Project Pitch Document

SHUTTLEWORTH FOUNDATION

Project name

Glia Gaza Office

Fellow(s)

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Short description

To establish a Gaza office that can follow and implement the research work of Glia in Gaza hospitals

Objective(s)

- Establish a fully functional, operational office in Gaza to increase the team's effectiveness at implementing Glia's mission for the creation of medical devices
- Permeate the broader values of local design and manufacture in the area

The Gaza team will:

- Be a centre of excellence for 3D printing and rapid prototyping in Gaza
- Be a centre of excellence for Free/Open Source Software and Hardware in Gaza
- Disseminate 3D printing culture in schools, universities and businesses
- Produce medical devices in Gaza
- Train hospital biomedical engineering departments in Gaza on use of 3D printing
- Establish centre for 3D printing and device development in University College of Science and Technology (Khan Younis)

Link to scope of fellowship(s)

The fellowship scope is to both create medical devices and to create the conditions for open source medical devices to thrive. Gaza serves as a live test for these devices, and an office is necessary to coordinate this work.

Context

Presently, the main dirigents of the project in Gaza are forced to work full-time to support their families, with Glia-related work being done in their spare time. The office in which the work is done is small and poorly equipped, with approximately 10-16 hours of electricity on good days (city grid + battery backups) and 4-6 hours on bad days. This project will allow these engineers to work full-time with Glia, and to have equipment that makes it possible to work efficiently and effectively.

Other projects to address the medical device shortage due to the blockade focus on importing devices and designing political and legal mechanisms to ensure transit. These projects require large expenditures of political and financial capital, and so tend to be reserved for big-ticket items or times of extreme deprivation.

The unique geopolitical context also means that duplication is an essential component of any project in Gaza, since any one location may be bombed at any time or the participants arrested. A goal of the Gaza office will be the creation of a network of printing and production centres over time. In the first year, the two targeted sites are the University College of Science and Technology (UCST) in Khan Younis and Work Without Borders (WWB) in Gaza city.

The Gaza office will train and equip these engineers over the next year. UCST will be tasked with producing stethoscopes as part of the partnership. WWB will be more a reservoir of engineering competence and development with a 3D printing focus. In the event that the office in Gaza is disabled, the printers confiscated or the main engineering team arrested, production should be able to shift with moderate effort to UCST.

Intended beneficiaries

- Ministry of Health (Gaza) – creation of needed medical devices
- Work Without Borders (Gaza) – training and support of their 3D modeling team
- University College of Science and Technology (Khan Younis) – training and foundation of biomedical devices division

Strategic partners

- Ministry of Health (Gaza)
- Work Without Borders (Gaza)
- University College of Science and Technology (Khan Younis)
- Tashkeel 3D

Boundary players

Boundary players are listed below in order of disruption as a function of ability and likelihood.

- Coordination of Government Activities in the Territories (COGAT) – Israeli unit responsible for blockade
  - Might deny project members entry to Gaza
  - Might deny equipment entry into Gaza
- Ministry of Interior (Israel)
  - Might deny project members visas to enter Israel
- Israel Security Agency (aka Shin Bet aka Shabak)
  - Might declare project members as terrorists
- Canadian Security Intelligence Service / Royal Canadian Mounted Police (CSIS/RCMP)
  - Might define work in Gaza as falling within Bill C51 (The Antiterrorism Act)
  - Might order confiscation of laptops / electronics
- Health Canada
  - Licensing barriers might create down-time in projects in Gaza

Methodology and activities

Manufacturing

The Gaza office is presently co-located with Tashkeel 3D, a 3D printing, CNC and PCB-manufacturing facility currently based in a 1-room workshop. The new office will have 4 rooms, 3 for Glia-related purposes, and one for Tashkeel 3D to continue its work. Glia will

cover $300 of the $400 rent, and Tashkeel 3D will pay for the remainder. All of Tashkeel 3D's equipment (CNC, tools, etc) will be available to Glia. See below in "Sustainability strategy" for the rationale on keeping Tashkeel 3D alive.

Research and development

Research and development in Gaza will be shared among three groups. The first is the Gaza Glia office, which will be responsible for quick-and-dirty projects (*e.g.*, tourniquet design).

The second group will be UCST-KY. Once set up, this college will be assigned one or two main projects per year to develop and deploy. Their team of biomedical engineers, engineers and health-related specialists will take approximately 2 years to grow, but should be productive once they take off.

The third group will be WWB. This group will most likely be used to create limited and easily achievable devices that require no strategic thinking. Examples include re-laying out a PCB (*e.g.*, an 8-layer PCB for ECG being re-done as a 1-layer PCB) or modeling devices (*e.g.*, surgical instruments).

Personnel

The office will have three paid personnel, two engineers (Mohammed Abu Matar and Mahmoud Al-Alawi) and a helper. Because the office represents a real-life work opportunity, unpaid interns seconded from Gaza's universities will be leveraged as well.

External training

External training began during February and is proceeding as follows:

University College of Science and Technology (Khan Younis)

UCST will have weekly training sessions for the first month, then biweekly sessions. Within 6 months, their program should be able to produce their first stethoscopes, which will ramp up to full production by 12 months' time.

Work Without Borders

WWB received their printer on 1 March 2017. The first training session was the same day. They will receive weekly sessions for the first month, then biweekly sessions for the next 5 months. Thereafter (August 2017), we will reassess and make a new plan as to how to proceed forward.

Outputs and deliverables

Medical device manufacturing

The primary task of the team will be to create and distribute medical devices. The first of these is a stethoscope. Using a graded model of distribution and continuous improvement, 100 stethoscopes will be delivered in the first 6 months, followed by approximately 500 in the 6 months thereafter. The creation of stethoscopes will be largely contingent on the entry of silicone tubing.

- Produce medical devices in Gaza:
    - Stethoscopes (2017)
    - Tourniquets (2017/2018)
    - Pulse oximeters (2018/2019)
    - Upper limb prosthetics (2017/2018)
- Train hospital biomedical engineering departments in Gaza on use of 3D printing

Medical device development

The Gaza team is already working on creating a combat tourniquet for penetrating injuries. They will cooperate with international engineers to finish development of this and other devices as their skills improve and further device needs develop.

Personnel development

Two engineers have been working extensively on 3D printing and its cultural dissemination in Gaza. They are Mohammed Abu Matar and Mahmoud Al-Alawi. Through this project, they will be given 1 day a week (6 day work week) to work on independent projects as they see fit to help them develop their skills and interests.

External training for 3D printing

UCST is a technical college with an excellent and open-minded administration. We will give them a 3D printer (already purchased and assembled in Gaza) and biweekly training sessions until they are capable of producing stethoscopes for use in Gaza.

Time frame

One year, renewable. Start date is effective immediately.

Resources and budget

Table 1. Capital costs

Item	Description	Quantity	Unit cost	Total cost
Solar system	5KW	1	4500	$4,500.00
3D scanner	MS Kinect module	1	50	$50.00
Battery Charger	40A	1	80	$80.00
Raspberry pi	Raspberry Pi 3	1	45	$45.00
Filament extruder	Filastruder	1	300	$300.00
Filament winder	Filawinder	1	170	$170.00
Printer enclosure cabinets	Each cabinet supports 6 printers	2	540	$1,080.00
Work chairs		2	30	$60.00
Total				$6,285.00

Table 2. Material costs

Item	Description	Quantity	Unit cost	Total cost
Thinner		20	3	$60.00
Plastic Pellets	Chi Mei Polylac PA-757 ABS	4	100	$400.00
Silicone tube				$500.00
Total				$960.00

Table 3. Monthly recurring costs

Item	Quantity	Monthly unit cost	Total annual cost
Engineering salary	2	1000	$24,000.00
Support staff salary	1	500	$6,000.00
Social media ads/expenses	1	10	$120.00
Maintenance	1	100	$1,200.00
Transportation	1	35	$420.00
Rent	12	300	$3,600.00
Total			$35,340.00

Table 4. Total costs

Capital costs	$6,285.00
Material costs	$960.00
Monthly recurring costs	$35,340.00
Total	$42,585.00

Measures of success

What changes in behaviour do you expect to see?

1. Independence of the engineers in Gaza to create, research and manufacture devices

2. Ability of UCST-KY and WWB to 3D print with competence

What changes in behaviour would you like to see?

NA

What changes in behaviour would you love to see?

Complete independence and collaboration between all teams.

Communication strategy

Intra-group communication will be done using Mattermost, Kanboard, email and in-person meetings.

External communication will be via twitter, facebook, instagram and public talks in Gaza and internationally.

Sustainability strategy

Sustainability of this project will depend on three main strategies.

For our partners (WWB, UCST-KY), the innate advantage of cooperating in the project will hopefully be worth contributions from both via future grants or internal funding pools.

For the development component, we will continue to apply for and obtain academic grant funding, hopefully even a major grant via the Canadian science research system (Natural Sciences and Engineering Research Council, NSERC; or Canadian Institutes of Health Research, CIHR).

The third strategy is to attempt to create a high-impact revenue stream by transferring some legitimacy and capability from this project to Tashkeel 3D, which should be in a position to take over Glia's funding needs by using commercial contracts to fund the office after the completion of the granting period.

Risks

The main risks for this office and its personnel are:

1. Personnel gaining status and taking higher paid jobs elsewhere
2. Personnel being targeted by Israeli authorities for perceived anti-Israeli activities
3. Personnel being targeted by Palestinian authorities for perceived anti-Palestinian activities
4. Theft, confiscation or destruction of office and equipment by Israeli or Palestinian forces
5. Theft of equipment by domestic competitors or idiots
6. Engagement of office personnel in non-medical activities of 3D printing, such as commercial or military uses.