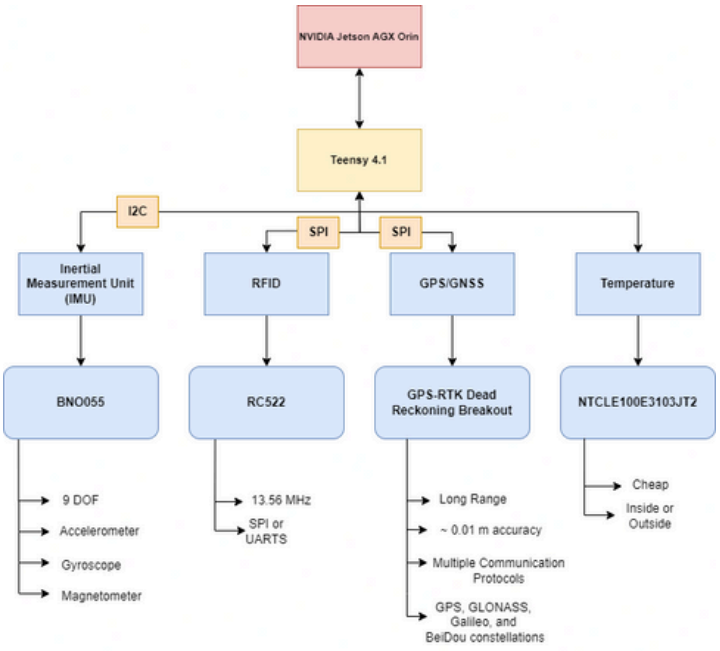
DEVAGYA BUDHIRAJA

MECHATRONICS ENGINEERING AT THE UNIVERSITY OF SYDNEY

devagyabudhiraja2015@gmail.com
www.linkedin.com/in/devagya-budhiraja-8372ad942
+61 451186671

ELECTRICAL ENGINEER AT SYDNEY INTERPLANETARY ROVER INITIATIVE



What?

- Building a half-scale rover and managing all the sensors.
- Designing a sensing HAT PCB for the team **using EasyEDA**.

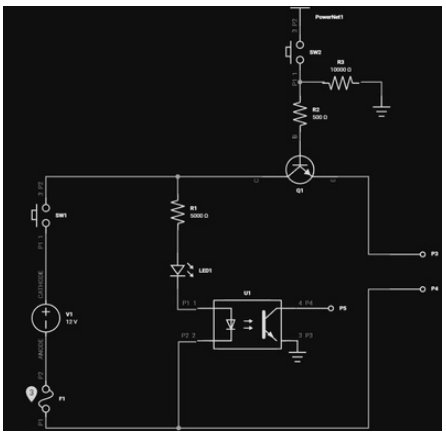
How?

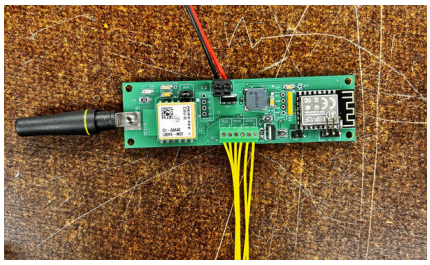
- Interfacing all sensors using **NVIDIA Jetson AGX Orin and Teensy 4.1**.
- Currently researching additional sensors, including air pressure, humidity, and UV index.

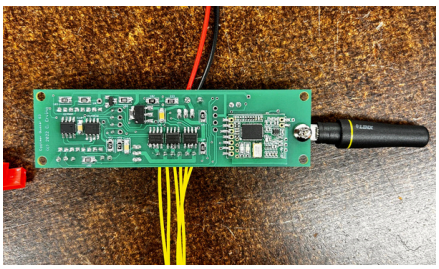
Results

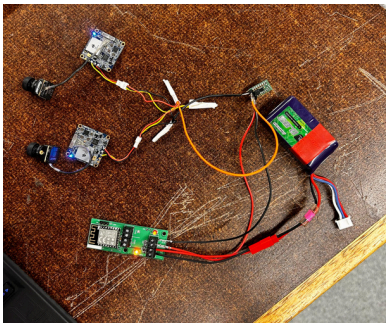
- The sensing HAT, designed using EasyEDA, will **control and log data** for measurements.
- The half-scale rover is being developed for the University Rover Challenge, which the team will participate next year.

GROUND CONTROL ENGINEER AT THE ROCKETRY TEAM









What?

- Designed an igniter circuit **using EasyEDA**.
- **Soldered the Eggtimer Quasar** for use in a testing rocket.
- Assembled and then soldered camera modules with a **Wi-Fi module**.

How?

- Researched and selected the required components for assembly and soldering.
- The **camera module** and Eggtimer Quasar were used for the testing rocket, Archtail while the igniter circuit was being designed.

Results

- After assembling, tested all components, which performed as expected.
- Initially, the igniter circuit worked partially during testing, but after further changes and updates, it functioned as expected.

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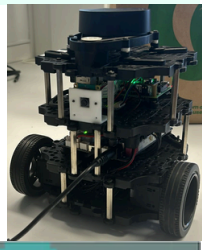
+61 451186671

AUTONOMOUS INVENTORY TRACKING ROBOT WITH ROS2



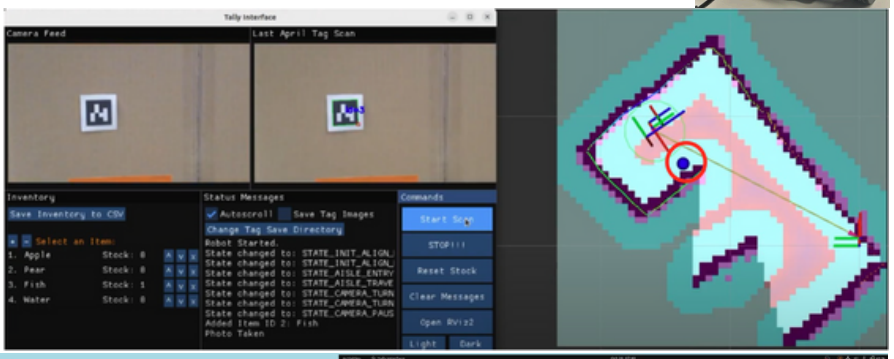
CLICK HERE FOR VIDEO DEMONSTRATION

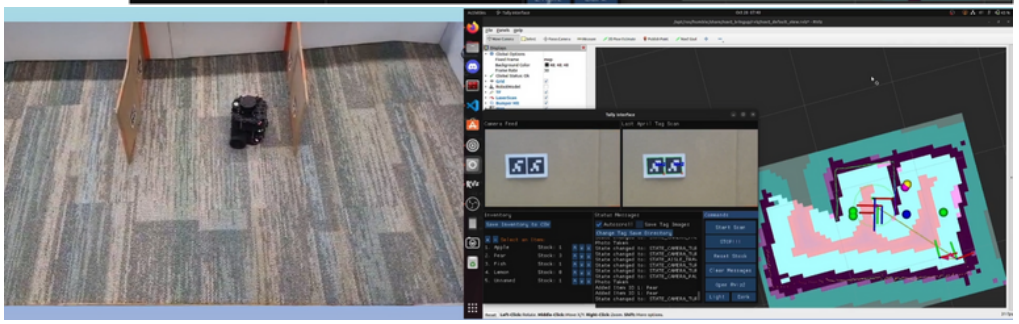
What?

- Developed an **autonomous inventory management robot** for a major project in MTRX3760 - Mechatronic Systems Design.
- Built a **ROS-based system** using **TurtleBot3** for autonomous store navigation.

How?

- Using **ROS2** and **TurtleBot3 Burger**, designed a system to autonomously navigate store aisles.
- Integrated **AprilTags** and **OpenCV** to detect and record inventory and used **SLAM** for real-time mapping and autonomous movement.
- Developed a **custom GUI** for remote control and live monitoring.
- Added duplicate scan rejection and Enabled **real-time inventory** updates for accurate stock management.

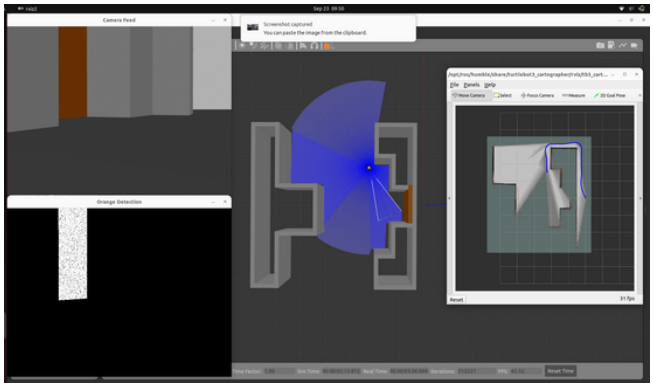


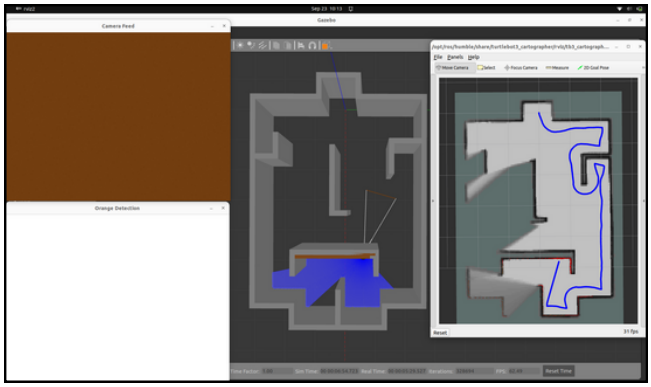


Results

- Developed skills in **C++**, **ROS2**, **OpenCV** and system integration.
- Demonstrated practical applications of robotics in real-world scenarios.

ROS2-BASED AUTONOMOUS NAVIGATION FOR MAZE SOLVING





What?

- Developed a **TurtleBot Maze Solver** Simulation for a project in MTRX3760 – Mechatronic Systems Design.
- Designed an **autonomous wall-following navigation system** in **ROS2** and **Gazebo**.

How?

- Designed a **multi-node ROS2 system** with LIDAR-based obstacle detection.
- Used **OpenCV** for finish-line recognition and adaptive navigation.
- Implemented **real-time trajectory** visualization to monitor and refine navigation.

Results

- Strengthened skills in **ROS2**, **Gazebo**, **LIDAR**, **OpenCV**, and **software development**.
- Achieved full maze completion with precise goal detection.

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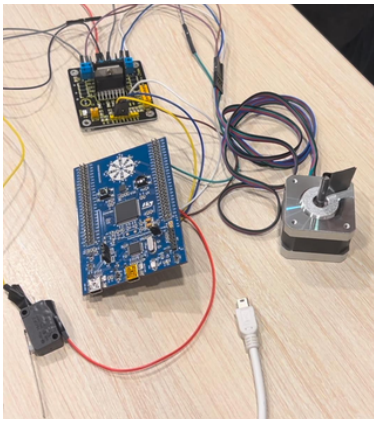
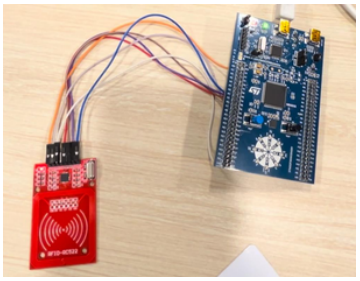
PINBALL MACHINE ARCADE GAME





What?

- Designed and built a **scaled retro pinball machine** for MTRX2700 – Mechatronics 2, major project.
- Combined mechanical design, electronics, and embedded programming to create an interactive game.

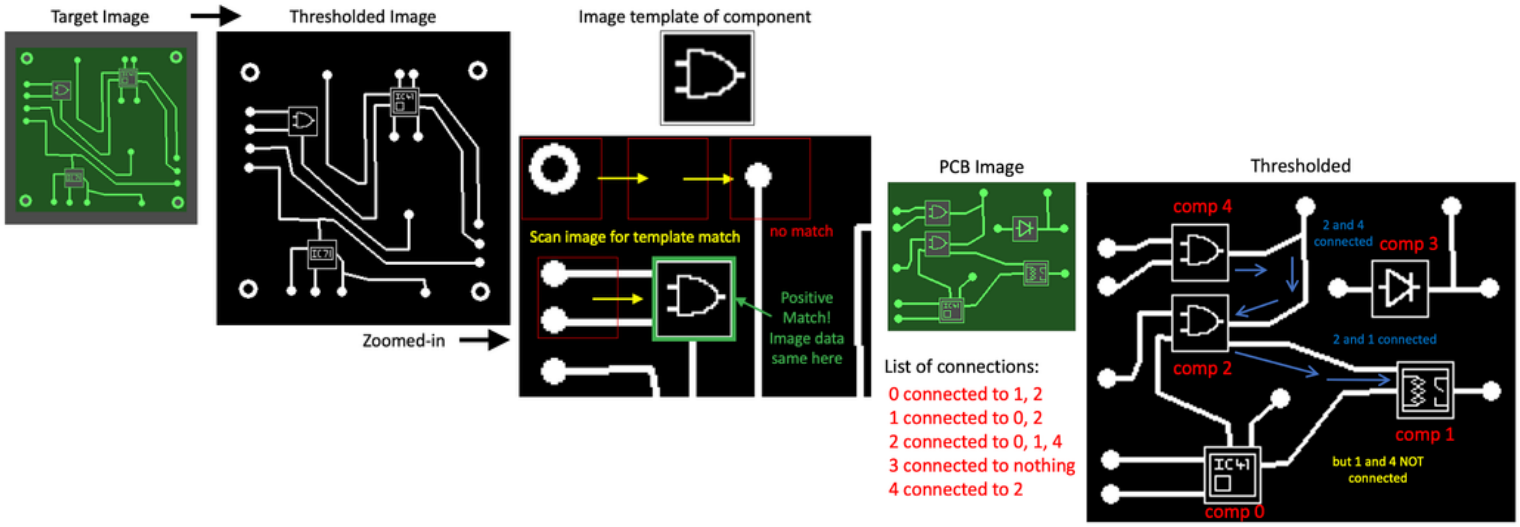
How?

- Programmed using the **STM32F303VCT6** microcontroller using **ARM Assembly** and **C**.
- Integrated motorized flippers, RFID-based game start, real-time scoring, and interactive elements.
- Developed a **real-time game interface** for tracking points and gameplay status.

Results

- Demonstrated skills in hardware-software interaction and real-time embedded systems.
- Strengthened embedded programming and microcontroller-based development skills.

PCB QUALITY CONTROL SYSTEM



What?

- Developed a PCB Quality Control system for MTRX1702 – Mechatronics 1.
- Designed an automated method to verify PCB manufacturing accuracy using **graph algorithms**.

How?

- Implemented **BFS and DFS algorithms** to analyze PCB layouts for circuit connectivity.
- Applied a graph-based approach to detect and verify connections.
- Used **C programming** to optimize algorithm efficiency for real-time PCB analysis.

Results

- Strengthened **C programming**, problem-solving, and **algorithm optimization** skills.
- Improved practice in graph algorithms, circuit analysis, and automated quality control.

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AIR TRAFFIC CONTROL SYSTEM

What?

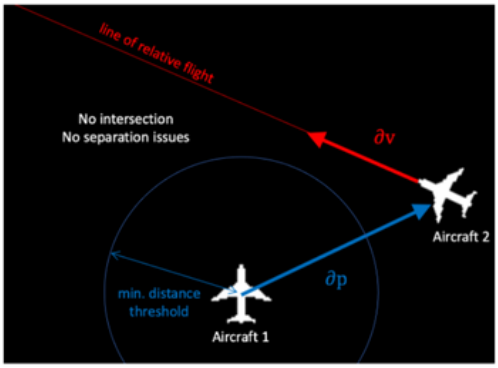
- Developed an **Air Traffic Control (ATC) system** for MTRX1702 – Mechatronics 1.
- Designed a system to process, track, and manage aircraft position data.

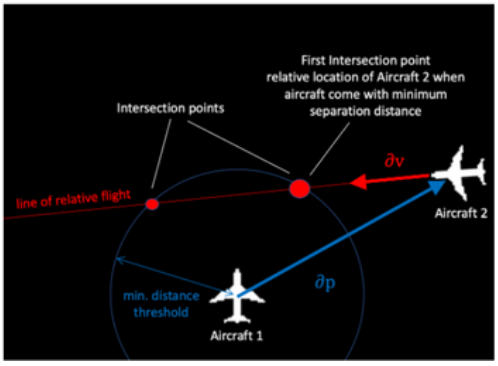
How?

- Implemented ADS-B packet decoding to track aircraft movements and **maintain trajectories**.
- Developed a **data management system** for monitoring and conflict detection.
- Using **C Programming** for efficient data parsing and retrieval.

Results

- Gained experience in **low-level data handling** and **system optimization**.



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#ADS-B:5977,time:18:35,N:328.0,E:119.4,alt:6500,head:-110.0,speed:205.0
#ADS-B:5977,time:18:42,N:247.1,E:90.0,alt:6500,head:-110.0,speed:205.0
*time:18:42,est_pos,5977
Aircraft (ID:5977): Estimated Position: N:247.1,E:90.0
#ADS-B:7073,time:18:45,N:-343.7,E:60.6,alt:7000,head:95.0,speed:240.0
*time:18:46,check_separation,5977,100.0
Separation issue: N:5.9,E:2.2
#ADS-B:5977,time:18:49,N:166.2,E:60.5,alt:6500,head:-110.0,speed:205.0
#ADS-B:7073,time:18:52,N:-243.3,E:51.8,alt:7000,head:95.0,speed:240.0
#ADS-B:282,time:18:55,N:-267.3,E:-224.3,alt:7000,head:55.0,speed:230.0
*time:18:56,check_separation,5977,100.0
Separation issue: N:5.9,E:2.2
*time:18:56,check_separation,7073,100.0
Separation issue: N:-87.4,E:38.2
*time:18:56,check_separation,282,100.0
Separation issue: N:-109.0,E:-113.5
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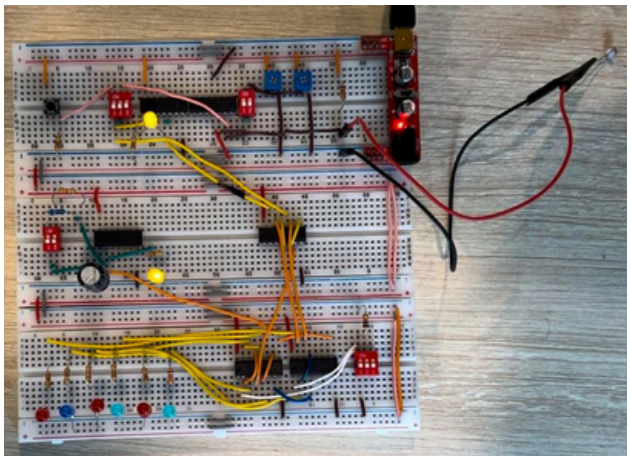
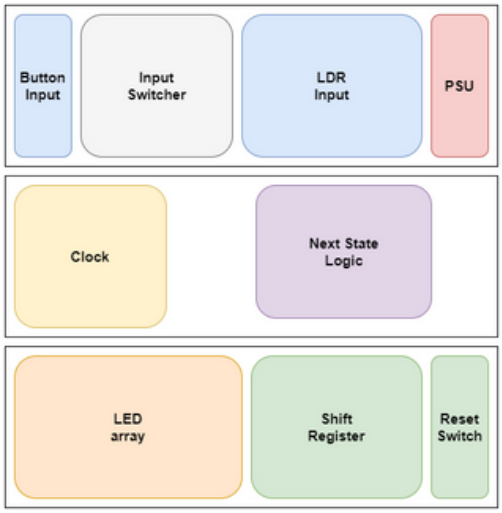
#ADS-B:7073,time:18:59,N:-142.9,E:43.0,alt:7000,head:95.0,speed:240.0
#ADS-B:282,time:19:02,N:-188.2,E:-168.9,alt:7000,head:55.0,speed:230.0
#ADS-B:5977,time:19:03,N:4.4,E:1.6,alt:6500,head:-110.0,speed:205.0
#ADS-B:7073,time:19:06,N:-42.5,E:34.2,alt:7000,head:95.0,speed:240.0
#ADS-B:282,time:19:09,N:-109.0,E:-113.5,alt:7000,head:55.0,speed:230.0
#ADS-B:5977,time:19:10,N:-76.5,E:-27.8,alt:6500,head:-110.0,speed:205.0
#ADS-B:7073,time:19:13,N:58.0,E:25.5,alt:7000,head:95.0,speed:240.0
#ADS-B:282,time:19:16,N:-29.9,E:-58.1,alt:7000,head:55.0,speed:230.0
#ADS-B:5977,time:19:17,N:-157.4,E:-57.3,alt:6500,head:-110.0,speed:205.0
#ADS-B:7073,time:19:20,N:158.4,E:16.7,alt:7000,head:95.0,speed:240.0
#ADS-B:282,time:19:23,N:49.2,E:-2.7,alt:7000,head:55.0,speed:230.0
*time:19:23,num_contacts
Currently tracking 3 aircraft
*time:19:23,check_separation,5977,100.0
No separation issues
#ADS-B:5977,time:19:24,N:-238.4,E:-86.7,alt:6500,head:-110.0,speed:205.0
#ADS-B:7073,time:19:27,N:258.8,E:7.9,alt:7000,head:95.0,speed:240.0
#ADS-B:282,time:19:30,N:128.4,E:52.7,alt:7000,head:55.0,speed:230.0
#ADS-B:5977,time:19:31,N:-319.3,E:-116.2,alt:6500,head:-110.0,speed:205.0
#ADS-B:282,time:19:37,N:207.5,E:108.1,alt:7000,head:55.0,speed:230.0
#ADS-B:282,time:19:44,N:286.6,E:163.6,alt:7000,head:55.0,speed:230.0
*time:19:45,close
closing
```

INTERACTIVE LIGHT PATTERN SEQUENCER





What?

- Developed an **interactive light pattern sequencer** for MTRX1705 – Introduction to Mechatronic Design.
- Enabled real-time adjustments such as speed modulation, direction reversal, and synchronization.

How?

- Designed a hybrid **digital-analog circuit State Machine** for a seamless light pattern control.
- Implemented **light-based communication** for multi-device synchronization.
- Developed a web-based interface for remote control and customization.

Results

- Strengthened expertise in **circuit design**.
- Gained hands-on experience in **real-time system control** and **logic circuits**.
- Successfully showcased the project through live demonstrations and technical reports.

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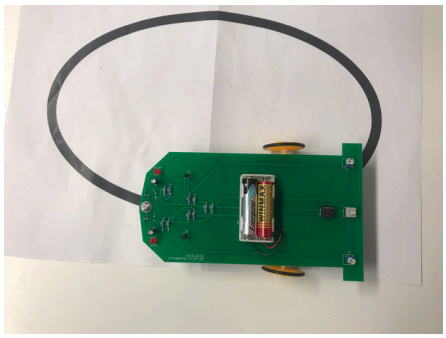
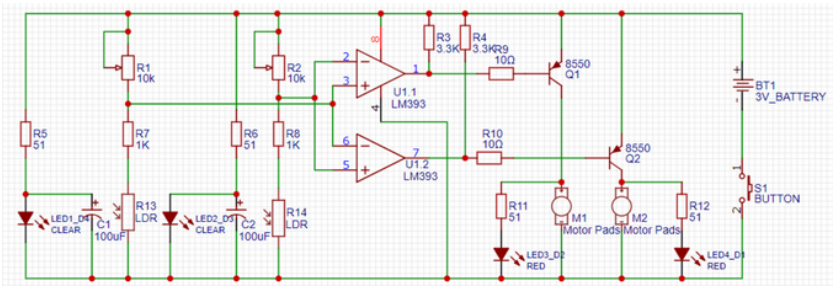
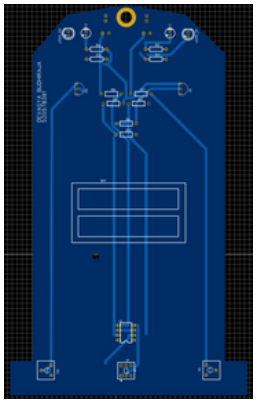
PCB-DESIGNED LINE-FOLLOWING ROBOT WITH BANG-BANG CONTROLLER







What?

- Designed and developed a line-following robot for MTRX1701 – Introduction to Mechatronics Engineering.
- Implemented a **bang-bang control** using the **LDR sensors** for line tracking.

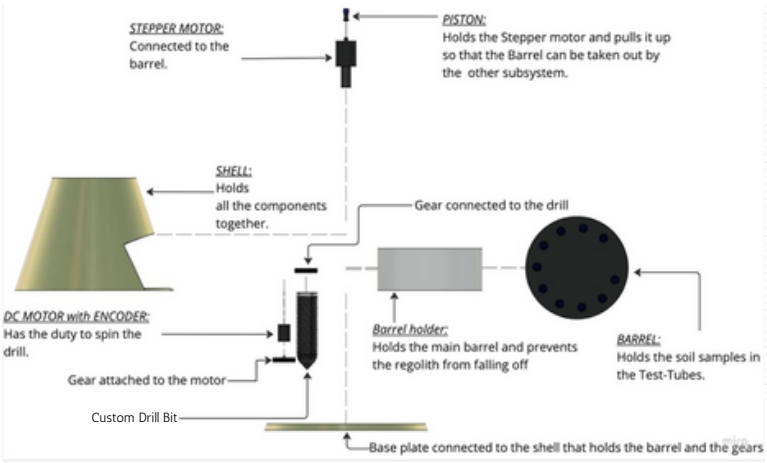
How?

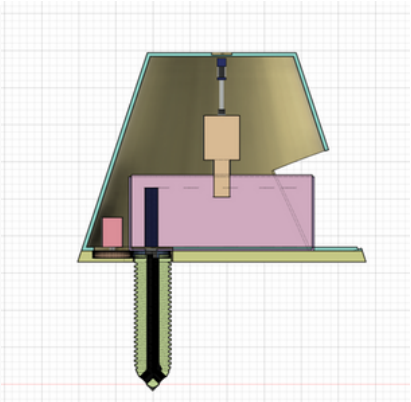
- Created a **custom PCB** using **EasyEDA**, integrating sensors and motor drivers.
- Used LDR sensors to detect the line and control motor movement.
- **Soldered** all the components and tested the robot.

Results

- Strengthened skills in **PCB design**, **embedded systems**, and **control algorithms**.
- Gained hands-on experience in hardware integration and real-time decision-making.
- Successfully developed a functional, autonomous robot that accurately followed a predefined track.

DESIGN OF A REGOLITH COLLECTION SYSTEM FOR LUNAR EXPLORATION





What?

- Developed a regolith collection system for MTRX1701 – Introduction to Mechatronics Engineering.
- Designed a mechanism for efficient regolith extraction, storage, and other requirements.

How?

- Modeled the drill and storage system using **Autodesk Fusion 360**.
- Optimized drill speed, torque, and regolith flow through mathematical analysis.
- Designed a mechanically efficient collection mechanism to minimize energy consumption and maximize regolith retrieval.

Results

- Strengthened skills in **CAD modeling**, and **mechanical design**.
- Improved skills in **mathematical modeling** and optimization for planetary surface operations.
- Developed a functional and efficient regolith extraction and storage system.

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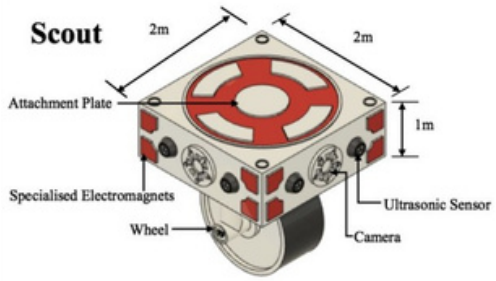
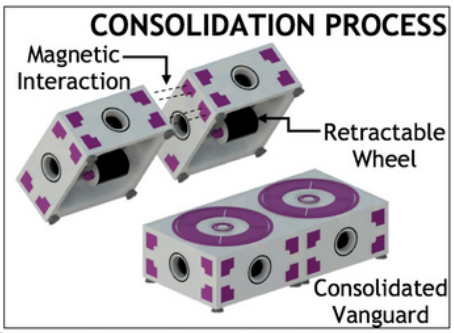
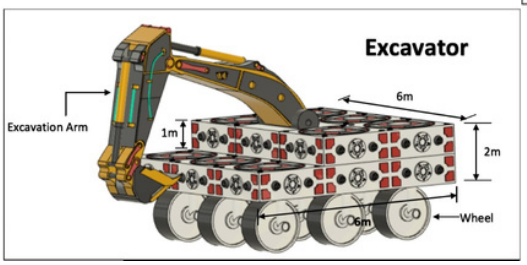
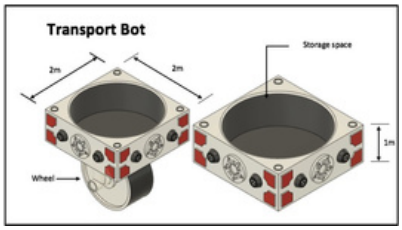
ASIAN REGIONAL SPACE SETTLEMENT DESIGN COMPETITION







Devagya B., Fusion 360



What?

- Got into the **Asian Regional Space Settlement Design Competition**.
- Designed robots to illustrate future construction methods for **space exploration and settlement**.

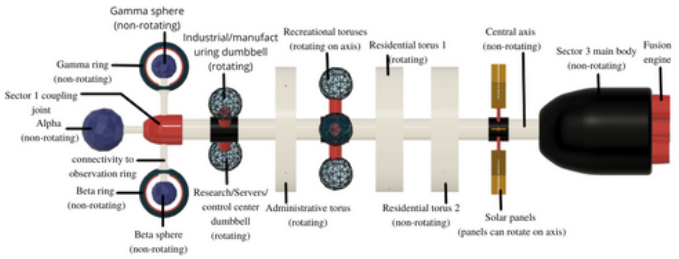
How?

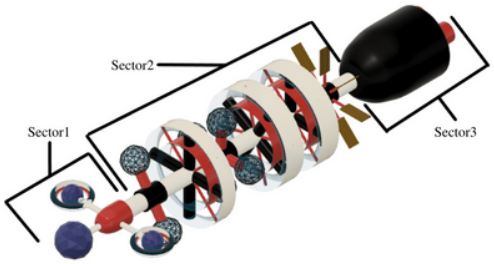
- Used **Autodesk Fusion 360**.
- **Designed multiple robots** to illustrate future construction methods.

Result

- Participated in the Asian Regional Space Settlement Design Competition and was the **runner-up** out of 50 teams.

INDIAN REGIONAL SPACE SETTLEMENT DESIGN COMPETITION





What?

- Got into the **Indian Regional Space Settlement Design Competition**.
- Designed a space settlement to **illustrate potential future locations for human habitation in space**.

How?

- Used **Autodesk Fusion 360**.
- Designed a space settlement to depict human habitation for space exploration and settlement.

Results

- Participated in the Indian Regional Space Settlement Design Competition and was the **runner-up**.
- Got into the **Asian Regional Space Settlement Design Competition**.

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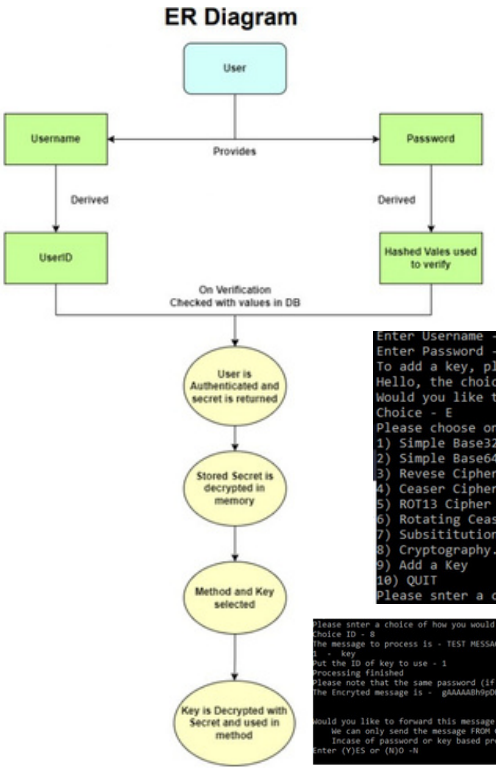
ENCRYPTION AND DECRYPTION




```
Enter Username - user
Enter Password -
To add a key, please put either E or D in the following Menu
Hello, the choices of Encryption and Decryption processes are -
Would you like to Encrypt (E) or Decrypt (D)?
Choice - E
Please choose one of the following Techniques -
1) Simple Base32 encode/decode
2) Simple Base64 encode and decode
3) Revese Cipher
4) Ceaser Cipher
5) ROT13 Cipher
6) Rotating Ceaser Cipher
7) Subsititution Cipher
8) Cryptography.Fernet Module
9) Add a Key
10) QUIT
Please snter a choice of how you would like to Encrypt OR Decrypt a message
```

```
Please snter a choice of how you would like to Encrypt OR Decrypt a message
Choice ID - 8
The message to process is - TEST MESSAGE
1 - key
Put the ID of key to use - 1
Processing finished
Please note that the same password (if provided) during this process must be used to optain correct decypted message
The Encryted message is -  gAAAAABh0pDK8IhIrLPjMhje-L3JLZBQ62r9VuJlIuSSWhCF79LJIGFze6pL1JrVn6CUcAXgCA0OtPqh62go0E0mpakmjJkaDg==

Would you like to forward this message as an email?
   We can only send the message FROM GMAIL Users, they would need this program to be able to decrypt the message
   Incase of password or key based protection, that would also be required to be sent to the reciver seperately and is not handled by us.
Enter (Y)ES or (N)O -N
```

What?

- Designed an **Encryption and Decryption** project.
- Uses different types of techniques to encode and decode messages.

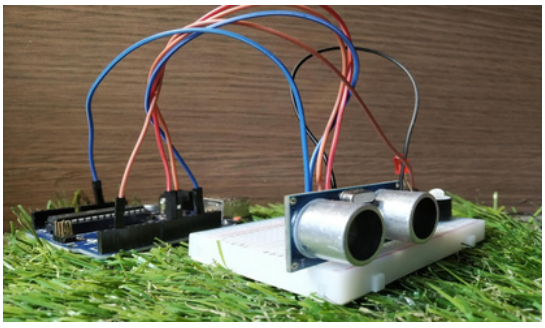
How?

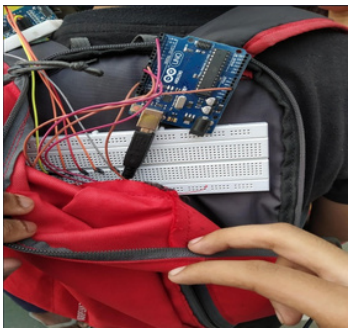
- Used **Python and SQL**.
- Utilized Python for interface, encoding and decoding messages, and SQL for database management.
- Used **SMTP** to forward messages via email.

Result

- The **code worked as expected** and could be improved by further modularizing and encapsulating it for enhanced efficiency.

EVOLUTION WITHOUT EYES (EvWE)





What?

- Developed a **prototype device** to **assist blind individuals with navigation**.
- Designed as an **affordable add-on** to the white cane, aiming to enhance navigation.

How?

- Developed the prototype device using **Arduino** to assist blind people with navigation.
- The device is designed to be small and affordable.
- The initial design used **Lego Mindstorms** before transitioning to Arduino.

Result

- The prototype device **worked as expected** but could be further improved by making it more compact and affordable. This could be achieved by designing a custom PCB and connecting it to the corresponding sensors.

DEVAGYA BUDHIRAJA

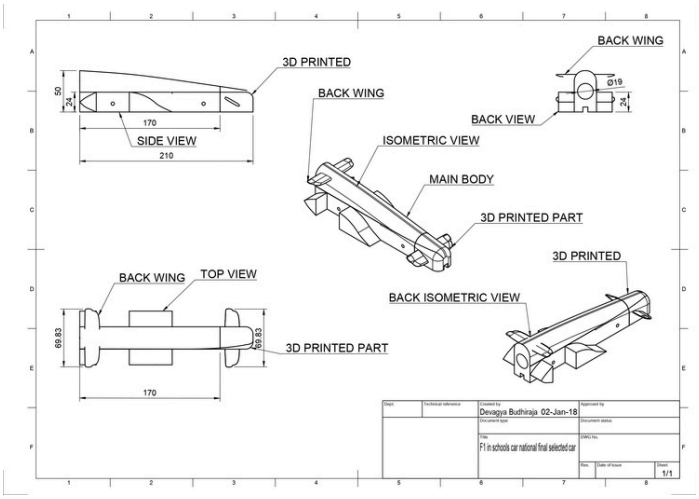
MECHATRONICS ENGINEERING AT THE UNIVERSITY OF SYDNEY

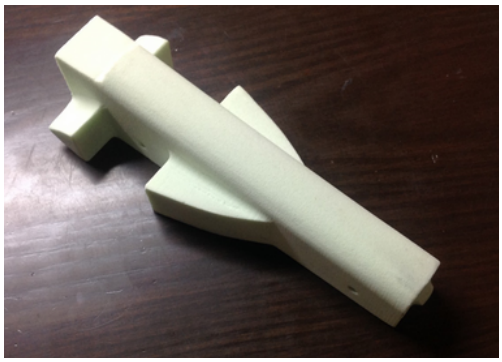
devagyabudhiraja2015@gmail.com

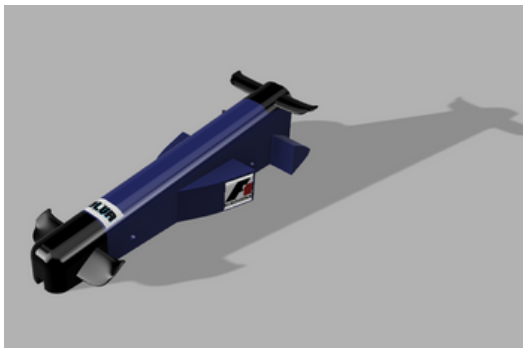
www.linkedin.com/in/devagya-budhiraja-8372ad942

+61 451186671

F1 IN SCHOOLS







What?

- Participated in the **F1 in Schools** competition.
- Took on the role of **Design Engineer** within the team.
- Designed a car powered by CO_2 canisters.

How?

- Used **Autodesk Fusion 360** for design.
- Manufactured the car using **3D printing and the Denford CNC router machine**.
- Used **Autodesk Flow Design** for simulation and analysis.

Result

- Participated in the F1 in Schools competition, placing 23rd out of over 100 teams.