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**Imperial College
London**

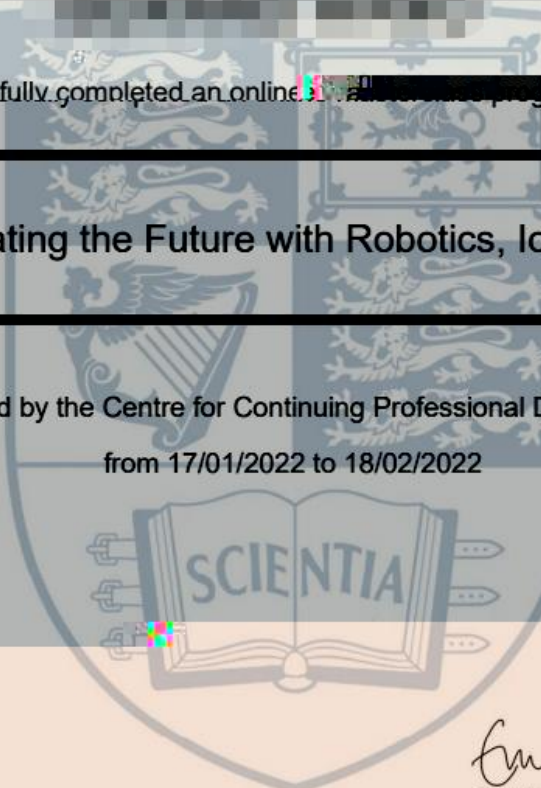
It is hereby certified that

_____ successfully completed an online _____ programme in

Innovating the Future with Robotics, IoT and AI

organised by the Centre for Continuing Professional Development
from 17/01/2022 to 18/02/2022

18 February 2022
Date


Emma McCloy
Vice Provost (Education)

DRAS
Academic Registrar

IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE
FOUNDED BY ROYAL CHARTER ON 8 JULY 1907

Project Score

Student name: «Name»


Course name: Online Masterclass
Innovating the Future with Robotics, IoT and AI


Course dates: Date Month 2022

Course hours: 18.5 hours

Grade (based on overall project assessment): «Percent»%, «Grade»

Grading scale:	
Grades	Percentage equivalent
A - Distinction	70-100%
B - Merit	60-69%
C - Pass	50-59%
D - Fail	0-49%


Betty Yue
Head of Centre for Continuing
Professional Development
Imperial College London


Professor Willy Sansen
Emeritus Professor of the K.U. Leuven, Belgium
Visiting Professor, Centre for Continuing Professional Development
Imperial College London

Date: day month 2022

18th February 2022

To whom it may concern:

It is my pleasure to confirm **CHENYU ZHU** has participated in the online masterclass programme entitled **Innovating the Future with Robotics, IoT and AI**, from 17th January to 18th February 2022, held online by Imperial College London.

This masterclass programme provides students with an understanding of robotics, AI and IoT technologies, apply the knowledge and learning experience to design, develop robotics, AI and VR applications and hear the latest applications and innovations in these areas.

On completion of this masterclass, students will be able to:

- Describe the latest development of robotics and AI technologies.
- Understand the basic knowledge about pervasive sensing, Internet of Things (IoT) and the associated technologies.
- Apply the knowledge and experience gained to develop Robotic and AI applications.
- Design and develop virtual reality applications.
- Create IoT and pervasive sensing enabled applications.

In addition, students will develop valuable professional skills in teamwork and presentation through a group robotic/AI project to create a functional and workable system using machine learning, computer vision techniques and software skills learnt from the programme, towards a group competition.

During the programme, this student was a member of the Runner-up group for their group project, demonstrating excellent teamwork and commitment in tasks assigned throughout the programme.

We wish this individual the very best in any future endeavours.

Yours sincerely,



Betty Yue
Head of Centre for Continuing Professional Development
Imperial College London



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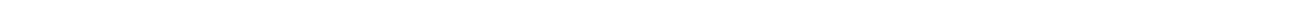
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Final Report

Group 3

1- Challenge and Business Opportunity



Building aging

The acceleration of urbanization leads to more and more buildings, many of which are aging and with risk every year, which has caused some hidden dangers on safety.



Plant safety hazard

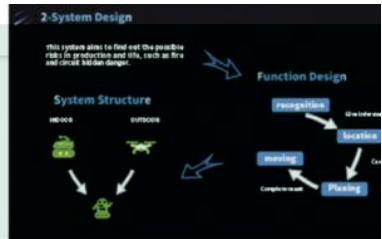
Heavy factories are built in simple structures, which are more and more in number, so it is necessary to carry out regular safety checks.



Fire hazard

According to statistics, there will be more than 220,000 fires in China in 2020, with an average of 700 fires occurring every 100 seconds. Property loss caused by fires is estimated to be 4.16 billion yuan in these events.

Opportunity - Establish an effective risk prevention system



2-System Design - A Virtual Example

For example, we can use VR to check the fault of high voltage transmission equipment. This can reduce possible injuries to maintenance personnel.



2-System Design - Model (SDF format)

```

-robot: robot
  -name: robot
  -model: robot
  -position: [0, 0, 0]
  -orientation: [0, 0, 0, 1]
  -parent: ""
  -children:
    -camera: camera
      -name: camera
      -model: camera
      -position: [0, 0, 1]
      -orientation: [0, 0, 0, 1]
      -parent: robot
    -sensor: sensor
      -name: sensor
      -model: sensor
      -position: [0, 0, 1]
      -orientation: [0, 0, 0, 1]
      -parent: robot
  
```

Some code of the model:
The model is based on 'ros' 'gazebo'.


Problem unsolved: SDF format models often get stuck when opening gazebo.

3- AI/IoT Solution and Demo - Recognition



Based on the COCO dataset, YOLO can detect the 80 COCO object classes (like human, fire, dog, glass, car etc.)

3- AI/IoT Solution and Demo - Recognition

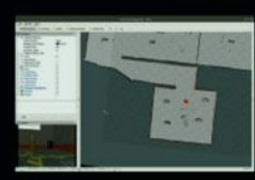


3- AI/IoT Solution and Demo - Location

ROS Mapping (SLAM) common, quick and easy

Rviz:

A data visualization tool of ROS, which can show the process of building maps by mapping and robot autonomous navigation to the destination to assist the operator to control the robot.



3- AI/IoT Solution and Demo - Path Planning

A* algorithm Why?

1. a direct search method for shortest path in static field network.
2. it is more concise than other algorithms with similar functions and effects.

Demo



For local programming, we use the artificial potential field method. You can observe a "hole" around an obstacle in the video, which can be considered inaccessible.