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SCIENCE IN DEVELOPMENT  
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## Do-it-Yourself Science and Innovative Thinking Workshop

20-21 June 2016

*King Mongkut's Institute of Technology Ladkrabang*

**Overview:** We will be holding a two-day science and innovative thinking workshop to teach young students about how the human brain works in a fun and hands-on environment through simple experiments and demonstrations. During the workshop, the students will be building low-cost, open-source electronics, an eyetracker, and EEG (electroencephalogram), which will be used for physical computing. This workshop will help the students explore how these electronics can be used for conducting cognitive science experiments. The key objectives of this workshop will be to:

1. Provide young students with greater access to low cost equipment and data resources to carry out experiments and conduct research independently
2. Empower students to make their own experiments and facilitate their own education in the sciences
3. Think and create in an innovative manner

The participants will learn how to create electronics that can be used to measure human interaction. They will also get an introduction to the field of cognitive science and understand how scientists investigate questions, how scientists think, and they will get to ask and answer some of these questions with their new hardware. During the workshop, the participants will also have a chance to learn how to think in an innovative manner.

After the completion of the two-day workshop, the participants will walk away with a worksheet that provides a summary of what they learned from the workshop. The worksheet will also contain a guide to the activities directly related to the workshop that the students can carry out independently. This worksheet will also have a set of online resources that the participants can use to learn more from and continue their studies from the workshop. These will be free online resources that are available to the general public.

This two-day science workshop is FREE OF CHARGE for all student participants.



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## Schedule

### Monday 20 June (9.00 – 16.00)

Time	Activity
9.00 – 9.20	Opening of workshop with introductions from workshop organizers
9.20 – 9.40	Ice breaking activity
9.40 – 10.00	Knowledge survey
10.00 – 10.15	Break, and go to activity stations
10.15 – 11.45	Session 1 – Activity stations
11.45 – 13.00	Lunch break
13.00 – 14.30	Session 2 – Activity stations
14.30 – 14.45	Break
14.45 – 15.45	Session 3 - Innovative Thinking Part I
15.45 – 16.00	Briefing and discussion, talk about plans for the next day

### Tuesday 21 June (10.00 – 16.00)

Time	Activity
9.45 – 10.00	Participants arrive and get settled
10.00 – 11.30	Session 4 – Activity stations
11.30 – 12.45	Lunch
12.45 – 14.15	Session 5 – Activity stations
14.15 – 14.30	Break
14.30 – 15.30	Session 6 - Innovative Thinking Part II
15.30 – 15.45	Workshop survey
15.30 – 16.00	Closing remarks and participants leave

## Activity Stations

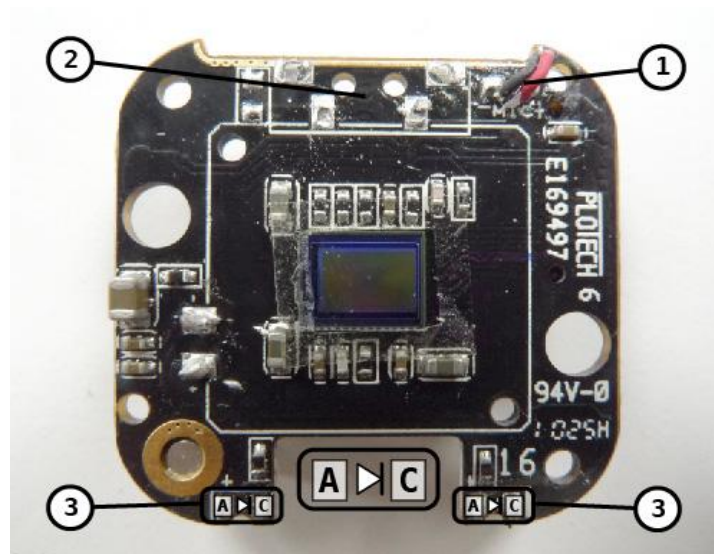
There will be 4 activity stations for the students will rotate through during the two-day workshop. The activity stations are shown below:

Station	Activity
Station 1	Build and experiment with an Eyetracker
Station 2	Build and experiment with an EEG headset
Station 3	Fundamentals of Eye Moments
Station 4	Fundamentals of EEG

Details for the activities for each station are provided below.

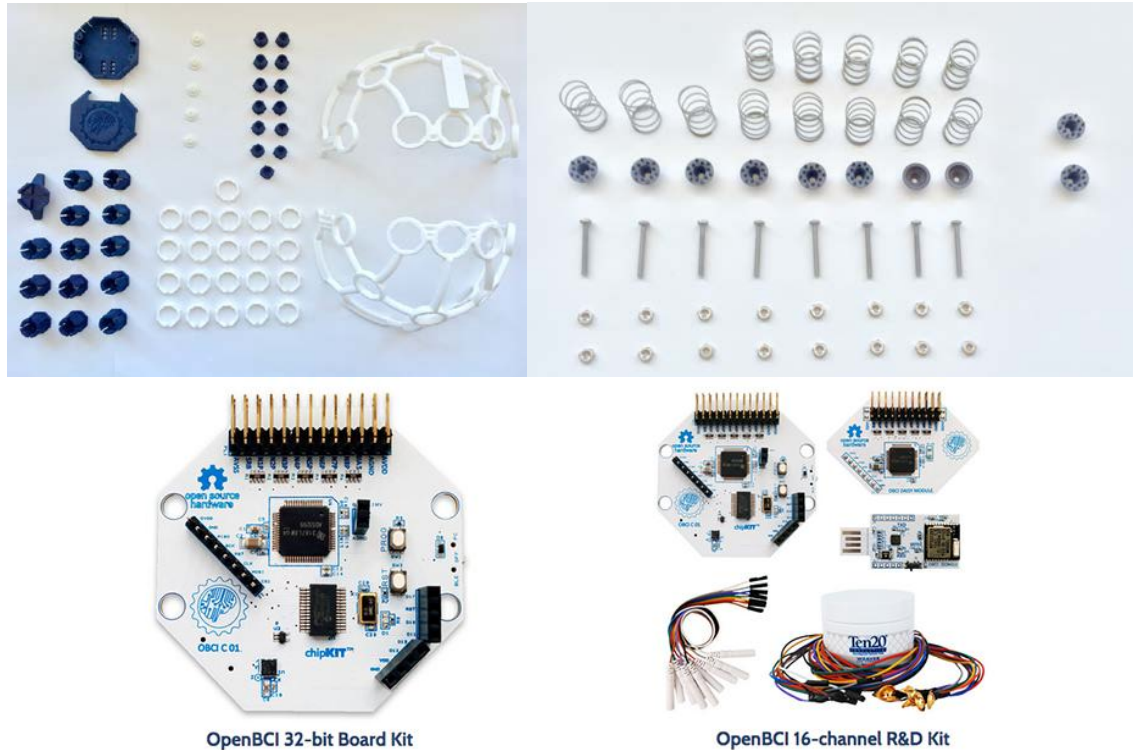
### Station 1: Build and experiment with an Eyetracker (hardware)

We will use existing technologies (webcam, IR LED, soldering) and build a customized DIY eyetracker from low cost parts. We will strip the webcam down to its component parts. We will then learn how to solder infrared (IR) LEDs to the exposed camera board, and then we use the finished product to track the eye.



## **Station 2: Build and experiment with an EEG headset (hardware)**

Using an open-source EEG board, and 3D-printed parts, we will construct an EEG headset that uses dry electrode to measure scalp voltage, and we will stream this data to the computer via Bluetooth. This will require stripping electrode cables, constructing electrode holders and mounting them to the frame.



## **Station 3: Fundamentals of Eye Movements (physiology)**

We will discuss the different types of eye movements we can observe, primarily the saccades, the quick successive movement from one location to another, fixation, the time spent on one particular location, and pursuit, the smooth trace of your eyes following a movement target.

## **Station 4: Fundamentals of EEG (physiology)**

We will discuss the different types of waves and frequency bands we can see in EEG recording: alpha (8-12), beta (16-30), delta (0.1-3), etc. We will discuss the underlying cause to the changes in voltage on the scalp, the coordinate firing of populations of neurons.

## Living Possibilities with an Innovator's Mind

### Sessions 3 and 6

1. Students will get a worksheet at the beginning of the workshop. This worksheet asks them to express their understanding about the EEG and eye tracker, the way of making it according to their knowledge or guessing, and the level of confidence to make it from scratch.
2. Then, they will continue with the activities.
3. After sessions 1 and 2 on first day, and sessions 4 and 5 on second day, the facilitator will review the students' answers on the worksheet, and ask them to reflect on their experience after actually building the EEG/eye tracker.
4. Facilitator will solicit the answers to develop a learning process, which would be concluded to assimilate the experiential learning cycle with the GROWME model (as shown below). This is a process most (if not all) inventors (such as Edison, Wrights, anyone who invents anything!!!) do.
5. Then, students are asked to share their opinions about their own learning, discovery of themselves from going through this process. The facilitator will draw on their answers to discuss the necessity of asking the right questions, taking action, overcoming fears, welcoming and learning from failure, and being resilient are key elements of inventors. Different kinds of questions to be asked for innovators will be discussed.
6. Facilitator will lead them on to discuss the importance of the ability to 'sell' the invention to users. This is necessary to complete the innovation creation process. – from creator to user.
7. The session (on second day) will conclude with the students sharing their ideas or interests in creating something new (or revised products) that serve the needs of people in present and near future, and how to 'sell' this ideas to their potential users.

