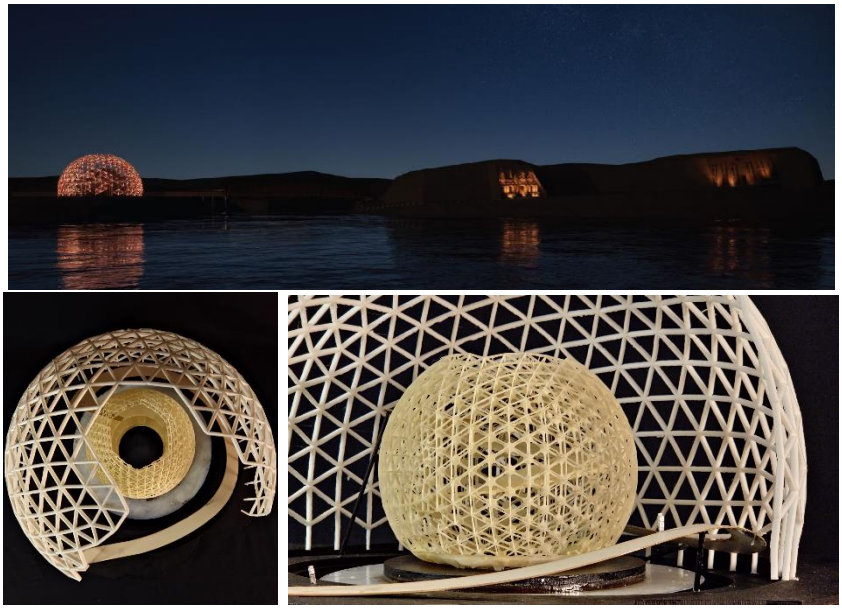
Research and Technology Exhibition

The university's research and technology exhibition is a vibrant showcase of innovation and creativity, bringing together projects from various faculties highlighting how students from various faculties work together to advance knowledge and innovation in an interdisciplinary manner. This collaborative effort reflects the university's dedication to integrating diverse fields to drive academic and practical advancements.

A Vision for Cultural and Structural Modernization

Nile Eclipse



This museum project is a celebration of the Nile's history and its deep connection to ancient monuments. The design features a unique element that utilizes sunlight aligning with water on July 1st, symbolizing the historic flooding of the Nile. This alignment is intended to showcase the power and significance of light, marking a moment of transformation and renewal that has been vital throughout history. The main exhibition within the design is a captivating sphere representing light's role through different areas, underscoring its historical and cultural significance. The design is harmonious with its surroundings, paying a respectful homage to the grandeur of Abu Simbel nearby. This careful integration ensures that the building respects and complements the majestic ambience of the historic site.

Flouka Ferry Terminal

The design of the **Faluca Nile Ferry Terminal** focuses on an efficient layout that incorporates essential zones, such as decks, public outdoor areas, terraces, and pathways for the diverse streams of users. This medium-sized building provides key infrastructure for the public, visitors, ferry passengers, and faluca boat tourists, while also housing a restaurant.

The project emphasizes functionality and environmentally friendly design, with innovative architecture blending into the Nile River and urban surroundings. It employs low- impact materials and self-sufficient energy systems for lighting, cooling, and heating, with natural ventilation as a key feature. The carbon footprint was carefully calculated using a CO2 assessment tool, ensuring minimal environmental impact.

Preserving Egyptian and Arab Design Culture

The Egyptian Design Archive (EDA) is an innovative initiative developed by students to document and preserve the contemporary visual culture of the Arab world. Its mission is to inspire, connect, and educate emerging talents, academics, and professionals across the region while contributing to the global recognition and visibility of Arabic graphic design.

EDA operates through several platforms, each with a specific focus on different aspects of Arab visual language and design. One of these platforms is 100/100 Best Arabic Posters, which serves as a hub for research and publications, celebrating the diversity of Arabic visual expression through dynamic poster designs. This platform showcases the richness and evolution of Arab design, highlighting its cultural and artistic significance.

Another key platform is Say My Name, dedicated to the archival exploration of female Egyptian designers and artists. It aims to bring visibility to the contributions of women in the Egyptian design scene, celebrating their work and fostering greater recognition for female creators in the region.

Together, these platforms provide a comprehensive and evolving archive that documents the unique visual narratives of the Arab world.

Transit-Driven Cairo Monorail Tower

The concept of “Urban Iconic Monorail Towers” introduces a new approach to urban development by building directly on monorail stations. This strategy focuses on transit-oriented densification, seamlessly integrating high-rise structures with transportation hubs. Rather than promoting outward expansion, the model encourages vertical growth, optimizing land use and reducing urban sprawl. It creates vibrant and sustainable urban centers by concentrating residential, commercial, and mixed-use spaces around monorail stations. This approach enhances mobility and fosters eco-friendly city environments while establishing these towers as iconic landmarks within the urban landscape.

Deconstructed Table

This innovative table, crafted from wood, showcases a deconstructed design that encourages a fresh perspective. Comprised of two individual pieces, it can be arranged in multiple ways, allowing for a custom look that fits the individual's personal style: a minimalist vibe or a bold, artistic touch.

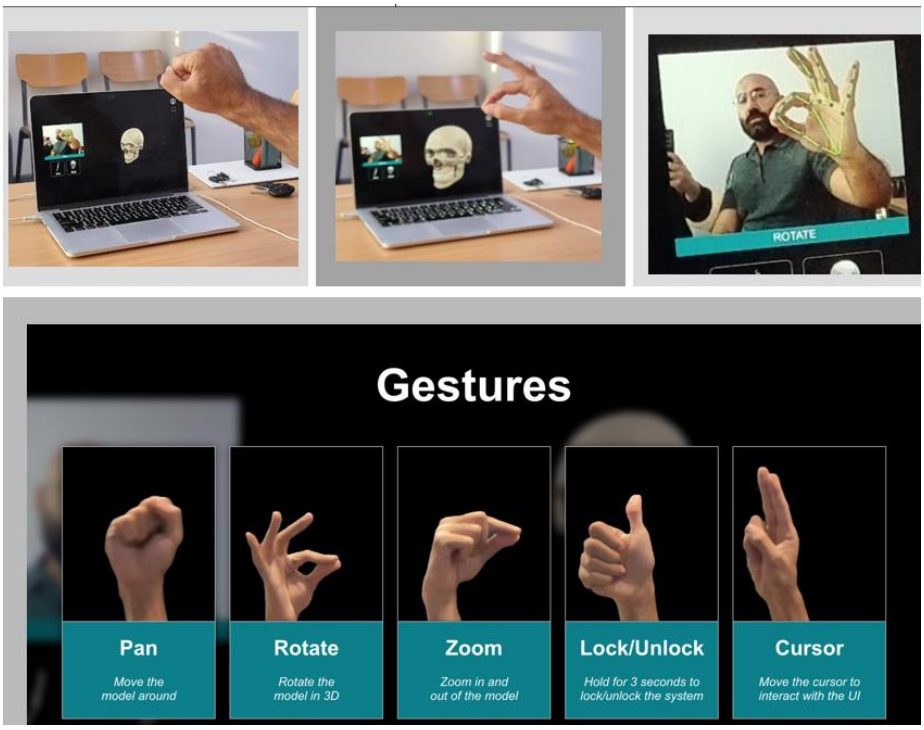
Its sleek wooden material adds an edgy appearance, while the unique construction highlights its distinctive charm. The boldness of the design is balanced by a softly spoken olive green accent. This deconstructed furniture piece adds a rebellious and artistic flair, embracing the beauty of imperfection and making a striking statement.

Revolutionizing Interactions with the Digital World

Aratronica

ARAtronica Telepresence robot is a sophisticated device that allows users to be virtually present in a remote location. ARAtronica features a motorized base, camera, screen, and audio system, and it can be operated from any location worldwide via the internet, typically using a computer, tablet, or smartphone. ARAtronica is transforming how we connect, collaborate, and interact over distances. It offers significant benefits across healthcare, education, business, and more, making it an essential tool for bridging the gap between physical and virtual presence.

A Computer Vision Based Low-Cost Touchless Screen Control

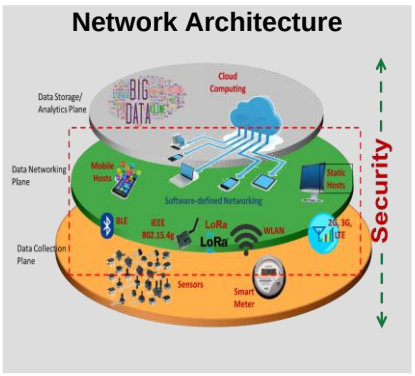


In this project, a robust gesture recognition system is developed that enables touchless control of 3D scans, thereby mitigating the risk of cross-contamination and improving operational efficiency in healthcare environments. The primary objective of this research is to design an intuitive interface that facilitates seamless interaction with 3D scans via predefined hand gestures using only the integrated webcam without using any additional equipment, such as 3D cameras or sensors. The system relies on an RGB camera and advanced machine learning models to accurately detect and interpret gestures in real-time, enabling users to manipulate and navigate 3D scans without physical contact.

3D Laser Scan – Digital Reality

These state-of-the-art laser scanners enable our students to capture precise and detailed scans of buildings, both inside and out. The data collected is seamlessly converted into Engineering Drawings, which are then integrated into Building Information Modeling (BIM) systems. This process creates a highly detailed digital twin of any structure, offering an exact virtual representation. This technology is not just a learning tool; it plays a critical role in real-world engineering. By using these digital twins, engineers can make informed decisions about structure rehabilitation, assess the health of the building, and monitor its ongoing performance. This hands-on experience prepares our students to meet the demands of modern engineering, ensuring that they are well-equipped to contribute to the maintenance and improvement of infrastructure in the future.

GUC Smart City Network



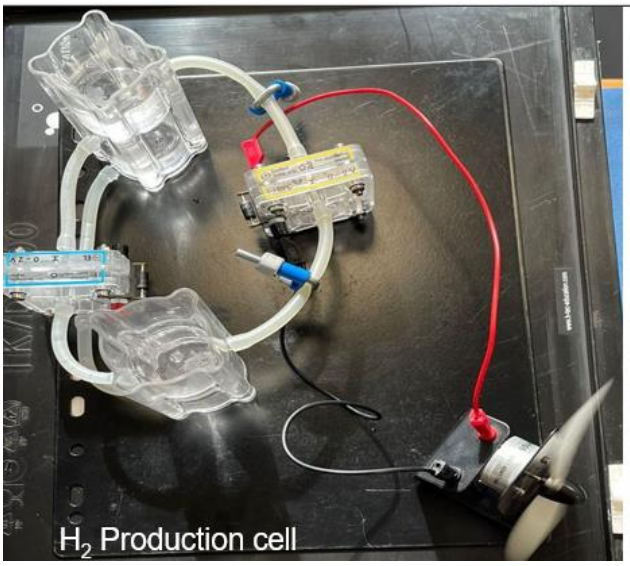
In the last couple of years, the world has witnessed an extensive proliferation of the Internet-of-Things (IoT) in our daily lives, with a reported 12.3 billion end devices with IoT connections to the Internet in 2022. The projection by IoT analytics is that IoT connections will further increase by more than 100% to reach 27 billion connections by 2025. In this new era of the Internet-of-Things (IoT), communication technologies have become an integral constituent of many applications within smart cities, such as environmental monitoring, waste management, traffic control, and smart metering, to name a few. The aim of this project is to develop within the German University in Cairo campus a fully operational Smart City Network with the objective of supporting community (i.e., start-ups and research institutions) interested in pursuing business and research opportunities in the domain of smart city infrastructures and applications.

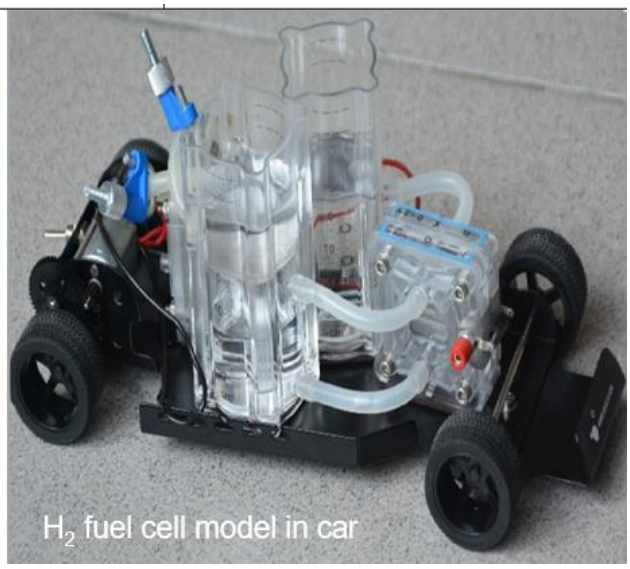
The Arts and Technology Tandem for a Sustainable Future

Ponic: Speculative Aqua Culture for a Sustainable Future

GUC graphic design students have conceptualized "Ponic," a speculative underwater aquaculture system aimed at addressing future challenges of resource and land loss due to population growth and increased animal food consumption. The project integrates hydroponic and vertical farming techniques to maximize crop yields in a minimal footprint, requiring zero input. It also includes an interaction design component—an app for farmers to monitor their crops—along with comprehensive branding, packaging, and sign systems tailored for the farms. The Ponic system is designed for efficiency and future sustainability.

Green Hydrogen Fuel Cell





Green Hydrogen H2 Fuel Cells energy production is under serious consideration as an alternative power source, as long as this energy consumption is designed to be more sustainable and more environmentally friendly. Simply fuel cell is formed from Anode, Cathode and Membrane. To date, fuel cell technology has been extended to a wider scope of applications, with the potential to power a range of devices from mobile phones and laptops to cars, buses, boats, houses, as well as space shuttles. In GUC our research focused on low temperature fuel cell (FC) in terms of design and efficiency of the Anode or Cathode catalyst materials, where catalyst accounts for 55% of the total cost of the fuel cells. Additional focuses on the hydrogen production using natural and nanomaterials to design the catalyst. This research is going along with the cooperation of Electrochemistry Institute, Ulm University, Germany.

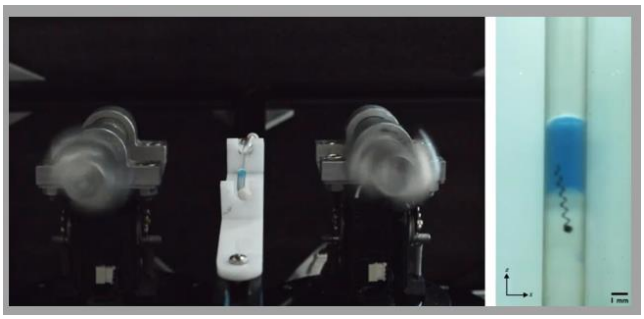
Design Interventions for a More Inclusive Cairo

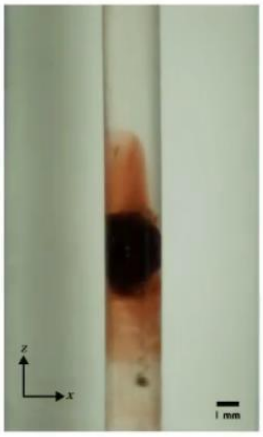
This project was conducted in a collaboration with German partner “Hochschule Osnabrück“ funded by DAAD to initiate intercultural activities between the students of product design and industrial design of both universities (GUC& HSOS).

Student-led design projects were created with a focus on enhancing public spaces in Cairo to encourage greater community engagement and promote activities that foster inclusion and coexistence. By exploring design challenges related to outdoor activities, students apply key design principles to improve the usability and appeal of public spaces. Through this project, they gain valuable experience in analyzing community needs and shaping the content and character of outdoor life, ultimately creating more attractive and sustainable solutions for Cairo's public spaces.

The Next Technological Leaps of Medical/Bio-Medical Engineering

Helimag Microrobot





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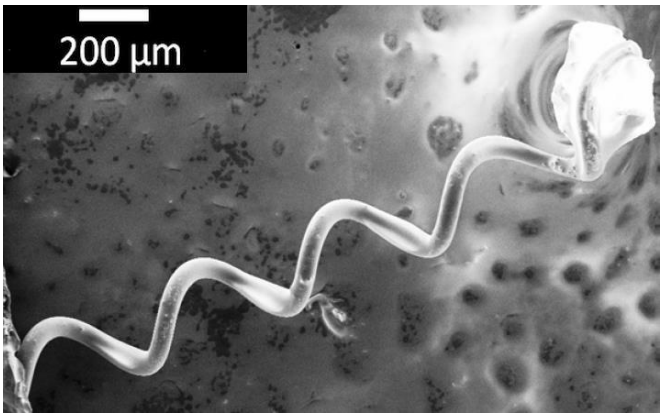
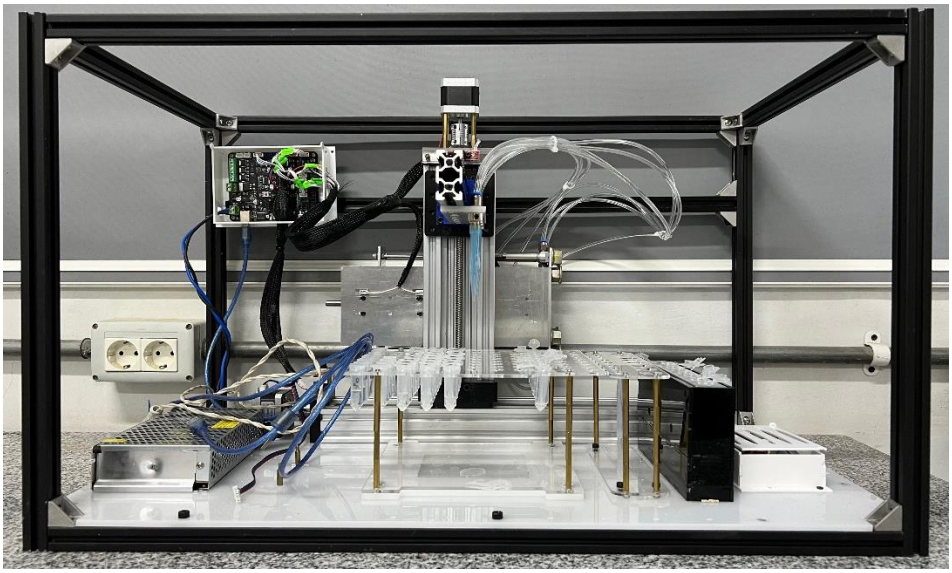
Size of the blood clot



Microrobots show potential in many biomedical applications owing to their relatively small size, allowing them to move inside the human body to achieve tasks that can't be attained through common remedial interventions. In the Medical Micro and nanorobotics (MNR) lab at GUC, our designed helical magnetic microrobot (HELIMAG) was controlled remotely using rotating permanent magnets in an open configuration system that allows for scaling up. Successfully penetration through blood clots, organ tissues and atherosclerotic plaque phantoms was achieved showing the potential of such a microrobot for performing complex operations.

Automated Platform for SARS-COV-2 Detection

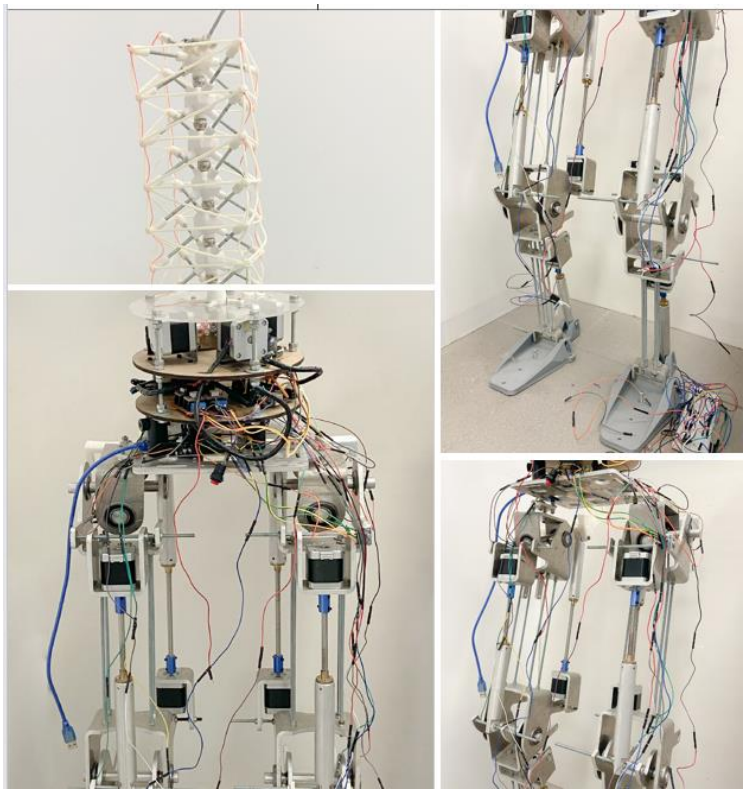


This machine operates in two stages:

1. Automated RNA Extraction: This process uses a special kit designed to precisely capture COVID-19 RNA using tiny magnetic beads. Unlike other kits that may extract both RNA and DNA (which can dilute the results), this kit focuses only on the COVID-19 RNA, ensuring more accurate results. Our goal is to make the process more efficient and cost-effective, especially when preparing samples for PCR testing.

2. Multiplex Conventional PCR: After the COVID-19 RNA is extracted, it goes into a machine that automates the next steps. This machine handles everything, from mixing the necessary ingredients to amplifying the RNA and separating it for analysis. It even takes pictures of the results, helping scientists measure the amount of COVID-19 RNA present. This automation simplifies and speeds up the entire testing process.

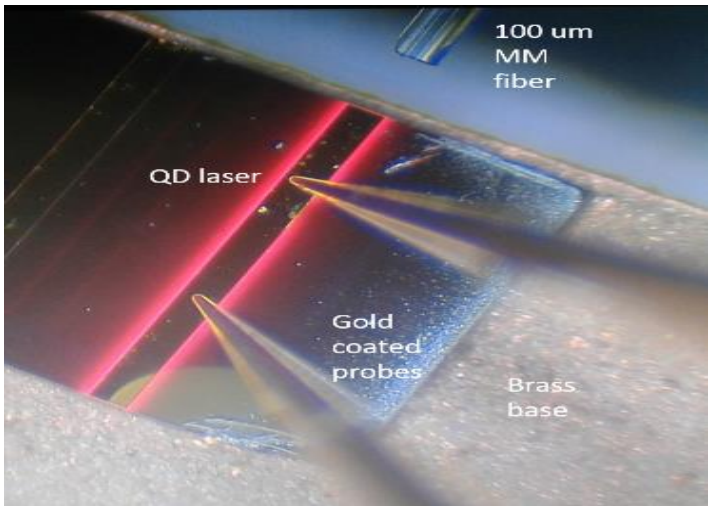
Bipedal Humanoid Robot With a Flexible Spine



A bipedal humanoid robot with a flexible spine is a type of robot designed to mimic the movement and structure of the human body, particularly in its ability to walk on two legs. The inclusion of a flexible spine allows for greater agility, balance, and more natural movements compared to rigidly structured robots.

The robot is designed to walk on two legs, similar to humans. This involves complex motor control to maintain balance, coordinate leg movements, and respond to dynamic environments. The flexible spine is a key feature that allows the robot to bend, twist, and adjust its posture dynamically. This spine mimics the human vertebral column, which contributes to natural, fluid movements and helps in balancing during complex motions like walking, running, or climbing.

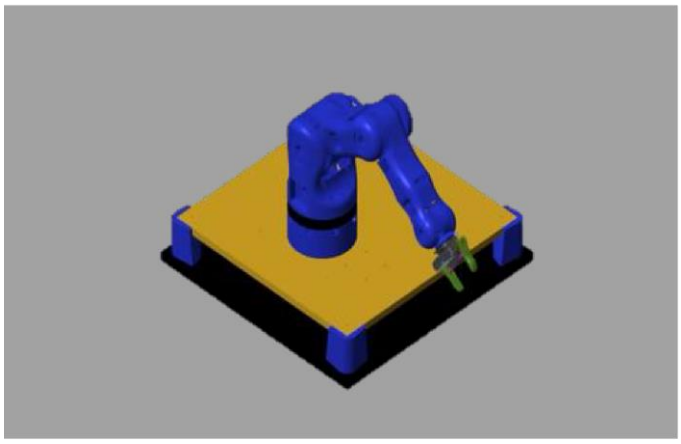
InP/AlGaInP Quantum Dot Laser



Quantum Dot (QD) semiconductor lasers were first introduced in the late '80s. The three-dimensional confinement allows for the creation of discrete energy levels, resulting in a small lasing threshold current value, high gain density, and high-temperature stability compared to conventional semiconductor lasers. The strong potential is foreseen in applications such as quan photodynamic therapy, optical sensing, Lidar, and visible light communication, where a red wavelength laser is required. In this project, a demonstration of a $state\ of\ the\ art$ 660 $nm\ red\ wavelength\ semiconductor\ \ laser\ source$ is presented. $The\ active\ region\ of\ the\ source\ is\ implemented\ using\ a\ mixture\ of$ "$InP/AlGaInP$" self-assembled. The GUC collaborators at the IHFG institute at Stuttgart University worked on the bandgap engineering of the QD materials to reach the specified wavelength range, whereas in the optics lab at the GUC, we explored the many characteristics of such cutting-edge devices.

Shaping a New World with Industrial Robots

5-DOF Robot Manipulator



This project presents a robotic arm (manipulator) composed of 5 Degrees of Freedom (joints). The robotic arm can move from one point to another, mimicking the pick-and-place applications used in different factories and applications.

This project demonstrates our students' capability to design, implement, and control a robotic manipulator based on in-depth analysis and understanding of its motion constraints. The project has been completely built in-house by our bachelor students. It involves many technical details, including analysis of the robot's kinematics, trajectory planning, and further control applications.

Quadruped Robot

This project demonstrates the implementation of a scaled quadruped robot that mimics the motion of a 4-legged animal (dog, cat, etc.). The robot starts from lying flat on the floor, then stands up to stretch a little then taking a few steps in multiple directions, as well as rotating to face the audience after taking steps to come closer It stands to demonstrate its capability to maintain balance even if its legs are lifted.

In this project, our students took on the different steps of designing, implementing, planning, and controlling the robot. All the implementations were done in-house. The project demonstrates the capability to accurately control a quadruped robot while stabilizing its motion against external effects. Moreover, it demonstrates the wide capabilities of analysis and planning behind the scenes.

Tower Crane Motion Control

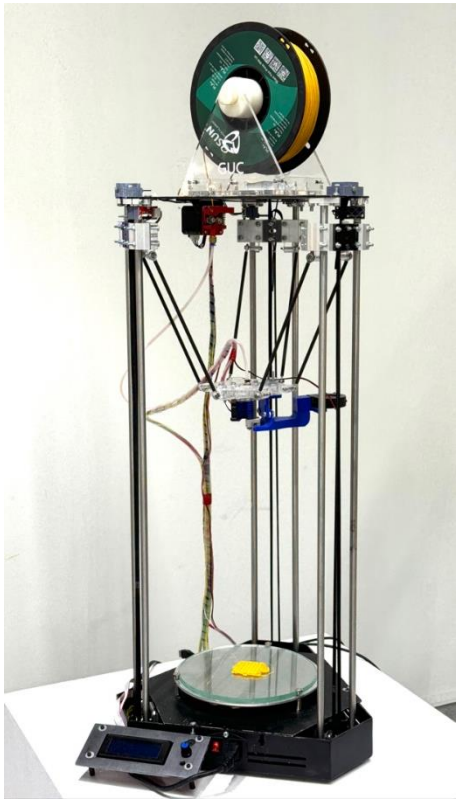
The automation of tower crane operations is a critical advancement aimed at improving the load transfer process on construction sites to resolve safety issues and increase efficiency. Advanced controllers aim to quickly handle payload oscillations resulting from the crane's dynamics and external disturbances, such as wind.

The primary objectives include achieving precise load positioning, eliminating oscillations, and reducing transfer times despite uncertainties and external disturbances. These goals are pivotal in ensuring that the crane's performance remains optimal and reliable, contributing to a smoother and more efficient construction workflow.

Delta Robot for a 3D printing application

The Delta robot is a highly efficient and precise robotic arm, commonly employed in industries for tasks that demand both speed and accuracy, such as assembly, packaging, and pick-and-place operations. Its unique parallel kinematic design enables it to perform rapid movements while maintaining exceptional precision, making it an essential component in automated manufacturing systems.

In the field of 3D printing, the Delta robot excels by enabling fast and accurate layer deposition, which results in quicker production times and improved print quality. Its ability to handle high-speed, repetitive tasks without sacrificing precision highlights its versatility in industrial applications.



This particular Delta robot was developed by students, showcasing their ingenuity and technical proficiency. The project was entirely conceived and built within the university's facilities, underscoring the institution’s commitment to fostering innovation and providing hands-on learning experiences for its students. This accomplishment reflects the students' practical understanding of robotics and automation technologies, positioning them at the forefront of modern engineering practices.