gardner - Managing Director Ambiquire

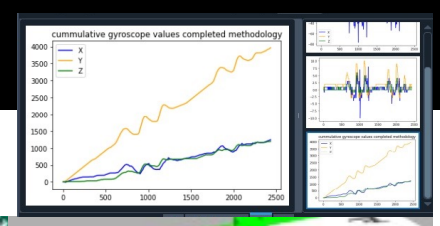
*"Joint pain is a common condition and it is estimated that 23% of individuals aged over 45 in Wales have hip and or knee osteoarthritis. For physiotherapists being able to monitor and provide feedback on how people move and carry out their exercises at home has the potential to transform treatment and maximise the benefit for these individuals"*

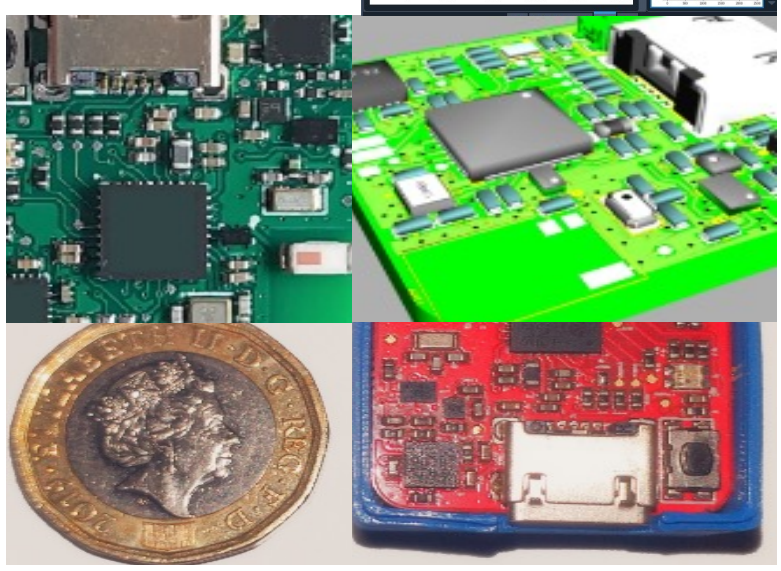
Dr Kate Button - Physiotherapist and R&D lead for Therapies in Cardiff and Vale University Health Board & Director of Research Governance & Active Health Research Theme Lead, School of Healthcare Sciences, Cardiff University

**Accelerate** is supporting the delivery of this collaborative project through Cardiff University's academic expertise and the provision of project management and facilitation through the Clinical Innovation Accelerator.

Ambiquire, will bring their expertise to the project in terms of the development of IMUs, and will contribute their experience in delivering commercially viable products.

From a clinical perspective, expertise will be provided by a specialist musculoskeletal physiotherapist from Cardiff and Vale University Health Board.



Ambiquire IMUs and example raw data

## EXPECTED OUTCOMES

- A new product market for the Ambiquire technology
- An affordable, objective measurement tool to support home-based rehabilitation
- Patient progression informed by objective movement data
- Opportunities for further collaboration and new funding stream between project partners
- Case studies & Peer reviewed publications

## FUTURE IMPACT

- Economic impact through expansion of the technology into different fields through a greater understanding of clinical need.
- Company growth driven by collaborative R&D
- Increased efficacy of musculoskeletal rehabilitation in the home setting
- Patient empowerment through increased internal locus of control
- Deliverables aligned with the Well-being of Future Generations (Wales)

Swansea University Prifysgol Abertawe · Cardiff University Prifysgol Caerdydd · Prifysgol Cymru University of Wales Trinity Saint David · Hwb Gwyddorau Bywyd Cymru Life Sciences Hub Wales

Cyflymu Accelerate

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

UNDEB EWROPEAIDD EUROPEAN UNION
Llywodraeth Cymru Welsh Government
Cronfa Datblygu Rhanbarthol Ewrop
European Regional Development Fund

# ASTUDIAETH ACHOS ARLOESEDD

## PERSONOLI ADSEFYDLU AR GYFER ANAFIADAU SY'N GYSYLLTIEDIG Â SYMUDIADAU'R CORFF DRWY ELECTRONEG GWISGADWY

**HYD: 12 mis**

**PARTNERIAID: Ambiquire, Bwrdd Iechyd Prifysgol Caerdydd a'r Fro, a Phrifysgol Caerdydd.**

**NOD: Creu patrwm triniaeth newydd a fydd yn rhoi data dadansoddi symudiad gwrthrychol i glinigwyr a chleifion i helpu i lywio therapi ar gyfer unigolion sydd â phoen yn eu pen-glin.**

## TROSOLWG

Cyflyrau cyhyrysgerbydol yw'r prif gyfrannwr at boen cronig ac anabledd, gyda phoen yn y ben-glin ymhlith yr achosion mwyaf cyffredin ymysg gleifion. Mae ffisiotherapi yn chwarae rhan bwysig yn y broses adsefydlu ar ôl anaf neu glefyd; fodd bynnag, mae monitro cynnydd cleifion yn aml yn dibynnu ar farn glinigol, ac adborth gan gleifion. Mae gan dechnoleg y potensial i ddarparu data gwrthrychol i gyflymu'r broses adsefydlu, ond mae angen gwneud rhagor o waith i drosi ei ddefnydd o labordai symudiad i gartrefi cleifion a chlinigau'r GIG

Mae Grŵp Ymchwil Ymyrraeth Ffisiotherapi Synhwyrydd (SPIN) ym Mhrifysgol Caerdydd wedi bod yn ymchwilio i sut y gall synwyryddion biomeol gwisgadwy chwarae rhan wrth ddarparu asesiad gwrthrychol ac adborth ar symudiad cleifion. Gellid defnyddio technoleg o'r fath i ategu dull cyson o arwain triniaeth a mesur newid.

Datblygodd Ambiquire, cwmni o Dde Cymru, ddyfais micro-wisgadwy (uned mesur inertiaidd) sy'n gallu caffael a ffrydio data "symudiad" amser real yn ddi-wifr.

Mae'r prosiect hwn yn ceisio dod â thechnoleg synhwyrydd symudiadau ynghyd â data biomeol ac arbenigedd clinigol wedi'i wreiddio i ddatblygu cynnyrch syml a fforddiadwy i roi adborth ar symudiad gwrthrychol i gleifion a ffisiotherapyddion. Y bwriad yw cyflawni hyn drwy'r canlynol:

- Datblygu algorithmau dysgu peirianyddol i feintioli'r paramedrau biomeol gan ddefnyddio unedau mesur inertiaidd Ambiquire sengl neu luosog (IMUs).
- Datblygu rhyngwyneb ar y we ar gyfer clinig biomeol a defnydd gartref

*"P'un ai a ydych wedi cael anaf chwaraeon, yn gwella o lawdriniaeth neu'n mynd yn hŷn, gall poen yn y cymalau wedi'i ysgogi gan symudiad fod yn gwbl wanychol. Er mwyn mynd i'r afael â'r broblem gynyddol hon, mae rhaglen Accelerate wedi darparu dull ardderchog o hwyluso'r broses gydweithio rhwng peirianwyr blaenllaw Ambiquire ac ymchwilwyr Bio-Fecanyddol arbenigol a chlinigwyr Iechyd Egniol ym Mhrifysgol Caerdydd.*

*Gan gyfuno dyfeisiau mesur electronig diweddaraf Ambiquire, dadansoddeg data a thechnegau casglu Deallusrwydd Artiffisial, nod y bartneriaeth yw datblygu system newydd i alluogi ymyriadau "sy'n benodol i gleifion" gael eu cynllunio a'u monitro'n effeithiol o bell yn eu cartref."*

Steve Gardner - Rheolwr Gyfarwyddwr Ambiquire

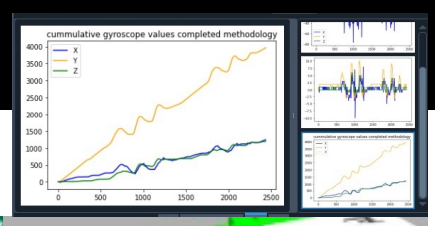
*"Mae poen yn y cymalau yn gyflwr cyffredin ac amcangyfrifir bod gan 23% o unigolion dros 45 oed yng Nghymru osteoarthritis yn y glun a'r pen-glin. Er mwyn i ffisiotherapyddion fonitro a rhoi adborth ar sut mae pobl yn symud ac yn cynnal eu hymarferion gartref mae gan hyn y potensial i drawsnewid triniaeth a sicrhau'r budd mwyaf posibl i'r unigolion hyn"*

Dr Kate Button - Ffisiotherapydd ac arweinydd Ymchwil a Datblygu ar gyfer Therapïau ym Mwrdd Iechyd Prifysgol Caerdydd a'r Fro a Chyfarwyddwr Llywodraethu Ymchwil ac Arweinydd Thema Ymchwil Iechyd Gweithredol, Ysgol Gwyddorau Gofal Iechyd, Prifysgol Caerdydd

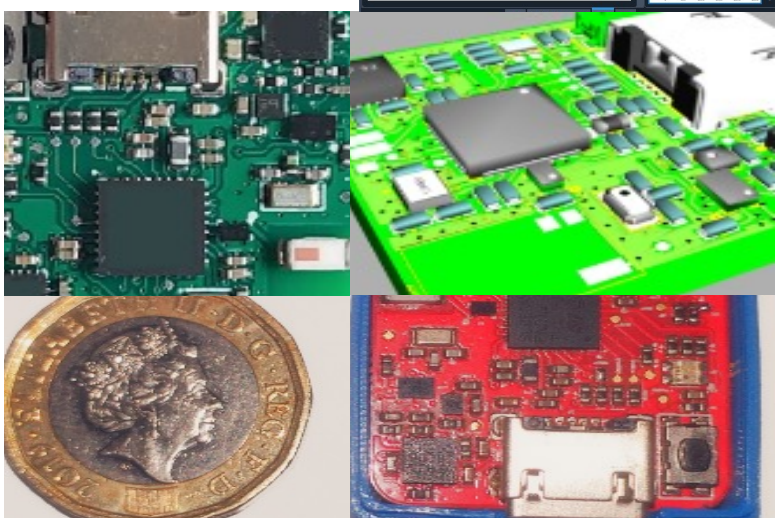
Mae **Accelerate** yn cefnogi'r gwaith o gyflawni'r prosiect cydweithredol hwn drwy arbenigedd academaidd Prifysgol Caerdydd a sicrhau darpariaeth rheoli a hwyluso prosiectau drwy'r Clinical Innovation Accelerator.

Bydd Ambiquire yn dod â'i arbenigedd i'r prosiect o ran datblygu IMUs, a bydd yn cyfrannu ei brofiad o ddarparu cynnyrch sy'n fasnachol hyfyw.

O safbwynt clinigol, darperir arbenigedd gan ffisiotherapydd cyhyrysgerbydol arbenigol o Fwrdd Iechyd Prifysgol Caerdydd a'r Fro.




Ambiquire IMUs ac enghraifft o ddata crai



## CANLYNIADAU DISGWYLIEDIG

- Marchnad gynnyrch newydd ar gyfer technoleg Ambiquire
- Adnodd mesur fforddiadwy, gwrthrychol i gefnogi prosesau adsefydlu yn y cartref
- Dilyniant cleifion wedi'i lywio gan ddata symudiad gwrthrychol
- Cyfleoedd ar gyfer cydweithredu pellach a ffrwd ariannu newydd rhwng partneriaid prosiect
- Astudiaethau achos a chyhoeddiadau a adolygir gan gymheiriaid

## EFFAITH YN Y DYFODOL

- Effaith economaidd drwy ehangu'r dechnoleg i wahanol feysydd drwy well dealltwriaeth o angen clinigol.
- Twf cwmnïau wedi'i ysgogi gan ymchwil a datblygu cydweithredol
- Mwy o effeithiolrwydd adsefydlu cyhyrysgerbydol yn y cartref
- Grymuso cleifion drwy fwy o locws rheolaeth fewnol
- Yr hyn y gellir ei gyflawni sy'n cyd-fynd â Llesiant Cenedlaethau'r Dyfodol (Cymru)

Swansea University Prifysgol Abertawe
CARDIFF UNIVERSITY PRIFYSGOL CAERDYDD
Prifysgol Cymru Y Drindod Dewi Sant University of Wales Trinity Saint David
Hwb Gwyddorau Bywyd Cymru Life Sciences Hub Wales