Budapest University of Technology and Economics

Faculty of Electric Engineering and Informatics

Department of Measurement and Information Systems

Real-time course evaluation as a cyber-physical system

Készítette

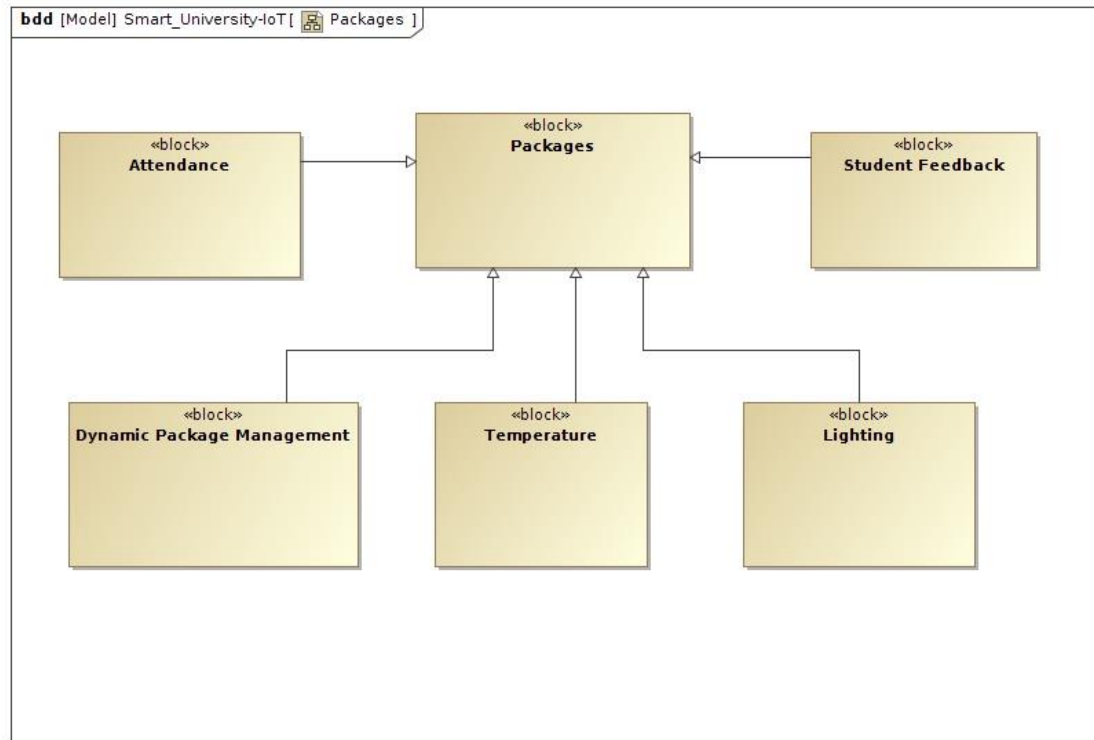Kamrás Márton

Konzulens

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Egyetemi tanár

2016

TABLE OF CONTENT

1. System design

Smart University is going to consist of multiple Packages (modules) which represent different, high-level functionalies as described below guided by the following diagram:

1.1. High-level overview of the packages

1.1.1. Temperature

The role of the Temperature package is to measure temperature of rooms in which lectures are held in so as to store data in the cloud and guide automated heat controlling installations in order to converge desired room temperature by altering heating levels and controlling air conditioner systems.

1.1.2. Lighting

Lighting package will have almost the same role as the Temperature package using data acquired by measuring luminance of the room. In order to handle brightness the Lighting module will handle the shutters and artificial lighting of the room.

1.1.3. Attendance

The aim of the Attendance package is to supersede paper-based attendance sheets used by many courses throughout universities. The main idea is to loose any procedural avtivity as part of checking the attendance of students during the lecture.

1.1.4. Student Feedback

The most important social aspect of the Smart University will be the feedback of students given during courses they attend. All data measured by physical instruments will be compared against this data in order to determine how physical factors alter the process of absorbing information presented by the professor/lecturer so as to optimize automated environment control by the system.

1.1.5. Dynamic Package Management

Dynamic Package Management will allow managers of the system to activate and deactivate packages of the system according to their desire.

1.2. Detailed overview of the packages

The following section describes detailed functionalities of the system design.
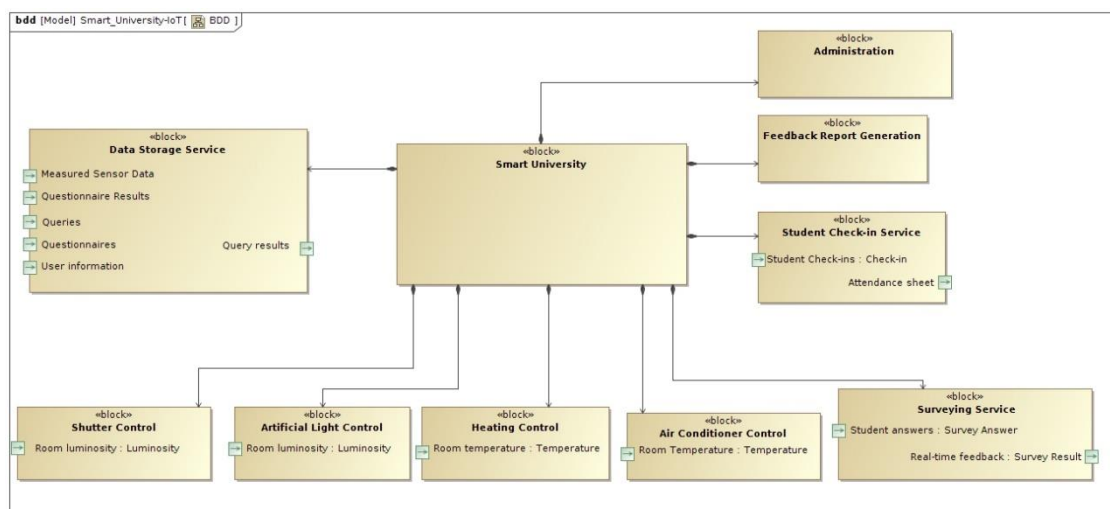
1.2.1. Heating Control

Heating Control will affect the room temperature using the heat radiators of the room when the temperature is below the given settings.

1.2.2. Air Conditioner Control

When the temperature is too high or the oxygen level is below desired in the lecture hall the air conditioner system will be turned ont o alter air conditions so as to converge the required state of air.

1.2.3. Shutter Control

The role of Shutter Control system is going to be the maintenance of set luminance by letting in or shutting out natural light according to the desired level.

1.2.4. Artificial Light Control

Artificial Light Control will alter luminance as well as the Shutter Control but it is going to increase brightness by turning on portions of lamps in the room as determined by the settings in case it is too dark in the room.

1.2.5. Student Check-in Service

Student Chek-in service will consist of an RFID-like and/or a smartphone application service that will be responsible for simplified tracking of student attendance at courses.

1.2.6. Surveying Service

Surveying Service will conduct periodical surveying so as to determine the level of understanding reflected by students in the subject they are learning at ongoing lecture. The collected data will be accessible by the lecturer in a real-time manner and will be transferred into the cloud as well.

1.2.7. Feedback Report Generation

Feedback reports will be available via an online interface that can be used to track the connection between physical and social measurments of the system.
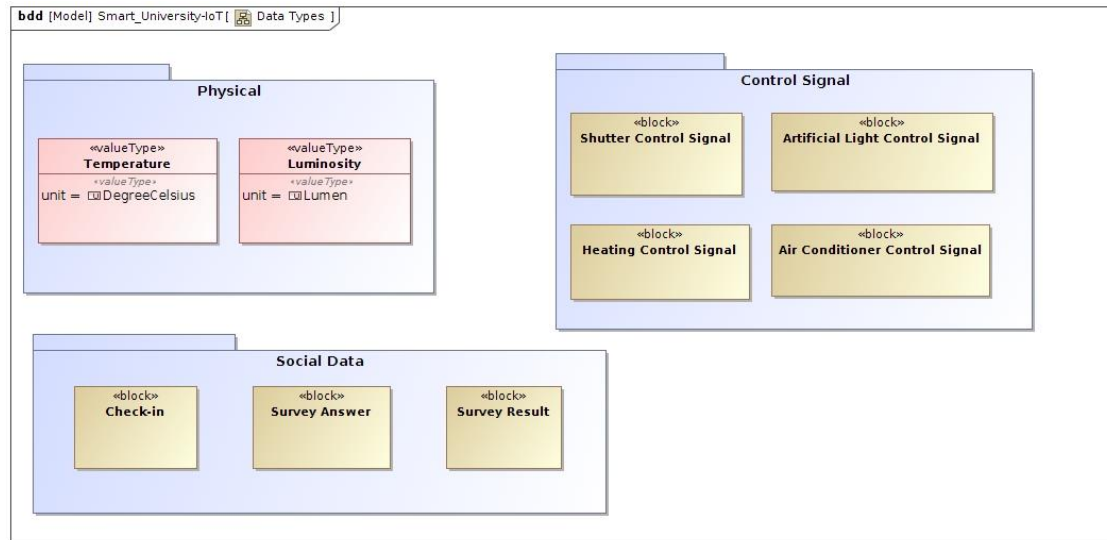
1.2.8. Administration

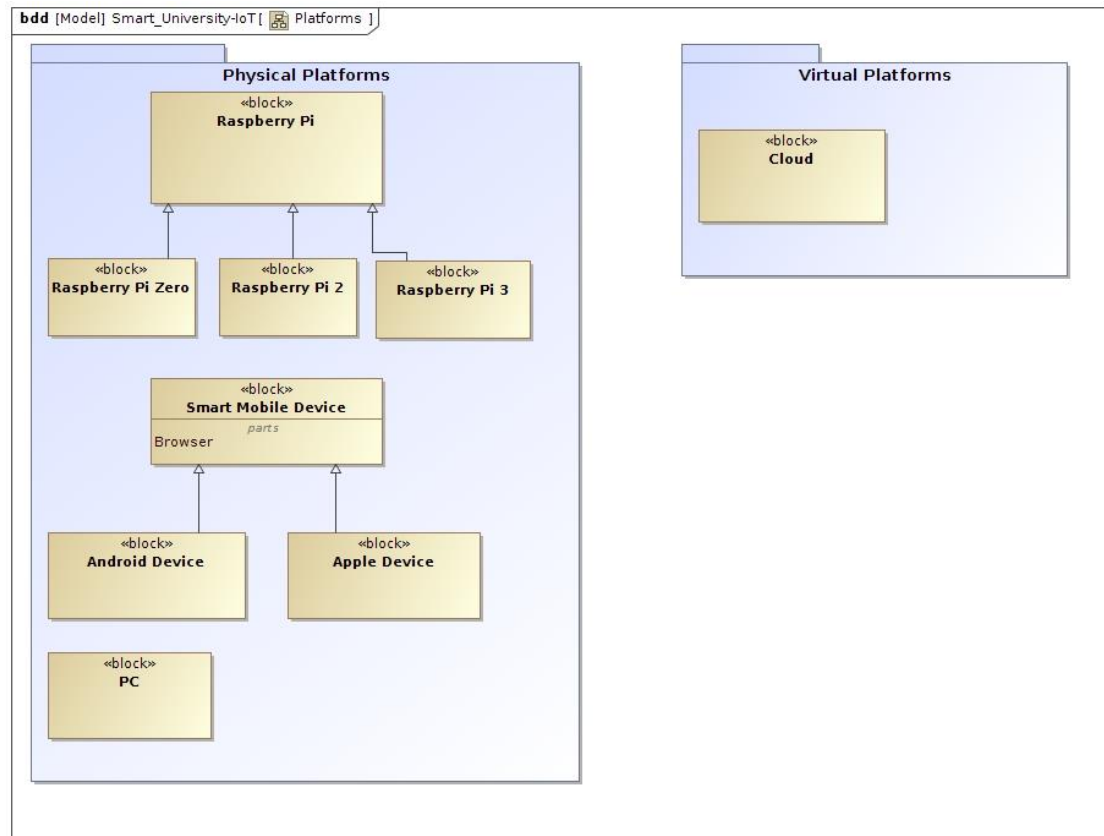Administration will be responsible for managing users and dynamic package management of the system.

1.2.9. Data Storage Service

All data collected by physical sensors and the social modules will be stored in a fault-tolerant manner by the Data Storage Service.
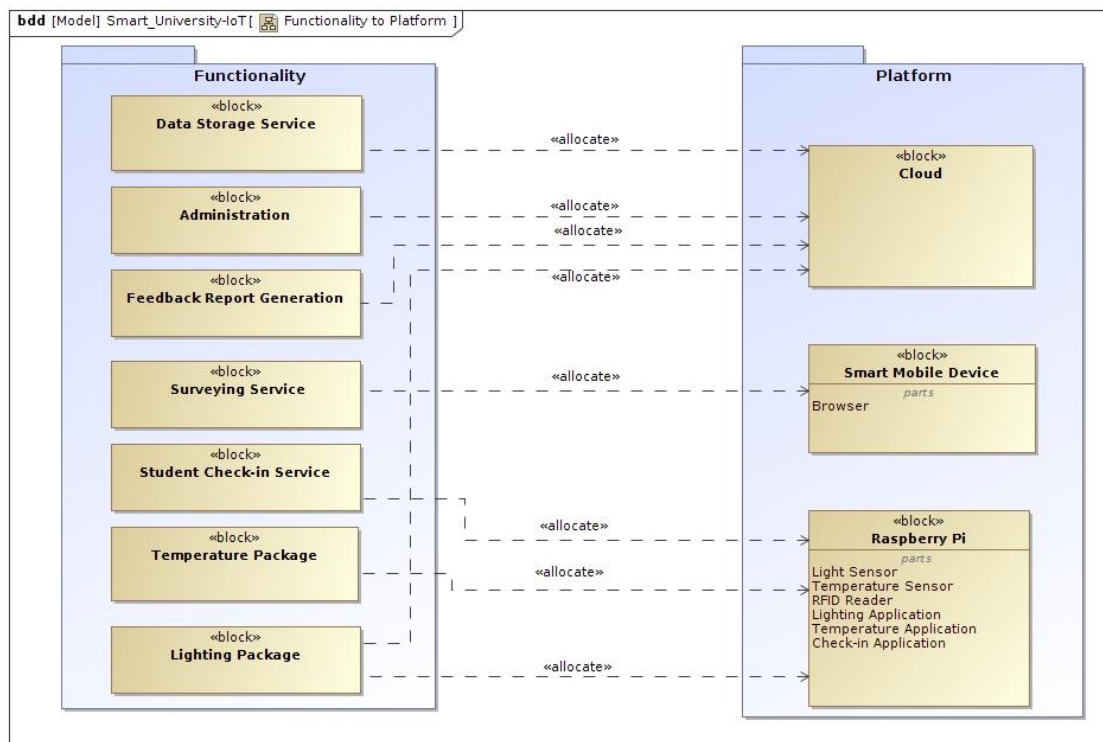
1.3. Data Types

bdd [Model] Smart_University-IoT [Data Types]

Physical

«valueType»
Temperature

«valueType»
unit = DegreeCelsius

«valueType»
Luminosity

«valueType»
unit = Lumen

Control Signal

«block»
Shutter Control Signal

«block»
Artificial Light Control Signal

«block»
Heating Control Signal

«block»
Air Conditioner Control Signal

Social Data

«block»
Check-in

«block»
Survey Answer

«block»
Survey Result

1.4. Platforms used throughout the system

bdd [Model] Smart_University-IoT [Platforms]

Physical Platforms

«block»
Raspberry Pi

«block»
Raspberry Pi Zero

«block»
Raspberry Pi 2

«block»
Raspberry Pi 3

«block»
Smart Mobile Device

parts
Browser

«block»
Android Device

«block»
Apple Device

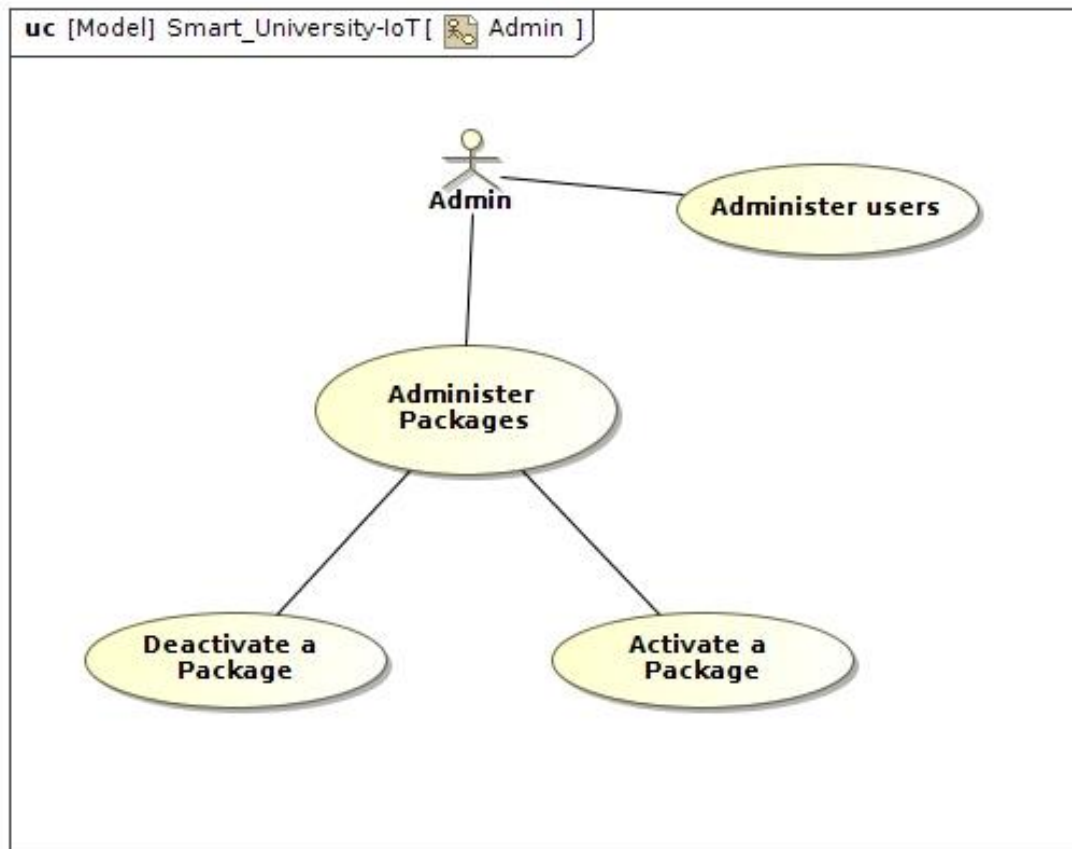«block»
PC

Virtual Platforms

«block»
Cloud

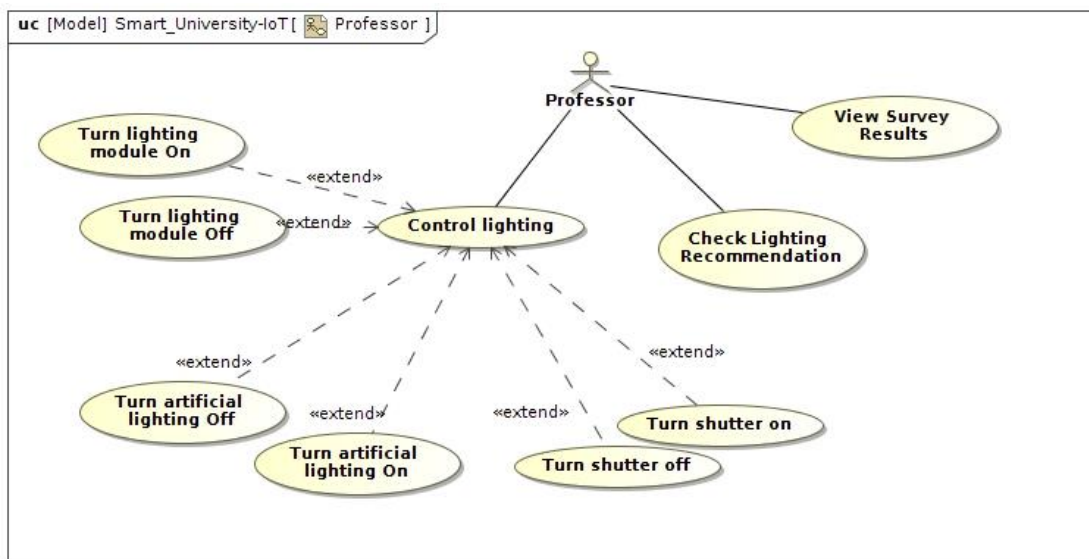## 1.4.1. Mapping of functionalities to platforms

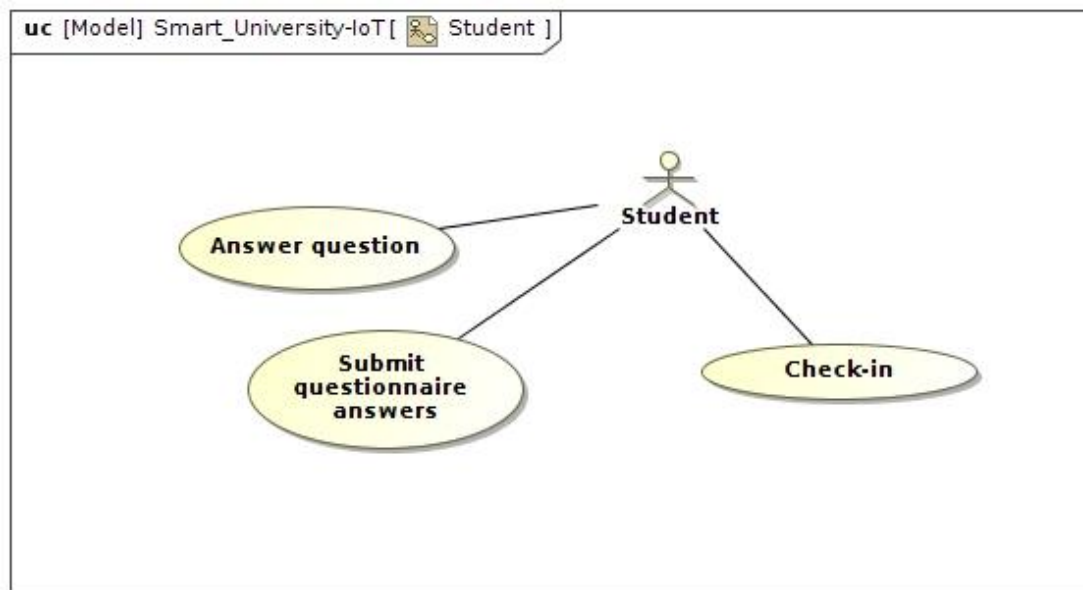## 1.5. Use-cases

1.5.1. Admin
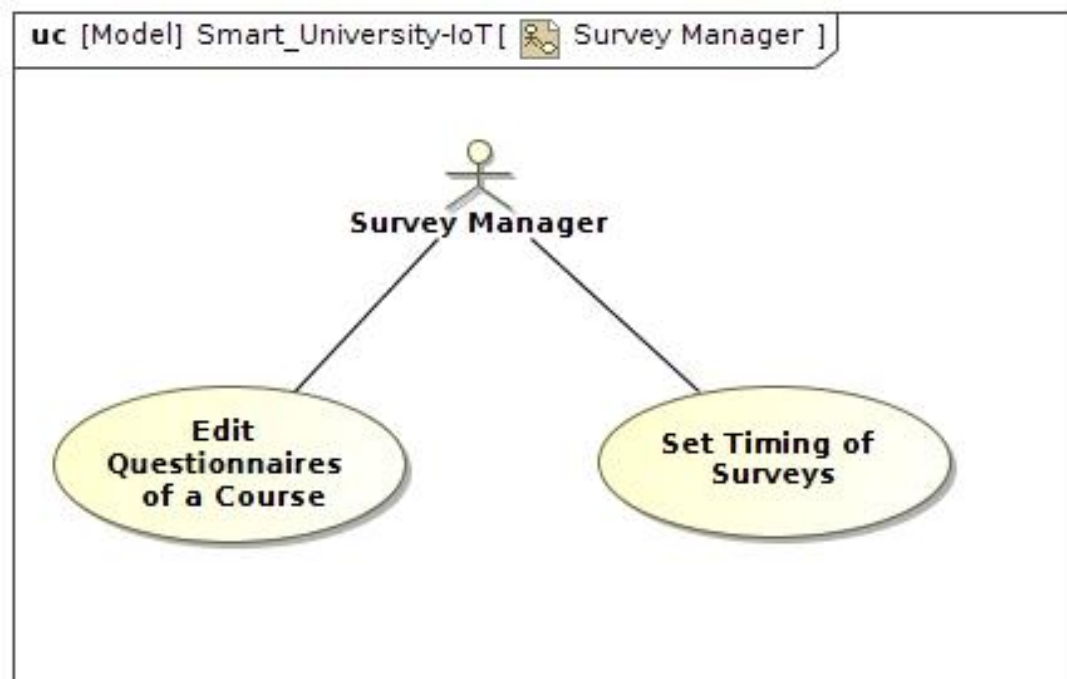

1.5.2. Professor/Lecturer

1.5.3. Student

1.5.4. Survey Manager

1.5.5. Report Creator