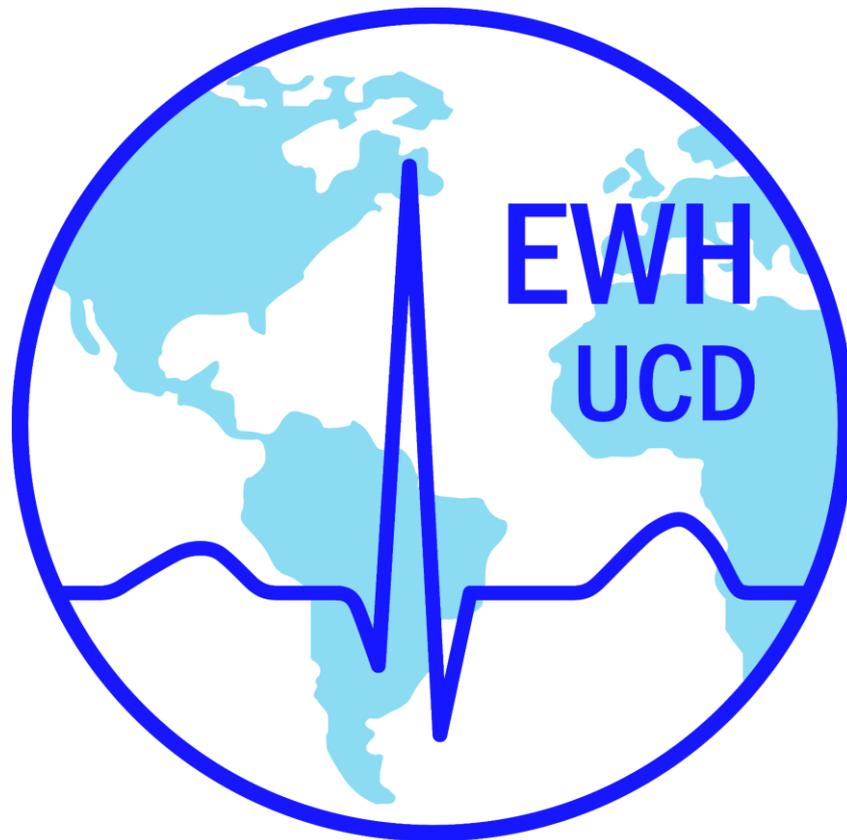# Chapter of the Year Competition Report

University College Dublin

30th May 2021

Section A: Programs and Projects Description

1. Design Projects

As a result of the growing membership of our chapter and the success of the initial hackathon style idea generation workshops that we ran at the beginning of the year, we decided to divide our group into two sub teams in order to devote our efforts to two design projects for the year ahead.

Bronchoscopy Team Summary

At the beginning of this year we sought to gain a better understanding of the current healthcare disparities that hospitals in low and middle income countries face. To achieve this we conducted an interview with a resident Doctor in Uganda in which he informed us of the severe lack of bronchoscopes and bronchoscopy training in their hospital. A bronchoscope is a medical device that is used to see inside airways and lungs and is essential when diagnosing respiratory diseases or removing obstructions in the airways. However, despite respiratory diseases being on the rise, the lack of essential equipment and training for bronchoscopy has left LMIC's with little capacity for adequate respiratory care.

Following this discovery we entered an intense research stage in order to understand the technicalities behind bronchoscopy procedures and the equipment involved. The vast scope of this problem soon came to light and became one of our biggest challenges. One of our main conclusions from this research period was that a lack of bronchoscopes is intrinsically linked with a lack of adequate training resources, with one virtually unattainable without the other. This made us examine the potential of providing a bronchoscopy training device that allows for realistic skill acquisition applicable to the bronchoscopy procedure. With current training models costing in the region of £2000 there is a definite gap in the market for a cost effective alternative that can be reused to provide training for numerous bronchoscopy and respiratory care procedures.

One of the most fundamental outcomes of bronchoscopy training through simulator models is to develop dexterity when navigating the key airways and a comprehensive knowledge of the respiratory system and bronchial anatomy. For this reason we designed our model to include a comprehensive anatomy of all the necessary airways that are used in bronchoscopy procedures. We prototyped our model using a combination of 3d printing and art supplies.

We incorporated a pressure sending matrix into our design which we implemented into the pharynx, larynx and carina of the trachea to detect the application of excessive force which could cause damage to a patient's tissues. The pharynx and carina were chosen as they contain a high number of cough receptors, the carina being the most sensitive, which upon the application of pressure triggers the cough reflex. The patient coughing is a useful tool used by trainees to determine the appropriate level of force required during the procedure and thus the inclusion of this feature enhances the realism of our model. Furthermore, following a meeting with Dr Tim McDonnell (St.Vincent's Private Hospital Dublin), a specialist in respiratory medicine, we decided to incorporate the larynx as he explained the difficulties with passing through the larynx into the trachea, especially for trainees which often results in damaging the larynx, making it a crucial component of our model for trainees to practice on.

Throughout the ideation phase of our work we devised a number of other feasible devices that could be used during bronchoscopy. These included the broncho-phone, an emergency anti choking device, an affordable disposable bronchoscope and an affordable training model. We continued to develop some of our initial ideas such as the bronchophone, which we entered into numerous accelerators, student enterprise initiatives and the Cisco global problem solving challenge.

Epilepsy Team Summary

There was great interest amongst the team in creating a solution that was scalable across low and middle income countries as well as high income countries. To this end, the team investigated healthcare problems that are prevalent across all countries, regardless of income brackets, but the impact of which are unevenly distributed to worse affect low and middle income countries. After conducting a thorough horizons scan, it was revealed that around 50 million people worldwide have epilepsy, making it one of the most common neurological diseases globally. However, nearly 80% of people with epilepsy live in low- and middle-income countries. Moreover, while it is estimated that up to 70% of people living with epilepsy could live seizure- free if properly diagnosed and treated, three quarters of people with epilepsy living in low-income countries do not get the treatment they need. This unequal disease state distribution is known as the 'treatment gap' and can be attributed in part to the lack of training in the administration of emergency epileptic medications. To this effect, we designed 'MidazoClamp', a solution that aims to address the 'treatment gap' by providing a reliable and effective way to dispense midazolam into the buccal cavity. The device will act as a clamp on the buccal mucosa, allowing the medication to be administered in the appropriate location in a safer and more efficient manner than a caregiver syringing the medication directly onto the inner cheek. Our device increases patient and caregiver safety by removing the need for the caregiver to place their hands close to the patient's mouth during a seizure.

Current solutions for the administration of buccal-midazolam involves syringing the medication onto the reception site which is prone to errors in both the placement and absorption of the drug. 'MidazoClamp' is carefully designed to be compliant to the characteristics of an ideal buccoadhesive system and therefore is not susceptible to these errors. The clamp is tailored to adhere to the buccal mucosa and release the drug in a way that prevents it from moving from the reception site either by saliva or by movement of the tongue or jaw.

In addition to an increase in the precision of midazolam administration, another important benefit offered by 'MidazoClamp' over the traditional method, is the convenience and dignity it offers patients. The incorporation of the clamp and drug tray element of the design means that once the clamp is in the correct position the medicine can be administered quickly and easily without the need for medical personnel holding the syringe in place or placing their fingers in or near the patient's mouth. This helps to make it a less invasive and safer experience for all involved.

2. Kit Builds and Equipment Repaired

Due to the ongoing Covid-19 pandemic, local hospitals have been reluctant to collaborate with our university team owing to the difficulty in allowing unauthorized personnel into hospitals with the increased restrictions in force over the past year. Despite this setback, we have made contact with a number of hospitals in the greater Dublin area and would be hopeful that this can be built upon to develop a meaningful partnership over the coming years.

The Covid-19 pandemic also meant that no students were permitted to meet up and use laboratory equipment to assemble the EWH kits. For our outreach education program (section 3) we designed tasks that could be performed in open space and didn't require electrical power tools to build so that social distancing could be maintained. Next year when in-person student activities are allowed the kits will be used to teach new members how to solder and the fundamentals of heart rate monitoring.

3. STEM Activities

During the year, an Outreach subcommittee of 13 chapter members was established. It consisted of volunteers who shared a drive to inspire and educate younger students about STEM with a particular emphasis on engineering.

An outreach program was designed and implemented aimed at students between the ages of 13 and 18. This program included informative sessions on STEM, the streams and opportunities associated with engineering, and the work that EWH does.

Our team also developed a series of creative, fun engineering challenges, designed to create excitement about the subjects of STEM. These challenges included building bridges from classroom objects such as pens and testing the weight they uphold, designing catapults and testing how far they could launch objects, designing roller coasters , inflatable lungs and much more.

The program was piloted with an all girls secondary school in Dublin. Approximately 100 students participated in the program. The feedback from both the students and teachers was overwhelmingly positive. Next year we plan to build on this project and expand the program to reach more students.

Additionally throughout the year, we collaborated with the Women+ in Stem Society committee and the Literacy and Historical Society committee in University College Dublin. We created a speech writing competition with subjects relating to STEM aimed at transition year students. This is currently being rolled out to schools across Ireland.

4. Future activities

This June, our teams will be presenting our two entries for the EWH Design Competition at the Dublin Maker Festival at a virtual booth. This festival is a showcase of invention, creativity and resourcefulness, and is attended by 10,000 people each year.

During this year, a subcommittee applied for the NovaUCD Student Enterprise competition. This is a competition that assists students in refining their start-up ideas through various structured workshops, taught content from industry experts, interactive workshops, pitching sessions and mentoring. Our subcommittee was successful in their application and are currently taking part in the four week competition.

Next Year's Goals
For the next year of our Chapter, we want to expand our membership. We would like to continue to develop some of this year's design competition entries and enter more competitions again such as the Cisco Global Problem Solver.

We plan to host more events with other societies and other colleges after the success of our collaborations this year. In Particular, we would like to host our Competition "Irish Solutions to Global Problems" for its second year in a row and allow even more teams to enter. Pending COVID-19 restrictions, we would like to host some or all of this competition in person next year.

Our Outreach Program will continue to expand next year and our engineering challenges will be brought to even more schools in Ireland with the aim to educate and inspire more students to consider studying engineering.

5. External Innovation Competitions

Teams from our chapter were involved in a series of competitions throughout the year.

Cisco Global Problem Solver Challenge
We entered a team from the EWH UCD chapter entered the Cisco Global Problem Solver Challenge to win up to $250,000 in equity free funding with a product, the Bronchophone, which allows the adaptation of out-of-date fiberoptic bronchoscopes into low-cost video bronchoscopes by combining the fibreoptic bronchoscope with a smartphone camera using an attachment comprising of a series of lenses. The idea also incorporates the internet of things technology as the captured video frames can be anonymised, analysed and used to train an image detection convolutional neural network for the identification of different kinds of bronchial tissues which would give it the ability to identify adenocarcinoma, squamous cell carcinoma, and other cancerous abnormalities to improve diagnostic procedures. The team made it into the 93 semi-finalist teams out of the 1745 teams that applied and are currently waiting to hear the list of finalists.

UCD Investors and Entrepreneurs Startup Accelerator and Dragons' Den
We also entered a small team into the UCD Investors and Entrepreneurs Startup Accelerator and Dragons' Den Pitch off which provided a series of workshops on starting a business by guest lecturers and ended in 2 rounds of pitching competitions, the semi-final involved pitching to members of the I&E society and the final to 3 successful Irish entrepreneurs. Our team, RespTech, won the competition beating a variety of other businesses and winning €400 in funding for the chapter.

Section B: Organizational Activities

1. Chapter Structure and Statistics

Our EWH Chapter Committee consists of 8 members - a President, two Vice Presidents and Treasurer which make up the Executive Committee, as well as the Outreach, Events, Sponsorship and Social Media Officers. These 8 Committee members meet weekly to oversee all EWH UCD Chapter business, to update each other on funding, events, the outreach program, general administration, and to plan for the coming weeks and any major events.

All events and meetings this year were virtual and held via Zoom due to Ireland's COVID-19 restrictions.

The Outreach Officer runs a sub-committee of 13 members who spearhead our Outreach Program. This involves creating STEM themed challenges for schools, running these challenges in said schools, and giving talks on engineering to pre-college students.

Our two EWH UCD Design Competition Teams meet weekly to work on their entries. The teams are composed of 10 and 14 members and have an average attendance of about 15-20 people.

Our Chapter has 34 members in total. Events run throughout the year had an attendance of at least 14. When hosting larger scale events with corporate sponsorship and collaborations with other university societies, attendance has been significantly higher, exceeding 100 attendees at our National Competition - Irish Solutions to Global Problems.

We use email and group chats to keep in contact with our active members. We use several social media platforms to update all of our followers including:

- LinkTree (https://linktr.ee/ewhucd),
- Instagram - 231 followers (@ewh_ucd)
- LinkedIn - 207 followers (https://www.linkedin.com/company/engineering-world-health-ucd)
- Facebook - 41 followers (https://www.facebook.com/ewhucd).
- Twitter - 18 followers (@EwhUcd).

Our social media posts include updates to do with our teams and committee, upcoming events, inspirational engineering design posts, and informational posts about anatomy and physiology.

2. Fundraising Approaches

By getting in contact with the Engineering faculty members, our sponsorship deck was sent out to a number of medical device firms. A number of meetings were held with senior members of these firms and a partnership was established between us and Stryker Ireland. They provided us with monetary sponsorship on top of sponsorship-in-kind where they provided the goodie bag prizes for our 'Irish Solutions to Global Problems' event.

Part of the winnings of our Dragon's Den sub-team, 'RespTech', were reinvested back into the chapter. The university provided the funds to pay our chapter fees at the beginning of the year.

Funding Source	Amount
Stryker Sponsorship	€1500
Dragon's Den Prize Money	€400
UCD Chapter fees	€450
Total	**€2350**

3. Other Chapter Activities

Irish Solutions to Global Problems
This year we launched our first ever EWH UCD hackathon. Over 100 participants signed up to take part in our 24hr hackathon named Irish Solutions to Global Problems. We had prizes from our sponsors for the top three teams and some special prizes too. The three topics teams could choose to focus on were;
- Healthcare in a Climate Crisis
- Aging Population in Low Income Countries
- Post Global Pandemic Solutions

We had some incredible solutions come out of this hackathon. The winning project was an app to reunite families after natural disasters.

Throughout the 24hrs we hosted 3 workshops for the participants to join. The three topics were;
- Design Thinking in the Modern World
- How to Bring a Product to Market
- How to Pitch Effectively

These were all given by high profile, experienced speakers.

Social evenings
As we were faced with a heavy lockdown here in Ireland there wasn't much opportunity to get to know the other members outside of our meetings. Therefore we ran fortnightly social evenings over Zoom, playing games such as Pictionary, Charades, Among Us and many more. We invited all students from the university to these and it helped in bringing in more members.

Guest Speakers
Apart from the hackathon we hosted a number of talks throughout the year open to all students around the country. Just some of these talks were from Stryker, Resmed, Doctor Tim McDonnell, Doctor Donna Eaton, Doctor Lalick Banda.

Collaboration
We have collaborated with multiple other societies for various events throughout the year such as, UCD Engineering Soc, Women in Stem Soc, Formula Student and UCD Medical Soc. For the hackathon we collaborated with similar societies from universities all over the country.

New Kit
This year the chapter members also invested in hoodies with our EWH UCD crest embroidered. It is our hope that this will help in advertising the chapter and gaining more members in the coming years.

Surgical Lamp
We collaborated with UNSW, the 2016 winners of the EWH international design competition on their uninterrupted surgical lamp. Our role was to build the electrical circuit they required, shown below.

Impact

In our debut year as a chapter, we were very fortunate to solidify our position within the university and grow our impact. Our 2019/2020 executive committee members were featured in two articles, one written by the university , 'UCD Engineering team with all-female executive wins international prize' and another piece by an external source - evoke.ie, 'Irish engineers win prestigious world prize for work with hospitals in developing countries.'

https://www.ucd.ie/discovery/risingstars/ucdengineeringteamwithall-femaleexecutivewinsinternationalprize.html

Section C: EWH Chapter Feedback

As a chapter based in Ireland, something we would like to see would be more events or collaboration projects that European chapters can get involved with.

Section D: Appendix

Appendix A: Images from Design Projects

Bronchoscope Project
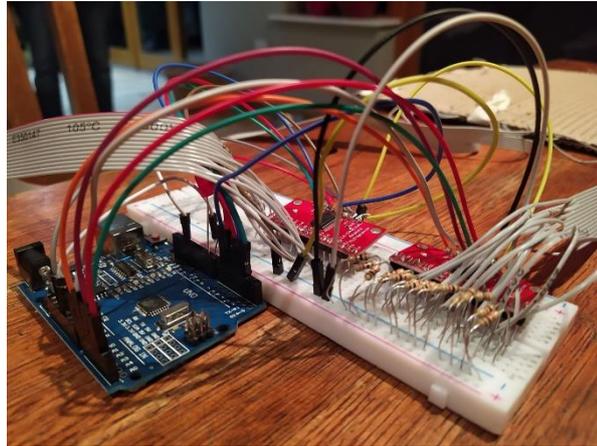
Epilepsy Project
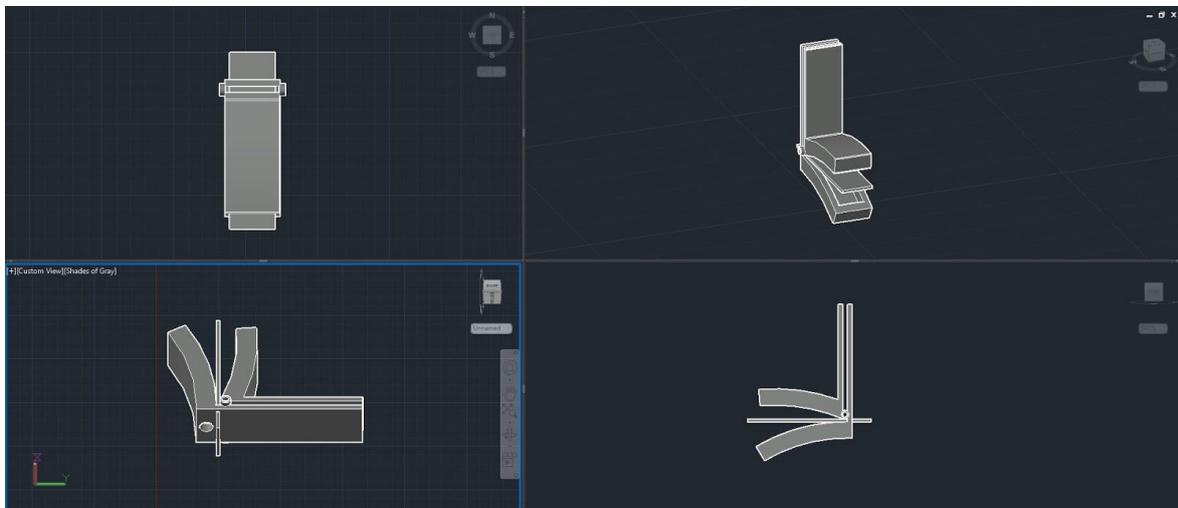
Appendix B: Graphics for our 2020/2021 Recruitment Campaign

engineering worldhealth UCD

We are looking for students from **ALL** disciplines to join our team

Information Evening – Thursday 1st October at 6pm on Zoom

To innovate and build new products, we want a range of students from **different disciplines**

Placed 3rd in the EWH International Design Competition

1st: University of Auckland: *Fishing: E-Learning Platform and ERP System for Limited Resource Environments*

2nd: University of New South Wales: *Thrifti Gyre Centrifuge: an Effective, Low-Cost Centrifuge*

3rd: The University College Dublin: *KeepTrack: A Blockchain Driven Communication Tool*

Being on the team is a chance to develop key skills such as...

Creative Solutions
Research   Design Thinking
New Technologies   Product Development
Management
Learning about Regulations   Innovation
Multidisciplinary Collaboration   Arduino
Leadership   Raspberry Pi   Communication
Problem Solving   3D Printing
Coding   Teamwork

Collaborated with the University of New South Wales' EWH Chapter on the "Uninterruptible Surgical Lamp" Project

Established a team of 25 graduate and undergraduate students who research and create groundbreaking medical technologies for under resourced communities

Appendix C: Outreach Programme

Informative Slideshow

Some creative designs from schools visited.

Some of the challenges designed by our subcommittee

Appendix D: Graphics for our Guest Speakers
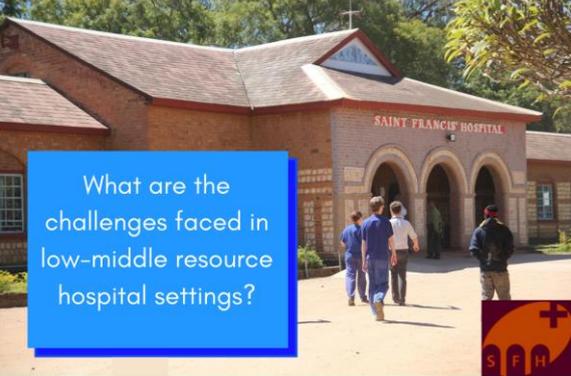
Appendix E: Graphics and Photographs from our National Competition - Irish Solutions to Global Problems

These graphics were used to advertise our event in various social media platforms by societies and clubs all over the country. The winners of our competition, descriptions of their products, and our six judges are pictured below.
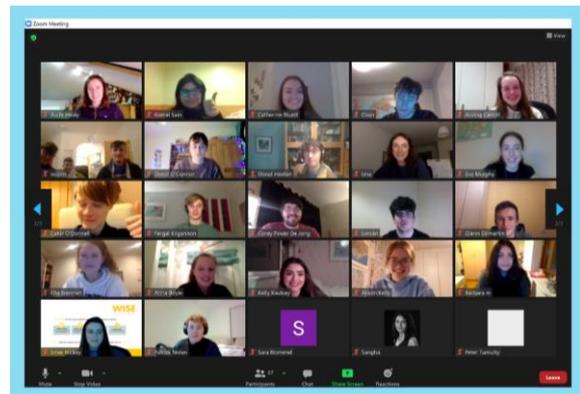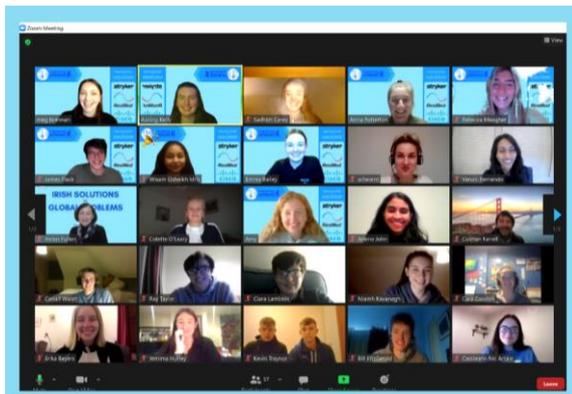
1ST PLACE

Team 6 - "Nexum"

Due to climate change, there is an increasing number of natural disasters every year. This leads to many families being separated for up to months, and hospitals being overrun with people trying to find loved ones.

Our app Nexum utilizes facial recognition software to identify people and help reunite them with their family. Our unique solution enables users to share their location with a select number of loved ones. Medical staff would also be able to scan the faces of patients which would be checked against a database of ID photos to identify the patient and notify their loved ones of their location. This reduces emotional trauma and could reduce hospital crowding.

12TH-13TH FEBRUARY 2021

2ND PLACE

**Team 8 - "CORE"**

Moving Mountains From Your Back Yard

CORE is an affordable domestic renewable energy generation system aimed at incentivizing and popularizing the climate change combat initiative. A user friendly unit paired with an intuitive energy tracker app, the CORE system network makes energy production attractive and competitive, while also an extremely efficient source of energy for your home.

12TH-13TH FEBRUARY 2021

3RD PLACE

Team 24 - "Wooden it be Nice"
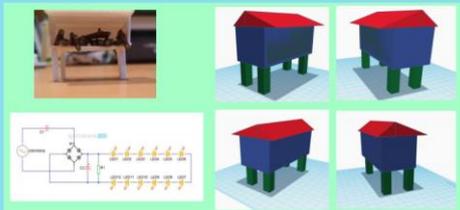
Using alternate firewood storage to inhibit the spread of Chagas Disease.

12TH-13TH FEBRUARY 2021

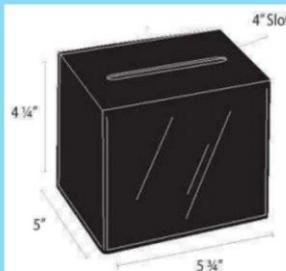## ETHICAL AWARD

Team 14 - "Sustainashoe"

Sustainashoe is a cheap yet durable shoe created from recycled tyres and face masks. This product will help reduce post pandemic waste while also reducing the prevalence of diseases such as trench foot in low-middle income countries.

12TH-13TH FEBRUARY 2021

MOST CREATIVE AWARD

Team 18 - "Phone Sanitizer"

A phone sanitising station, so mobile devices can be used in a healthcare setting

12TH-13TH FEBRUARY 2021

BEST PITCH AWARD

Team 19 - "Aidvantage"

In a time where online shopping is become more prevalent and tailored towards younger people, Aidvantage is an E-commerce platform that offers a tailor-made customer experience specifically for elderly people.

12TH-13TH FEBRUARY 2021

Varuni Fernando
Product Manager at ResMed's
Digital Health Technology Labs

Colin Keogh, PhD
Innovation Consultant at INELCOM,
R&D Engineer, Co-Founder Open
Source Ventilator

Colette O'Leary
Director, IT Business Partner,
Global Advanced Operations

Colman Farrell
Medical Doctor &
Entrepreneurial Educator

Sarah Chearnley
Quality Engineer at Stryker

Helen Fullen
Pre-Accelerator Lead at NDRC
& Mentor at Enterprise Ireland

Appendix F: Graphics for External Competitions

Appendix G: Graphics for our Social Events

Appendix H: Schematics from Surgical Lamp Project
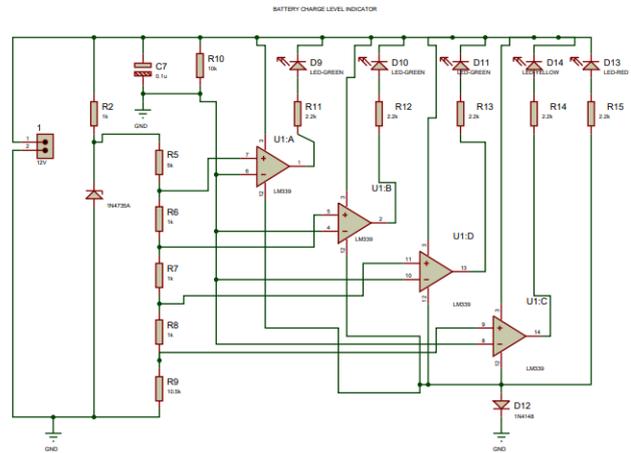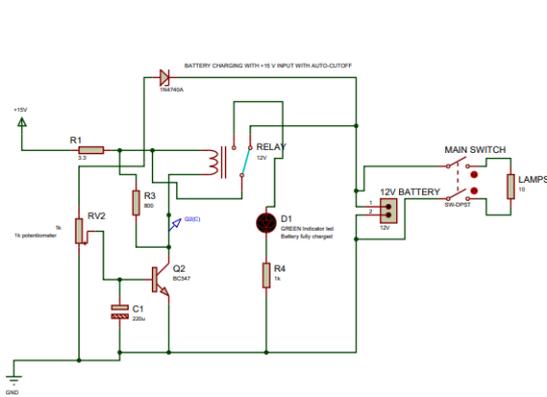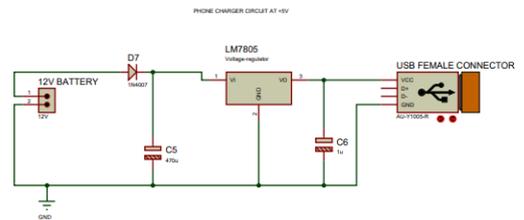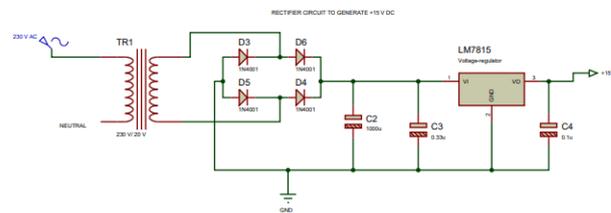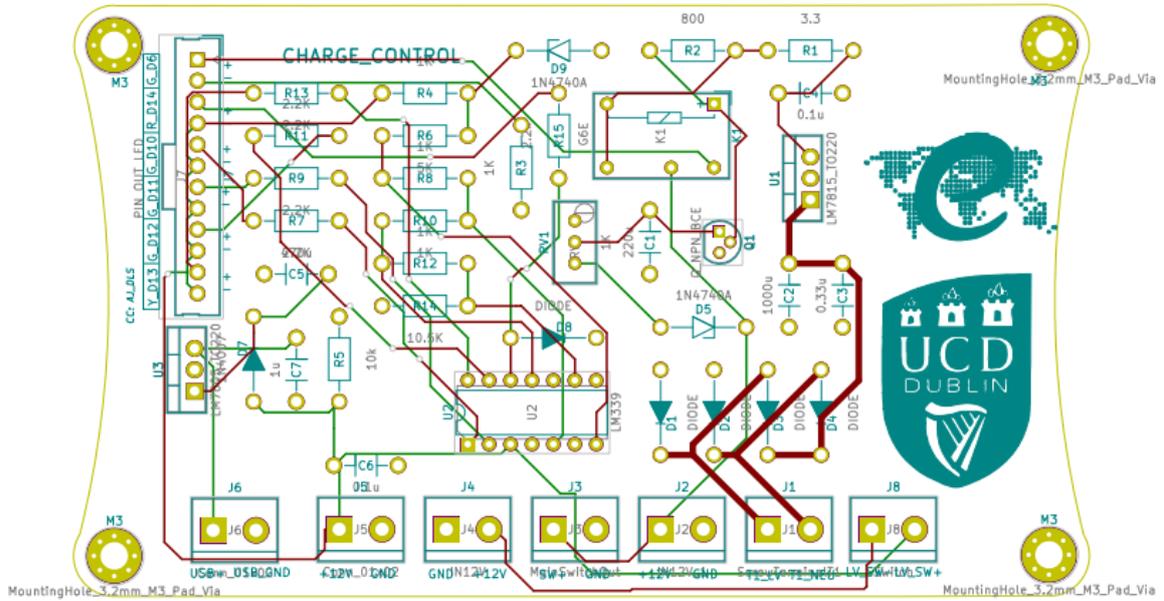
Appendix I: Sponsorship Deck

UCD ENGINEERING WORLD HEALTH

What is **Engineering World Health**?

Engineering World Health is a non-profit organization that engages the skills and passions of students and professionals from around the globe to **improve healthcare delivery** in low-income countries.

"For every $1 million EWH spends on education, $4 million globally is returned in value through the repairing and improvement of essential medical equipment."

With programs in Asia, Africa, and Latin America, their **volunteer engineers** install and repair **life-saving equipment** in resource-poor hospitals.
EWH also train **local technicians** in order to build sustainable capacity.

The **EWH Design competition** is an international competition where teams from different university chapters submit an **innovative medical instrument** designed for areas with limited resources, with hope of **commercializing,** so that it can one day be utilized where it is needed.

Who are **EWH UCD**?

Competition Winners 2020

1st: University of Auckland: *Fishing: E-Learning Platform and ERP System for Limited Resource Environments*

2nd: University of New South Wales: *Thrifty Gyre Centrifuge: an Effective, Low-Cost Centrifuge*

3rd: The University College Dublin: *KeepTrack: A Blockchain Driven Communication Tool*

UCD engineering team with all-female executive wins international prize

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Who are **EWH UCD**?

EWH-UCD is Ireland's **first** ever chapter of Engineering World Health (EHW). Founded in late 2019, the UCD EWH chapter has grown into a multi-disciplinary, diverse chapter representing students from many faculties.

We are a team of **undergraduate and postgraduate** students determined to put our engineering knowledge to the test and **make a change** in the health care systems of low –income countries.

We do this through educating ourselves on the **core root of the problems** many developing nations face in health care.
We are committed to **pushing boundaries** and making **impactful contributions** to global health.

Our **impact**

- Ranked 3rd in the 2020 EWH Design Competition, in our first year of operating as a chapter.
- Made history as the first ever EWH Chapter established in Ireland.
- Established a team of highly motivated students, working towards improving the standard of healthcare around the world.
- Established industry and faculty links.
- Grown our chapter and gained university wide attention.
- Collaborated with universities across the globe, working towards final phase prototype development

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Our Past **Projects/Collaborations**

Keep Track: A blockchain driven communication tool, 3rd Place 2020 Design Competition:
We designed a blockchain-supported RFID donation logging system, which uses basic materials and cheap technology, allowing it to be sustained in a low resource setting. Our debut into the design competition saw our entry beating EWH chapters around the world. We were delighted to rank in 3rd place.

Uninterruptible Surgical Lamp: A multi-disciplinary, international collaboration with the University of New South Wales, Australia.
We collaborated with UNSW on the final phase prototyping of their 2016 winning design competition entry. Our team focused on the electronic and electrical side of the lamp, including the uninterruptible power supply, while the Australian team developed the mechanical aspect.

EEG Simulator:
In identifying problems with the administration of EEG readings for infants in the developing world, we developed an idea to make a dry electrode cap (which is easier to administer and doesn't require the replacement of parts). We plan to implement this with a machine learning module which will make decisions based on the brain signals and categorize them in order to assist doctors and physicians that must read these brain signals.


EWH UCD **Estimated Expenditure**
Total Budget: €5000

Design Challenge:
In order to compete at the international design challenge, we need to ability to purchase materials for prototyping.
-This includes the purchase of Arduinos, software licencing, sheet metal, etc.
-This also includes the cost of manufacturing and testing prototype.

Events: A small budget will be maintained to make it possible for us to host events for our own chapter.
-These include talks from our sponsorship representatives, networking events with our industry and faculty contacts, team-building activities and open evenings.

Education Outreach:
A fundamental aspect of Engineering World Health is inspiring the next generation of biomedical engineers We hope to achieve through outreach with local communities and schools.
-This requires the purchase of demonstration materials, kits, transport, etc.

EWH Summer Institute Scholarship
The EWH summer institutes, where students travel to low income countries for humanitarian purposes, to repair hospital eequipment and provide essential technician training. This costs in excess of €7000. This puts it out of reach of most UCD students.
We aim to make this more accessible to students by subsidising this endeavour.

(Pie chart values: 35%, 1%, 10%, 50%)
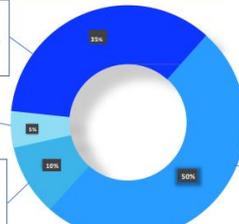
The **value** that **EWH** brings to your organisation

- The opportunity to invest in future engineers and direct access to leading student talent.
- Heightened visibility for you brand on a global and local level.
- Recognition of your support in all our promotional materials
- The chance to allow local students to effect actual change

Sponsorship

The success of our team is built upon the dedication, passion and hard-work of our members, but also from **collaboration** with organisations, businesses and individuals.

Our sponsors enjoy exposure to a large pool of **highly motivated** student talent.
We have an **ongoing relationship** with our sponsors, who regularly give talks/information sessions regarding internships and recruitment sessions.
We also value sponsorship visibility. Sponsor's logos will be visible at all our events, marketing and design entries.

We aspire to encourage **creativity, critical thinking and problem-solving skills** not only amongst our members, but we also believe in giving back to our communities. We aim to educate and **inspire future generations of engineers** through school outreach and community workshops. This local outreach endeavour would be tied with your brand.

Join our current sponsors!

ResMed

HR ElectricalServicesltd.

Haven Pharmacy

CISCO

engineering worldhealth UCD

@Engineering World Health - UCD

@ewh_ucd

@ewhucd

@EwhUcd

UCD engineering team with all-female executive wins international prize

Pictured left-right: Biomedical Engineering students Emma Bailey, Rebecca Meagher and Meg Brennan.

Irish engineers win prestigious world prize for work with hospitals in developing countries

By **Galen English** - 01/11/2020

f | Facebook   Twitter   Email

MORE INSPIRE

Kildare woman Louise Nealon lands six-figure deal for debut book and film rights

Appendix K: Pictures from Meetings