Course Syllabus - BLOCKCHAIN 4 SMART CITIES

Language of Instruction: English
Professors: Miquel Oliver and Lluïsa Marsal
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(for students: please send an email to schedule an office meeting)

Course Contact Hours: 30 hours
Recommended Credit: 4 ECTS credits
Weeks: 2

Course Prerequisites: Although there are no pre-requisites, the course is recommended for students enrolled in IT-related fields, urban studies, economics and law.

Language Requirements: English level B2.2

Time modules: This is a mixed modality, a combination between Modality 2 and 3 but intensive as it adds 3 mornings in the second week:

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MORNING SESSIONS $1 to $10 make a total of 20 h
AFTERNOON SESSIONS City Council visits are a series of 3 on-site and hands-on workshops with partner cities

Course Description:
The course aims to introduce the main concepts of blockchain in a city environment using an applied approach. It consists of 3 modules. The first module comprises the basic technological definition and analyses some examples on methodologies and solutions shaping urban environments. The second module consists of an analysis of the different activity areas shaping our cities (i.e policies, planning, regulations and standards). This second module includes innovation-discovery workshops to identify relevant cases that students might use as projects. The last module focuses on the specifics of cryptourbanomics, a term identifying the role of cryptoeconomics in the urban context. In this module, students work on a specific project and are given the opportunity to discuss it with city representatives in a real institutional context. To that end, a set of visits to city councils will be planned.

Keywords: Blockchain, smart cities, city management, ethereum, bitcoin, public administration, cryptourbanomics.

Learning Objectives:
At course completion the student will:
- understand the basics of a public blockchain, including potential applications and their limitations
- be able to identify areas related to city management and city planning where blockchain can bring the benefits of decentralisation, self-verification, distribution and disruption
- be capable to design a real-situation project at proof of concept level, where blockchain is involved as a vehicle to solve that city challenge
Course Workload
The course includes lectures, seminars, and field workshops. Moreover, students should allow for 2 to 4 hours of additional home-based work per day consisting of reading recommended lectures (mostly during the first week) and project preparation with their team (mostly during the second week).

Methods of Instruction:
In-class sessions take place all afternoons, Monday to Friday, the last week of June and the first week of July 2018. Classes will start promptly at 15.30 and end at 17.30. A 10 min grace window will be given to students arriving late and no student will be allowed to come in after that. Usually classes will start with a one-hour lecture followed by a discussion seminar or practical exercise.

Regarding the three-morning workshop visits, cities and partner administrations are not yet known thus locations cannot be advanced. Travelling outside Barcelona will be left at students discretion, being able to decide whether they want to take workshops in one city or another. Should students have to travel outside Barcelona, it will be mandatory to travel on public transport and refunds will be made only if proof of expense is given.

Method of Assessment
Course project will be developed at a proof-of-concept level and it will constitute course’s assessment, distributed as follows: project definition (20%); development and use of references (40%); final presentation as a recorded video (30%); in-class participation and team engagement (10%).

Absence Policy
Attending classes and field workshops is mandatory and will be monitored daily by professors. The impact of absences on the final mark will be announced soon.

The BISS attendance policy does not distinguish between justified or unjustified absences. The student is deemed responsible to manage his/her absences.

Emergency situations (hospitalization, family emergency, etc.) will be analysed on a case by case basis by the Academic Director of the UPF Summer School.

In-class rules:
· No food or drink is allowed
· Classes will start promptly at 15.30, a 10 min grace period will be given to students arriving late, after which doors will be closed.
· There will be a twenty-minute break during field workshops.
· Students must come to class fully prepared. Since students will have to install software, it is recommended to bring along a personal laptop. In its defect students will be given use to UPF’s labs desk computers.

Course Contents:
MODULE 1: Introduction to Blockchain
S1-Blockchain definition (Monday, June 25, from 15.30 to 17.30)
The students will be introduced to the basic concepts, as well as to a short history about the blockchain and its applications. After this introductory session, the students will participate in a seminar to explore and apply the key ideas behind blockchain technology to examples of their own personal life. The session will end with a short presentation on ideas for blockchain application.

S2-Evolution of blockchain (Tuesday, June 26, from 15.30 to 17.30)
This second session will be devoted to go deeper on the blockchain technology (public/private keys, hashing, consensus algorithms, etc.) to understanding the significance of each of these mechanism as well as their boundaries. Recalling on the
ideas given by the students during the first sessions, the second part of the class will be oriented towards challenging the former proposals.

**S3-Cryptocurrency case: bitcoin and ethereum** (Wednesday, June 27, from 15.30 to 17.30)
Cryptocurrencies in general and bitcoin and ethereum in particular use proof-of-work (PoW) as consensus algorithm. In this session, students will learn the particular cases of bitcoin and ethereum since these are the top two cryptocurrencies in what market capitalisation is concerned, besides being the most well-known blockchain use cases. During the second part of the session the students will discuss applications of blockchain beyond cryptocurrency, in particular by using ethereum’s smart contracts.

**MODULE 2: Cryptourbanomics**

**S4-Discovering Cryptourbanomics** (Thursday, June 28, from 15.30 to 17.30)
This lecture will serve as kick-off of students' projects and will therefore consist of a put-together of the already learnt crypto laws principles to design blockchain solutions for the urban domain. We will review the cryptourbanomics recipe for project drafting in a Q&A format: do I need a blockchain for this project? Should my project aim for all three blockchain ingredients (disruption, distribution, and decentralisation)? What’s the role of the city council in the cryptourbanomics space? And of the private sector? How can I design a digital divide-free cryptourbanomics project and thus bring off-line/analogue people in? As project designer, what will be my role in my own project and level of responsibility? How can I navigate the current blockchain outlawed situation? If my project returns profits, should I cash it and put it in the fiat system, or keep it in the crypto space? This lecture will be attended by partnering cities and public administrations and an open discussion on cryptourbanomics will take place afterwards.

**S5-The disruptive element** (Friday, June 29, from 15.30 to 17.30)
From the lecture, students will learn why blockchain-based solutions generate disruptive environments and how the role of stakeholders changes if compared to the same solution when solved without blockchain. The one-hour lecture will be followed by a seminar in which the disruption of an urban situation will be discussed. Specifically we will focus on an Urban Policies use case, for which stakeholders’ roles will be identified and the system’s forum will be built along with its data model. On the organisational side of the course, the distribution of projects and partner cites will be made and teams will be formed.

**S6-The distributed element** (Monday, July 2, from 15.30 to 17.30)
During the lecture, students will be given the key tools to build a distributed urban system and will understand why distribution has physical connotations, thus being urban systems a great example. Moreover, the effects that distribution has in increasing systems’ resilience and robustness will be argued. The lecture will be followed by a seminar where students will practice distribution concepts by analysing an Urban Planning use case. They will identify subsystems involved, build subsystems interactions and draft the corresponding relationships model.

**S7-The decentralised element** (Tuesday, July 3, from 15.30 to 17.30)
The lecture will empower students to understand in which situations a decentralised model is better than a centralised one and the importance of setting common and democratic governance rules in distributed systems. Also, the lecture will present the role of standards to consolidate proven working methods and how standards drafting itself can be decentralised. During the seminar hour, students will be given a use case on Urban Regulations and Standards and they will first have to differentiate these two elements to next identify decentralisation opportunities, build system’s rules and its corresponding operational model, and think of possible applications thus drafting an export/replication and scalability model.
MODULE 3: Cryptourbanomics in Use

**S8a- City council Workshop Part I** (Wednesday, July 4, from 9.30 to 13.00)
In teams, students will visit their corresponding hosting administration in the morning to gather first-hand information and guidance on the structure of their project to nail down project’s disruptive fit. They will be asked if they need to talk or have a meeting with a specific person.

**S8b- Programming & measuring disruption** (Wednesday, July 4, 15.30 to 17.30)
The two hour afternoon session will be dedicated to discuss morning results, with special focus on the disruptive element of the project. Students will get teacher’s feedback but also from other teams.

**S9a- City council Workshop Part II** (Thursday, July 5, from 9.30 to 13.00)
This will be the second visit to the respective hosting administrations to progress the design of their project, focusing on distribution characteristics. Meetings with officers requested the previous day might also take place during this second visit.

**S9b- Executing distribution and its costs** (Thursday, July 5, 15.30 to 17.30)
The two hour afternoon session will be dedicated to discuss morning results, with special focus on the distributed element of the project. Students will get teacher’s feedback but also from other teams.

**S10a- City council Workshop Part III** (Friday, July 5, from 9.30 to 13.00)
This will be the third and last visit to partners cities and will be dedicated to make the project’s case for decentralisation. Throughout the three-day workshop, students are kindly advised to bring a camera at all times but especially in this last visit so that any on-site supporting material for their video presentation can be gathered. Last chance for any pending meetings with officers.

**S10b- Empowering transparency in a decentralised economy** (Friday, July 5, from 15.30 to 17.30)
The two hour afternoon session will be dedicated to discuss morning results, with special focus on the decentralised element of the project. Students will get teacher’s feedback but also from other teams. Also, guidance on the elaboration of project’s video and its submission will be given.

**Required Readings:**
The following readings are essential for students, in preparation for the corresponding session:

S1 and S2: no specific readings are necessary

*Ethereum White Paper* from Github


Marsal, ML. (2017). *Future living framework: Is blockchain the next enabling network?*, Technological Forecasting and Social Change, on-line first

S7:
Recommended bibliography:

Students are encouraged to consult the following sources in preparation for the course:

**ON BLOCKCHAIN:**


**ON SMART CITIES AND THE COMMONS:**


Swanson, T. (2014) Great Chain of Numbers. Creative Commons