The Study of a Course Design of IoT Manpower Training based on the HOPPING Education System and the ESIC Program

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Abstract

Internet of things (IoT), Cloud, Big Data and 3D printer are the ICT technologies that recently has been on the rise in domestic and in global. The IoT is expected to be a future growth engine by grafting ICT technology to traditional industry.

The most important matter for internet of things to grow as successful business is incubating professional man power. The course of university can't hold a candle to the field. And the course of academy is not systematic. Thus, it is continue a problem that human power production not be applied to the field directly.

Thus, this study is to suggest how to design systematic education programs for internet of things and to operate those programs in efficient.

In this paper, proposed an effective training courses and educational operating system by introducing the HOPPING education course and the ESIC program. The system proposed in this paper will be available in an IOT specialized manpower training and a SW education.

Keywords: HOPPING education system, ESIC program, Internt of Things, Manpower training system

1. Introduction

Industry of convergence has leaded the change of global paradigm in 21C, by converging different technologies and industries. It has been developed to convergence of humanity and art. Such as Apple and Google the leading companies has already taken the lead in global market, on the contrary, other industries insufficient to respond are losing market competitiveness. Thus advance countries like USA and Japan are aware of the importance of convergence and actively promoting strategies for developing industries.

Such convergences of industry reactivate the traditional industries such as agriculture, forestry and fishery. Furthermore, it is expected to be the solution for the various social demands in eco-friendly, healthcare and culture &arts sectors[1-3]. Internet of Things, especially, means (IoT) where it, as a representative technique, identifies that shares information which is made by the things through internet in this environment [4].

Gartner that presents up-to-date promising technology every year includes IoT in hype cycle from 2011 and prospects that it is going to a major influential technology in coming 5~10 years. It also selected it as the one of the 10 strategic technique of advanced and new technique that will affect significantly upon businesses. [5].

The most important matter for the IoT to be successfully established, fostering the professional manpower is necessary. Thus this study presents how to design the efficient programs to train manpower for IoT.

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2. Overview of IoT Education Course

Cisco born in Barcelona in Spain declared that he would incubate executives, researchers, and innovators who will lead the world in IoTWF 2013 held in Oct. 2013. For this, cisco offered IoT curriculum, evaluation system and education portfolio composed of Cisco® Specialist Certification that will be open in the future. In addition, in collaboration with partners in the major industrial sectors have developed a new training portfolio. And, cisco is announced that training of automation, manufacturing, energy industries and IP network experts, be retrain of existing ICT workforce [6].

Park [7] analyzed domestic and foreign robot based curriculums and relevant cases to develop robot related education programs in primary school and middle school, suggested the achievement objectives in the robot area as a sub category of the computer science curriculums which will be revised, and proposed teaching-learning method and evaluation method.

Jang [8] analyzed current IT education being executed in universities and checked into availability of existing education programs by survey that conducted with specialists in Humanity& social. He suggested developing the efficient and demand-oriented education programs to make the efficient education those specialists in Humanity& Social demand and need.

Kim [9] suggested a stepwise enrichment curriculum that enables the gifted and talented students to be equipped with creative problem-solving skills and computational thinking abilities. In this regard, at first, the problem with existing research and educational institutes for the gifted and talented in informatics were analyzed. Next he had developed a concrete stepwise enrichment curriculum in accordance with the practical educational objectives of the gifted and talented in informatics.

Also, in order to design the Gifted Learning Model, proper for an area-specific characteristics, Renzulli [10] suggested the enrichment triad model and Bett [11] suggested the autonomous learner model.

2.1. Element of Internet of Things

IoT can be categorized broadly into sensing technology, wire-wireless communication and network technology, interface technology, security and contents production technology [12-13].

Sensing technology is the core technique that senses the surrounding information and conveys the information in real-time by attaching electronic tag in places and things. Wire-wireless communication and network technology supports connecting things to internet, offering IP or imbedding wireless communication module, it is said to be the representative technique. Interface technology is to interlock the each element that composes IoT to service. Security and contents production technology is an overall technique to be served for consumers.

<table>
<thead>
<tr>
<th>Table 1. Technical Elements of Internet of Things</th>
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<tbody>
<tr>
<td><strong>Sensing Tech.</strong></td>
</tr>
<tr>
<td><strong>Communication and Network Tech.</strong></td>
</tr>
<tr>
<td><strong>Interface Tech.</strong></td>
</tr>
<tr>
<td><strong>Security and Contents production Tech.</strong></td>
</tr>
</tbody>
</table>
Weakness in security, the most threatening factor, should be strengthening for the IoT to be established as a successful business.

2.2. Design of Education Course

IoT professional education programs consist of professional training course (basic courses, advance course and project course) and cooperation training course. The curriculum of education is based on technique parts for Internet of things as seen in Table 1.

First, education program for sensing and circuit implementation includes programs of sensor control and device control with the test kits (Arduino, Raspberry Pi, Intel Edison module). Because the selected reason of test kits is can used to the non-experts.

Second, the education programs of communication and network technology includes technique in communication & network control by test kits and finally by smart devices to approach and control various things.

Third, it includes the programs for the technology to connect users to Internet of things such as UI UX focused user interface technique, web3.0 based web interface technique and universal design.

Fourth, the program for security and contents production are basic language such as Java, HTML5, C language, smart contents production courses by using Android. JNI and security course like Database, OS, security & coding.

Fifth, for convergence & practicum program. There are course to create products of Internet of things adopting students’ ideas to the already learned technique in project courses and cooperation training courses.

The project program is designed for offering the customized projects for businesses based on survey and making students carry out the projects to advance job opportunity where they were engaged in the future.

The cooperate program is focused on commercialization of the results produced during the education or internship in companies through project courses designed for narrowing the gap between demand of cooperation and students.
2.3. Feature of the Education Course

The most important feature of the proposed education course in this paper is train SW professional with integrated thinking ability in IoT era by merging HOPPING education course and ESIC program. First of all, it provides an opportunity to students to step it up by completing HOPPING education course. Then, students improve their capabilities and skills that are related with employment, entrepreneurship and improvement of work capacity.

![Figure 2. Concept of Proposed Education Course in This Paper](image)

The HOPPING curriculum is proposed in this paper consists of a hierarchical course, ordered course, project course, practical course, ING course. Hierarchical course maximize educational efficiency and convergence by adopting systematized curriculum, step by step learning process and horizontal education operating system.

Ordered course proceeds training by determining project topics and course design before each course start based on investigation on company demand. In addition, this course cultivate the applying skill and practical capabilities that student learnt by accomplishing company demand projects. Moreover, practical course is made for solving miss-matching with companies by performing field based training through field training and start-up operation.

Finally, ING course is aimed a sustainable virtuous cycle educational operation for all offered classes. It provides a platform for innovation and idea generation(Innovation), a practical education system in collaboration with NCS(NCS), environment that prospective employees, potential start-up companies and the incumbent can grow(Growth).

As a result, Hopping education course cultivate site oriented SW professionals by providing opportunity for “hopping”.

![Figure 3. Concept of HOPPING Course](image)
ESIC program is divided into four different categories entitled, education(E), startup(S), incubator(I), field work and career(C) and is to adapt the workplace effectively through support from expert groups in each field.

2.4. Design of the Detailed Education Course

General education courses are composing of 10 detailed courses under categories of reinforcement the basic course, the core course, the practical course and the working course shown Figure 5.

In the basic course, the 1st level, there are Java programming course and mini project. The 2nd level course includes course for web framework and web mini project.

The 3rd and 4th course, the reinforcement practical capability offers students course for learning basic knowledge, applying technique of Android and carry on app designing project.

The core competence capability is made up IoT specializing courses from level 5 to 9. They are course of IoT basic, 1, 2, application, IoT specialists and Project-IoT.

The IoT specialist’s course, especially, is focused on practicum on basic knowledge of project companies suggest, IoT project course is focused on completing the project offered by companies. Next 10 levels are for internship at the companies that suggest project and to engage students in that field comprehencing tasks and commercializing the projects.
2.5. Design of Project Course

The project course is to cultivate student’s practical abilities on contents they learned during mini projects relevant to each level 1, 2, and 4. Finally, IoT course of 9 levels is for 6 more or less project teams of 4~5 members and operate collaborative projects by matching 1:1 mentor of engaged company and a team.

The theme for project should be selected in priority as follows.
- 1st: the project the company plans to commercialize.
- 2nd: Cooperate project suggested by company in demand survey.
- 3rd: project selected from idea meeting of the team

![Figure 6. Design of Project Course](image)

2.6. Design of Special Course

Special courses are included to incubate the creative IoT special manpower in the programs. The courses are the session of vision, insight, profession. These sessions are aimed at learning overall knowledge for start-up business and employment.

<table>
<thead>
<tr>
<th>Vision Session</th>
<th>To motivate and present vision for trainees to concentrated in programs. (SW business prospect, integrated business ideas, creative thinking strategy and skill. Presentation skill and business start-up &amp; employment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insight Session</td>
<td>Establish clear direction and goal through change of cognizance, communication skill, and business skill. Storytelling technique, planning of project, entrepreneurship, intellectual property)</td>
</tr>
<tr>
<td>Professional Session</td>
<td>Train to be specialist for IoT with understanding on practical industry(special class from senior as a role model, visiting industrial places and meeting with the professionals, public relations and global marketing)</td>
</tr>
</tbody>
</table>

3. The Strategy for Operating Programs

3.1. Enterprise Connection Strategy

It is to train the specialized manpower for Internet of things that companies require by taking the cooperation into participation from the begging of programs and preparing the foothold for trainees based on the survey of companies’ and organizations’ demand for
manpower and by operating the field-oriented education relevant to needs of companies during advanced programs.

The job support management team and education program evaluation team is involve an enterprise. And offer the education course for job-seeking and business start-up by operating PTS (Project Training System). Also, support systematical job finding and business start-up by operating ECMS (Employment Curriculum Management System). Lastly, it is to provide trainees with one-stop service through offering the projects linked to cooperation.

Figure 7. The Strategy of Company Connection

3.2. Strategy for Apply the TA

It is need to raise class participating degree to maximize the efficiency of education and provide trainees with sufficient learning motives. So this study designed to offer effective education programs by team teaching between professional instructors and TAs (Teaching Assistance) during programs.

It is for enhancing the function of supervising on PI and TA, having a TA-Leader and PI-Leader who supervise professional instructors and TAs and for having MG and PG support and mentoring the programs.

Figure 8. Strategy for Apply the TA
3.3. Employment Management for Trainees

To support the job-seeking and business opening for trainees, operate programs for maximizing education, supporting services for employment and business, offering to promote job-opportunities for the drop-offs.

Lead to participate in education, board of committee, projects and interviews. To keep constant connecting between cooperation and students from the beginning of the programs.

![Diagram](image)

**Figure 9. Strategy of Job Seeking of Trainees**

3.4. FPS Mate System

In this paper, we introduce a concept named “mate system” to improve learning capability, employment rate and reduce student wastage rates across entire courses. The mate system helps students to change their mate in regular base in consideration of problem solving capability, teamwork ability, student career path and current health condition. The system distinguish mate into 3 different group, named friend mate (F), project mate (P) and study mate (S) and its reallocation cycle can be weekly base or monthly base.

In addition, FPS mate system provides atmosphere for relieving the boredom of the studying environment by changing student seating space and desk layout as needed. It also effectively manages any incurring problems with deep collaboration between supervising lecturers and class monitoring people.
3.5. Evaluation Method for Education Course

Education evaluation is divided into formative evaluation, final evaluation and personality evaluation to make them reliable. All evaluations should be systemized to be delivered to instructors, managers and trainees by feedback system.

Table 3. Evaluation Method for Education Course

<table>
<thead>
<tr>
<th>evaluation index</th>
<th>evaluation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>studying</td>
<td></td>
</tr>
<tr>
<td>formation</td>
<td></td>
</tr>
<tr>
<td>quiz</td>
<td>a simple quiz test on a daily lessons. Released before the next class after resolving the problem in self-study time</td>
</tr>
<tr>
<td>examination</td>
<td>objective test and description test</td>
</tr>
<tr>
<td>practical</td>
<td>a evaluation of problem-solving skills through a one-time practical evaluation at the course end</td>
</tr>
<tr>
<td>total</td>
<td></td>
</tr>
<tr>
<td>comprehensive</td>
<td>contest way test</td>
</tr>
<tr>
<td>interview</td>
<td>interview, a cognitive power evaluation of a curriculum</td>
</tr>
<tr>
<td>personality</td>
<td></td>
</tr>
<tr>
<td>diligence and laziness</td>
<td>a overall evaluation through a learning attitude, a personality, and a self-management skills</td>
</tr>
<tr>
<td>attendance</td>
<td>Scoring by the attendance information (lateness, leaving early, absence)</td>
</tr>
</tbody>
</table>

To encourage participating in evaluation, reward the superior grades and give priority to have job opportunity. Also, it determines whether employment possibility once a month through the external evaluation.

Execute the education evaluation by Feed-Back System (EFBS) once a month to improve the learning ability of trainees. Reduce the drop offs and inefficient learners by verifying the capability of trainees based on the result of the evaluation though evaluation committee.
First of all, a general course evaluation system is used to control the academic level of students by analyzing the subject-specific learning ability through weekly assessments. Through the partner assessment method among various evaluation methods, individual’s ability for problem solving, collaboration, teamwork are analyzed and evaluated.

After the evaluation, a complementary learning system including weekly based student relocation is operated for maximizing learning outcome, and students with low grade are actively managed through reporting->notification->consultation->action process. Similarly, students with high grade on each subject were awarded to inspire and motivate them to study.

The project team constitutes the best project team by considering the problem-solving skills and congenial trainees. A final idea is chosen among more than 10 ideas derived from each project team and then expert apprenticed project map for each area is also established.

Through more than 2 time’s presentation, each student compensates their project defects and get confidence. Each presentation is evaluated based on completeness, technical skills, creativeness, teamwork by the panel of judges for its fairness.

In order the job history management, to manage the project outputs (project plans, presentations, source) and students with low grade are actively managed through
reporting->notification->consultation->action process. Similarly, students with high grade on each subject were awarded to inspire and motivate them to study.

![Figure 13. Evaluation System of Project Course](image)

3.6. Evaluation Method for Education Satisfaction

Student satisfaction surveys on lecturer, class contents, text book and support/operation are conducted to evaluate overall education operation. In particular, courses with low student satisfactory level are immediately redesigned to ensure an appropriate level of education quality. This helps effective learning effect and course operation, and the overall analysis and satisfaction results are also reflected to course design for next term.

<table>
<thead>
<tr>
<th>Table 4. Evaluation Method for Education Satisfaction</th>
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<tbody>
<tr>
<td>Criteria</td>
</tr>
<tr>
<td>----------</td>
</tr>
</tbody>
</table>
| Satisfaction with instructors | • Stimulate trainees’ interest  
• specialized knowledge  
• Performance of textbook education |  |
| Satisfaction with educational contents | • Stimulate trainees’ interest  
• specialized knowledge  
• Performance of textbook education  
• Stimulate trainees’ interest  
• specialized knowledge  
• Performance of textbook education | • Survey  
• Evaluation on subjects  
• After 5 days of Class start  
• Evaluation for finalizing the class |
| Satisfaction with textbook | • Stimulate trainees’ interest  
• specialized knowledge  
• Performance of textbook education |  |
| Satisfaction with supporting system | • Stimulate trainees’ interest  
• specialized knowledge  
• Performance of textbook education |  |

4. Conclusion

The most important matter for the Internet of Things to be advance to the successful industry is cultivating professional manpower. Education in universities cannot follow up the needs of field. It is also not so systematic. That manpower graduated from universities has difficulties adopting themselves to the field.
In particular, the IOT age has the role of SW education is becoming more important. However, domestic reality is absolutely lacking the SW manpower. This paper, therefore, suggests designing the efficient programs and efficient measures to operate them to train manpower for Internet of Things. In this paper, proposed an effective training courses and educational operating system by introducing the HOPPING education course and the ESIC program. The system proposed in this paper will be available in a IOT specialized manpower training and a SW education.

Next study should focus on processing and connecting the already designed programs and management system to practical education programs. The study is to generate optimized education courses.

References


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