

Smart Home and Internet of Things

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The U-STEMist Scheme with SKH Lui Ming Choi Secondary School

Project Introduction

This project was designed for SKH Lui Ming Choi Secondary School students in grade 8th to 11th in academic year 2018/2019 with the support of Mr. Lo Wai Yip, our project went smoothly. 13 students joined the first workshop which was designed to inspire and motivate students in field of Smart Home and Internet of Things. 9 students joined the second workshop which was designed to gain hand-on experience of building an application of IOT in household appliances. The two workshop was conducted on two Saturday in March.



- ❖ Two groups of students taking photo in front of their artifacts on workshop 1, the senior group stayed to the last and took selfie with the tutors.



- ❖ A group photo with our supervisors Dr. Valerie Yip and some captured moments in the second workshop.

Design Rationale

The major learning contents are;

• Internet of things

Students will be able to discover the idea of internet of things by **comparison** with the idea of internet of people. Students will be able to discover the working principle of sensor by **comparison** with the idea of human sensor.

• Smart home

Students will be able to discover that the innovations of smart home are popular by **viewing** a video about the current appliances and future vision of smart home, and by **imagining** their future dream house, they will be able to discover that any ideas in smart home are possible with lower cost and lower techniques. Students will be able to **make** application of IOT in household appliances which are hosted under the teacher's instruction.

• Algorithm in programming

Students will be able to understand the coding by **drawing** flowchart to describe the process and functions of the appliance. Students will be instructed to **discover** the meaning of the coding in an orderly way and step by step. Students will be able to **write** and **test** their coding to accomplish the following functions;



- ❖ Internet controlled Buzzer: A device for locating the losing things by controlling the buzzer via mobile phone.
- ❖ Blowing Lamp: A device that can be turned on or off by blowing air towards the sound sensor.
- ❖ Movement detector: A device for detecting movement in a room by receiving signal from the microwave proximity sensor and sending a message to the user by IFTTT.
- ❖ Potted plant with internet control: A device to draw water by controlling the water pump via mobile phone.
- ❖ Anti-theft drawer alarm system: A device to keep something untouched without monitoring all the time by light proximity sensor.

• Electronic

Students will be able to present the electronic design by **drawing** the virtual circuit and **applying** the idea of basic electronic to **create** and **test** a circuit on a breadboard.

• Engineering design process

Students will be able to **apply** the idea of engineering design process to **discover** the problems from the inconvenience of daily life, the problems can be solved by **applying** the idea of internet of things. Students will be able to **discover** the considerations of product design by **differentiating** the good and bad product design in the cases study.

The highlights of the project are;



- ❖ Strengthen students' confidence on expressing and sharing ideas.
- ❖ Strengthen Students' collaboration on solving problem.
- ❖ Students can create posters with game cards to present their understand and ideas of the tasks.
- ❖ Each group followed with one tutor for giving instruction.
- ❖ Students can choose to join one of the group that making different applications of IOT in household appliances
- ❖ Students can try to discover the solution by following the instruction from "The Cook Book of Coding".

Limitations and difficulties

• Students lack of knowledge about coding with "Flags blocky".

The lesson is not going to train future programmers, but to cultivate students' understanding of the idea of programming, and providing changes to experience the coding. Since we have a small group of students with plentiful teaching resource, each group of students will be provided one experienced teacher in programming, to help students implement their idea, and guiding them to complete the code for accomplishing the goals.

• Students are coming from different grade and with larger diversity of learning background.

During the activities, we observed that the group which mixed with different grade student tend to be passive on the activities tasks, on the contrary, the group with students from the same class tend to be more active and enjoy with the challenges from the tasks.

• Missing a sublimation for the activities.

It is easy to discover that this project included activities to inspire and motivate students, and conducted a direct-instruction hand on activates. There were missing an opportunity for students to practice their coding skill to create an application which they hope to create. If so, we may know that students have develop the learning objectives, namely, as a method to assess students' ability of knowledge transformation.

• The restraint of activity site.

The fixed furniture in a regular computer room and a lot of old electrical devices around the room were restricting the collaboration space where the sharing of ideas occurs.

Individual Reflections

Eliza: As a student from STEM specialism, I always hope to conduct an instructional design of STEM activities which can achieve the idea of STEM effectively, but this idea has no consideration for the acceptance and expectation of students, some students may not interest in the activity and some students may unfamiliar with the background knowledge. Next time, I would like to make a survey of students' ideas, to reduce the complexity of the tasks, and to prepare a good design instruction.

Kawai: It is an impressive experience for me to join this project. I have learned a lot from it, such as how to draw students' attention during the class and how to prepare learning materials. Eliza is an experienced teacher. It was gratifying to be one of her group mates since she always gives helpful and constructive feedbacks for us to follow. In my viewpoint, we have organized a wonderful STEM activity for students.

Queenie: The project has offered me an opportunity to gain a deeper understanding in STEM education and the rationale of STEM. As a science education student, it was rewarding for me to grab this chance to learn some basic programming skills and computational thinking through holding model-making workshops for students. It is particularly fruitful when I learn these skills from my generous groupmates from different backgrounds and teach students what I have learnt. This process allows me to be more familiar with the new knowledge and at the same time learning different generic skills from my groupmates.

Lui: I learnt how to cope with different sort of student in this activity. It was a great opportunity for me to explore the rationales behind viable devices as I am far not an expert on computing and electronic construction. Thus, I am glad to take and give new knowledge from my teammates and to the cooperant students. Thank you all!

Conclusion and Recommendations

Students have acquainted the engineering design process in the activities by the tutors' instruction, the learning activities are aimed to cultivate students' interest in the idea of the Internet of Things, Smart Home, Electronic and Algorithm in programming. Moreover, strengthen students' abilities of cooperation and communication. Most of the students showed interest in the assigned tasks in each activity, however some students were not confident in expressing their opinion in the group discussion, we would like to recommend the school to organize more STEM activities, therefore stimulate students' innovative mindset and thus help to nurture their interest and performance in STEM-related disciplines. Workshops or competitions related to innovation are encouraged for schools to put forward, that serves as the first step for schools to foster STEM education, and enlightening students to apply their skills learned in their daily lives. Furthermore, investigating the students' interest in the different type of STEM activities and design STEM activities with the consideration of students expectations and willingness.

Some recommendations of implementing these activities in the future;

- ❖ Prepare extra electronic modules and categorize the necessary electronic modules into a bag for each group of students.
- ❖ Prepare a worksheet for students to clarify the connection between the electronic modules, better draw the virtual circuits before working on real product.
- ❖ Prepare a series of guiding exercise for students to understand the meaning of the codes, decompose the code into several functions element and explain the means of each functions.
- ❖ Prepare examples of product design and introduce the simple pathways of engineering design process. And provide more time for students to discuss and create, be a company of your students with patient.