School of Computing / Faculty of Engineering

UNIVERSITY OF LEEDS

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To whom it may concern:,

I am writing this letter to strongly recommend Ilyass Taouil's admission to your program. I think Ilyass is one of those special students that every advisor would like to have. I strongly believe he can succeed in any program in the world in the areas he is interested in.

I have known Ilyass for a relatively short time, since September 2017. This is when he started taking my Robotics module at the University of Leeds, School of Computing. Within this module we teach robotic motion planning, control, localization, mapping, and computer vision. The students had to work with simulated and real robots (Turtlebots) using software tools such as ROS, Gazebo and OpenCV among others. This is a double-credit module with four hours of lectures and four hours of lab sessions every week. It provides good opportunities to get to know a student in terms of both theoretical and practical capabilities. Ilyass excelled in both.

Ilyass showed great understanding of the theoretical discussions in class. He was one of the students to ask questions and start discussions in class. In addition, Ilyass regularly dropped by my office to ask questions. His questions were always about going beyond the explanations we presented in class or in the labs. For example, one of the tasks that the students had to complete on the robots was to locate a marker in an environment and align with it such that the robot camera would look straight towards the marker, which was placed on another object. Most other students performed this alignment in an iterative fashion, where they would rotate the robot in place, locate the marker, take a step parallel to the marker, and perform this sequence again, until the robot was happy with its alignment with the marker. But Ilyass was the first student to drop in my office and ask me how exactly he can use the 3D transformation matrix of the marker to identify a position for the robot in one go, that would perfectly align the robot with the marker. After I explained him the spatial transformations required to do this, he was able to implement it perfectly on the robot.

Ilyass also showed excellent practical skill with his implementation of the module project on the Turtlebots. In their project, the students had to develop a program that plays "Robotic Cluedo": the robot had to explore an environment with rooms, and find, identify, and report the positions of a character and a weapon in the environment. They had to demonstrate their program on the robot at the end of the semester and also write a report about it. Students worked in groups of four, with ten groups in total. I can confidently say that, out of ten groups, Ilyass' group had the best implementation that worked fastest and smoothest. One important task within the project was about

exploring the environment to search for the Cluedo characters/weapons. Most groups chose to discretize the environment, visit each discrete point, and check if the robot saw a character/weapon at that point. While this worked fine most of the time, it was rather inefficient, and resulted in long execution times. Only a few groups attempted to use a more efficient method, where the robot would perform wall following, by using laser scan readings to keep a certain distance to the wall. This was, however, more risky, as the environment had narrow passages that could confuse the robot. Ilyass' group was the only one who implemented this robustly, which made their implementation the most efficient and successful one. I also know from my interaction with them that Ilyass took a leadership role in the group and was crucial in the implementation of this functionality.

Overall, Ilyass ranked 1st , out of 41 students, in the module according to the grades he has collected overall.

In addition to Ilyass' success within the module, he also impressed me with his interest in and enthusiasm about postgraduate research. At the Robotics Lab in our school, we hold weekly meetings where either a PhD student / postdoc presents a piece of research or we watch online academic talks by other robotics researchers. Ilyass has told us that he was interested in attending these meetings, and he has taken part in some of these discussions. He was the only undergraduate student in these meetings. Moreover, when we had to perform a public demo with one of our robots, Ilyass volunteered to help the other students with some of the robotic setup. In this sense, Ilyass started to learn what it means to be part of a postgraduate research lab. Ilyass has the theoretical and practical skills, the leadership qualities, and the necessary enthusiasm to do excellent postgraduate research. I recommend him for your program without any reservations.

Sincerely,

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