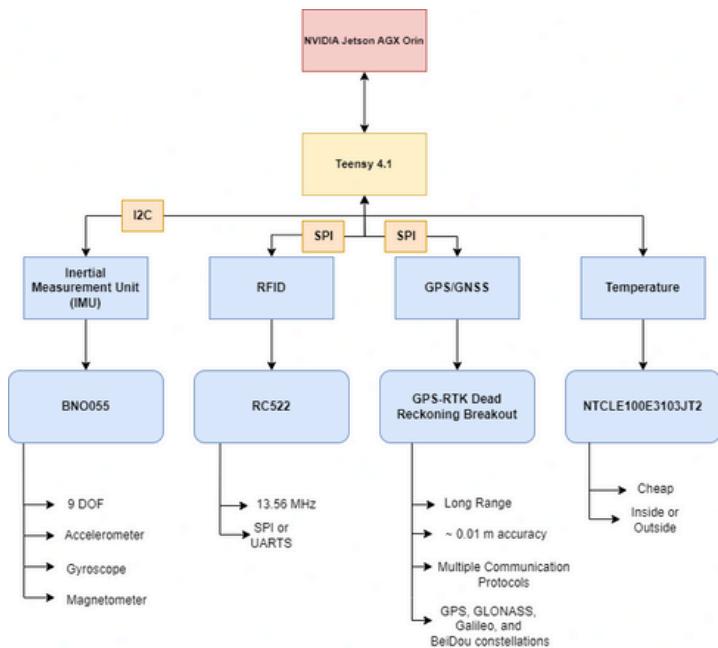


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## ELECTRICAL ENGINEER AT SYDNEY INTERPLANETARY ROVER INITIATIVE



### What?

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

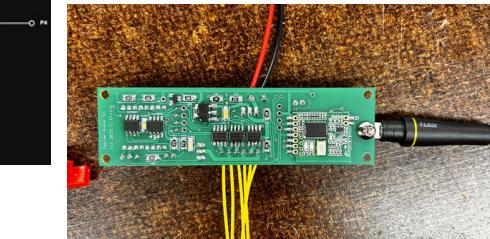
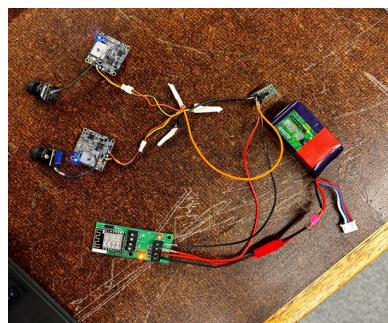
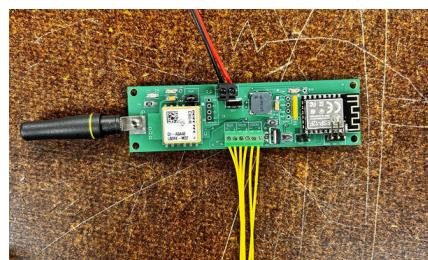
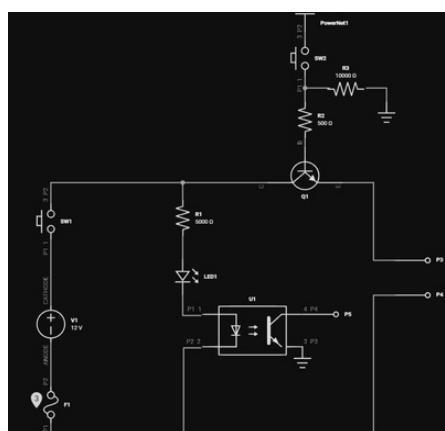
### How?

- 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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## AUTONOMOUS INVENTORY TRACKING ROBOT WITH ROS2

### 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.

[CLICK HERE FOR VIDEO DEMONSTRATION](#)

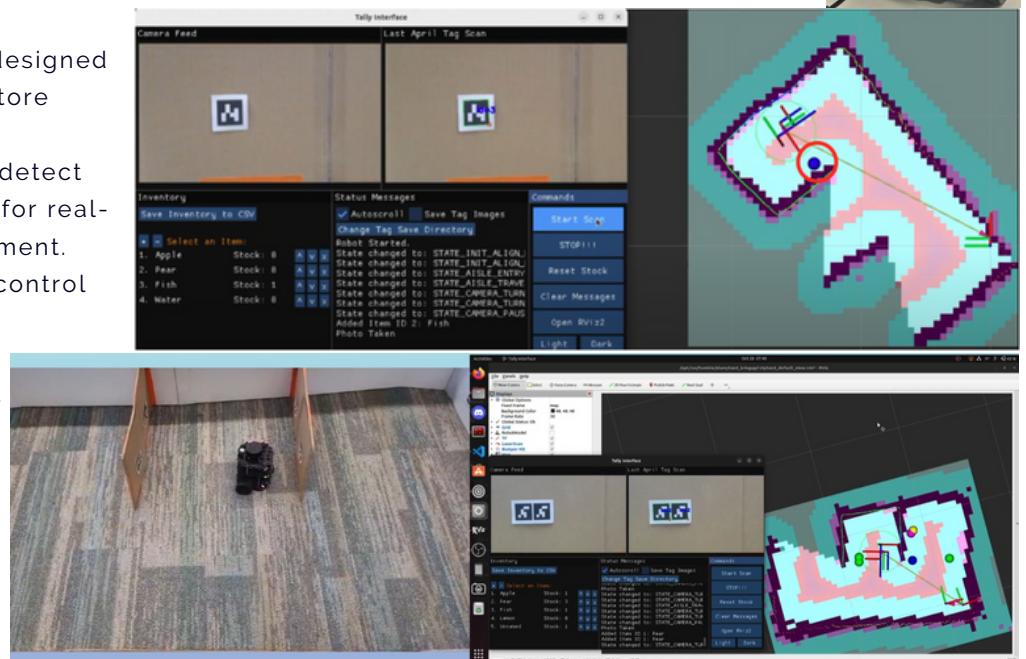


### How?

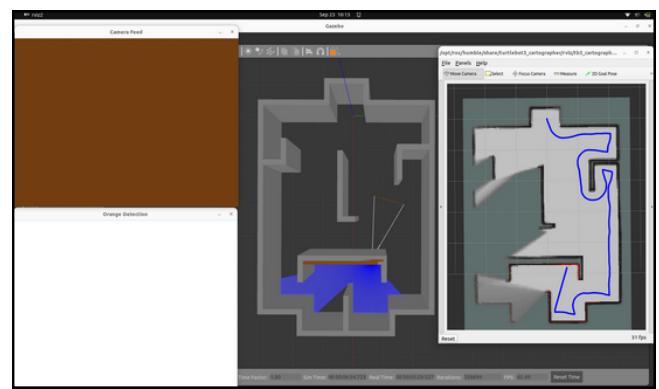
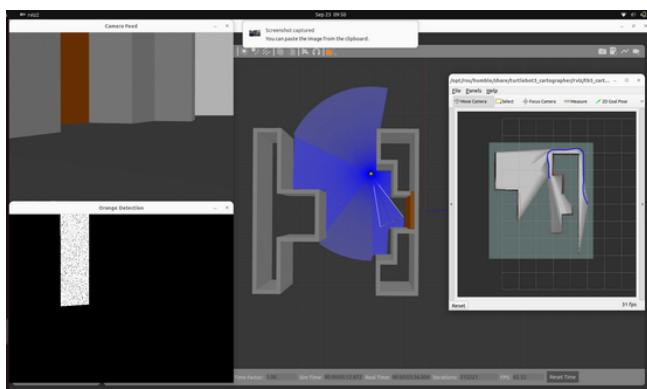
- Using **ROS2** and **TurtleBot3 Burger**, designed a system to autonomously navigate store aisles.
- Integrated **AprilTags** and **OpenCV** to detect and record inventory and used **SLAM** for real-time mapping and autonomous movement.
- Developed a **custom GUI** for remote control and live monitoring.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

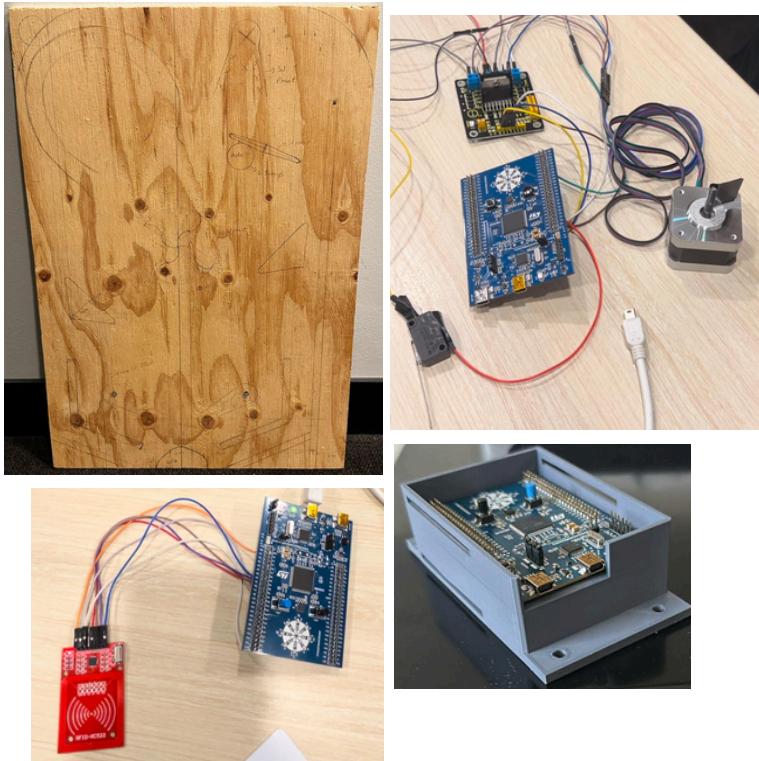
### Results

- 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.

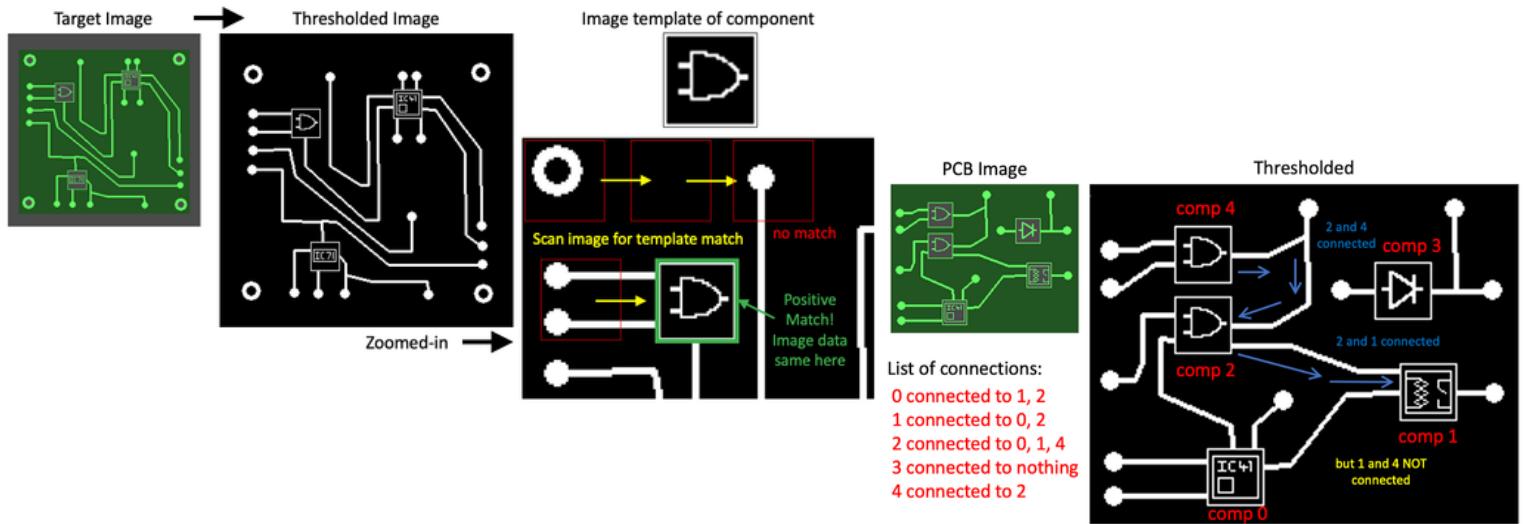
### How?

- 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?

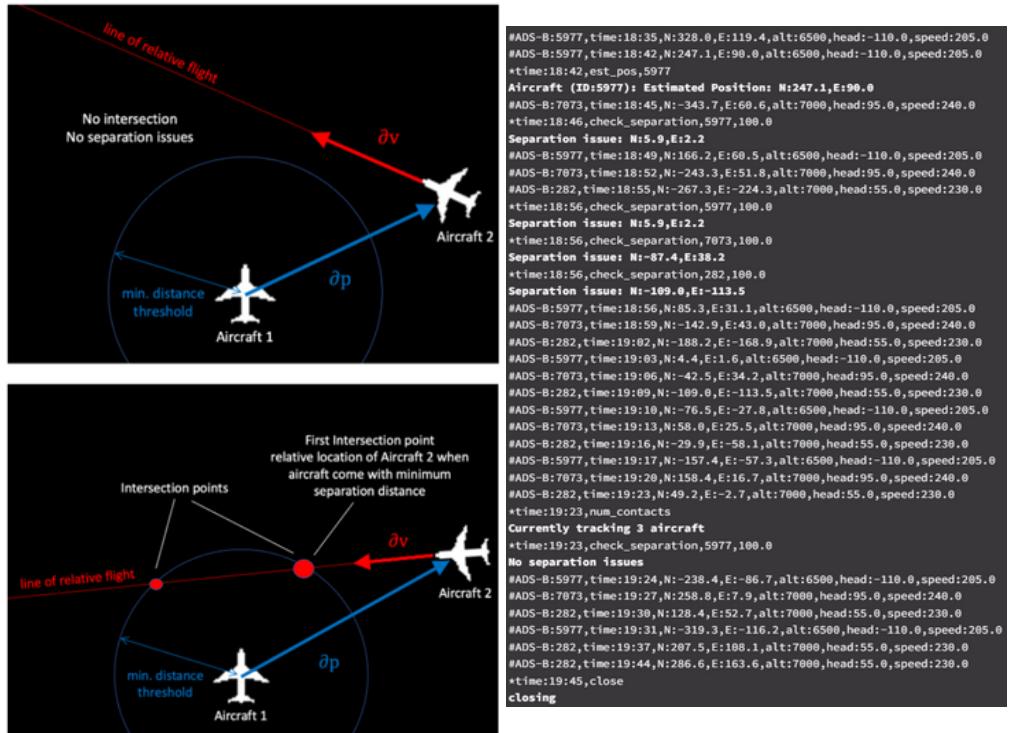
- Developed an **Air Traffic Control (ATC) system** for MTRX1702 – Mechatronics 1.
- Designed a system to process, track, and manage aircraft position data.

### How?

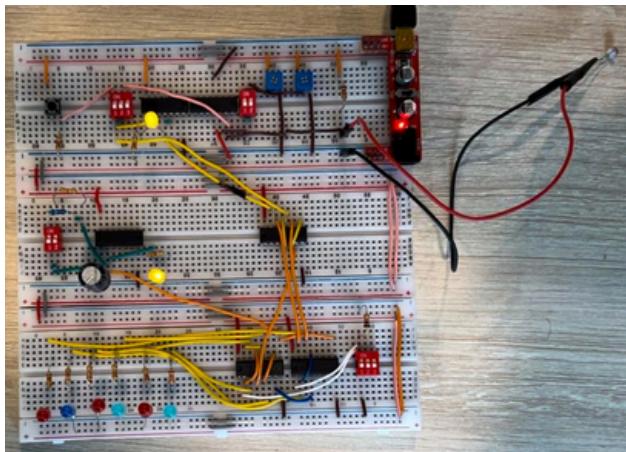
- Implemented ADS-B packet decoding to track aircraft movements and **Maintain trajectories**.
- Developed a **Data management system** for monitoring and conflict detection.
- Using **C Programming** for efficient data parsing and retrieval.

### Results

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



## 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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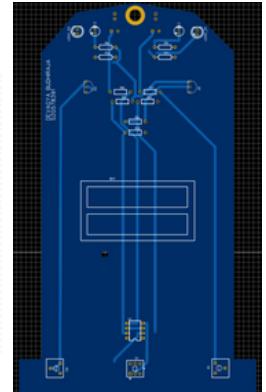
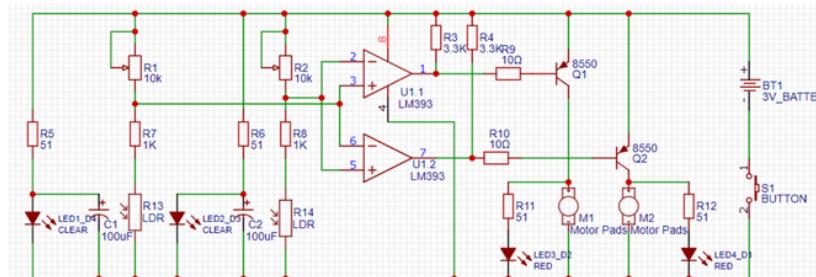


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## PCB-DESIGNED LINE-FOLLOWING ROBOT WITH BANG-BANG CONTROLLER



### 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.

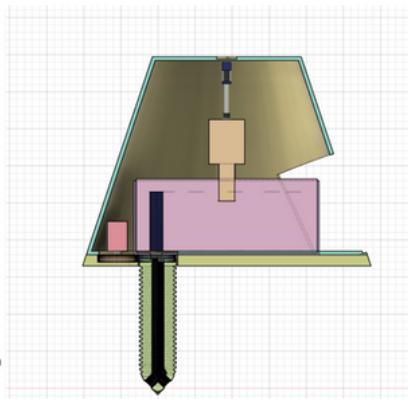
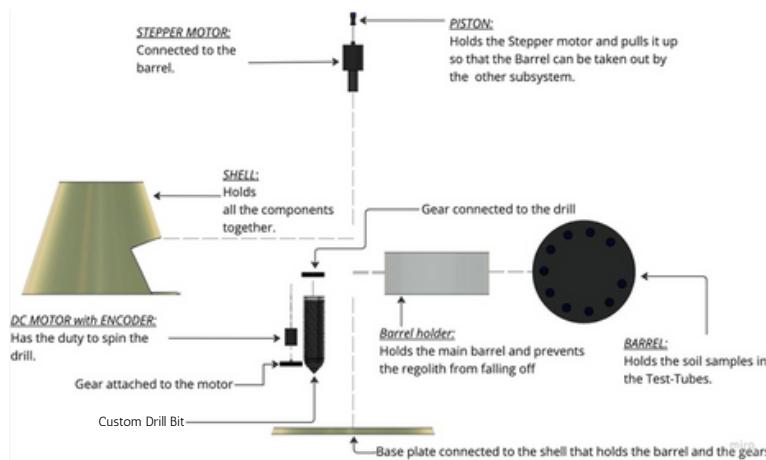
### How?

- 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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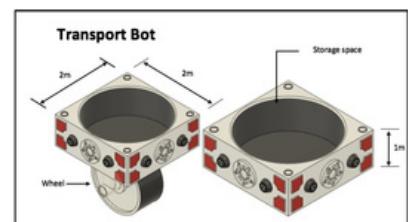
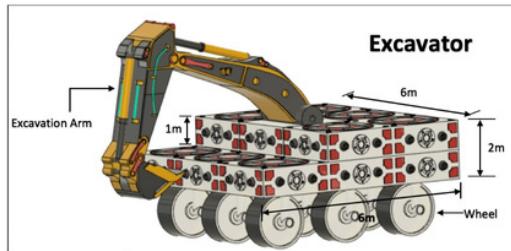
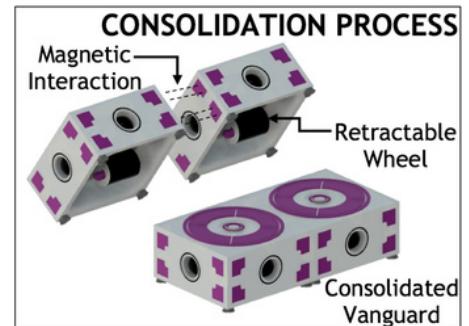
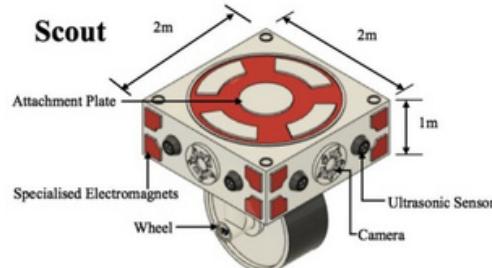


## ASIAN REGIONAL SPACE SETTLEMENT DESIGN COMPETITION



### 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

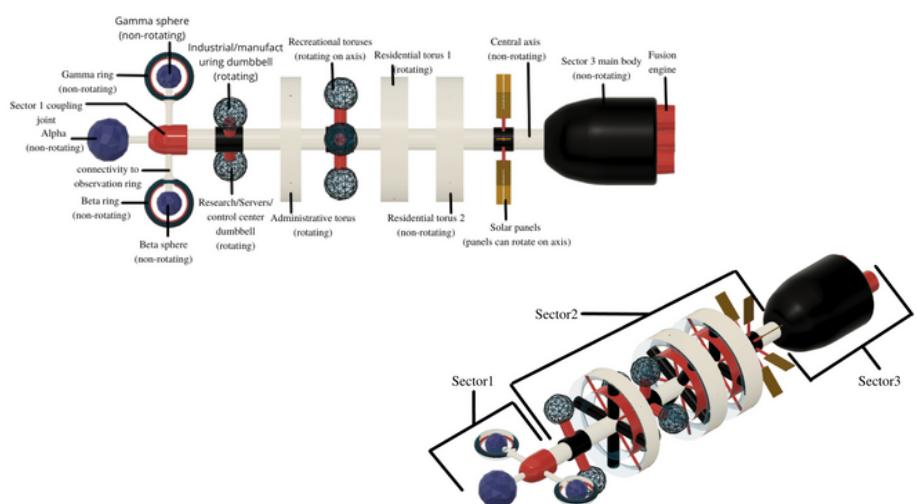
- Participated in the Asian Regional Space Settlement Design Competition and was the **runner-up** out of 50 teams.

## 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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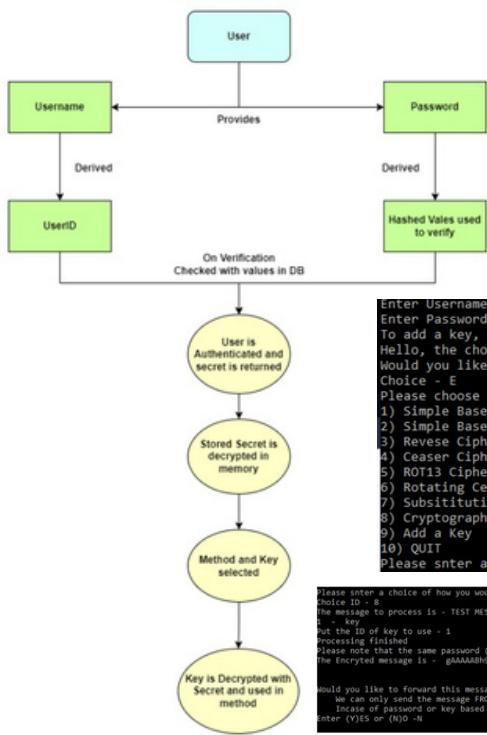
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## ENCRYPTION AND DECRYPTION

ER Diagram



### What?

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

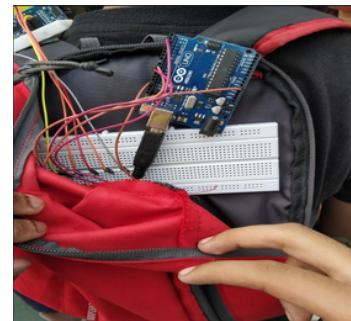
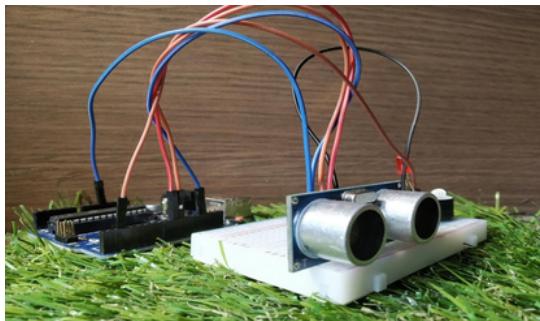
### How?

- 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.

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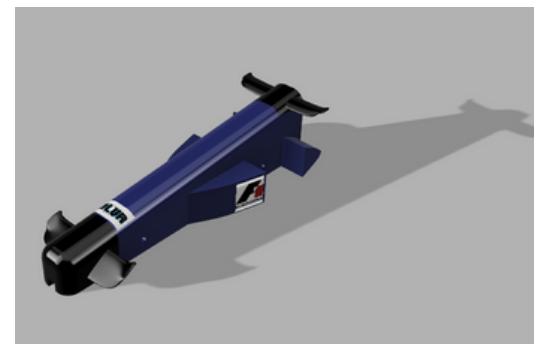
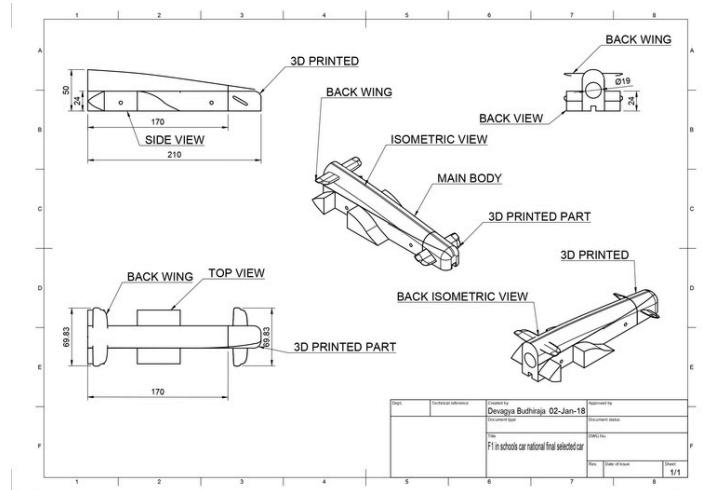


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## F1 IN SCHOOLS



### What?

- Participated in the **F1 in Schools** competition.
- Took on the role of **Design Engineer** within the team.
- Designed a car powered by CO<sub>2</sub> 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.