

Innovate UK

Results of Competition: Digital Health Technology Catalyst 2017 Round 1

Competition Code: 1707_CRD_HEAL_DHC2017

Total available funding is up to £6m

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
RETINOPATHY ANSWER LTD	RetinaScan: AI-enabled automated image assessment system for diabetic retinopathy screening	£657,856	£460,499
University of Surrey		£326,860	£326,860

Project description - provided by applicants

Diabetes mellitus (DM) is a global healthcare problem. In 2014 there were 422m diabetics, forecast to rise to 642m by 2040 [WHO]. Diabetic Retinopathy (DR) is a common complication (>50% of sufferers) caused by physiological changes in the retina. It is a major cause of blindness (>7% UK blindness) but easily ameliorated through laser or drug treatment.

Annual routine screening enables DR to be captured and treated early. Images of the retina are taken using readily available cameras for qualified people to review for symptomatic features. Few countries have managed to run a diabetic eye screening programme (DESP), the UK being one. Whilst highly effective, current DESPs are:

labour intensive, requiring manual grading of images by up to 3 specialists
slow, with a targeted 6-week turnaround, impacting on patient retention
expensive, generating an annual NHS screening cost of >£100m

Automated retinal image analysis systems (ARIAS) utilise image analysis algorithms to detect disease features. ARIAS have shown potential to transform DESP delivery with speed, non-scaling cost of operation and significant cost savings. However, achieving accuracy at the level required to provide an effective replacement of level 1 human grading has not yet been realised.

RetinaScan meets this challenge through an innovative ARIAS solution: an advanced algorithm methodology design by experts in diabetology associated with the University of Oxford; with novel AI based imaging analysis systems (convolution neural networks - CNNs) developed at the University of Surrey. Led by Retinopathy Answer Ltd (RAL), a proof of concept prototype has been devised and validated. RALs Augmented-CNN design brings together deep understanding of imaging data and methods to automate consistently qualified human levels of performance.

Advancing on this prototype, RetinaScan will: i) further develop the system architecture for end-user scenarios; ii) advance retina scan datasets for system training and testing; iii) develop regional and eye level image processing engines for accurate disease grading; and iv) develop and demonstrate a complete web-based system prototype through user trials.

The key outcomes of the research will be: a fully capable prototype suite of trained Augmented-CNN technology; ii) prototype validation via user trials; and a detailed business plan for commercialisation as a cloud-based service for markets globally.

The potential addressable global market for ARIAS is estimated at >£2.98 billion. The partnership targets ~£14.98 million business growth within a 5-year period (~£27.89m cumulative sales), creating >35 new jobs and generating a >30-fold ROI.

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BEAVER COMMUNICATIONS LIMITED King's College London	FundamentalVR: A surgery simulation training platform utilising innovative haptic feedback and advanced VR modelling	£711,936 £81,770	£320,371 £81,770
Project description - provided by applicants			
Surgical training has not significantly changed in 100 years despite significant advances in nearly all areas of healthcare. Currently, medical students practise surgeries on cadavers, which causes a number of problems: 1) Cadavers are expensive, the cost of having the license, the facilities and maintaining the labs is an expensive option for medical schools. 2) They are single-use, each part of the body can only be practiced on once so if mistakes are made, students cannot reattempt the surgery. 3) They are limited in scope, live procedures cannot be practiced as they exist in a dead tissue environment with no blood flow. This means their functionality is limited to anatomical familiarity and a few orthopaedic surgeries. FundamentalVR seek to create an innovative, affordable & interactive VR solution using off-the-shelf hardware that will provide a comprehensive platform for medical students to learn and practice a variety of surgical procedures. The system can also be used unlimited times for students to repeat surgeries, assess performance and highlight areas for improvement of the trainee.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MEDAPHOR LIMITED	Virtual reality aid for ultrasound-guided needling	£634,876	£444,413
Cardiff University		£21,529	£21,529

Project description - provided by applicants

We aim to revolutionise interventional ultrasound needling using augmented-reality and an artificial intelligence technique known as deep-learning.

During this project, we will develop and test an ultrasound needling assistant that:

Automatically locates the needle-tip using deep-learning (ie by using computer vision to find the needle-tip in the ultrasound image)

Uses an augmented reality headset worn by the clinician to project a holographic ultrasound view over the patient's anatomy highlighting the needle track and important anatomical structures in the correct position "within" the patient.

Doctors use interventional needling in a variety of medical procedures: for example, to biopsy tissues, to drain fluid, to insert cannulas, and to administer regional anaesthesia in a procedure known as a peripheral nerve block. Particularly when guiding the needle to deep structures, it is important that they do not damage other tissue. Clinicians therefore need to be able to see the needle-tip. They often use ultrasound to do this since it is a safe imaging technique and the equipment can be brought to the bedside.

For many needling procedures, NICE recommends that ultrasound guidance always be used.

Ultrasound uses sound to visualise tissues. The ultrasound transducer emits a narrow beam of sound (rather like sonar on a submarine). Reflected sound is received by the machine and used to image the tissue it is reflected from.

Ultrasound needling is a difficult technique to master: the clinician must manipulate the needle and ultrasound transducer whilst looking at the ultrasound machine's screen (away from the patient) rather than at the patient themselves. They must manually keep the needle-tip within the ultrasound beam whilst advancing it towards its target. If the tip moves out of plane, it can become confused with the needle-shaft on the ultrasound image with potentially serious consequences.

Using augmented reality allows the ultrasound to be placed over the patient so the physical needle can simultaneously be seen, additionally highlighting the needle and important anatomical structures in the ultrasound view.

This will help the patient (by the clinician not missing the biopsy target and avoiding damage to adjacent structures), the health service (by reducing procedure time and cost) and the clinician (by reducing repetitive strain injury as the procedure will be more ergonomic).

These will give significant benefits to the NHS (both for patients and in improving the healthcare economics of ultrasound-guided needling) as well as significant export potential for a world-leading new digital health technology.

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BIG HEALTH LTD	Enabling better health and self-care at scale with digital sleep medicine	£591,380	£413,966
Oxford Academic Health Science Network		£407,294	£407,294

Project description - provided by applicants

The purpose of this Digital Health Catalyst project is to find the best way of providing people who have insomnia (persistent poor sleep) with an alternative to taking sleeping pills. This is important because most people and their doctors would prefer a self-help approach, and a very effective self-help solution exists. It's called Cognitive Behavioural Therapy (CBT for short). The problem is that CBT is usually provided by a therapist, and because there are 12 million NHS prescriptions written by doctors each year for insomnia, in person CBT is a huge challenge.

This project aims to close this treatment gap and give people with insomnia immediate access to CBT. This is achievable because 'Sleepio' is a web and mobile 'digital' CBT programme, proven in clinical studies to effectively solve sleep problems and improve day-to-day functioning.

Big Health, the company that developed Sleepio, will work with the NHS through the Oxford Academic Health Sciences Network (AHSN) to discover the best way to make Sleepio available. We will look for examples at how GPs might prescribe Sleepio instead of pills, and ways that people might get more direct access to Sleepio e.g. through a website or through an employee wellbeing scheme. Once we have found the most successful approach, we will develop an 'implementation toolkit', a kind of blueprint plan. This can then be used more widely than can be achieved in this initial demonstration project. There are AHSNs throughout the country, so there is the prospect of them 'adopting' the toolkit in their areas.

At the same time as looking at these practicalities, the project will also be exploring the best approach to 'commissioning'. Commissioning is how the NHS forms agreements about service contracts, and ensures best value for the public money it spends. When it comes to commissioning digital self-help solutions the NHS is entering a relatively new realm. This in fact is one of the reasons that this Digital Catalyst funding has been made available in the first place. Therefore this project will be a world-leading first that will pave the way for the NHS to provide and pay for cost-effective digital solutions such as Sleepio.

Having found methods to introduce a safe and effective digital solution for persistent poor sleep, these same approaches can be used as a foundation to consider how digital CBT could help with other common mental health problems.

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NEUROFENIX LIMITED	Gameball: A novel platform to provide enjoyable and affordable hand and arm rehabilitation following a stroke	£451,432	£203,144
Brunel University London		£201,204	£201,204

Project description - provided by applicants

Strokes are the most common cause of long-term disability in Europe. In the UK, 1.2 million residents are stroke-survivors, and stroke incidence-rate is expected to continue to increase. Strokes often leave survivors with significant physical, cognitive, social and emotional problems, with the quality of rehabilitative healthcare offered post-stroke critical for limiting/reversing stroke effects, helping survivors return to more independent living. With private physiotherapy costing ~£100/hour, most survivors cannot afford an optimum treatment programme- one that is affordable, can be easily self-managed at home, and is engaging. This project, undertaken by Neurofenix in collaboration with Brunel University London, will address these challenges, and a successful outcome will have a profound effect on healthcare delivery for stroke survivors through development of 'The Gameball Platform'. This development project will create an innovative, digital approach to stroke rehabilitation, designed specifically with patient-input from initial conception. The solution offers an easy-to-use hand-controller connected to an innovative software platform, allowing all-in-one upper-limb training through uniquely designed rehabilitation games, an analytics platform that tracks patient progress and supportive online community. The Gameball platform will allow physical/occupational therapists to monitor multiple patients simultaneously, freeing-up their time. By empowering stroke survivors to self-manage their rehabilitation, Gameball aims to speed a stroke survivor's return to pre-stroke functionality, with physical recovery leading to improvements in daily-life activities and mental well-being.

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MYWAY DIGITAL HEALTH LIMITED	MyDiabetesIQ	£741,872	£519,310
NHS GRAMPIAN		£6,072	£6,072
NHS Greater Glasgow & Clyde		£14,836	£14,836
NHS Greater Glasgow and Clyde		£70,726	£70,726
NHS LANARKSHIRE		£5,983	£0
NHS Tayside		£13,000	£13,000
University of Dundee		£146,762	£146,762

Project description - provided by applicants

This project brings together a unique partnership of niche expertise across NHS, academia and the commercial sector to create a new and world leading diabetes artificial intelligence product (MyDiabetesIQ) driving tailored decision-support for clinicians and patients. This project aims to design, develop, test, implement and evaluate MyDiabetesIQ in Scotland and NW London to demonstrate its commercial potential.

Focus: Scotland is world-renowned for diabetes care, driven by a unique national data-linked complete shared electronic health record for clinicians (SCI-Diabetes) and patients (MyDiabetesMyWay (MDMW)). MDMW has already been commercialised through a university spin-out company, MyWay Digital Health Ltd (MWDH), and there is huge potential to build on this success. Computer aided learning in this project will focus around key areas of diabetes care including i) prediction of medicine response in individual patients: to improve prescribing, reduce waste and side effects ii) prediction of chronic complications (including lower limb/ cardiovascular disease), iii) prediction of acute complications such as hypoglycaemia (low blood glucose) and ketoacidosis to enable early intervention, and iv) prediction of diabetes type (e.g. type 1, type 2, genetic diabetes (MODY), latent onset autoimmune diabetes) to prevent misclassification, and thereby supporting accurate and safe treatment.

Innovation: This proposal is highly innovative; it moves beyond current approaches using algorithms. MyDiabetesIQ will aim to combine a wide variety of data sources i.e. NHS data (laboratory, anthropometrics, medical history, medications), and patient recorded data (activity tracking, home glucose monitoring, insulin pumps and self-reported mood, outcomes, experience and activation/ motivation scoring) as available from large national datasets.

MyDiabetesIQ will facilitate prediction of multiple diabetes related outcomes creating a sophisticated learning health system for diabetes. The outputs will drive practical evidence based advice via individual and population based alerts, reports, and dashboards, to clinicians and patients, breaking AI out of the realms of academia into everyday practice, with the potential to re-model for other longterm conditions. MyDiabetesIQ will feed into commercial products MyDiabetesMyWay (patient portal) and MyDiabetesClinical (clinician portal) serving a market demand for cost saving digital health interventions in a climate of high costs and rising disease prevalence.

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ACCURX LIMITED	Stream: A software solution to safely shift general practitioner workload to non-medical clinicians	£709,543	£496,680
Bury Knowle Health Centre		£143,636	£100,545
Manor Surgery		£143,636	£100,545

Project description - provided by applicants

Almost one million patients per week are unable to access a GP appointment. This is due to increased demand for GP appointments (due to an ageing population, rising prevalence of long-term conditions, population growth and rising expectations) and reduced supply of GP availability (due to early retirement of GPs, an increased number of GPs working part time and record numbers of vacant training posts). This staffing shortfall will only get worse with 40% of GPs planning on retiring over the next five years.

Despite the British Medical Association calling for a 40% increase in GP funding (September 2017), increased funding alone will not tackle this crisis as it takes over ten years to train a GP. This project will develop AccuRx Stream, decision support software that will upskill nurses, pharmacists, paramedics and other practice staff to allow them to shift workload from GPs. Stream will be based on AccuRx Chain, existing decision support software that focuses on improving antibiotic prescribing accuracy, and is used most by nurses.

Stream integrates with existing GP software and provides decision support for routine conditions that can be used with the patient. By pulling data from the patient's record, patient-specific recommendations can be given without requiring extensive questioning, and a full audit trail of the consultation is automatically documented. Stream also generates personalised self-care advice for the patient to take away, that is sent to their phone and printed. This evidence-based decision support allows allied health professionals to safely and confidently manage consultations that they could not previously. Consultations that Stream will support include minor ailments, chronic disease management, contraception, diagnostic services, infections and lifestyle advice.

By upskilling allied health professionals, Stream provides new opportunities for career progression, increasing retention and morale of the entire practice team. Relieving practice pressure will also help reduce burnout and early retirement of GP partners.

Shifting workload from GPs will not only relieve workforce pressure and reduce costs to primary care, but will also reduce pressure on the wider health system. For example, patients unable to book a GP appointment are more likely to attend A&E, practices with insufficient resources are more likely to refer patients unnecessarily for hospital care, and patients with poorly managed chronic conditions are more likely to be admitted to hospital. Increasing access to primary care by reducing waiting lists will also help to reduce health inequities.

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BFB LABS LTD	Empowering digital health innovations with a real-time clinical trial platform	£506,738	£228,032
University of Nottingham		£96,999	£96,999
Project description - provided by applicants			
<p>BfB labs is building new technology which empowers high quality mental health research to be performed at a lower cost and by a larger group than ever before.</p> <p>Health services are unable to meet demand. A flood of health innovations have emerged to meet remaining needs but are startlingly ill-evidenced with less than 1% collecting clinical data of any kind. A critical lack of evidence means providers like the NHS are unable to procure this new wave of innovation without putting patients at risk.</p> <p>Our technology enables substantially cheaper and more efficient applied research in health, guarding patient safety while creating better health outcomes at a lower cost.</p>			

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FIRST OPTION SOFTWARE LIMITED	An Enhanced Artificial Intelligence Breast MRI Scanning System (IntelliScan)	£489,473	£342,631
Brunel University London		£293,008	£293,008
Teesside University		£194,655	£194,655
Project description - provided by applicants			
<p>Breast cancer is the most common type of cancer in women worldwide, with nearly 1.7 million new cases diagnosed in 2015 (second most common cancer overall). This represents about 12% of all new cancer cases and 25% of all cancers in women. According to the World Health Organisation (Global Health Estimates 2013), over 50% of breast cancer cases and 42% of deaths occur in developed countries. This includes the UK, where one in 5 cases of breast cancer results in a fatality.</p> <p>This project therefore seeks to develop INTELLISCAN, an Artificial Intelligence, machine learning enhanced breast MRI scanning system for use as a highly efficient, more accurate breast cancer screening tool. Our technology applies computer based image processing to deliver improved, instant, automated anomaly detection of breast MRI scans. Based on yearly licensing fees received, the successful exploitation of the technology will result in cumulative revenue of £32.5m 6 years post-launch in the healthcare market.</p>			

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