1. INTRODUCTION

With the rapid development of educational digitalization, information technology is shouldering the mission of reforming education and teaching. Traditional education has inclined to use the teaching philosophy of cramming method, where teachers repeat the content of the book whilst students gain the knowledge passively. It is not conducive to the interaction between teachers and students, where teachers may not be able to cultivate students' practical and innovative ability as well as their spirit of retrospection. The current educational digitalization has changed the medium of learning, as it transforms the cramming teaching from face-to-face to digitized one. In traditional methods, learners miss the consciousness of participating actively in the interaction between teachers and students as well as among students, which leads to the partiality, hysteresis and passiveness on the feedback of learning process. Also, traditional means cannot effectively improve students' learning enthusiasm, initiative and innovation [12]. Furthermore, it lacks the mechanism for stimulating the update of courses' contents.

Open Education Resources (OER) initiatives have led the effort on the development of open access courses in higher education. In 2000, MIT proposed a plan called "OpenCourseWare (OCW)" with the gradual maturity of Internet and computing technologies. Basically, it uploaded all courseware to the Internet and allows learners from all over the world to freely access the course resources. Unlike MOOCs, OCWs do not offer an entire course, but materials. Later in 2002, The Educational, Scientific and Cultural organization (UNESCO) of The United Nations (UN) further proposed the idea of OER to provide non-commercial educational resources to the educators, students and autodidacts through information technology [13]. OCWC (Open-CourseWare Consortium) was formed in 2005, including OCW-Universia (Open courses alliance in Spanish colleges and universities), CORE (China Open Resources for Education), African

Virtual University, Korea OCW Consortium, and Japanese OCW. Still in 2005, George Siemens proposed the theory of connectivism [19], claiming that the knowledge had become dynamic and networked in the networked era, and Stephen Downes proposed the concept of Connective Knowledge, where he raised that connective knowledge had four characteristics: diversity, autonomy, interactivity and openness [2]. In 2008, Siemens and Downes set up the course called "Connectivism and Connective Knowledge" [3], within the framework of Open and Distance Learning (ODL) initiatives offered by institutions and teachers around the world.
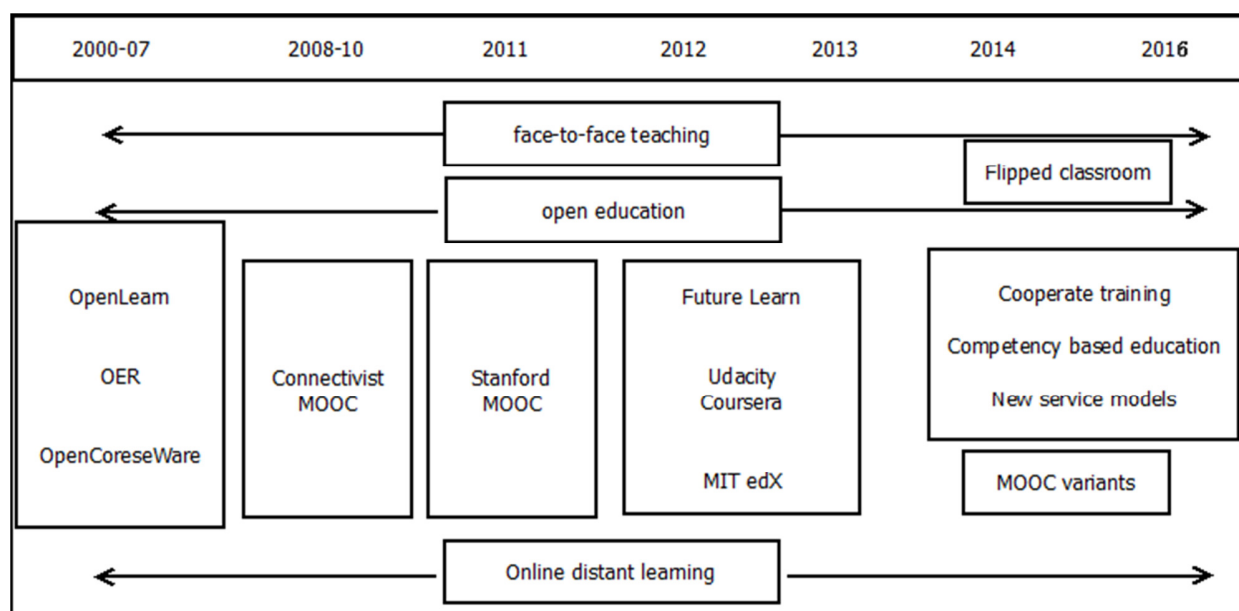
Fig. 1 The timeline of MOOC and open education development [15]

The changes and movement for open education were envisioned and moved forward [3] considering: (1) open technology, mainly related to open source software for education; (2) open content, with reflections on some OER initiatives, and (3) open knowledge, with practical suggestions for sharing educational practices and considerations on openness in education from institution perspective [9]. In [2], 2,200 people signed up and hundreds of people around the world attended the CCK08 course, and each person had different be-

haviors, outcomes and levels of involvement. These facts inspired the definition for MOOC [19].

To fulfill the research gaps in current MOOC course delivery, it is proposed in this paper the concept of COOC, where the major innovation is the development of courses based on crowdsourcing cooperation, by turning the open teaching mode even broader.

The rest of this paper is organized as follows. In Section 2, the research challenges and motivations will be stated by reviewing related works, and a comprehensive design scheme of the proposed COOC is discussed in Section 3. The innovative COOC along with it implementation is empirically evaluated and comparisons on the pros and cons of the traditional MOOC and COOC in Section 4, and the ways how COOC can improve the current MOOC delivery model in Section 5. Finally, conclusion remarks and items as future work are depicted in Section 6.

2. RELATED WORK

2.1 Research Challenges

The utilization of MOOC has created a novel alternative in education, which started to focus on the need of individual and society [23]. It reflects the educational trend of self-directed and self-regulated learning as well as lifelong learning, accelerating the process of popularization and internationalization of advanced education resources and technologies. The timeline of MOOC and the development of open education are shown in Fig. 1 [15]. However, there are disadvantages and limitations in the promotion and development of MOOC:

1. The cost to set up a platform for MOOC is relatively high for a single institution.

Available MOOC platforms, such as Coursera [21] and Udacity [22], cost tens of millions US dollars, and are affordable by most of schools independently. Hence, the majority of schools could only release their courses through existing MOOC platforms that had greatly reduced the liberty and enthusiasm.

2. The knowledge of many engineering, science, and information technology (IT) subjects is being rapidly updated. Technicians and managers can access technical and management skills at earliest release, since there is a long delay period before an avant-garde technology is updated and reflected in textbooks taught by educators. Nevertheless, the main teaching personnel of MOOC are faculty members in colleges and universities. Technicians and managers have bare opportunities to participate and transfer new information and knowledge to the learners. That is to say, current MOOC is unable to keep pace with the social demands and industrial development. Hence, a gap exists which is backward to the updates of course contents, teaching materials, and courseware.

3. Learners do not have the access rights to make contributions to courses and textbooks. Even though teaching environment has been changed, the learning management system is still isolated.

4. For engineering and science disciplines, especially, the gain of knowledge heavily relies on practice and experimentation, whereas MOOC seldom support practical experimentation, especially the manipulation on real devices. Hence, it is difficult to improve the corresponding educational and learning outcomes.

2.2 'From xMOOC to cMOOC'

Inspired by the theory of connectivism, practitioners of MOOCs originally sought to lev-

erage the Internet as a collaborative communication platform to facilitate connections among learners and dissolve traditional ideas of "knowledge giver" and "knowledge receiver", hence learner-generated contents are also of increasing importance in MOOC delivery (Kharbach 2012) [8]. They also made efforts on making use of mobile devices to facilitate MOOC learning be realized anytime and anywhere. As result, most MOOC providers promptly released their mobile apps on mainstream mobile OSs and adapted their webpages to fit the screen size and operation mode of mobile devices in order to catch the trend of mobile learning and enable more convenient use for learners [18][28][32].

MOOCs have developed through several stages in the five years since the term first appeared. A number of MOOCs use different audio and video formats, like video lectures, combining the old type and traditional way of teaching with new technology [20]. As MOOCs have developed, there appear to be three different types. The most important ones are those that emphasize the connectivist philosophy, and those that resemble more traditional courses. Among all of them, two major types of new MOOC stood out, namely cMOOC and xMOOC [19] [7]. In detail, the original MOOCs structured out of Athabasca and connected with Connectivism, Canada and George Siemens are named Connectivist MOOCs, cMOOCs, Canadian MOOCs, or MOOC 1.0 respectively.

The second generation of MOOCs launched by top US universities and the venture-capital funded platforms they have spawned, are known as xMOOCs, MOOC2.0, or progressively, as they have commanded headlines, as MOOCs. For example, the well-known edX[1], has launched its xMOOC which significantly broaden the number of students who can be exposed to under- and post-graduate level courses.

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[1] https://www.edx.org/

Concepts of collaborative work, such as peer-to-peer learning and virtual flipped class-room, are largely adopted in MOOC teaching [4][5]. The University of Pennsylvania's ModPo MOOC undertook a hybrid approach by adopting contemporary MOOC structures, detailed course syllabus and discussion forums as instance, while taking advantages of platform's ability to create a massive global community of interacting learners and incorporating such dynamicity into pedagogical approach.

The idea of crowdsourcing has been widely considered in e-learning platform design and construction. The case using GitHub as a collaborative tool to learn programming was presented in [10], which was mainly used to manage laboratory assignments. Comparative results between traditional and collaborative ways of learning were performed, and experimental results could show that students using collaborative method had better grades than those using traditional method [16]. In [6], authors mentioned a project-based learning case for a mobile app development course, in which they applied GitHub as a communication and code management/review tool. Since a student commits to a piece of code, they can have their teachers/tutors reviewing and grading their code, either merge the commitment to mainline or reject the commitment next. Authors also compared student perception rates before and after the course.

In [18][28][32], by embracing the advantages of the cloud environment, authors have identified a learning flow based on Kolb team learning experience to realize a collaborative approach. The novel learning flow can be executed by a newly designed system and denominated as Teamwork as a Service (TaaS), in conjunction with the cloud-hosting learning management systems. Following this learning flow, learners can benefit from the functions provided by cloud-based services when cooperating in a mobile environment,

being organized into cloud-based teaching strategies named "Jigsaw Classroom", planning and publishing tasks, as well as rationalizing task allocation and mutual supervision. From the experiment results, it is claimed that their approach is capable to facilitate teamwork, while learners' abilities and preferences are taken into consideration.

Based on aforementioned analysis, it is proposed in this paper the design of a new open education mode - Collaborative Open Online Courses (COOC), where the objective is to maximize the usability of courses in all subjects, distribute and share to everyone who can update/modify, freely browse, download and use the materials in COOC platform. In other words, COOC is oriented to OERs and utilizes the crowdsourcing concept to realize the collaboration among peers.

3. COOC DESIGN SCHEME

3.1 Background and Preliminary Study

As discussed above, online learning through MOOC is one of the latest and widely-applied technologies in distance education. As an emerging trend in education area, MOOC is evolving and leading as a new pedagogy to benefit both teachers and students (CC licenses, 2016). However, since research and development of MOOC is still in its infancy, there are evidently many opportunities to improve the MOOC based on existing learning mechanisms. A number of researches have explored to identify more open and fair pedagogical approaches. R. Baraniuk at Rice university, USA setup the website Connexion ([17], renamed as OpenStax CNX) in 1999, where both educators and learners could share and modify contents of the textbook in this open platform. For example, as shown in the Fig.2, an open textbook 'Introduction to Statistics' can be easily accessed

from user-friendly interface provided by OpenStax.

Furthermore, it enables everyone to involve in the compilation, translation, and release of the textbook. Thousands of online textbooks with diverse topics and numerous subjects are produced in this website, and they are available with free access.

A MOOC brings together people attracted in learning and experts who seek to facilitate the learning. Connectivity is regularly provided through social networking, and a set of freely accessible online resources provides the content or the study material. Moreover, they generally have no pre-requirements, fees, formal accreditation, or predefined required level of participation [30]. Participation in a MOOC is totally voluntary and is dependent on the individual. The collaborative space of a MOOC can span over several different platforms and technologies. For example, MOOC participants may create their blog posts or micro blogs such as Twitter by discussing features of the MOOC in different spaces and/or to express themselves [31].
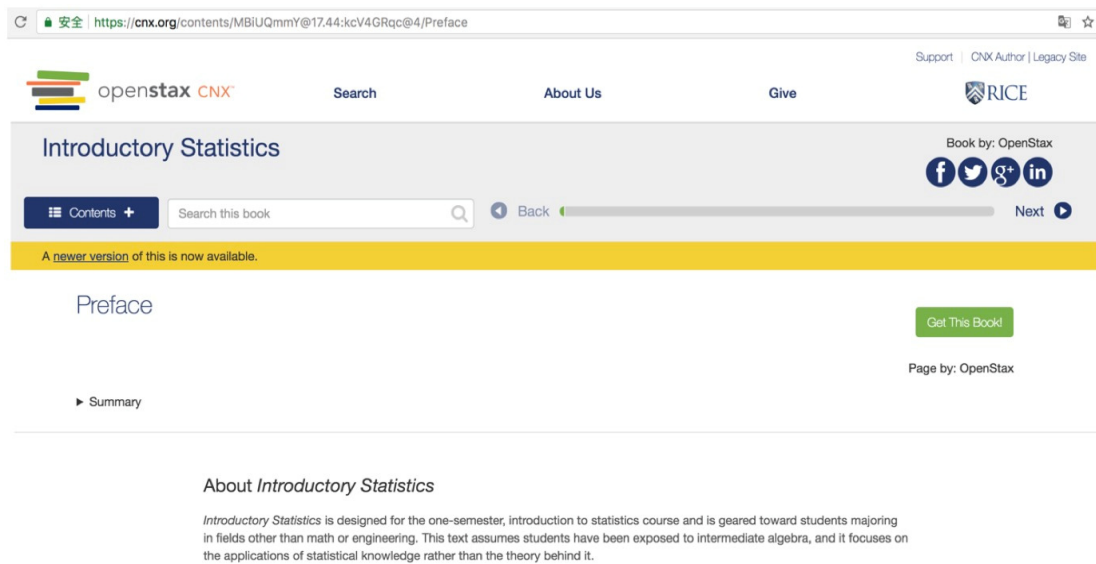

Fig. 2 The example of an open textbook "Introduction to Statistics" in OpenStax [17].
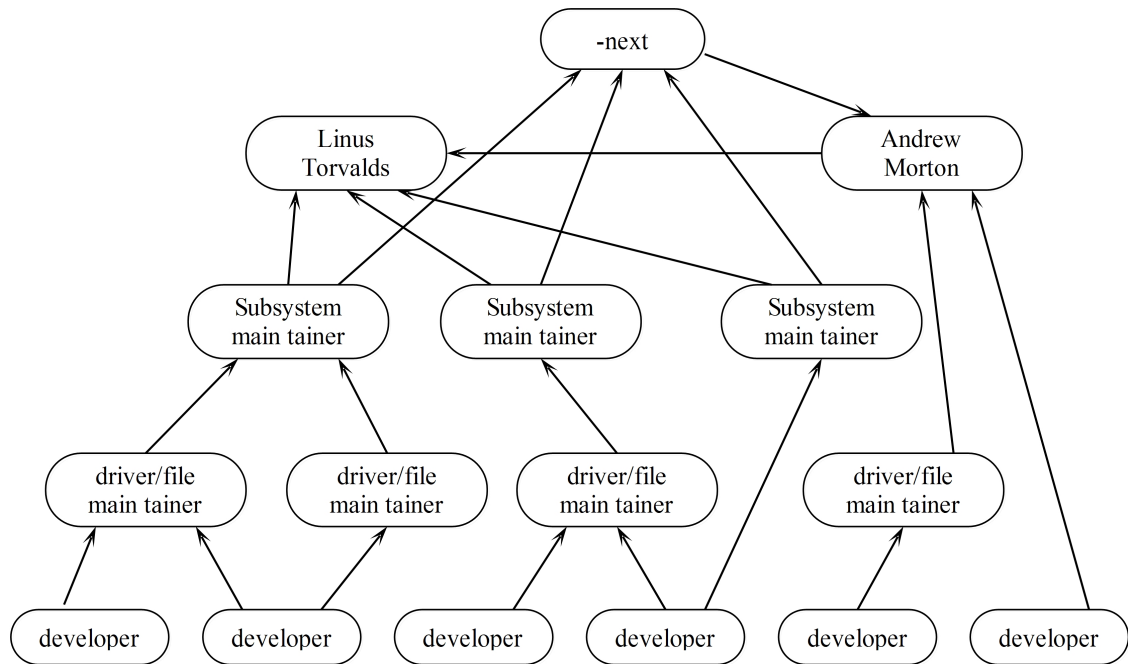
Fig. 3 Flow chart of the development of Linux kernel [24]

OpenStax CNX is one of the largest open online learning platforms. It does not provide teaching services, and since textbook is only part of learning process, all other services are provided by MOOC. Unfortunately, it still lacks the support of practical experimentation operation.

A successful example of 'open mode' is Linux kernel development, depicted as a tree model in Fig. 3. Developers are urged to copy the trunk code from Git to their own branch [26]. That is, each change in the branch made by the developer is issued one unique ID to Git system. All developers are requested to double confirm the changes, whereas they may ask the head of the mainline branch to adopt the changes. This mode guarantees every developer has his/her own branch and every branch has direct relation with the trunk. Apart from the few people who are in charge of the trunk code, thousands of developers have no clear tasks and their individual contributions are judged by number of the code lines present in Linux kernel. Hence, every developer can make contribution

to Linux kernel. On the other hand, the supervisor of the mainline branch can guarantee the quality of the adopted code through rigorous review processing. The development mode of Linux kernel is worth mimicking, and the tool of version control (Git) provides important technical solution for open education.

The concept of COOC (Collaborative Open Online Courses) was firstly proposed to realize the construction of mobile application courses and enhance the vitality of courses at a workshop of the construction of mobile application courses held by Google. After a warm discussion of the definition, features, and ways to carry out the construction of COOC, it was finally defined as Web-based collaborative open online tutorials.

3.2 Architecture Design

The design of COOC adopts the concepts of crowdsourcing [1]. In detail, teachers, professionals and learners are expected to set up the courses content and learning context together, therefore empowering the courses construction based on the collaborative, open and shared textbooks, and online experimental platform. By this means, visitors are not only a user or a consumer, but also contributor of online course materials. COOC has several novel features that can promote current MOOC delivery. Firstly, the construction of courses is based on GitHub, which realizes multipoint-to-multipoint online courses. GitHub is an open source code library as well as a network platform of version control. With more application programs being transferred to the cloud, GitHub has become the first and top selection in managing software development yet finding existing similar codes. Because most users of GitHub are program developers, normally they have better understanding of latest technologies and social needs. Therefore, the quality of teaching will be improved greatly if they are able to participate in the implementation of courses.

With the generation of textbooks by GitBook, sections, open source textbooks are fastly organized and rapidly updated. GitBook is a tool to compile books, and it uses GitHub/Git to create open source electronic books. A major advantage is the shorter creation and preparation time for courses and textbooks through cooperation and updates at any time. With the emergence of new software technologies, the update of systems occurs very fast, different from traditional books that cannot be updated within short period of time. The use of GitBook can support the community to update the textbooks timely.

Finally, online experimental platform follows the concept of Internet of Things (IoT), which makes remote operations of equipment possible. In order to realize the distance experimental platform, software environment needs to support the following functions: remote access, embedded online programming, real-time monitoring, and others. Remote access needs to implement a web-based terminal emulator, allowing users to directly operate the virtual machines and development boards via web interface. The realization of web terminal emulator is on the basis of web server and executes as a web-based Secure Shell (SSH) client on a specified port, thus it is able to be accessed remotely and control a Linux server and virtual machine. The architecture of experimental platform is shown in Fig. 4.
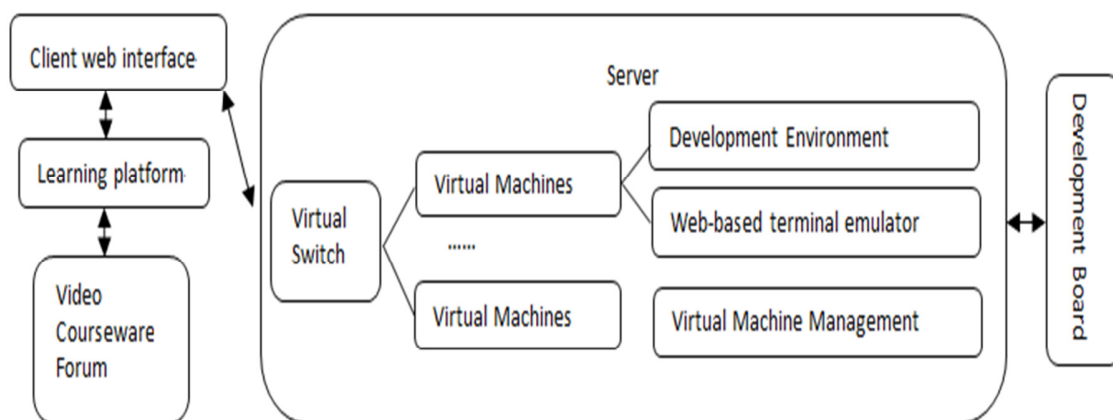
Fig. 4 Architecture of the experimental platform

The complete architecture of COOC is depicted in Fig. 5. COOC focuses more on the collaborative construction of the courses, as well as integrating the courses by making use of GitHub and GitBook. This can enrich and update the course contents efficiently, constantly, and dynamically. Collaborative and diverse sources of courses are continuously updated, as the courses are availably managed for update. The courses are not directed only by teachers in colleges and universities, but also from the social celebrities, enterprise mentors, and professional elites. The forms of course contents range from courseware, textbooks, and videos. When the course contents need to be modified, a branch of courses for updates can be set up, which can then be merged with updates by quality control personnel. The use of courses and all its derivatives must abide by the protocol of CC BY.
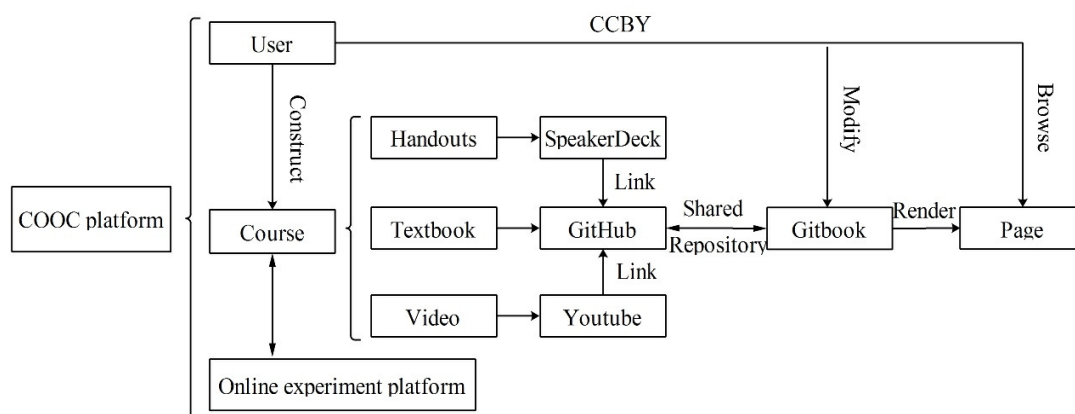

Fig. 5 Platform architecture of COOC

3.3 Third Party Support

GitBook provides an online compiler that could preview the design sketch, and thus

compile textbooks conveniently. After the compilation, we can generate static website managed by GitHub pages or output as PDF through GitBook. GitHub provides a simple way of collaborative creation. It is designed with a friendly web interface, and users can easily make contributions to the course construction through "pull request" mechanism to apply for emergence of their code.

Git is only suitable to store small size files like text and code however. Hence, for large-size files such as video, PDF files, and animated files, alternative solutions should be used. After comprehensive consideration of the protocol, SpeakerDeck was chosen to render PDF, animated files, and YouTube to store video and animated files. Based on the above mentioned solutions, we can classify and store the course resources and later edit them in GitBook. The procedure of the storage processing is illustrated in Fig.6.
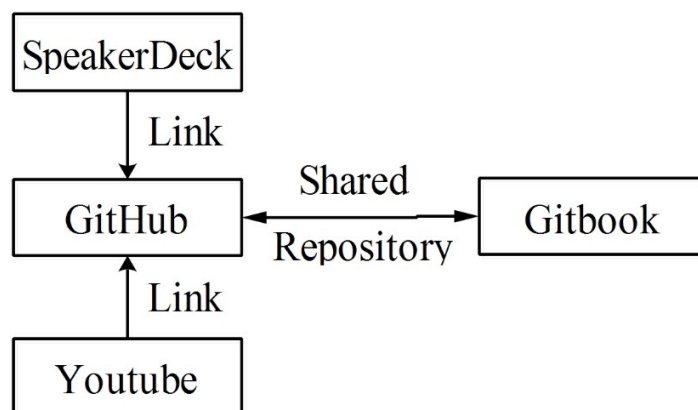

Fig. 6 Storage Architecture

3.4 Course Construction

The construction of a new course in COOC consists of three parts, sequentially, (1) GitHub, used for storing sources of a course, (2) GitBook, used for page generation, showing textbooks and videos through plug-in and links of third-party courseware, and (3)

Learners, used to complete remote experiments through an online experimental platform.

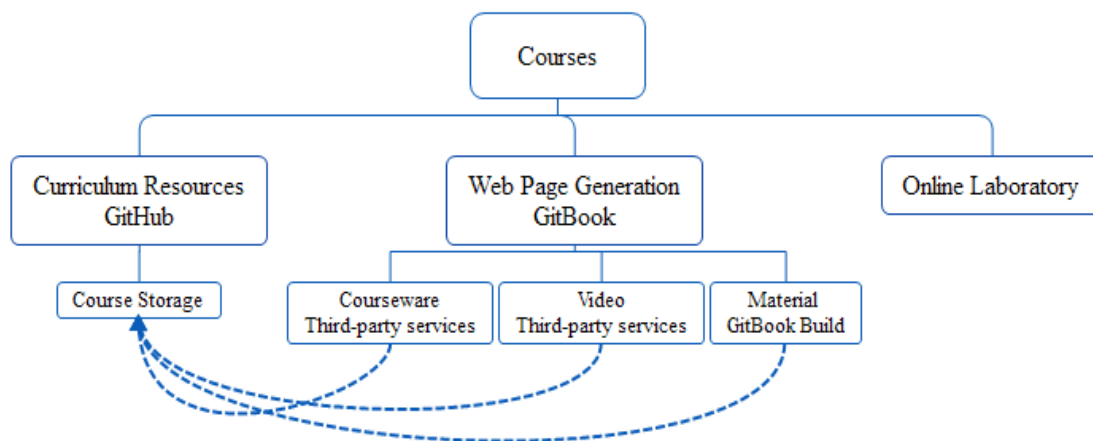The implementation scheme of the course construction is illustrated as in Fig. 7.

Fig. 7 Course construction

3.5 Intellectual Property and Quality Control

For the open mode, it is an important issue to consider how to guarantee the protection of the contributors' intellectual properties. Courses released in COOC are protected by the RPOC Copyright Law. Meanwhile, COOC adopts the protocol Creative Commons (CC) BY to release contents that indicates that, as the new and updated work are created based on original work, it clearly indicates the original author's name and the new work that applies to the same type of license agreement, given that the agreement approves re-arrangements, extracts, or creations of the original work for both commercial and non-commercial use. The license agreement is similar to the open source software license agreement, where all the new work created on the basis of the original work apply to the same type of license agreement, so all work derived and created on the basis of the original work can be moved into commercial use. For instance, if the textbook written by a

teacher has been released by a press, and the right of distribution is awarded only to the publishing company, at this point the teaching material contents cannot be publicized on the COOC platform. On the other hand, if the teacher uploads the course onto COOC platform first, modified and then completed by multiple people, the release is completely free. Upon with the indication on the working contents of other partners, it can be used for commercial or non-commercial purposes.

For education purposes, another important issue is to control the quality of the teaching contents. In order to ensure the quality of service, COOC borrows the tree pattern model of Linux kernel and adopts the approach of peer review to check the uploaded course contents. Since the course contents are stored in the form of a warehouse in GitHub, users can make comments in the course for communication, and feel free to use Git repository to fork the original course. After autonomously modifying and later contacting with original author, they can complete the merge and update the course contents. COOC platform reviews the updated warehouse, and then releases it in the platform, thus ensuring the quality of the course contents.

As illustrated in Fig. 8, the master branch will be maintained by Teachers/Tutors, each student can create his/her own branch, adding annotations, modify or even update their own copies of textbook (their own branch) and push the branch to a remote side (GitHub) in COOC. Whenever a student considers his/her comment/opinion/position to be possibly helpful, he/she can submit a "code review" to teachers or tutors, who then decide whether to include the student's commit or not to the mainline (master branch), so that other students can also benefit from the student's work. Still in Fig. 8, each node refers to a certain "Git commit". Updating in master branch will bring it to everyone (teach-

ers/tutors/students) and updating in other branches (non-master) will not affect the remaining branches unless certain commit is merged into master branch. Every student can create his/her own branch, modify and maintain his/her own copy of the textbook or learning materials. Hence, every student (even teacher/tutor) can benefit from others' work and can also benefit others by pushing his/her work to the mainline.

We proposed a three-step solution to control the quality of courses:

1. Attribute sufficient right to the course author, who has full control of repository management,

2. COOC platform stores the clone version of the courses regularly. The coordinator of the main branch is in charge of the review to ensure the high quality of courses and avoid infringement of copyright,

3. Excellent work is selected (according to the feedback, questionnaires and number of visits), collected and moved to course platform.

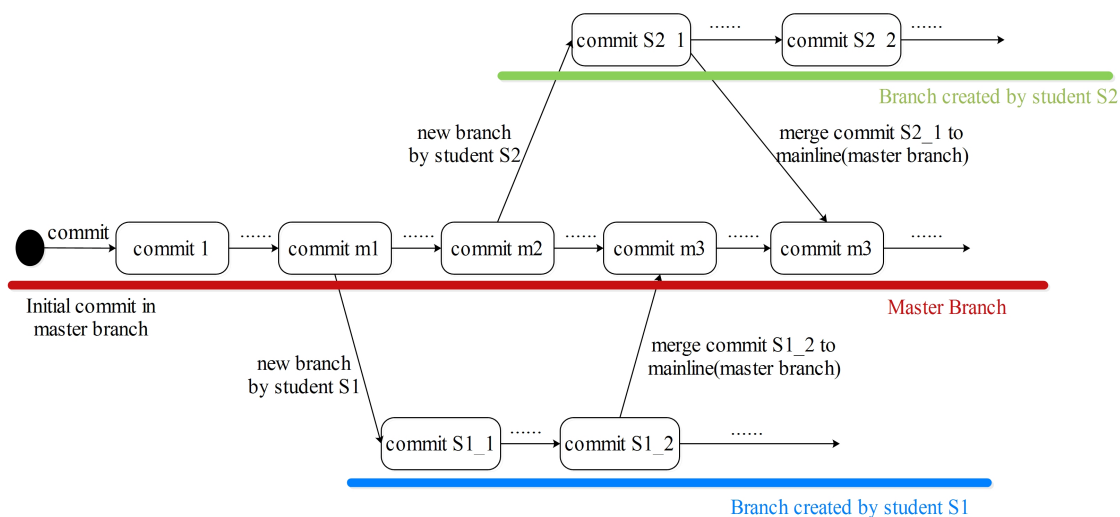**Managing Course Materials/Textbook with Gitbook/GitHub**

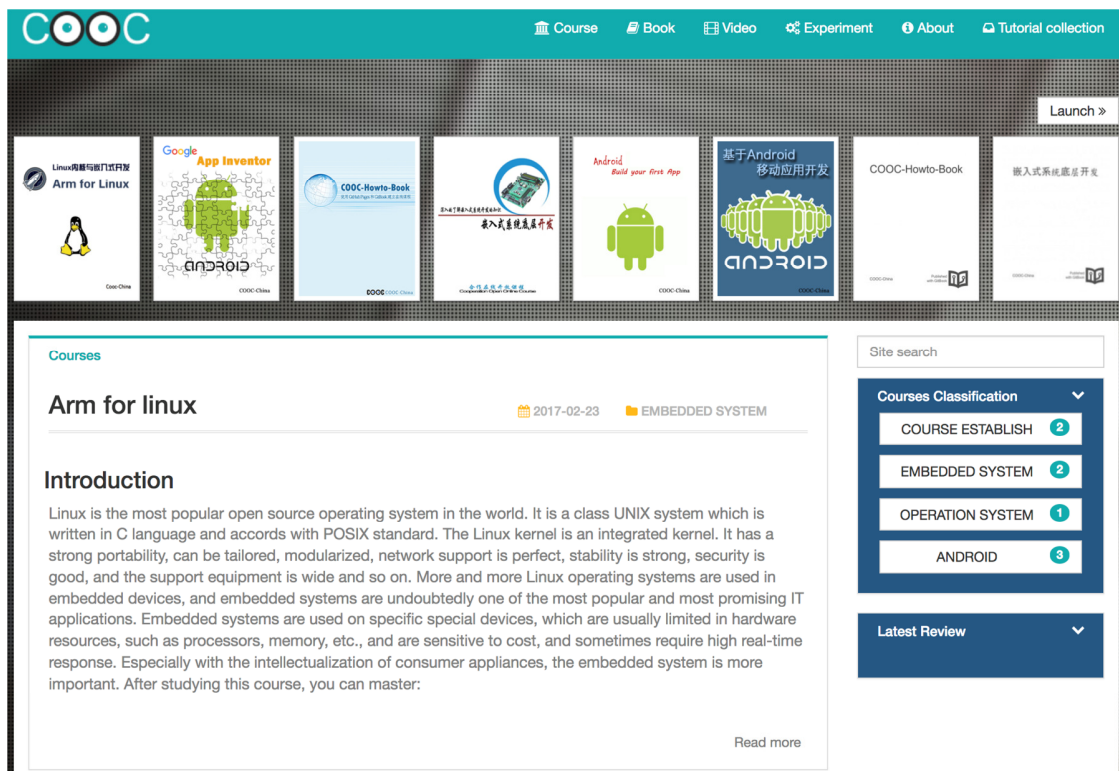Fig.8 Course management with GitBook/GitHub

Fig. 9 COOC China course website

4. EXPERIMENTS AND IMPLEMENTATION

As depicted in Fig. 9, the sample course site is the COOC website already set up in GitHub, and accessible following the URL http://cooc-china.github.io/. A number of universities in China, including the top ranked Zhejiang University (in engineering) and Lanzhou University (in science) are utilizing this course site. As prototype, the courses are samples and for evaluations only, constructed by GitBook and synchronized to GitHub. Although setting up a course in GitBook has a number of advantages, such as conveniences on operations and a unified style, it presents some disadvantages. For instance, it is not convenient to control the style how the courses are displayed. In order to

simplify and guide users to complete the construction of courses, template and guidebook are provided as example in the website, as shown in Fig.10. Additionally, the introduction of GitBook, registration and login link, link GitHub, create book, installment environment are also available and shown in Fig.11. Under the promise of abiding by the above-mentioned intellectual property, every user can own sample courses on the GitHub (shown in Fig.12), as well has the authority to modify the contents of the courses and request update through the supervisor who in charge of the courses' quality control on COOC.
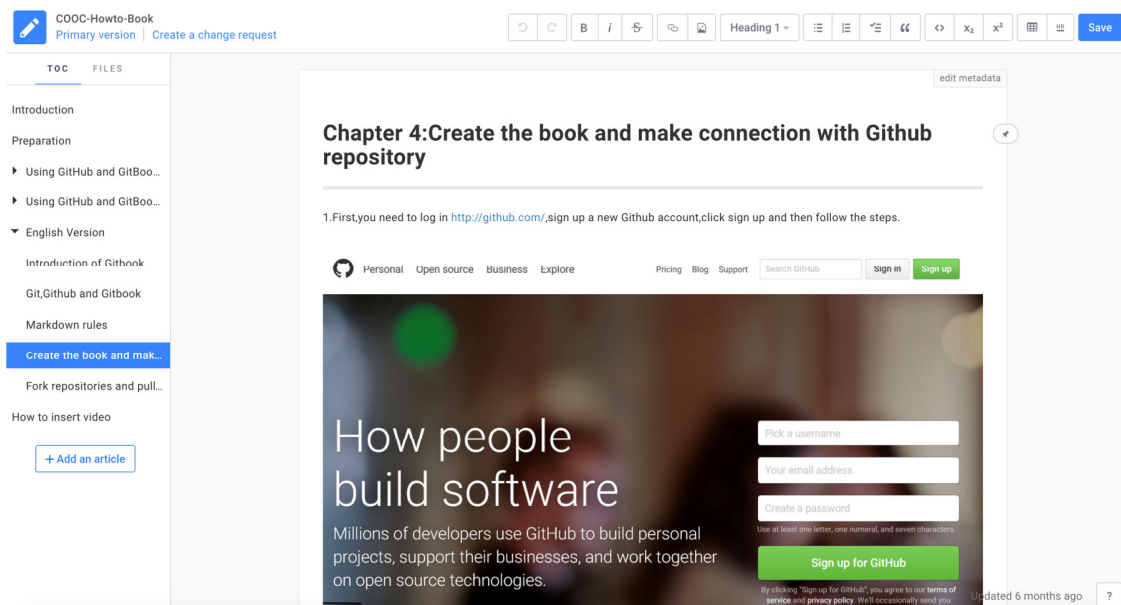
Fig. 10 Sample: how to setup a course in COOC

Fig. 11 Sample course of "Low Level Development of Embedded Systems".
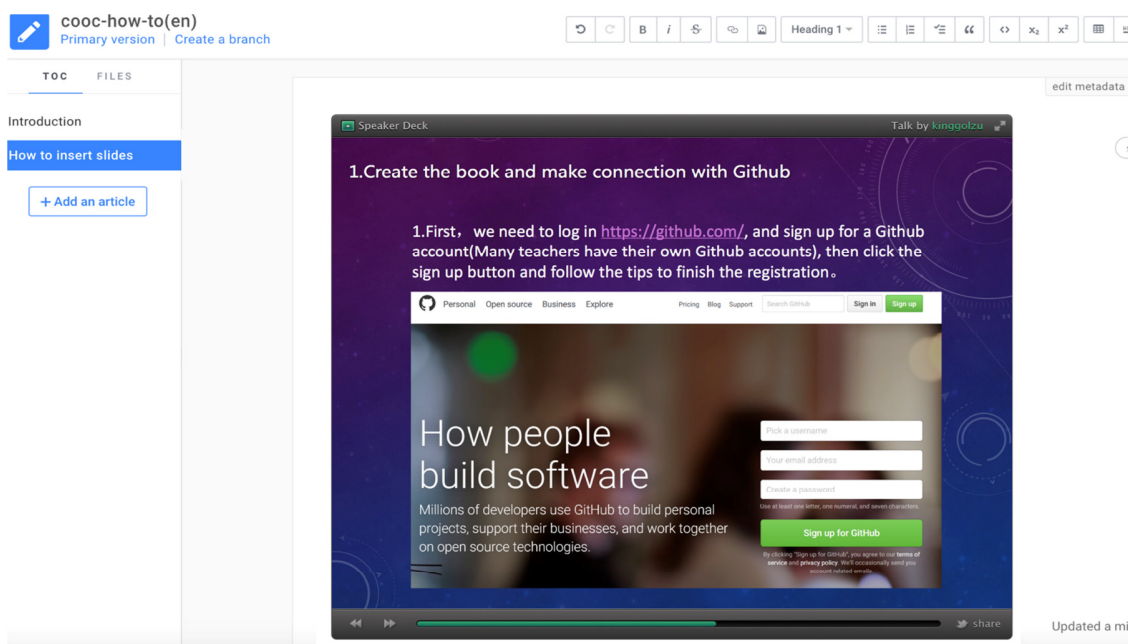

Fig. 12a

Fig. 12b

Fig. 12c

Fig. 12 Contents of an example course.
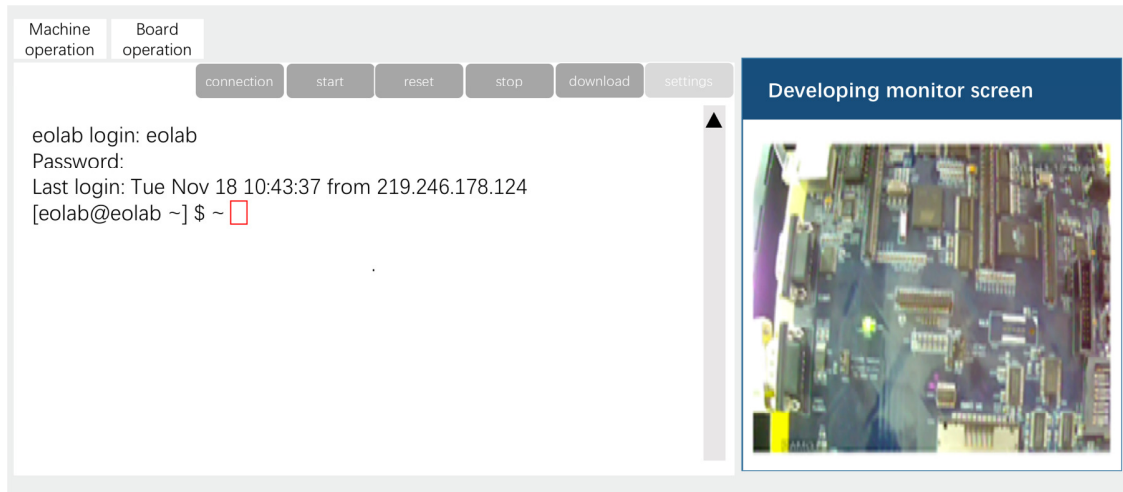
Fig. 13 Real-time monitoring of the online experimental platform.

Current sample course contains the layout of graph-text mixed (Fig. 12a), slides (Fig. 12b), and video (Fig. 12c) etc. In addition, COOC also contains the embedded online laboratory to realize online practical operations. The interface of experimental platform is shown in Fig. 13.

5. COMPARISON AND DISCUSSIONS

COOC is architected and implemented by integrating the advantages of traditional education and MOOC. According to feedback on the prototype and insightful reflections on the design of COOC, the list of comparisons among traditional courses, MOOC, and COOC is discussed and summarized in Table.1.

Table.1 Comparison among traditional courses, MOOC, and COOC [25]

	Traditional course	MOOC	COOC
Experiments	Yes, in real labs	No	Online
Content of course	Fixed	Fixed or difficult to update	Update at any time
Learning mode	Teacher centered	Student centered	All-for-one and one–for-all
Student in-	Rarely, passively	Online feedback	Take part in the construc-

			tion of the courses actively
Feedback	In class	In and after class	In and after class
Evaluation	Paper copies of exams	Exams, teacher evaluations, peer assessments	Exams, teacher evaluations, peer assessments
Inter-school	Rarely	Yes	Yes

5.1 Advantages of MOOC and the Successor COOC

Some advantages on building COOC over the basic MOOC platform are summarized as follows.

1. Open online courses make fine-tuned education resources to be shared in an effective way aimed at open learning environment. The learning process is not restricted by time and place and allows learners to study freely out of their interests. COOC uses an open source platform, which makes courses open-sourced, information available and enhanced within direct and convenient way to get access to curriculum resources [14] [27],

2. Via online communication and discussions, MOOC offers teachers and teaching assistants' on-line answers and communication to the students. COOC's online communication is also convenient, since there are many participating authors in a course, and any of them can answer the problems that students may meet, realizing the multipoint interaction (M users x N authors),

3. Through intelligent mobile devices, both MOOC and COOC are accessible on-the-go and within fragmented time pieces. Learners now gain opportunities to make the maximum use of their off-time and participate in the learning activities organized by leading educational institutes without the restriction of location [29],

4. MOOC is a complete teaching and learning framework that permits constant changes

and updates in teaching contents, convenient communication and discussions, as well as a comprehensive assessment and evaluation mechanism, including teaching courseware, video resources, images, animation, test and other study materials. COOC makes use of GitHub platform, so that courses are updated timely, yet communication is convenient,

5. COOC can attract wider range of users, especially technicians or specialists. It offers a convenient way to people that have real and ad hoc learning needs, yet a cost effective way for colleges and universities to release online courses. Contributors of COOC are not only limited to teachers, but also including professionals and even students, who can update and make contributions to the courses and teaching materials. It makes the courses better match the needs of society and have extensive pool of users.

5.2 Disadvantage of MOOC and the Improvement in COOC

Improvements of COOC on overcoming the disadvantages of MOOC are listed as follows:

1. Through online learning, a fully immersive experience for students will be absent [1] [2] [3]. In the process of online learning, learners mainly watch videos and other resources during self-study, but learners of engineering disciplines need to do experiments to better grasp the relevant knowledge. Therefore, COOC tends to provide an online experimental platform for remote control of laboratorial devices manipulated through IoT controllers. Equipped with real-time monitoring, experiments are more intuitive,

2. For the learners' participation, although MOOC provides online communication,

learners' minimal participation in learning materials and subjects makes the course construction relatively less open, and this is turning against the development of the course contents [4]. However, through the cooperative mode of COOC uses, learners can be involved in the course construction, and it is more conducive to motivate their participation,

3. In current MOOC learning scenario, collaboration can only be achieved by the instructors' organization, while there are not many tools or online environments to formally support the collaborative learning process or teamwork, nor any measure to ease the way of participating in collaboration or new publication of cMOOC content,

4. In traditional MOOC, teaching materials are created and wrapped up by college teachers; social celebrities, enterprise mentors, and industry elites are difficult to participate directly in educating, which makes teaching disconnected from social needs. On the other hands, engineers or similar professionals are more familiar with GitHub, so engineers and social elites are more likely to get involved and make contributions to COOC,

5. Additionally, there are studies indicating that personality and learning styles play significant roles in influencing academic achievement [28]. As learners commonly do not have sufficient expertise in customizing learning schedules for themselves, and perhaps they are not familiar with their own learning styles, there are high probabilities that they cannot access the right sets of MOOC content. This may affect them to achieve satisfactory learning outcomes though a lot of time might be spent. In COOC, learners can self-regulate their own studies according to their own styles in a more proactive and controllable way.

5.3 Discussions

COOC is constructed over Github, an open source code library and version control system, which assists the innovation via reorganizing the process and environment of education. In addition, it promotes updated content learning, blended learning and participatory learning. And it is a cost effective way to provide services and participation for open online courses. However, there are still open issues that need to be paid attention.

On one hand, a huge challenge comes at the first place which is how to persuade providers of excellent courses to move from other cloud-based distance learning platforms to COOC platform. We need effective incentive mechanisms to attract excellent teachers and engineers to make their content authoring contribution to COOC platform. A solution to this issue can be a project in cooperation with non-profit COOC foundation co-founded by a number of top universities and educational organizations by awarding providers that share excellent courseware and make meaningful contributions to contents such as video, teaching materials and textbooks. Moreover, it is preferred to appeal to educational elites to voluntarily contribute to the platform and realize "all-for-one and one–for-all" modes like Wiki and Linux kernel.

Attracting students to learn in the COOC platform is another issue. It is not easy to change students' learning habit or learning mode. The quality of the educational resources should be dynamically and constantly improved. For instance, high frequency retrospective tests should be provided during the class to consolidate the learning effect and strengthen the interaction with learners. Furthermore, Q&A platform should be established, so learners can bring questions into discussions that may enhance their learning

enthusiasm [11]. Generally, the average time length for a quiz on Coursera is about 22 minutes, which is very convenient and efficient for learners to get the answers and can be used as a reference. Additionally, we can also design some incentive mechanisms to guide and attract potential learners to use the COOC platform. Taking advantages of Wiki, YouTube, Google, Facebook, Blogs, QQ, WeChat and other social networking software and cloud services to promote discussions, and to have educational resources downloaded and shared from COOC and enhancing learners' enthusiasm is another way to popularize COOC and generate publicity. New researches and feedback from community should become more constructive suggestions and comments towards improvement and wider establishment of the COOC platform.

6. CONCLUSION AND FUTURE WORK

In this paper, we introduced a platform which aims to provide online courses, courseware and online experimental platform based on third party's open source platform, such as GitHub and GitBook. COOC platform not only combines the advantages of high quality online resources and face-to-face classroom teaching, but also stimulates the collaborative construction and improvement of courses through educators and learners, realizing the reconstruction and innovation of education process at dynamic and real-time.

As future work, not only adding more courses and learning materials to the prototype COOC platform to attract more learners, but also optimizing user interface of the platform, strengthening quality control on all types of resources in a COOC platform.

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