2SC6490 – Development of a sensor monitoring system

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Language of instruction: FRANCAIS
Campus: CAMPUS DE RENNES
Workload (HEE): 40
On-site hours (HPE): 27,00

Description

In partnership with other students of the campus following the thematic sequences "Smart Building" and "Health" STs, the objective is to develop the information system that will enable the collection and processing of data from sensors, and to provide services for the regulation. The educational objective is to perceive the specificities of the development of applications in the cloud et to discover the interest of design choices to facilitate the software evolution, and the benefits of an AGILE organization.

Quarter number
ST5

Prerequisites (in terms of CS courses)

- Information System and Programming
- Algorithm and complexity

Syllabus

From a technical point of view, we will aim to develop by a team a complete infrastructure for collecting, processing and displaying data from sensors. Data from other project groups in other STs will pushed and hosted on a local server but will then be pushed onto a cloud-like infrastructure. At this stage, no treatment is performed. The data is then re-extracted and can be processed to be projected into a final data model suitable for presentation. This data will be stored in a database to be implemented by the development team. This data is then presented via a REST API to the part of the team developing the application frontend.

Class components (lecture, labs, etc.)
Students will be divided into a project team organized around a project leader (which can change every day). At the beginning of the day, each project team will be given features to be provided at the end of the day. In addition, every day, minor improvements will have to be made in order to respond as quickly as possible to the needs expressed by students from other STs during a meeting bringing together all the ST students concerned.

To support the EI, it is expected:

- a computer room that can accommodate up to 25 people
- access to a Cloud Computing infrastructure
- possible VPNs to connect the different software components

Grading
Oral presentations

Resources

- computers
- sensors for testing and from other STs

Learning outcomes covered on the course

- Understand and model the client requests
- Implement as a team a solution answering the client requests

Description of the skills acquired at the end of the course

- C4.1 Analyse customer needs, the constraints of other stakeholders as well as include societal challenges.

Evaluated by a presentation of the global solution fully integrated with the development of other ST.

- C7.1 Persuade at the level of core values; to be clear about objectives and expected results.

Evaluated by a non technical presentation of the global solution in coordination with other ST.

SCIENCE AND ENGINEERING CHALLENGE N°7 COURSES

ST7 – 71 – STOCHASTIC FINANCE AND RISK MODELLING

Major : MDS (Mathematics, Data Sciences)

Language of Instruction : English

Campus : Paris-Saclay

Engineer problem

The financialization of the economy is a remarkable phenomenon in the past thirty years, which pushes financial markets to the heart of the globalized economy. Accordingly, risk management by financial institutions is crucial to the economy as a whole.

The subject aims to introduce the fundamental concepts of financial risk management to students, and in particular the corresponding mathematical aspects. This module will allow the students to be familiar with stochastic models of asset pricing in discrete time, to discover common derivative products and to address real issues of risk management. For engineers working in the financial industry, the understanding and full control of these models are essential.

Prerequisites

Students are required to have followed the courses CIP, PDE and Algorithms and complexity. The knowledge of measure theory (found in CIP) is essential, e.g. sigma-algebra, measurable space, measure/probability, conditional expectation, etc.

Nevertheless, the ST4 Data and Statistics in Finance is NOT necessary.

Modules and challenges : A series of conferences will present different fields of financial risk management methods and their applications. Themes and speakers may change every year. Conferences may deal with :

- derivatives products ;
- asset management: portfolio allocation and risk management ;
- actuarial science and risk management of insurance ;
- commodities and energy markets ;
- etc.

Specific course (60 HEE) : *Modeling of financial risks*

- **Quick description :** This course is an introduction to discrete time financial mathematics. It deals in particular with the valuation and hedging of derivative products as well as risk management in a stochastic discrete time framework.

Content : Discrete time market models. Arbitrage. European derivatives. Complete/uncomplete market. Evaluation. Hedging. Risk measurs and portfolio optimization. American derivatives.

Tutor class (TD) : Various questions/problems arising in finance are formulated in mathematical language. Theorems/tools/techniques presented during the course are needed to solve them.

Homework (TP) : Homework is in general in the format of a project. It makes students have a deeper understanding the goal of this course and requires them to apply the results to solve problems in practice.

Project : *Financial risk management*

- **Associate partners :** Industrial partners may change every year. Recent partners include BNP Paribas, Generali, Volga Technologies, ODDO BHF, etc.
- **Location** : Paris-Saclay
- **Quick description :** Students enrolled in this course are asked to study a quantitative method in a financial risk management setting. Subjects are proposed by an industrial or academic partner.

Goals: to be able to model problems of financial risk management, to be able to implement numerical solutions.

Each project deals with a quantitative method for risk management, e.g., pricing or hedging of a financial product, or asset allocation, portfolio management, client portfolio analysis, etc. Real financial or client data is provided by the project partner. Each project requires the coding of the method investigated.

Students will work in groups (group formation rules will be specified at the start of the ST).

Evaluation : Students will be graded respectively for the course and the project.

- **Course :** The score is given as max(0.5*x+0.5*y, y), where x stands for the score of homework (TP) and y is the score of final exam. More details can be found during the first class or in Edunao.
- **Project** : Final grade is decided after an oral presentation, by a jury including the industrial supervisor.