

# Implementing a Robotics Course in Virtual Learning Environments – challenges and opportunities

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**Abstract**—The COVID-19 pandemic has created the interruption on the education system by challenging the classical interactive and hand-on learning and experimentation to a distance learning mode. Ensuring learning continuity during the time of closures of higher education sector, online learning has taken place through recorded lectures and online pages. This paper will share the experience on creating Robotics course based on Canvas platform, with 150 remote students, while highlighting the structure of the course, tools used in canvas, and iterative feedback and evaluation procedure of the students.

**Index Terms**—Engineering education, Virtual Learning Environments, Robotics, Challenges

## I. INTRODUCTION

The COVID-19 pandemic has a largest impact in a history on the education sector, while affecting 1.6 billion learners in more than 190 countries and all continents [1]. Ensuring the continuity of the education for learners, the higher education sector started to use a wide range of distance learning tools and mainly move to online platforms to deliver the lessons. Online learning is mainly provided in two ways: a) synchronous and b) asynchronous environments [2]. As oppose to online synchronous learning, asynchronous style takes advantage of accessing materials anytime and anywhere, while reaching out to a larger group. This article is providing an overview of the asynchronous online engineering course entitled “Robotics for All-R006E”<sup>1</sup> at Luleå University of Technology, which is hosted at the Canvas Network<sup>2</sup>. Although the course is conducted asynchronously, but there are weekly live group discussions and interactions arranged in the course to initiate interaction between students, as well as keeping them motivated with the course. This article will also discuss the tools that are used to evaluate the students, challenges and lessons learned from the current course.

The main aim of *Robotics for All* course, is to provide the fundamental knowledge in the area of robotics, concepts that could form the basis for all the future directions education and research in the exciting field of robotics. The aim of the course will be also to provide knowledge on the most popular programming aspects of robots, as for example the case of the Robotic Operating System (ROS) [3], while providing

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<sup>1</sup><https://www.ltu.se/edu/course/R00/R0006E/R0006E-Robotik-for-alla-1.198481?kursView=kursplan&l=en>

<sup>2</sup><https://www.canvas.net/>

the initial insights and knowledge for various robotic aspects such as in robot modelling, controlling and path planning, simulation environments using Gazebo [4] and how to transfer these theories towards realizing the real-world robotic technologies and applications. In order to address to a greater mass, the course language is set to English and the target group are learners who have a solid background in Swedish upper secondary school courses Mathematics 3b/3c.

## II. CHALLENGES AND LIMITATIONS

More self-discipline is required by students in online courses, compare to traditional classroom education [5]. To address this challenge, we structure the course with multiple modules, which contains multiple sections. The maximum length for the module and each section are 90 min and 30 min respectively. Depending on the learning outcomes of the module, different number of sections are assigned. Students can watch the corresponding materials with their own pace. Additionally, we have designed quizzes and assignments at the end of each section to track their performance. In order to emphasise on the students’ learning, entire attention of the course assessment are emphasised completely on the quizzes and assignments rather than any final exams. Additionally, keeping the learners enrolled, engaged, and motivated in online courses are the challenging job as a physical interaction between the instructor and the learners are missing [6]. To motivate the students, all lectures contained with real-life application of that lecture and demonstrate the activities of Robotics & AI Team. To this end we believe that, students obtain theoretical knowledge and the connection to the practical examples during the course.

Also for a successful completion of a distance learning course, student’s motivation is of the most important. To address this issue we have provides multiple discussion forums at the end of each modules. In addition, to further motivate students and to give a feeling of inclusiveness offered by a classroom learning, every week an online session was designated to promote the student for having discussions with peer-peer doubt solving under the supervision of the expert supervisor in the respective area, so that the supervisor could step in if the discussion was deviating away form the point or to answer doubts in a correct way.

Feedback is one of the most important factors for knowledge development, thus we have provided a survey after each module to get the feedback’s from the students. One of the main feedback we got during the course was the quality of

the audio in the lectures, however due to covid-19 pandemic and limited access to studio, we could not address the issue.

Finally, we have omitted the final written examination for the course and successful completion of all the quizzes and assignments are the main key for passing the course. With this measures we motivate the students to have an active role in the course.

### III. DISCUSSION AND CONCLUSION

We have adopted our courses due to pandemic, and moved our content to the asynchronous online course. We have noticed that we have received above 150 students enrolled in the course from the whole part of Sweden, which shows the impact of the online courses. However, on the other hand we noticed the challenges in online courses and the difficulty to keep the students motivated in the continuing the course materials. We see it very challenging when the number of participant is huge and we tried to address this by using online tools such as forums, quizzes, assignments and example of real world.

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