BIS3061

Internet of Things (IoT)

Syllabus Winter Term 2019/20

Begin: November 18, 2019 (until Dec. 12)
Rooms & times: see lecture plan
Lecturer: Kevin Johnston  kevin.johnston@uct.ac.za  +27(0)83 415 0892
Prerequisites: There are no special pre-requisites for the course beyond being interested in Information Technology. Don’t take the course if you expect to miss more than one class because active class participation and attendance is critical. Students will need at least one mobile device connected to the internet in all classes.
Accessibility: The course is for 1st semester IT students.

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KA Johnston

IoT 2019
1. Learning Objectives
The course aims to provide students with an understanding of the complexities and issues involved in the Internet of Things (IoT). The Internet of Things is continually expanding, and business and IT professionals need to understand what IoT is, how it works, what is the potential of IoT, and how to use IoT to improve business. The course will examine the broad concept of IoT in business, then the sensors and devices (the ‘things’) that make up the IoT, how these things are programmed, how the data is gathered and analysed, how the components are networked together, how cybersecurity is handled, and where the components sit. Then how to manage IoT projects and the change they create, how to manage innovation, and how to design will be briefly addressed. Finally, the challenges and value add of IoT will be examined.

By the end of the course students should:
• understand what the Internet of Things (IoT) is
• be able to explain the relationship between business requirements and the potential of IoT solutions
• be able to identify the current sensors and devices available and in use in IoT
• be aware of the programming and software required in IoT
• understand and apply design and design concepts with reference to IoT
• appreciate and be able to apply Big Data, Analytics and Business Intelligence in IoT projects
• appreciate the networks, and standards associated with IoT projects
• identify and analyse IoT security and privacy risks
• understand where IoT exists, both in and on the edge of the cloud
• understand and be able to apply Project and Change Management
• have an understanding of Innovation Management
• understand challenges in designing, implementing, and managing IoT
• appreciate how IoT can add value in businesses
• create and present an IoT concept design that solves a problem, is ready to prototype and test.

2. Basic outline and organization
The course is based on the Internet of Things (IoT), information technology and management issues as at 2019.

All students will be expected to participate in the discussions, and will be evaluated on their contributions made in class. All students are expected to bring AT LEAST ONE mobile device to each seminar, which MUST be on at all times.

All students will be expected to read, research, pose problems and questions, develop and submit answers to questions in class. The instructor may give guidelines and additional literature sources.

One or more students will be pre-selected to source a video (maximum of 5 minutes) which explains the topic.

**DURING each Seminar (90 minutes):**
1. The instructor will usually give a lecture of maximum 45 minutes. The lecture will provide theoretical background and raise questions.
2. The pre-selected student(s) will then show a 5-minute (maximum) video they have sourced on the topic to the class.
3. There will then be an open session of maximum 10 minutes to discuss, ask and answer questions on the topic.
4. There will then be exercises or activities for 30 minutes.

The seminar approach is based on interactivity, so each student should come prepared by having read the reading, and prepared answers and questions.

3. Reading

| Participation/Answers/Questions in seminar | 20% |
| Videos in Seminar                         | 20% |
| Project Presentation                      | 50% |
| Reflection                                | 10% |
| Total                                     | 100% |

Marks are gained from each activity performed.

4. Course Materials

There is no prescribed text book; students are expected to find and read a range of Journal articles and academic literature on the internet. The course is based on the issues raised in academic and industry research. Students will need at least one mobile device connected to the internet in all classes.

5. Availability of the lecturer and teaching philosophy

Prof. KA Johnston will be available before and after seminars, for a meeting please email kevin.johnston@uct.ac.za.

I expect each of us to learn and grow during our time together. I do not believe anyone knows all the answers, but I believe that everyone has questions. I believe that learning begins with inquiry, with questions. I hope to get students to develop and ask questions that stimulate debate, provoke reflection, get useful information, and initiate action.
I believe that there are no stupid questions, only stupid answers. I wish to make students comfortable to ask insightful questions.
If you have any problems or questions, please speak up, or e-mail as soon as you possibly can. The longer you wait the fewer options we have to help you.

This course strives to give students a taste of LIFE (Learning, Innovating, Financing and Empowering), and options/choices for LIFE.

Learning – we all learn to walk, talk, question, copy, fail etc., as part of our natural development. Questioning and learning should be part of our daily lives, and we should be open to learn from many sources all the time.

Innovating - Innovating is coming up with a new idea, process, or device which often results from research. Innovating creates more effective ideas, processes, products, services, technologies, jobs for markets, society and governments. We are all capable of being innovative. Innovating aims to produce outcomes that are both original and of value.

Financing - providing funding for activities, purchases or investments. Financing facilitates and allows Learning, Innovation and Empowerment. Financing is about the allocation of assets and liabilities over time under varying conditions. We all need to be aware of the financing aspect of LIFE.

Empowering - to invest in the power and capability of choice. We each need to empower our minds to function most optimally, and to develop the capability of choice.
The course is as Green as possible, there are no paper hand-ins or hand-outs – all deliverables and documents are electronic on Moodle, including final test.

The course follows a constructivist learning approach, which puts the student at the centre of active learning as shown below. Learning is not a passive activity in which students acquire knowledge, rather it is an active approach in which students find, contextualize and process information to construct knowledge. The student is expected to draw on their own personal experiences, interact and draw on the personal experiences of fellow students, interact with the academic, and the environment to source information and to develop knowledge.

This course uses four approaches to ensure the student is active in constructing knowledge.

1. Supported learning – providing scaffolding and bite-sized chunks plus feedback. Students are provided with readings.
2. Exploratory learning – students are encouraged to explore and discover new knowledge, to source videos.
3. Collaborative learning – students obtain multiple perspectives and critical thinking skills, and collaborate to produce presentations.
4. Problem based learning – students are encouraged to post problems, questions as well as answers on the topics.
5. Evidence Based Management (EBM) or practice, which uses four main sources of evidence: Scientific literature, Professional expertise, internal organisational data, and Stakeholders values and concerns. The EBM approach is Ask, Acquire, Appraise, Apply and Assess.
### 6. Schedule for IoT

The schedule will be as follows:

<table>
<thead>
<tr>
<th>Date</th>
<th>Times</th>
<th>#</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>18/11</td>
<td>13:45 15:15</td>
<td>1</td>
<td>Introductions/Preliminaries/Assessment/Project allocation</td>
</tr>
<tr>
<td>18/11</td>
<td>15:30 17:00</td>
<td>2</td>
<td>IoT Architecture &amp; Business Processes</td>
</tr>
<tr>
<td>19/11</td>
<td>11:30 13:00</td>
<td>3</td>
<td>IoT Sensors &amp; Devices</td>
</tr>
<tr>
<td>19/11</td>
<td>14:45 15:15</td>
<td>4</td>
<td>IoT Networks &amp; Platforms</td>
</tr>
<tr>
<td>20/11</td>
<td>19:00 20:30</td>
<td>5</td>
<td>IoT on the Edge of the Cloud</td>
</tr>
<tr>
<td>21/11</td>
<td>09:45 11:15</td>
<td>6</td>
<td>IoT Programming &amp; Software</td>
</tr>
<tr>
<td>21/11</td>
<td>13:45 15:15</td>
<td>7</td>
<td>UI, UX &amp; Design Thinking</td>
</tr>
<tr>
<td>22/11</td>
<td>11:30 13:00</td>
<td>8</td>
<td>Design Thinking Workshop</td>
</tr>
<tr>
<td>25/11</td>
<td>13:45 15:15</td>
<td>9</td>
<td>IoT Big Data/Analytics/Business Intelligence</td>
</tr>
<tr>
<td>25/11</td>
<td>15:30 17:00</td>
<td>10</td>
<td>IoT Security &amp; Privacy</td>
</tr>
<tr>
<td>26/11</td>
<td>11:30 13:00</td>
<td>11</td>
<td>IoT Project Management</td>
</tr>
<tr>
<td>26/11</td>
<td>13:45 15:15</td>
<td>12</td>
<td>IoT Innovation Management</td>
</tr>
<tr>
<td>27/11</td>
<td>19:00 20:30</td>
<td>13</td>
<td>IoT Value</td>
</tr>
<tr>
<td>12/12</td>
<td>09:45 11:15 13:45 15:15 15:30 17:00</td>
<td>14</td>
<td>Project Presentations</td>
</tr>
</tbody>
</table>
7. Preparation and Assessment

7.1 Videos in Seminars (20%)
The student(s) must carry out a focused search for a recent and relevant academic/business video which contains a succinct, focused and relevant contextualization and definition of the topic.

Videos will be marked according to the following table:

<table>
<thead>
<tr>
<th>Excellent 5</th>
<th>Very Good 4</th>
<th>Good 3</th>
<th>Fair 2</th>
<th>Poor 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent video containing a succinct, focused and relevant contextualization and definition. Key concepts clearly identified and explained.</td>
<td>Very good video containing a clear and relevant contextualization and definition. Key concepts identified and explained.</td>
<td>Good video containing good contextualization and definition. Key concepts identified and explained, with a small amount of irrelevant material.</td>
<td>Video which is weak in contextualization, and definition. Key concepts not clearly identified or explained.</td>
<td>Poor video which is unclear or poor in contextualization, and definition. A fair amount of irrelevant material.</td>
</tr>
</tbody>
</table>

7.2 Project Presentation (50%)
The Project presentations should be structured, and applied. The project presentation may use relevant theory or models. Students should engage in the process of designing an IoT solution, from initial analysis of the creative idea to planning out the product, research and design. The presentation must be complete in a maximum of 5 minutes. Points are awarded based on a 5 point scale, where 1=poor, 2= fair, 3= approaches expectation, 4= meets expectation, and 5= exceeds expectation.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation (25%)</td>
<td>/25</td>
</tr>
<tr>
<td>Scene setting of the situation of concern or opportunity</td>
<td>1-5</td>
</tr>
<tr>
<td>Visual Aids/Delivery</td>
<td>1-5</td>
</tr>
<tr>
<td>Structure – introduction, conclusion, story line</td>
<td>1-5</td>
</tr>
<tr>
<td>Depth of Treatment</td>
<td>1-5</td>
</tr>
<tr>
<td>Time Keeping (maximum 5 minutes)</td>
<td>1-5</td>
</tr>
<tr>
<td>Content (75%)</td>
<td>.../75</td>
</tr>
<tr>
<td>Overview (Background, creative idea, problem statement, purpose, business, justification &amp; potential benefits)</td>
<td>1-5</td>
</tr>
<tr>
<td>COLLECT - IoT Devices (clear statement of sensors and devices (Things) to be used, should be related to the problem &amp; realistic)</td>
<td>1-10</td>
</tr>
<tr>
<td>CONNECT - NW &amp; CLOUD (clear statement of how Things associated with the project are to be connected)</td>
<td>1-10</td>
</tr>
<tr>
<td>ANALYSE – Big Data, Analytics, Programming &amp; Software (clear statement of the analysis and Insights expected for the IoT project)</td>
<td>1-10</td>
</tr>
<tr>
<td>ACT – Programming, Software &amp; Business Intelligence (clear statement of Business Intelligence and Actions expected for the IoT project)</td>
<td>1-10</td>
</tr>
<tr>
<td>Security &amp; Privacy in the IoT (clear statement about the security and privacy implications of the IoT project)</td>
<td>1-10</td>
</tr>
<tr>
<td>Empathy Map</td>
<td>1-5</td>
</tr>
<tr>
<td>Value, benefit and relevance of IoT Project - expected contribution</td>
<td>1-10</td>
</tr>
<tr>
<td>Presence, interest, variety, appeal, quality, humour</td>
<td>1-5</td>
</tr>
</tbody>
</table>
7.3 Participation/Discussion/Questions in Seminar (20%)
Participation (key word) by students in class, discussion and questioning is core to this course. All students are expected to bring AT LEAST ONE mobile device to each seminar, which MUST be on at all times. Students are expected to participate in online quizzes, and to search for and find information relevant to the topic under discussion. Effective participation is only possible by regular class attendance and active class interaction. Students should be prepared to ask questions, give answers, and act as scribes. All students will be expected to participate in the discussions, and will be evaluated on their contributions made in class during the course. Asking questions is an important part of this course. Students will not gain marks simply by asking an obligatory question or two, nor will marks be based on the number of questions or comments made. Marks will be gained by asking open ended questions which cause students to think and grow. Participation grades will reflect the total impact the student has had on the class over the term, through significant and insightful comments, and a demonstration of good problem-solving and analytical skills. Finding relevant and recent technological and academic examples and showing these to the class will be rewarded. Leadership is not knowing all the answers, it is knowing which questions to ask, to whom, and listening to the answers. Peter Druker once said, “The leader of the future will be a person who asks.”

Each question and answer will be assessed and given a mark (1-5), based on the following criteria:
5 – Excellent, demonstrates knowledge, understanding, insight, and or creativity.
4 – Very good, could be clearer and or shorter, but covered key points, one or two minor faults/omissions.
3- Good answer, most points covered, shows some knowledge of the subject matter, perhaps some application.
2- Shows some knowledge of the subject matter, but no application.
1- Meaningless, nothing relevant, a token gesture.

7.4 Reflection (10%)
Reflection is not simply reporting events, reflection shows some analysis, explores motives for views/behavior, reflection can be critical of views/actions. Reflection contains an element of ‘standing back’ from an event/issue, and reflection recognizes that one’s frame of reference can change. Reflection also takes the views and motives of others into consideration, and considers them against one’s own views and motives. Reflection recognizes that previous experience, thoughts, socialization, background etc., interact with the production of one’s own behavior. Students are expected to submit a reflection piece (maximum 250 words) a maximum of a week after the final lecture. All students are invited and encouraged to reflect on two issues (a & b):
   a. What are the two-four most important things I learned in this course?
   b. Did the course change any of my opinions, which ones, and how?

Each reflection will be assessed and given a mark (5-1), based on the following criteria:
5 – Excellent, critical reflection which takes account the socio-political context in which events take place and decisions are made (roles, relationships, responsibilities, gender, ethnicity, etc.).
4 – Very good, dialogic reflection which is a form of discourse with one’s self, mulling over reasons and exploring alternatives (I wonder...? perhaps ...? maybe...?).
3- Good, descriptive reflection which provides reasons (often based on personal judgement), although only in a reportive way (I did x because y).
2- Fair, descriptive, but not reflective, merely reporting events with no attempt to provide reasons (I did x; s/he said y).
1- Poor – neither descriptive nor reflexive.
0-No reflection.

8. Plagiarism
The University considers plagiarism to be the deliberate passing off of another person’s work as though it was your own, and will NOT be tolerated. At the very least, you would get zero for your work, and we would request that you withdraw from the Course.

Since so much of the course mark is awarded for work done outside of our direct control, a great deal of trust is involved. We therefore view plagiarism in the same way as we do cheating in examinations. Similar rules apply to all student work such as projects, essays and other assignments.

Some examples of what we would consider to be plagiarism are:
- You downloaded material from the Internet and submitted it as your own work
- You downloaded material from the Internet and copied whole paragraphs or pages of text into your assignment, but you edited them slightly so they fitted in. You might have written other parts of the assignment yourself, but chunks of it are made up of copied material.
- You found a few articles or books that really say everything you need. You designed the structure of the assignment yourself and wrote quite a bit of it. But one or two sections are almost word-for-word from the articles or books you used. You did this because they said things in a way you felt you could not improve upon.
- You acquired assignments from previous year’s students and used them in the manner described above.
- Someone else wrote all (or part of) the assignment or project for you, either as a favour or for some kind of reward.
- Falsifying or manufacturing (creating) of any data.

So what would the consequences of plagiarism be? At the very least, you would get zero for your assignment/submission, you will have to appear before the Dean, and we would request that you withdraw from the Course. In cases where blatant copying has taken place, we would take disciplinary action, which could result in suspension or expulsion from the University.

What is acceptable?
Part of the objective of the course is for you to find lots of other material. All we ask is that you use it in an ethical, honest and scholarly way. This requires you to be able to analyse and discuss a broad selection of the material you found, and that you reference the material you use!

Acceptable use of another person’s material at undergraduate level means that the assignment structure, layout and contents are all your own work. AND
- You used no more than one directly quoted paragraph per page, and you referenced the author as per APA 6th guidelines
- You used ideas, phrases, concepts, diagrams and statements already stated by others, but you rewrote them in your own words AND you referenced them
• You have quite a lot of references on each page, but they are taken from several different sources. (If they are all from the same source, then you have relied too heavily on that source!)

9. Challenges to you
Know what's expected of you – ASK QUESTIONS
Question everything (WIIFM?)
Change and facilitate change
Listen
Learn
Plan, plan, plan – “failing to plan, is planning to fail”
Look for examples around you
Pass
Enjoy yourself – have fun

10. Disclaimer
While every effort has been made to be as accurate as possible in this document, it sometimes happens that changes occur – particularly dates. If in doubt, please check with Kevin Johnston or the Course Administrators.