HackerspaceSG Community Group Submission for Singapore Maker Extravaganza 2019

Roland Turner 2019-06-24

Background

As in previous years, HackerspaceSG proposes to run:

- a set of six-eight booths indoors to showcase various of our community's creations (larger this year because FOSSASIA is exhibiting with us instead of independently); and
- antennas and radios outdoors (whether in a provisioned booth or our own gazebo) for amateur radio creations.

Duration

We propose to exhibit for all three days.

Exhibitor Name

HackerspaceSG Community

Short Description

A science lab in your pocket, automated farming, fermentation, open source microscopy, biotech experimentation, improving lives with open technology, software-defined radio, and DIY electronics for long-distance radio communication.

Long Description

Pocket Science Lab: FOSSASIA Team

From the project website:

> *PSLab is a small USB powered hardware extension for your Android phone or PC that lets you measure all kinds of things. PSLab comes with a built-in Oscilloscope, Multimeter, Wave Generator, Logic Analyzer, Power Source, and we are constantly adding more digital instruments. PSLab is many devices in one. Simply connect two wires to the relevant pins and start measuring. You can use our Open Source Android or desktop apps to view and collect the*

> *data. You can also plug in hundreds of compatible I2C standard sensors to the PSLab pin slots. It works without the need for programming. So, what experiments you do is just limited to your imagination!*

The plan is to show off the device at the booth. Note that this is relevant to the Maker Extravaganza in two different ways:

- it is open hardware designed by a FOSSASIA collaborator; and
- it is a tool for makers working with electronics.

There is at present **no** intention to sell the device from the booth.

FOSSASIA would also like to run a simple electronics workshop to show how a diagnostic tool of this type is so useful, and by extension why a <S$90 device which replaces thousands of dollars worth of instruments is very useful.

Automated Micro Greens Farm: Darin Lobo

Darin hasn't provided a more detailed description this year, although the title appears pretty self-explanatory.

Fermentation GutHub: Saad Chinoy

From the group website:

> ***Fermentation GutHub Manifesto:***
>
> - 1. Growth - Fork your ferments
> - 2. Sharing - KrautSource everything
> - 3. Abundance - Lust not your neighbours'jars
> - 4. Reciprocity - Give constructive feedback
> - 5. Sustainability - Honour the b2b (bacteria-to-bacteria) community
>
> *We are a community of food tinkerers and bacteria enthusiasts fermenting our way to better guts. We hope to build some fruitful gut connections and facilitate a community where like-minded people share their passion and discoveries of all-things-fermenting.*
> *Fermentation GutHub is a social platform for online - offline exchanges of fermentation experiences and starter cultures. Regular GutHub meetups are organized in the Hackerspace.sg ---> check our FB group for details. We have a nice small Fermentation Bank for free deposits and withdrawals of starter cultures. We also make our own tools, such as the Mother 0.1. starter culture incubator or the StarterSwarm map. The GutHub Github serves as a scrapbook of recipes, tutorials and other data around the fermentation theory and practice.*

The plan is an exhibit describing GutHub and sharing taste-samplers of home-made ginger ale and other fermented goodies from the meetup from the recent meetup and a donate as you like box to help offset costs (no sales, no suggested gift).

Open Source, 3D Printed Microscopy: Saad Chinoy

From the project website:

> *The OpenFlexure project aims to make high precision mechanical positioning available to anyone with a 3D printer - for use in microscopes, micromanipulators, and more.*
> *Currently the OpenFlexure project has two main focuses:*
> ***The OpenFlexure Microscope***
> *An open-source, 3D-printed microscope, including a precise mechanical stage to move the sample and focus the optics.*
> ***The OpenFlexure Block Stage***
> *A 3D printable stage including sub-micron mechanical positioning, with a focus on good mechanical stability.*

The plan is an exhibit describing the project and showing off printed instances of the microscopes examining tiny objects.

Biotech Experimentation: Yasaman Nemat, 42Lab

From the company's website:

> ***42Lab*** *envisions to develop future leaders in the field of BioScience by providing students an early and better understanding of Biotechnology during their middle to high school years. Most schools struggle to introduce* ***Biotechnology Education*** *to their students due to high equipment cost and troublesome experiment preparation. 42Lab solves this problem by providing a wide array of experiments as students learn in a more engaged manner. We also provide a companion app which serves as an electronic manual for students and a management tool for teachers.*

The plan is to show off the portable biotech experiment kits. There is at present **no** intention to sell kits from the booth.

Yasaman would also like to run a workshop on making edible water bubbles and optimising the formula for highest strength. Kids will hone their scientific thinking and problem solving skills

FOSSASIA: Mario Behling, Marco Antonio, Wei Tat Chung

From the organisation's website:

> *We bring amazing people together to create, develop, design and make things with Open Technologies - hardware and software - and share our work for the benefit of all.*
> *...*
> *Our main goal is to improve people's lives by sharing Open Tech solutions. We want to see that information technology and science has a positive impact on our society. We believe this can be achieved if people have access to digital tools and knowledge. Open Technologies offer free and open access.*
> *...*

> *We are an organization of people from all continents based in Asia. We want to see progress and improvements of people's lives in Asia and everywhere. We are developers, designers, event organizers and contributors who want to learn and share ideas, create and make digital software tools and hardware, that benefit people around the world.*

In addition to the PSLab-specific exhibit described above, the plan is an exhibit describing open technology and its importance, and FOSSASIA's activities in particular.

Software-Defined Radio: Joyce Ng 9V1AN

Software-defined radio completely changes how radios are produced and in particular makes experimentation and tinkering easier.

The plan is for Joyce to show off at the booth her recent experiments in making working radio components as software, including:

- A basic demonstration of how digital signal processing works using a microcontroller with analogue-to-digital and digital-to-analogue conversion.
- A more complex setup with actual transmit (into a dummy load), and received by another radio.

DIY electronics for long-distance radio communication: Roland Turner 9V1RT

While the cool kids are tinkering with software-defined radios, old-school electronics is how radios have been made for a century. Working HF SSB radios, capable of communicating over thousands of km, can be constructed with DIY electronics of moderate complexity.

The plan is:

- at the booth: Exhibit working DIY radios that are not powered up.
- outside: Erect antennas (a subset of the antennas exhibited at the 2017 Maker Faire), connect one or more of the DIY radios, and demonstrate real-world long-distance communication. If possible, the operation will be remotely performed from the indoor booth, meaning that no booth will be required outside, just the antennas and associated equipment. As in 2017, a detailed plan will be provided for approval by both the Facilities and Occupational Safety and Health groups at Science Centre Singapore.

UN Sustainable Development Goals Addressed

Project	UN SDGs Addressed
Pocket Science Lab	4. Quality Education 9. Industry, Innovation, and Infrastructure
Automated Micro Greens Farm	2. Zero Hunger 9. Industry, Innovation, and Infrastructure

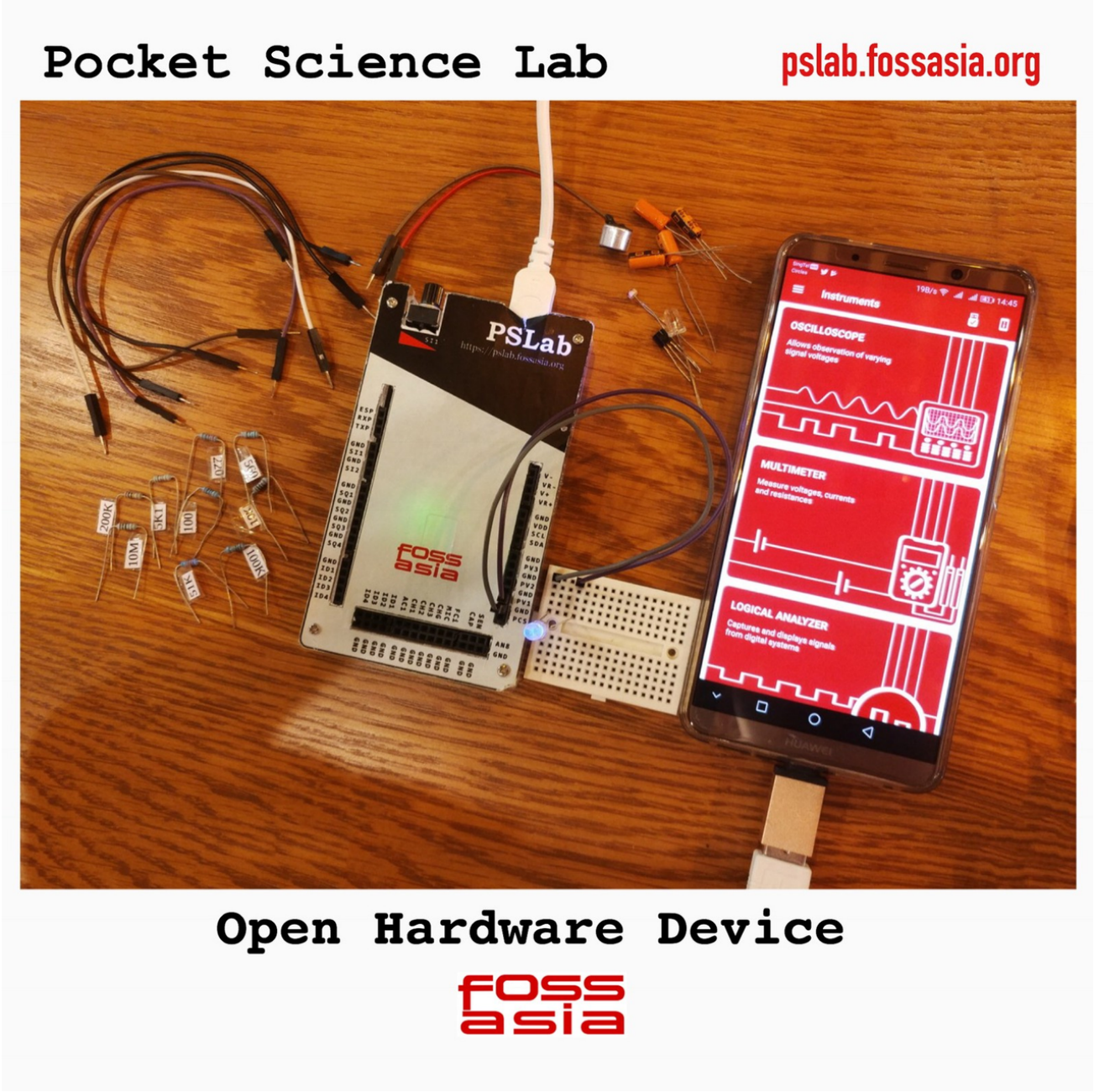
	13. Climate Action (very local food production)
Fermentation GutHub	9. Industry, Innovation, and Infrastructure 12. Responsible Consumption and Production
Open Source, 3D Printed Microscopy	4. Quality Education. 9. Industry, Innovation, and Infrastructure
Biotech Experimentation	4. Quality Education 12. Responsible Consumption and Production (biofuel, degradable plastics, etc.)
FOSSASIA	4. Quality Education 9. Industry, Innovation, and Infrastructure 12. Responsible Consumption and Production (models of production not critically dependent upon investors)
Software-Defined Radio	4. Quality Education 9. Industry, Innovation, and Infrastructure
DIY electronics for long-distance radio communication	4. Quality Education 13. Climate Action (communications resilience during disasters, as in Puerto Rico in 2017)

How STEAM is Used

Project	UN SDGs Addressed
Pocket Science Lab	S: Electromagnetism T: Open technology hardware/software E: • Tool design and design for manufacture. • Use of the tool in designing other things. M: Function generation, signal analysis, signal processing.
Automated Micro Greens Farm	S: Biology E: Design and construction of automated equipment.
Fermentation GutHub	S: Biology E: • Selection of organisms. • Preparation and supervision of fermentation process. A: Aesthetic selections for pleasant eating.

Open Source, 3D Printed Microscopy	S: Microscopy for all relevant sciences, particularly biology. T: Open technology hardware/software. E: Tool design and design for 3D printing.
Biotech Experimentation	S: Biology T: Biological experimentation techniques. E: Design of low cost experiments.
FOSSASIA	T: Promotion of open technology in all fields. E: Development and promotion of development of working open technology hardware, software, knowledge, etc.
Software-Defined Radio	S: Electromagnetism. T: Applying computation to RF signal processing. E: Design and production of working radio components. M: Signal processing.
DIY electronics for long-distance radio communication	S: Electromagnetism. T: Analog electronics. E: DIY production of radios. M: Signal processing

Project Photos



Pocket Science Lab

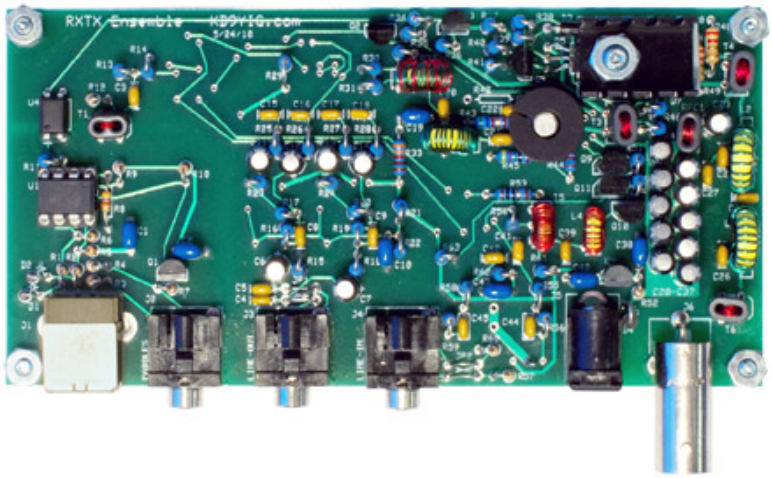
Fermentation GutHub

OpenFlexture Microscope

42Lab LabX

FOSSASIA

Software Defined Radio (HackRF One)



DIY HF Radio (Softrock RXTX)

Project Videos

Project	Link to Video
Pocket Science Lab	https://www.youtube.com/watch?v=aZ7vf4wLENQ
Open Source, 3D Printed Microscopy	https://www.youtube.com/watch?v=fHv1to_YjkA
Biotech Experimentation	https://drive.google.com/file/d/1JsZEnU2TYAPwiNOyYgCtXAwMl8VsMKHJ/view

FOSSASIA	https://www.youtube.com/watch?v=TqIhu0cKD9c

Target Audience

Project	Children	Families	Educators	Adults	Makers	Other
Pocket Science Lab			Yes	Yes	Yes	
Automated Micro Greens Farm				Yes	Yes	
Fermentation GutHub				Yes	Yes	
Open Source, 3D Printed Microscopy			Yes	Yes	Yes	
Biotech Experimentation			Yes	Yes	Yes	
FOSSASIA			Yes	Yes	Yes	
Software-Defined Radio			Yes	Yes	Yes	
DIY electronics for long-distance radio communication			Yes	Yes	Yes	

Additional Requirements for Booth

Power

- A 13A power socket per indoor table will be adequate.
- Outdoor power requirements TBD; will depend upon details of antenna placement.

WiFi

- Several of our indoor exhibits will be WiFi-dependent. Like most IOT devices, Wireless@SG-style “login with a web-browser” approaches usually won’t work; WPA2-PSK is preferred.
- Outdoor equipment will make use of what we can find (e.g. stray Wireless@SG), or we’ll use mobile telco services directly.

A Note on WiFi Congestion

Per our post-event feedback last year, **we’d strongly encourage SCS to institute - as a condition of maker/exhibitor participation - a ban on makers/exhibitors running their own WiFi.** Without this, there will be dozens or hundreds of personal hotspots in close proximity to each other, all of them jamming each other, making all WiFi unworkable for almost everybody. Banning personal hotspot use by members of the public generally (e.g. non-maker/exhibitor visitors) may tread on IMDA jurisdiction, however exhibitors participate under a separate Maker Agreement with SCS

and are perfectly free to take on a contractual obligation not to operate their own WiFi. As ever, exceptions will be requested, particularly from makers of course; we'd suggest:

- Those are asking for consent to operate their own WiFi either "just in case" or because they're not sure what they need are exactly the people who created the problem last year. These people should be encouraged/required to use the event WiFi.
- Those whose creations have embedded access points (e.g. some drones) really will need to be able to operate their own WiFi. We'd suggest:
  - (a) registration of such exhibits;
  - (b) the use of the lowest power setting that the device supports, where there is a setting for this; and
  - (b) strictly channels 11 (2,442-2,482MHz) and 165 (5,815-5,835MHz) only, those being the highest "non-overlapping" channels permitted for use in Singapore on 2.4GHz and 5GHz respectively, leaving all other channels clear for makers/exhibitors generally to use to get Internet access via the event WiFi.

The idea of requiring non-use may feel like an uncomfortable constraint to impose, however we'd suggest that it's comparable to how you'd handle an exhibitor who was using sound amplification so loud that it rendered conversation impossible in adjacent booths, except that:

(a) uncoordinated WiFi will instead disrupt IOT exhibits themselves; and
(b) it is difficult and time-consuming to identify the source of interference once it exists, meaning that prior restraint would appear appropriate.

It may also make sense to apply this constraint indoors only, on the basis that outdoors exhibitors are less numerous and some of whom can reasonably be expected to make audible noise too.

Hazards

None of the proposed indoor exhibits present safety hazards.

The outdoor antennas present the usual range of hazards that antennas present. The detailed plan submitted for Facilities and Occupational Safety and Health approval will detail both the hazards and the protective measures employed.

Workshops and Presentations

Project	Duration	Capacity	Price
Pocket Science Lab	30 minutes	15	$0
Biotech Experimentation	20-60 minutes	30	$5

Workshop details are in the project descriptions above. Either of these workshops can be scheduled on any of the days. No presentations are proposed.

Workshop Photos

Pocket Science Lab Workshop photo as above for the project.

42Lab Bubble Strength Workshop