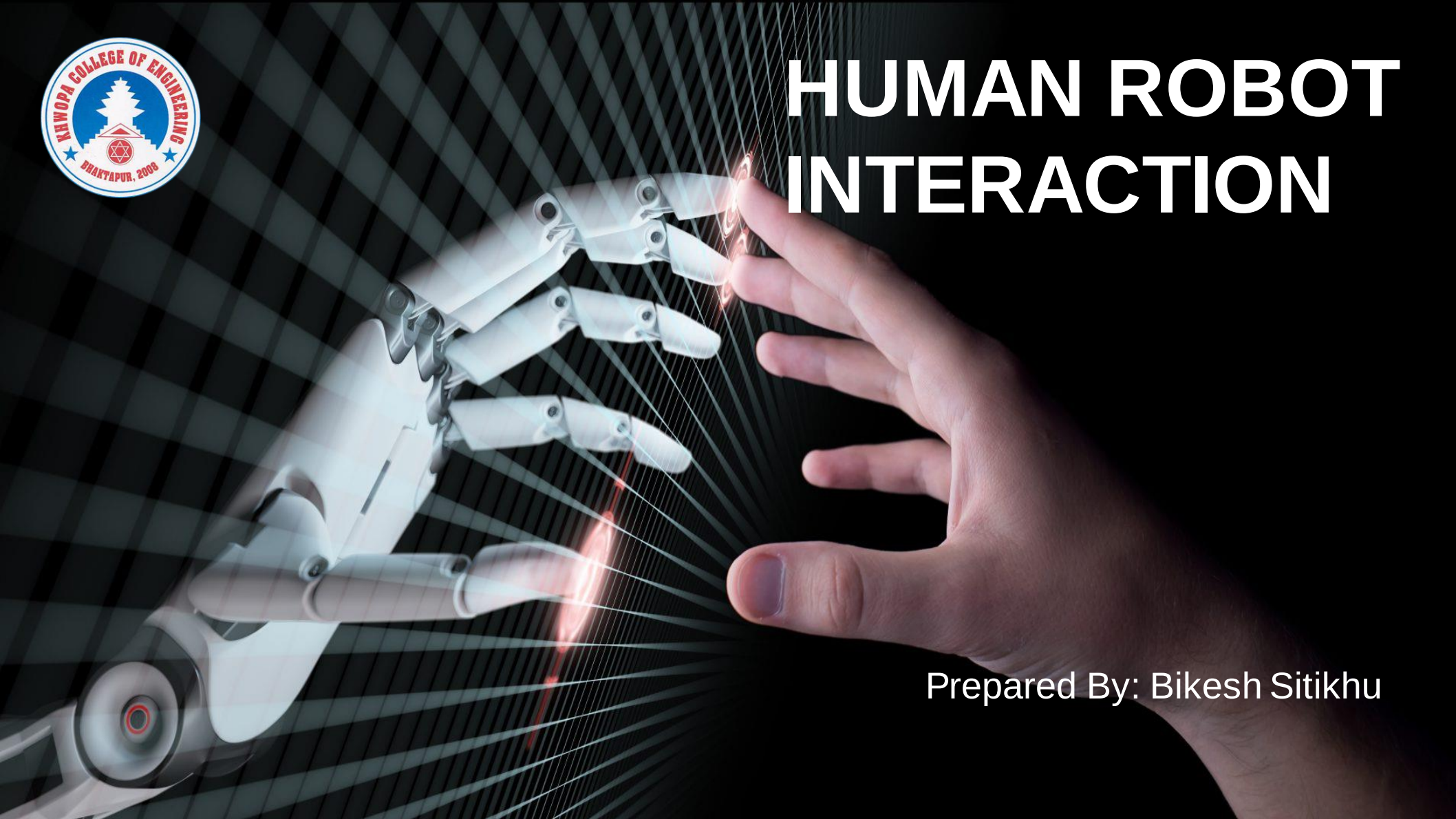
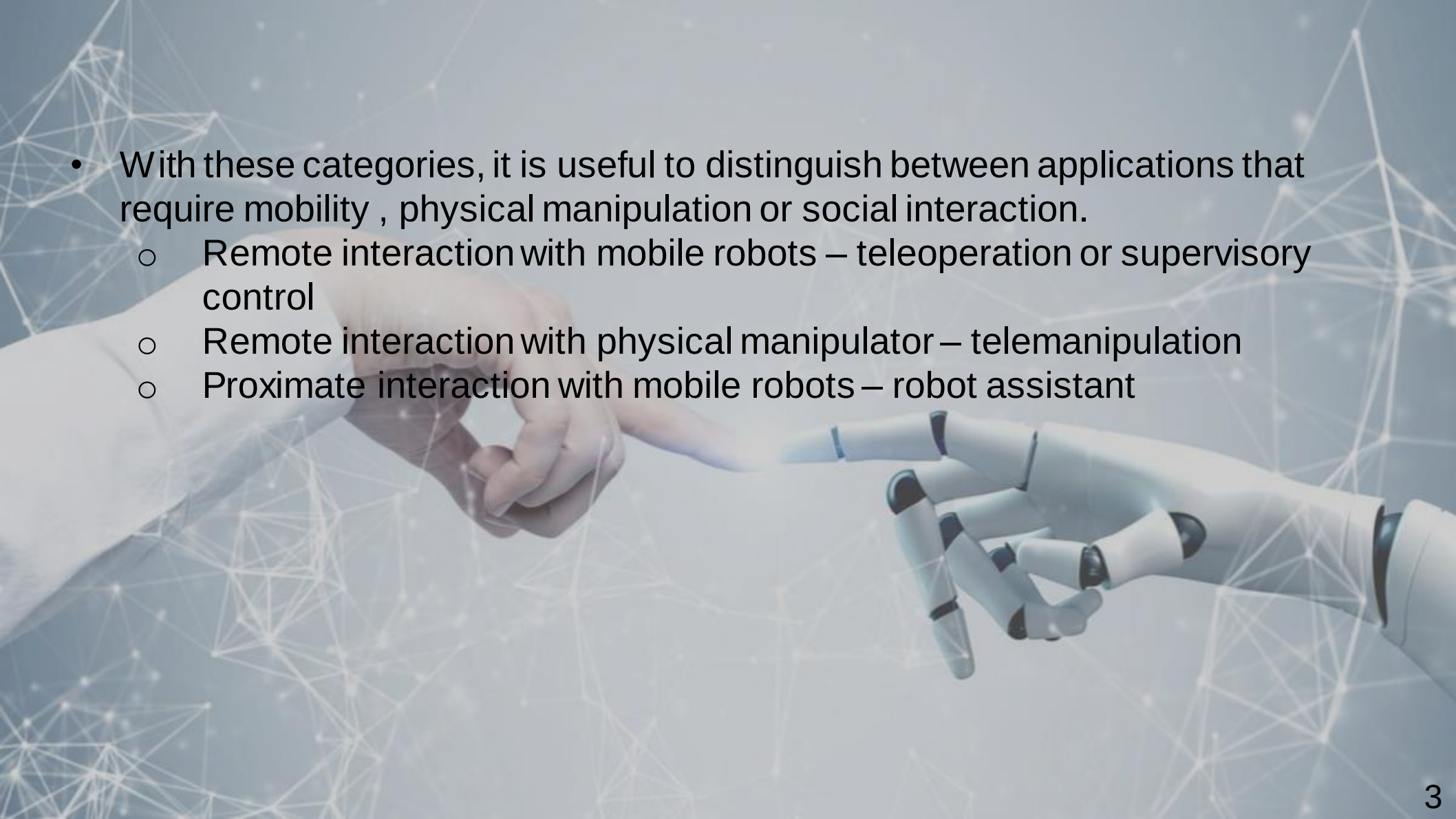


HUMAN ROBOT INTERACTION

Prepared By: Bikesh Sitikhu

Introduction

- Also termed as HRI
- HRI is a field of study dedicated to understanding, designing and evaluating robotic systems for use by or with humans
- HRI is a multidisciplinary field with contributions from human-computer interaction, AI, robotics, natural language understanding and so on.
- Communication between human and robot may take several forms
- There forms are largely influenced by whether the human and the robot are in close proximity to each other or not
- Interaction can be separated into two categories
    - Remote Interaction
    - Proximate Interaction



- With these categories, it is useful to distinguish between applications that require mobility , physical manipulation or social interaction.
  - Remote interaction with mobile robots – teleoperation or supervisory control
  - Remote interaction with physical manipulator – telemanipulation
  - Proximate interaction with mobile robots – robot assistant

Origins

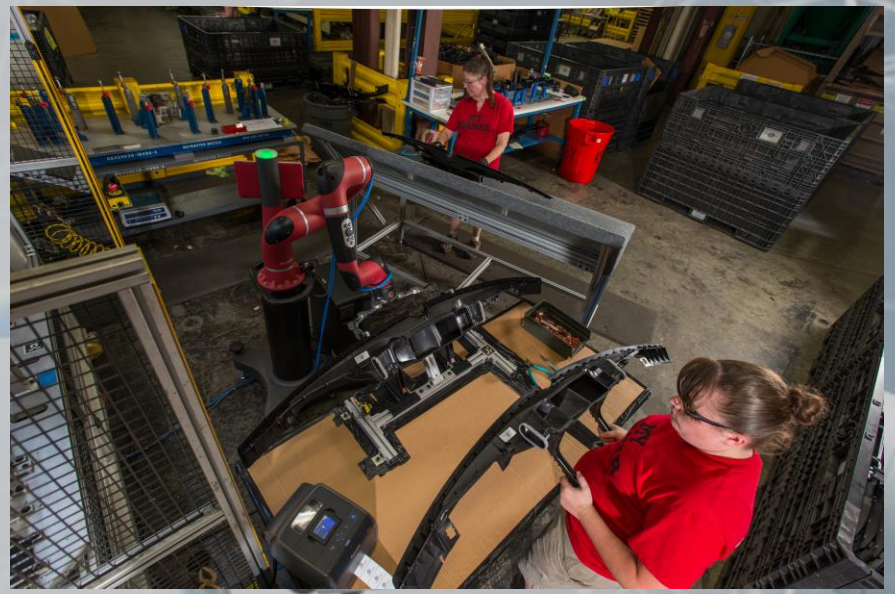
- HRI has been a topic of both science fiction and academic speculation even before any robots existed
- Was stated by 20th century author Isaac Asimov in 1941 and he state 3 laws of Robotics as:
  - A robot may not injure a human being or, through inaction, allow a human to come to harm.
  - A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
  - A robot must protect its own existence as long as protection does not conflict with the First or Second Law.

Goals of HRI

- To build an intuitive, and easy communication with the robot through speech, gestures and facial expressions.
- Dautenhahn refers to friendly Human-robot interactions as "Robotiquette" that is comfortable and acceptable to humans.
- For effective human robot interaction, numerous communication skills and related features should be implemented in the design of such artificial agents/systems.

Application of HRI

- Industrial Robot
  - to colllaborate with humans to perform industrial manufacturing tasks.
  - humans have the flexibility and intelligence to solve the problem and robot are able to be more precise and more consistent in performing repetitive and dangerous work.
  - collaboration demonstrates robots have the capabilities to ensure efficiency of manufacturing and assembling

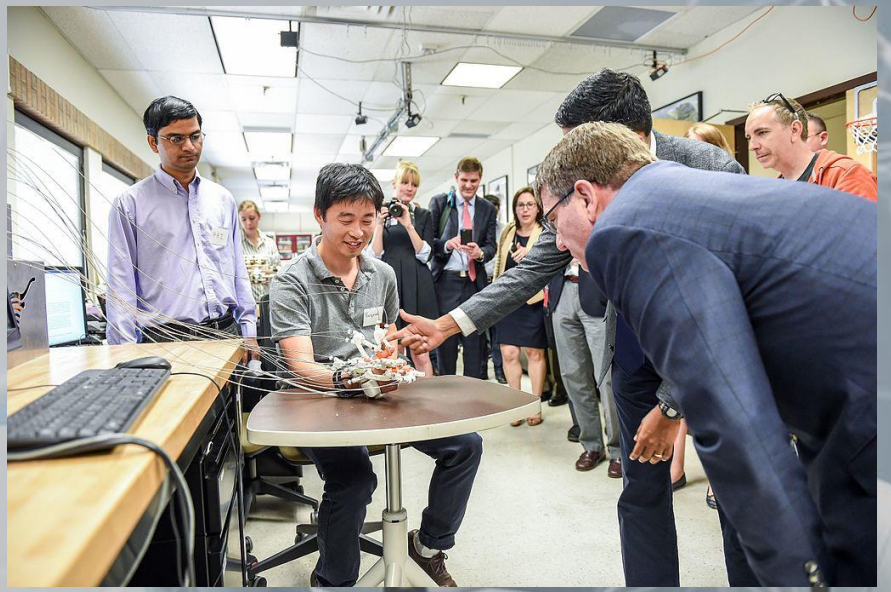


industrial collaborative robot

- Medical Robot
  - Rehabilitation

  - Rehabilitation robot is a robot-aided system implemented in health care.
  - would aid stroke survivors of individuals with neurological impairment to recover hand and finger movements.
  - Elder Care and Companion Robot

  - Nursing Robot are aimed to provide assistant to elderly people who may have faced a decline in physical and cognitive function and consequently developed psychosocial issues



Rehabilitation Robot in helping hand movements

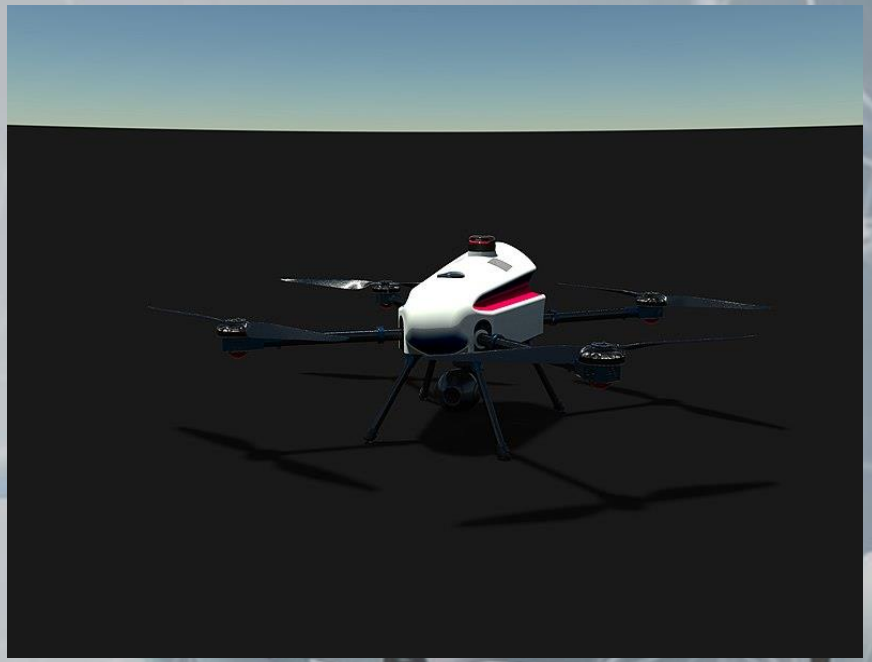
- Social Robot
  - Autism Intervention

  - Human Robot Interaction has shown promising outcome in autism intervention
  - Children with autism spectrum disorders are more likely to connect with robots than humans

Robots for Autism children as their toys

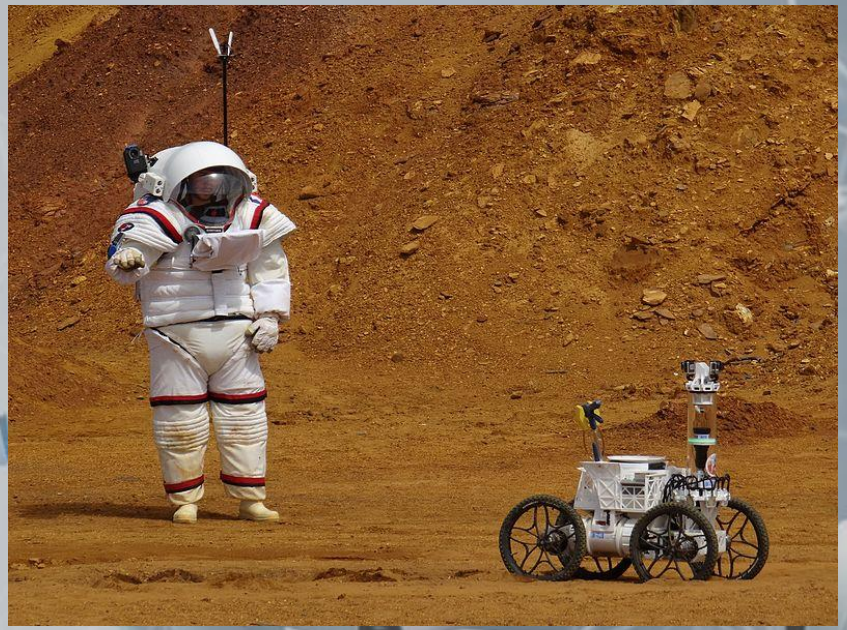
- Automatic Driving
  - Human vehicle interaction in automated driving
  - To ensure safety, security and comfort in automated driving systems.

- Search and Rescue
  - Unmanned Aerial Vehicles(UAV) and Unmanned Underwater Vehicles(UUV) assists search and rescue work in wilderness areas



Drone as example of UAV

- Space Exploration
  - Space exploration such as manned mission to Mars

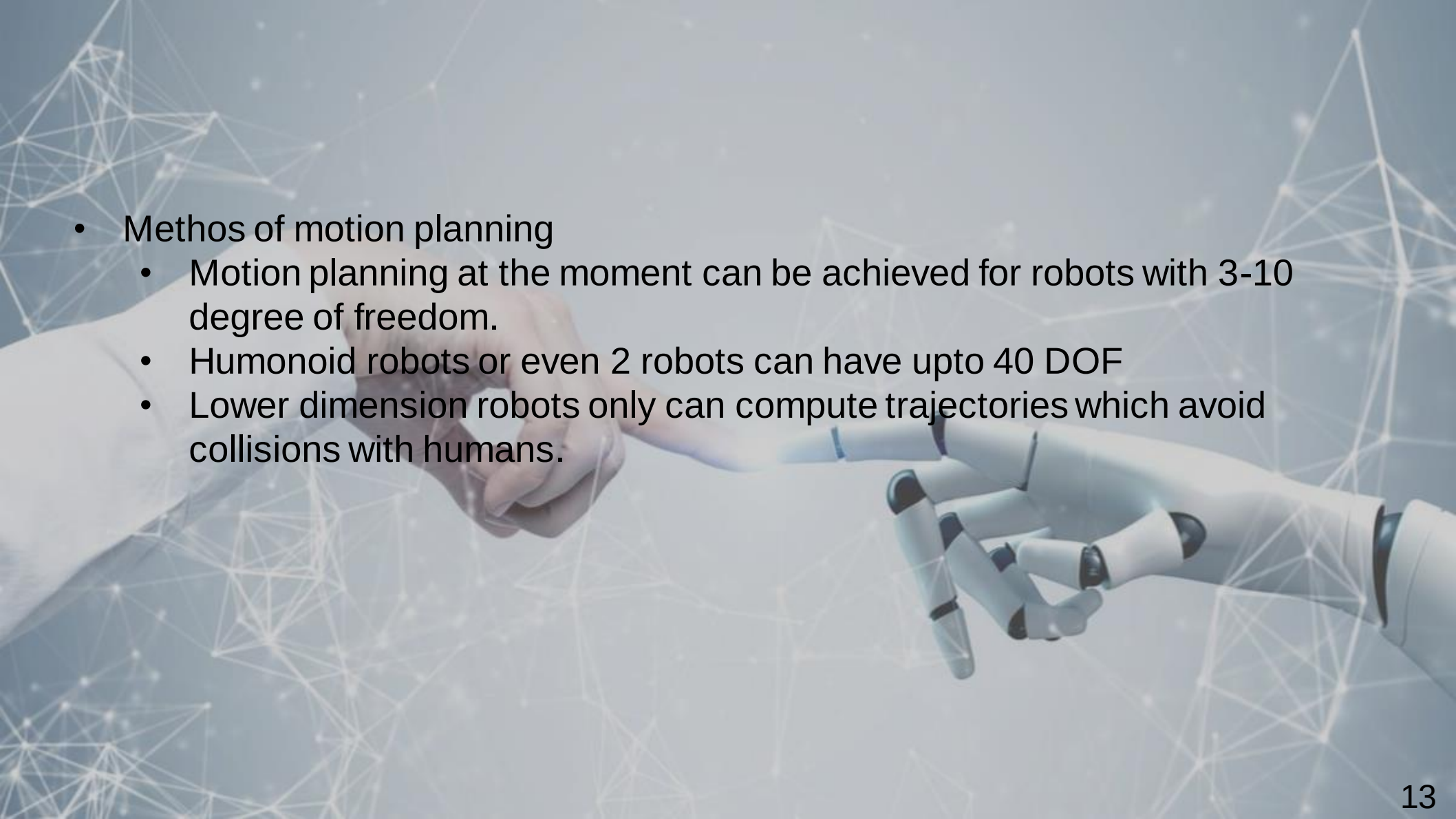


The project "Moonwalk" is aimed to simulate the manned mission to Mars and to test the robot-astronaut cooperation in an analogue environment

General HRI research

- Methos of perceiving humans
  - Based on sensor information
  - Research on sensing components and software led by Microsoft provide useful results for extracting the human kinematics
  - 3D model of environment, proprioception sensors and speech recognition system
  - By combining these information, human position and state can be perceive

- Methos of motion planning
  - Motion planning at the moment can be achieved for robots with 3-10 degree of freedom.
  - Humonoid robots or even 2 robots can have upto 40 DOF
  - Lower dimension robots only can compute trajectories which avoid collisions with humans.



- Cognitive models and theroy of mind
  - Human exhibits negative social and emotional responses as well as decreased trust toward some robots

- Methods for human robot coordination
  - HRI has looked at how humans and robots may better collaborate. Methods: monitoring the behaviours of human using eye tracking, making interfaces about human task intent and proactive action on the part of robot.

Some Robots

- Robosen Robotics Debuts T9 at CES 2020 – The World's Most Advanced and Programmable Robot

- Sophia – a social humanoid robot developed by Hong Kong-based company Hanson Robotics

- KUKA KR 1000 titan is the world's largest and strongest robot developed by German industrial robot manufacturer KUKA Robotics.