

## STudent REseArch Mobility Programme (STREAM) Project proposal



**Host University:**  
University of Cambridge

**Field (drop-down list):**  
Engineering, manufacturing and construction

**Specified field, subject:**  
Engineering Design/Systems Engineering/Information and Computer Engineering

**Research project title:** Design and implementation of an intelligent control system for a Lego Mindstorms model of a production line (Legoline) using MATLAB

**Possible starting month(s):**

Sep	Oct	Nov	Dec	Jan	Fev	Mar	Apr	May	Jun	Jul	Aug
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**Possible duration in months:**

1	2	3	4	5	6
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*Exact starting and end dates will be discussed between the supervisor and the student:*

Start date is flexible in June or July but must finish before the end of September

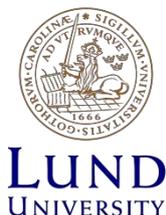
**Suitable for students in:**  Bachelor level  Master level

**Prerequisites:**  
Programming with MATLAB

**Restrictions:**  
NONE

**Description (maximum 2,000 characters):**  
*Research project may be adapted according to the student profile and the period/timeline*

The Engineering Design Centre (EDC) has over the past few years, developed a Lego Mindstorms model of a production line called "Legoline". This is used as a resource for teaching Integrated Systems Design (ISD) at the postgraduate level. Legoline is a system comprising 11 Mindstorms controllers, 29 motors and 39 light, touch and colour sensors controlled through MATLAB. The second generation of the system used rubber bands as conveyor belts for pallet transfer. These bands degraded frequently and were very time-consuming to replace. During the summer of 2017 an undergraduate student working over ten weeks redesigned the system to replace the rubber bands with chain links which will require no maintenance and are much more effective in transferring pallets. The new design, however, requires a new control system.





Over the coming summer it is desired to design and implement a new control system for Legoline in MATLAB to replicate all the functionalities of the old system and reflect the new pallet transfer solution. This project will focus on the software challenge but students will need to work closely with other students who might be doing further work on the mechanical design side of the system. A GitHub organisation has already been set up for this system and the successful applicant may use this to manage the project.

For this project, the student will be expected to:

- Develop a good understanding of Legoline and the old control system in MATLAB.
- Follow a rigorous design process in the analysis of the problem and the synthesis of a solution.
- Develop and rigorously test the software solutions for three levels of control:
  - Local control, where NXT bricks do not communicate with other bricks.
  - Intermediate control, where NXT bricks may share data with adjacent bricks.
  - Global control, where all NXT bricks can communicate with other bricks.
- Work together with other students focusing on other parts of the system in achieving a reliable, resilient and robust system as a whole.

An ideal candidate therefore would have good understanding and significant experience with programming using MATLAB. Experience building complex structures with Lego, an interest in design with good attention to details are desirable. You must also be able to work well independently as well as in a group.



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DI MILANO



UNIVERSITÉ  
DE GENÈVE



Universiteit  
Leiden



Comprendre le monde,  
construire l'avenir



Universiteit Utrecht



University of  
Zurich<sup>UZH</sup>

**Faculty and/or Department:**

Engineering

**Contact person, including position:**

Dr. Charlotte Brand, coordinator UU Honours College

**Contact email:**

honourscollege@uu.nl

**Deadline for nomination to reach host university:**

31<sup>st</sup> March 2018

**Notification of admission given by the end of:**

30<sup>th</sup> April 2018

**Additional information:**

A YouTube video of a previous generation of the Legoline system is available here <http://www.eng.cam.ac.uk/news/legoline-innovation-teaching-systems-engineering>

A photo of the third generation of the system is shown below:



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