TO STUDY UNIVERSITY SMART CAMPUS TO MATCHING REQUIREMENTS OF INDUSTRIAL REVOLUTION 4.0 IN EDUCATION CASE STUDY: 'AL-MADINAH INTERNATIONAL UNIVERSITY MEDIU'

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Abstract - Cyber-physics system is combination of physics with cyber components potentially networked and interconnected devices, individually any of these would have a large impact. together, it is a perfect storm of change, Cloud computing uses remote servers to store, manage and process data for faster processes, 3D printing lab, robotics and IoT lab in smart University, Augmented reality is impact smart classroom to allow student to study theoretical subjects with interaction in 3D data, Big data can determine future actions and improve evaluation and analyzing and cyber Security protects smart campus most valuable data, Internet of things IoT which connected internet to machine to send, receive and process data, Simulation ideal for training university staff and scenario planning, Autonomous systems program machinery and robots to act autonomously, Therefore, the 4.0 IR makes a University interoperability which is machine, devices and people connect and communicate with one another. The aim of this study is to propose conceptual model of smart university campus and smart education based on new method of teaching and advance technology and identify the main distinctive features, components, technologies and systems of smart university, the qualitative study andinterview shows that the five academic programs from information Technology faculty and Business faculty small percentage of IR 4.0 areas are included in the curriculum used nine pillars of cyber-physical systems.

Keywords - IR 4.0, Smart Education, Iot, Cybersecurity, Smart Classroom, Smart Services.

I. INTRODUCTION

Nowadays, the increased and rapid changed on technology in several sectors such as smart home, smart campus due to interconnected devices and high bandwidth of internet speed, where is data store in cloud computing in real time, and due to data generated from several resources while Artificial Intelligent became much more complexity algorithm, therefore, the new era which is represented the advance technology in embedding systems or it's called cyber-physical systems the era is called Industrial revolution 4.0 IR 4.0 or Industry 4.0 [1], the IR 4.0 has potential to disrupted the existing conventional approach in enterprise, manufactories and as well university campus, therefore, there is interoperable systems decentralization, transparency and making decision systems, those allow to coordinated more effort among industrial, enterprise, universities and even countries [2], the Internet communication technology ICT facilities smart machines, storage systems and production facilities capable of autonomously exchanging information and also called smart factory, The term of IR 4.0 has been introduced in 2013 by Germany group in academic, business and politics to adopted new era of high tech-strategy for 2020, and was revived in 2011 at the Hannover Fair. There are number of technologies making up IR4.0 such as AI, Robotics, Automation, genetic engineering/biotechnology, Nano technology, Most of these are autonomous, things that happen without human intervention.

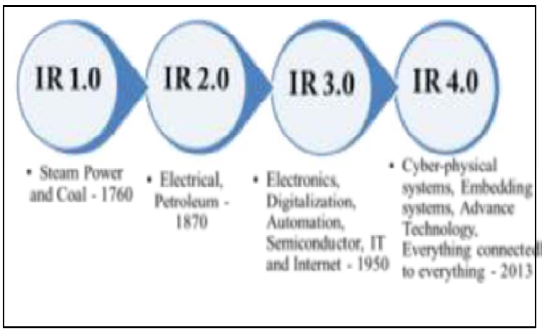


Fig1. History of Industrial Revolution

Figure 1 is represented the historical of industrial revolution where is first industrial is mechanical industrial and it was based on steam power and coal, the second is electrical industrial and represented by steal, petroleum and electrical, the third industrial has several name such as electronic, digital automation production and sustainable,digitalization, semiconductors, information technology and internet, while the fourth industrial is called cyber-physical systems means everything is connected to everything digital, physical and biological[3].

Cyber-physics system is combination of physics with cyber components potentially networked and interconnected devices.

Individually any of these would have a large impact. together, it is a perfect storm of change, Cloud computing uses remote servers to store, manage and process data for faster processes, Adaptive manufacturing which is digital 3D design data builds in layers by depositing materials, Augmented reality

save expense of a physical trail to show a product, Big data can determine future actions and improve processes and cyber Security protects manufacturer's most valuable data, Internet of things IoT which connected internet to machine to send, receive and process data, Simulation ideal for training employees and scenario planning, Autonomous systems program machinery and robots to act autonomously, Therefore, the 4.0 IR makes a factory interoperability which is machine, devices and people connect and communicate with one another, information transparency system: create virtually copy of physical world through sensor data, decentralization decision-making which is cyber-physical systems make simple decisions become as autonomous as possible, technical assistance: the system support humans in making decisions and solving problems and assist with tasks, and every industrial is planning substantial investments.

What are the challenges for the workforce? Increased expectations regarding individual flexibility, Change of necessary qualification, Improvement through the use of robots, Create of new jobs for high skilled workers.

The proposed project is based on improvement of building services efficiency, smart services and smart tools.

The IR 4.0 consist nine pillars of advance technology which are impact to education and new method of teaching. Those pillars as shown on figure below:



Fig.2. IR 4.0 and nine pillars of advance technology Objectives of smart University

One of requirements to enable smart university is smart education, which is needed to enhancing curriculum and activities in order to offered IR 4.0 advance technology in curriculum, these technologies as illustrated on figure 2 play important role education to increase effectiveness of education in classroom and eLearning and for knowledge to be effectively on future for student by sharing and training, the innovative and advance technology such as augmented and virtual reality, cloud computing which allow to enhance the effectiveness of data management in smart campus [5].

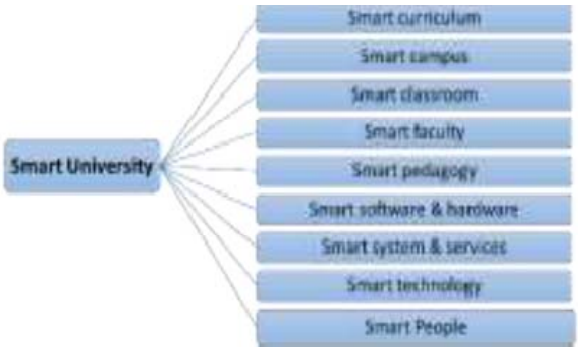


Fig. 3. University Smart Campus

In Figure 3. illustrated University smart campus and figure 4 presented framework of education 4.0, teaching factors to upgrade traditional learning factors by emerging digital technologies [5], the Learning factory module is presented and has been discussed [6], To make university services and facilities much more agile and flexible, ease and fast, responsive to students needs and promote competitive of advance technology IR 4.0 to able to move to smart campus, it possible to create smart campus by using wireless sensors and many other advance technology IR 4.0 used[4].New infrastructure of interconnected devises IoT, and application of IoT. In this paper present smart campus framework as shown on the figure 3.

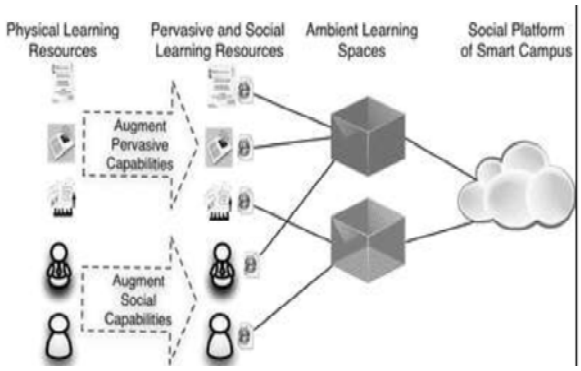


Fig4. Smart campus framework

II. PROPOSED CONCEPTUAL APPROACH OF UNIVERSITY SMART CAMPUS

Objective of research paper is to propose conceptual model of universities smart campus used smart campus framework as a system based on smart university framework, level of a smart system, smart classrooms, smart faculty, smart pedagogy, smart software and hardware systems, smart technology, smart curriculum, smart campus and smart services, and to identify the main distinctive features, components, technologies and systems of smart university. Ref toMalaysia Education Blueprint 2015-2025 (Higher Education) [7, 8]

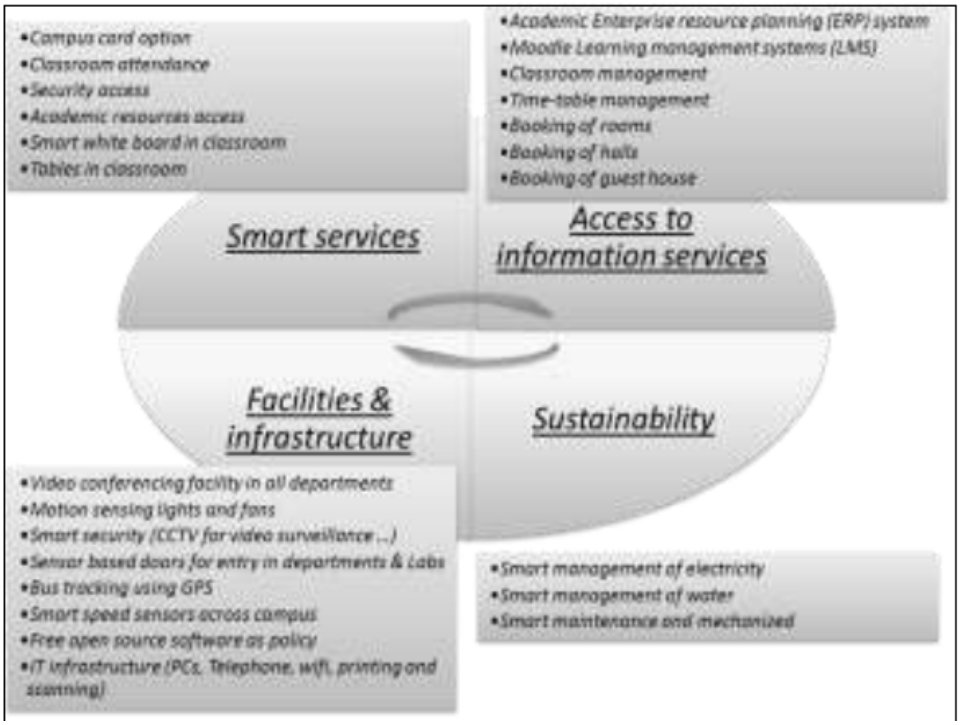


Fig. 5 Architecture of the conceptual proposed approach of university smart campus

III. SMART UNIVERSITY TAXONOMY: FEATURES, COMPONENTS AND SYSTEMS

The idea of next generation of smart classroom system that should significant emphasizes not only software/hardware features but also smart features and functionality of smart systems. Therefore, next generation of smart classrooms should pay more attention to implementation of smartness to create taxonomy of a smart university, smart features, smart services,and identify components and systems that go well beyond those a traditional university face-to-face classes and learning activities.

As illustrated on figure 4, the new approach of university smart campus is represented the four important factors such as smart services, access to information services, facilities & infrastructure and sustainability.

Identification features of Software systems to be developed as following:

Web-lecturing systems (with video capturing and computer screen capturing function) for learning content

Smart classroom in-class activities recording systems

Smart cameraman software systems

Systems for seamless collaborative learning for both OC and OL in smart classroom and sharing learning content/ documents.

Collaborative web-based audio/video one-to-one and many-to-many communication systems

System to reply automatically recorded class activities and lectures.

Repository of digital learning content and online Smart learning analytics and smart teaching analytics systems

- Speaker/ instructor motion tracking systems
- Speech/ voice recognition systems
- Speech-to-text systems
- Text-to-voice systems.
- Face recognition systems
- Emotion recognition systems
- Various smart software agents
- Automatic translation systems

A. Construct smart campus based on cloud computing platform and internet of things IoT

The approach used is Smart campus development approach is based is based on higher stage of education information systems that connect everything through RFID, technology, sensors and Internet of things IoT.

ITEM	DETAILS
Details	Smart campus includes portal architecture, management and services, smart management, infrastructure…, smart campus system integrates hardware smart and non-smart devices, cloud storage as the means of data storage
Identification features	▪ Internet of things IoT ▪ Systems for seamless collaborative learning for both face-to-face and learning on distance for remote students, in smart classroom and shared learning content/ documents. ▪ Repositories of digital learning content and online (web) resources, learning portals
Smartness levels addressed	▪ Adaptive of classroom model ▪ Sensing by technology specification used for identification

TABLE I: Smart campus based on cloud computing platform and internet of things IoT

B. Smart University taxonomy: features, components and systems.

The approach used the idea of next generation of smart classroom system that should significant emphasize not only software/hardware features but also smart features and functionality of smart systems. Therefore, next generation of smart classrooms should pay more attention to implementation of smartness

ITEM	DETAILS
Details	The objective to create taxonomy of a smart university, smart features, smart services,and identify components and systems that go well beyond those a traditional university face-to-face classes and learning activities.
Identification features	Software systems to be developed. ▪ Web-lecturing systems (with video capturing and computer screen capturing function) for learning content ▪ Smart classroom in-class activities recording systems ▪ Smart cameraman software systems ▪ Systems for seamless collaborative learning for both OC and OL in smart classroom and sharing learning content/ documents ▪ Collaborative web-based audio/video one-to-one and many-to-many communication systems ▪ System to reply automatically recorded class activities and lectures. ▪ Repository of digital learning content and online ▪ Smart learning analytics and smart teaching analytics systems ▪ Speaker/ instructor motion tracking systems ▪ Speech/ voice recognition systems ▪ Speech-to-text systems ▪ Text-to-voice systems. ▪ Face recognition systems ▪ Emotion recognition systems ▪ Various smart software agents ▪ Automatic translation systems ▪ Technology to be deployed ▪ Internet-of-Things technology ▪ Web-lecturing technology ▪ Cloud computing technology ▪ Collaborative and communication technologies ▪ Smart agent ▪ Smart data virtualization ▪ Computer gaming ▪ Remote labs (virtual) ▪ 3D visualization tech. ▪ Wireless sensor ▪ Sensor technology (motion, temperature, light. Humidity, etc) ▪ Radio frequency identification ▪ deployed Hardware systems ▪ Panoramic video cameras ▪ Ceiling projector and 3D projectors ▪ Smart board and interactive white board ▪ Smart pointing devices ▪ Controlled and self-activated microphones and speakers ▪ Interconnected big screen monitors or TV ▪ Interconnected laptops or desktop computers ▪ Biometrics-based access control ▪ Robotic controllers and actuators
Smartness levels addressed	▪ Adaptation ▪ Sensing (awerness) ▪ Inferring (logical reasoning) ▪ Self-learning ▪ Anticipation ▪ Self-organization and contracture

TABLE 2: Smart campus based on cloud computing platform and internet of things IoT

C. System Features needed

The features needed in smart classroom as shown on the table below.

SYSTEM FEATURE	DESCRIPTION
Screen capture	Allow instructor to record dynamic and static visual from PC screen
Audio capturing	Allows instructors to record sound, narrations for videos, VoIP calls, audio comes from other application
Capturing from webcam	Allows PC webcam to record instructor in classroom or makes video
Capturing streaming files	Allows to record streaming video and audio files onto a computer
Scheduled recording	Allows instructor to set a time and date for an application to automatically record
Capturing from mobile device	Allows instructor
Add more features	Zoom&pan, Add Media, Adjust audio, Add titles, Add annotations, Split/join video and audio files

TABLE 3: Systems Features Needed

IV. DATA COLLECTION

The data collection stage consisted of 12 individual interviews carried out with Computer and business professors from various disciplines, who teach design courses in the Faculties, the interviews were one hour long included written questionnaire based on method of teaching and offered subjects related to advance technologies included cognitive in blooms taxonomy.

V. RESULT SURVEY AND QUALITATIVE

In this section shows samples of questionnaire of MEDIU head departments and staff lecturer faculties of Computer Science & Info Tech. and also from faculty of business and administration.

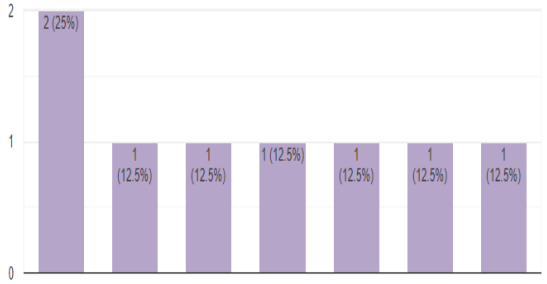
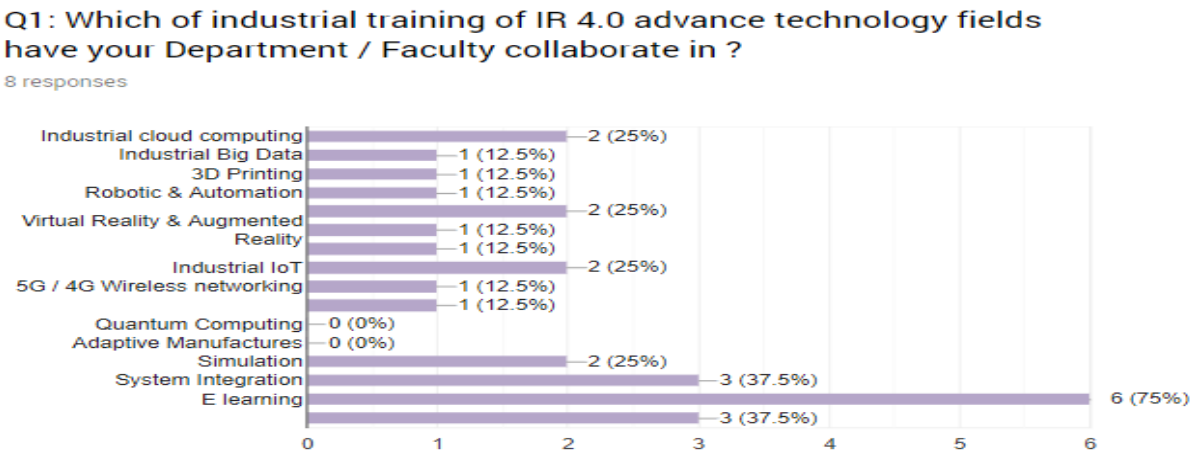
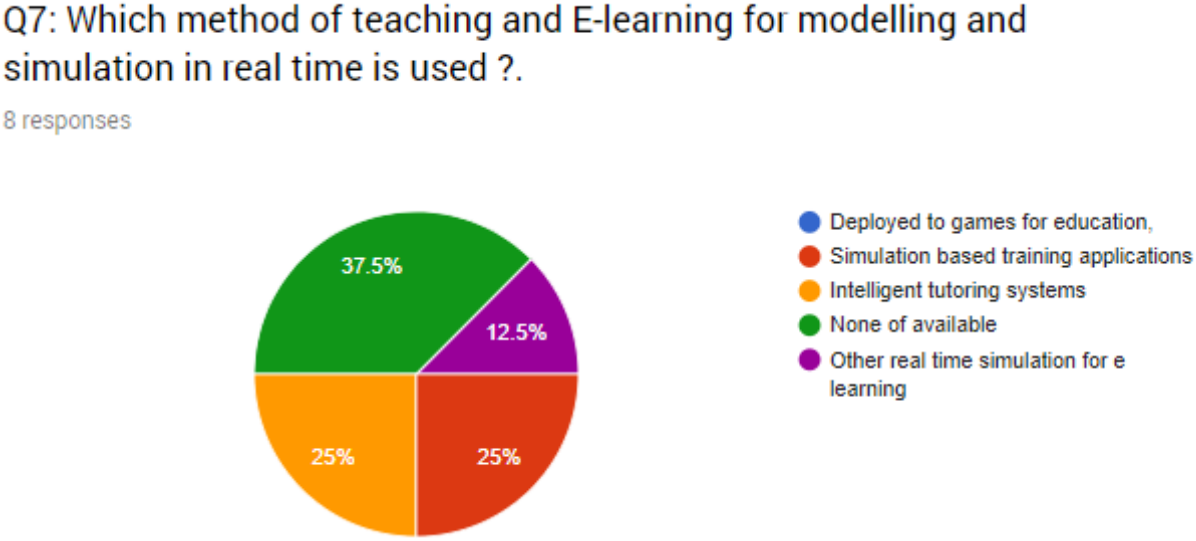


Figure 5. Illustrated percentage of teaching subjects in areas of advance technologies

The questions samples in section of department vision

First Question sample:



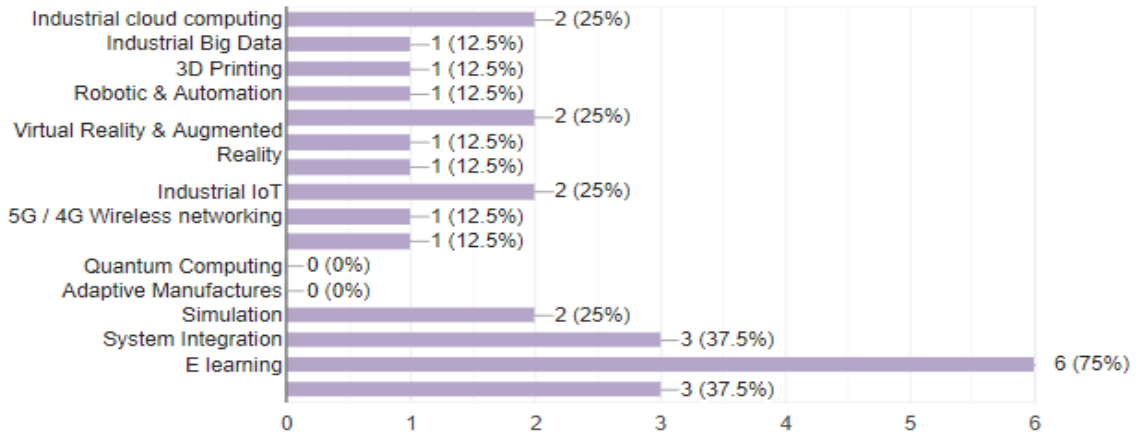


First question sample shows percentage of teachning subject in areas of advance technologies



Q1: Which of industrial training of IR 4.0 advance technology fields have your Department / Faculty collaborate in ?

8 responses



Q2: How will IR 4.0 impact your discipline of academic programs in your department?

8 responses

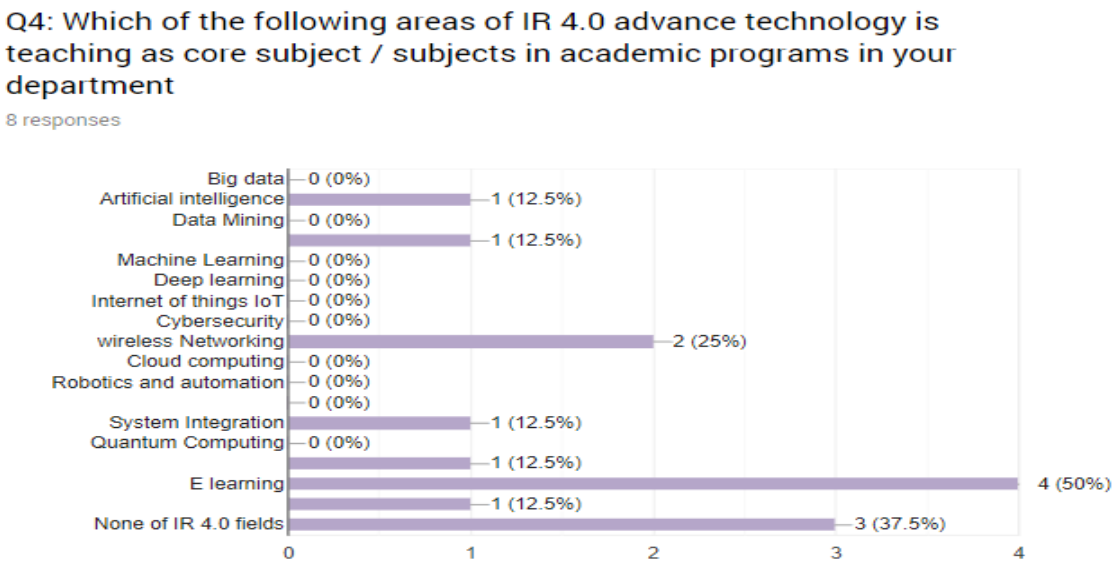
Education 4.0 is suggested to affect all the domains (Cognitive, Affective and Psychomotor) in the Bloom's model. In the cognitive domain, Application, Analysis, Evaluating and Creating will become way more important relative to the lower level cognitive skills. Since professional undergraduate Engineering programmes are subjected to control/regulation by accreditation bodies, out-of-the-box ideas cannot be introduced here immediately.
The curriculum content would have to be updated to educate students on the nature and benefits of Industry 4.0 as well as model within the educational context how some of the characteristics of the Industry 4.0 have been applied to offering services at the University.
resilience in delivering the program and foster understanding and mastering the sujects
make my jop better
will enhance the IT subjects
the main area of IR 4.0 which impact to Islamic science discipline is Artificial Intelligent AI and elearning
Certainly, the curriculum content would have to be updated to educate students on the nature and benefits of Industry 4.0 as well as model within the educational context how some of the characteristics of the Industry 4.0 have been applied to offering services at the University.
In the future, Human Resource will be combined with robots and virtual beings. The HRM system must be adaptable towards the combination of humans and other beings.

Q8: Is the department offered topic/ topics related to IR 4.0 Advance Technology in any subject curriculum of academic program? what is the title of topic and subject name?

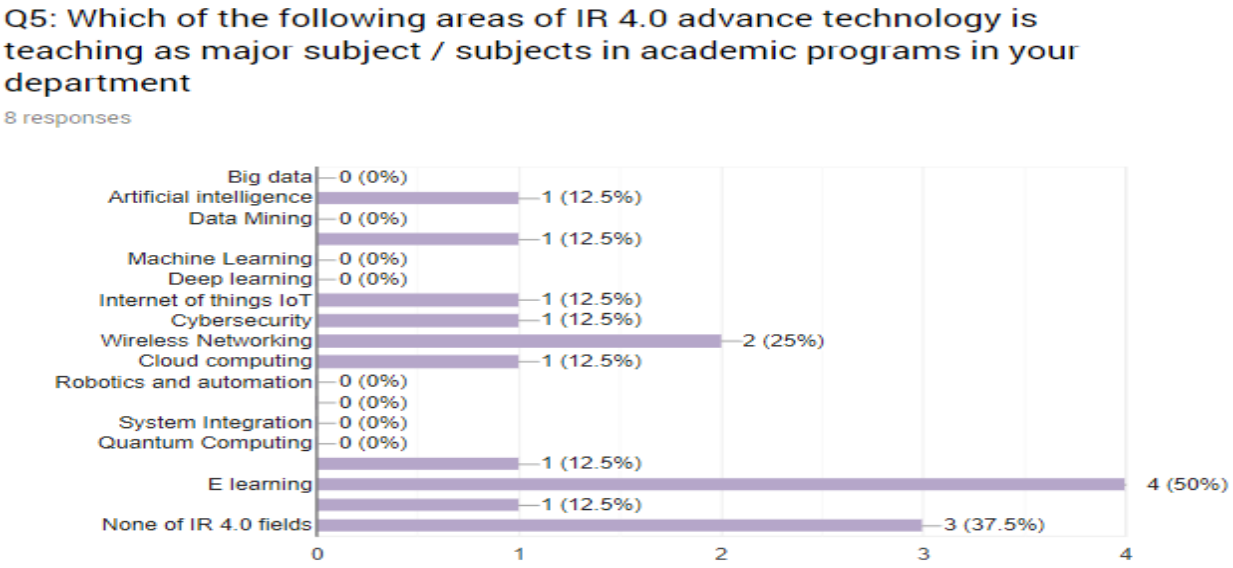
8 responses

Computer program, Instrumentation and control, wireless communication, fabrication technology, multimedia system and network
Entrepreneurship, Software Engineering, Computer Programming, Mathematics for Computer Scientists, Digital Systems, Database Management System, Computer Architecture, Computer Networks, Data Communication & Telecommunication Systems, Multimedia Network, Human-Computer Interaction, Computer & Information Security, Network Analysis and Design, Parallel and Distributed Systems, Cryptography and network security.
None
no
NO
None topic related to IR 4.0
Nope
Human Resource and techonology, cyber security, communication and technology, Management Information System, Human REsource Management Information System.

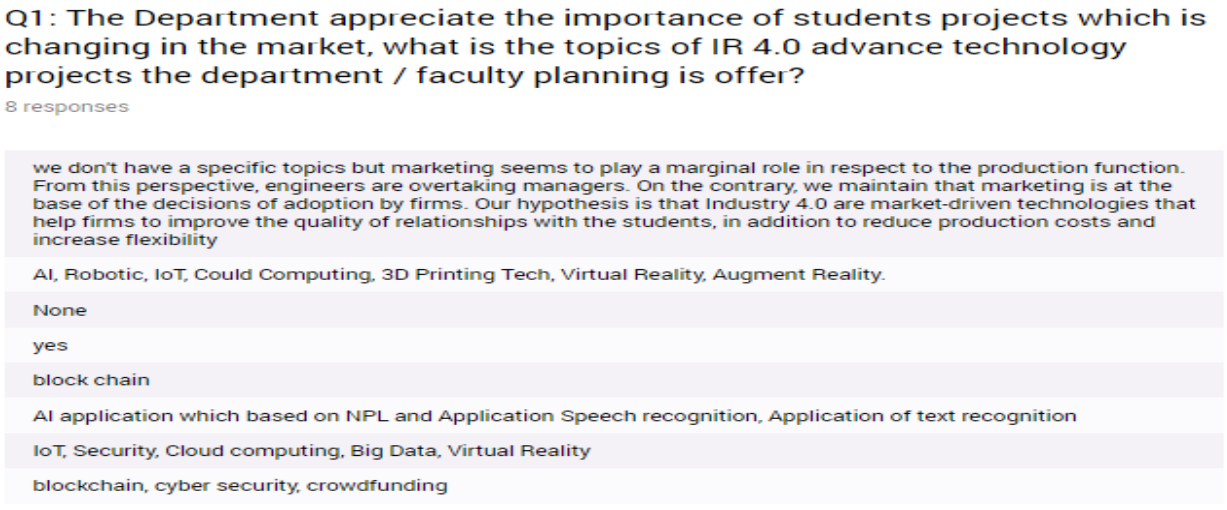
Figure shows teaching subjects in areas of IR 4.0 as core subject in academic program.



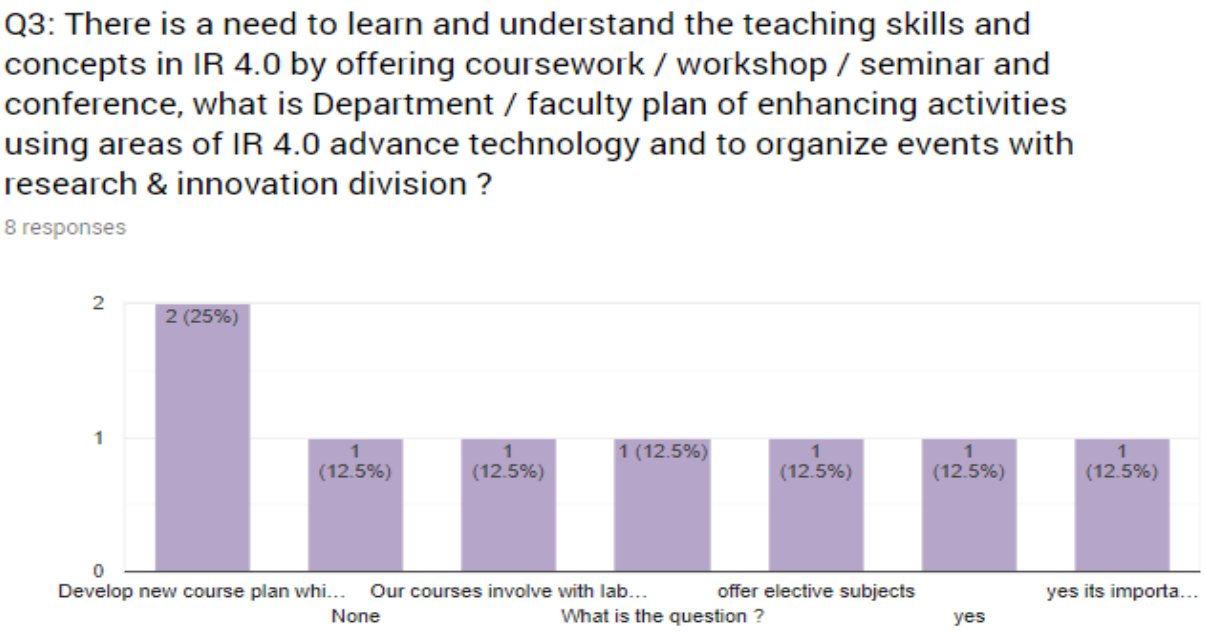
The question sample shows teaching major subjects in area of IR 4.0,

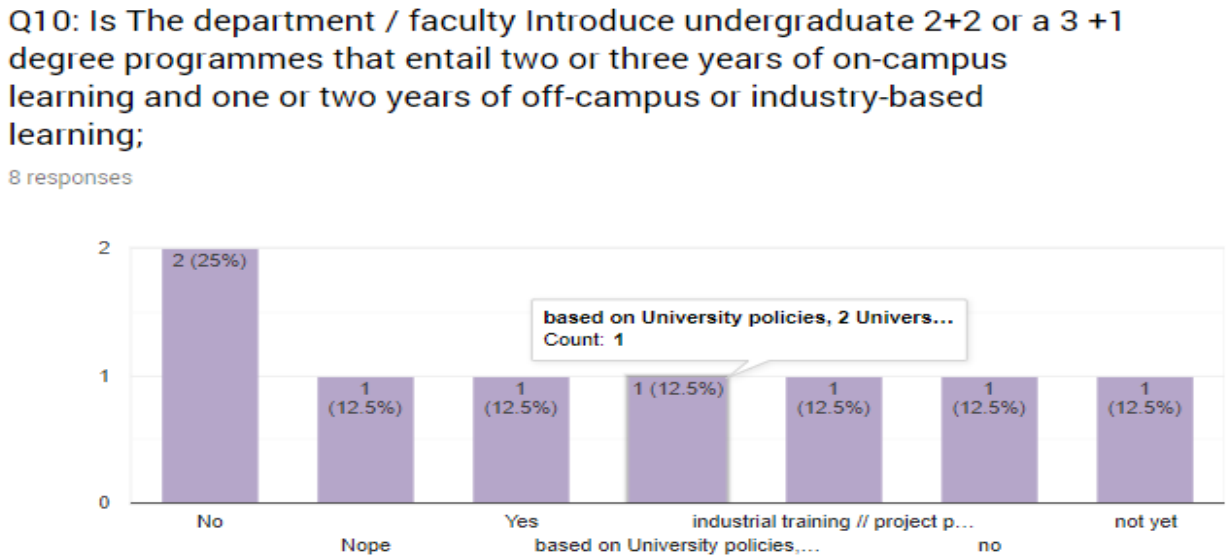


Below question sample in department vision of teaching subjects in areas of advance technologies.



Question shows department plan and vision in organize events workshop, seminar





VI. CONCLUSION

This research paper presented cyber-physical systems and nine pillars of industrial revolution 4.0, the requirement of university smart campus features, proposed conceptual model for smart campus where studies the needs services and devices for smart lab, smart classroom and smart services all important aspects to enable smart campus in the university.

This paper presented the collaboration of human and machine in education systems. And skills need for handling combined task elements. Collaboration of human and intelligent machines triggers mutual learning.

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