Plastic Identifier

ENGINEERING THESIS (COMPLETED)

PROJECT OUTLINE

This project is what I completed for my Engineering Honours thesis. I elected to pursue my own project idea, which was a handheld device that can identify plastic types. It works by measuring the relative reflectance of IR light off a plastic sample and passing that data through a machine learning algorithm to determine the most likely plastic type. For my work I received the highest mark (95%) and the UTS Rapido Future Innovator Award

PROJECT DETAILS

- The final prototype achieved a real world accuracy of over 92% accuracy, being able to identify 7 types of plastic.
- I developed a custom PCB that housed all of the spectroscopy related components. This includes IR LEDs LED driver, photodiode, OP AMPS, ADC and other passive components. The device uses components for the 900-1700nm range of Infrared light.
- The ML model was developed in python using Tensorflow. It is a 3 layer multi-classification model that was trained on over 4000 scan data points I collected using the device.
- A touch screen was integrated into the design to act as both input and output for the device. This allows for more complex operations, such as training the ML model.

SKILLS USED/DEVELOPED

- PCB Design
- 3D Printing
- C++
- Python
- Soldering & wiring
- Machine Learning
- Mechatronics Design
- Optics/Spectroscopy

7DoF Robot Arm

WORK PROJECT (COMPLETED)

Sperospace

PROJECT OUTLINE

The objective was to develop and test a TRL5 (NASA Technology Readiness Level) prototype as apart of a grant secured by Sperospace from the Australian Space Agency. For efficiency the project was split into the Arm, Gripper and Software teams, and integration was managed by the Chief Project Manager.

PROJECT DETAILS

- Helped develop the functional requirements of this prototype arm.
- Gained extensive knowledge into space applications and concepts, such as cold welding, launch conditions/vibrations, Radiation Hardening and thermal shielding.
- Responsible for the CAD design of the entire mechanical structure of the robot. I completed this in Fusion360 and outsourced the manufacturing to a CNC shop.
- Developed the robotic actuators from concept through to integration. This involved design of mechatronic systems, electronic component research, soldering and embedded programming.
- Worked closely with the Software team to place the arm in a simulation environment, develop communication over RS485 and control the arm through a GUI.

SKILLS USED/DEVELOPED

- Mechanical Design
- Mechanical Drawings
- Mechanical Assembly
- Lathe Work
- Testing and Validation of systems
- Actuator Design
- C++ Development (Linux)
- Robotics
- Soldering & Wiring

CNC Router

PERSONAL PROJECT (IN PROGRESS)

PROJECT OUTLINE

This is a side project that I started last year because I was very interested in both the design and uses of CNC machines. The CAD was completed last year and all of the components have been purchased, however due to time constraints the only thing that has been built is the welded steel frame.

PROJECT DETAILS

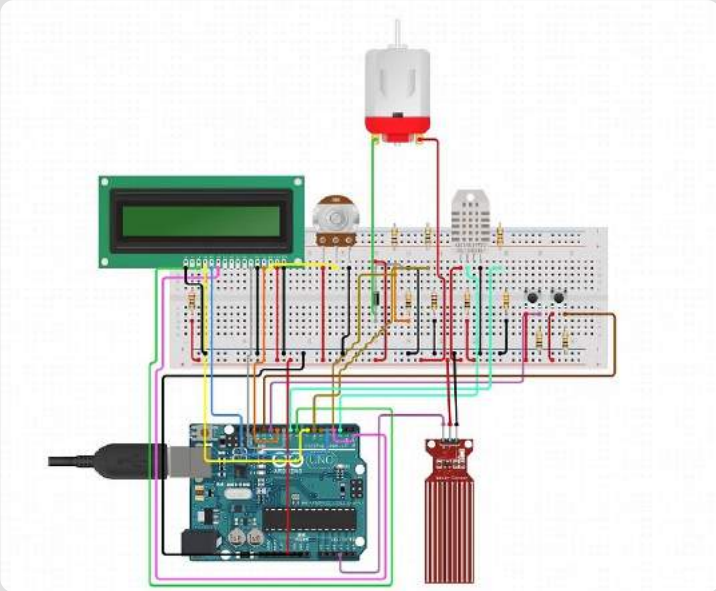
- This was designed as a versatile CNC machine, that can be used as a router, laser cutter/engraver and/or plasma cutter.
- It has a 1250x1250mm cutting area, which was done so that it can do operations on half-sheet sizes, or on full-sheet sizes in two operations.
- The base is made from welded 50x50x3mm steel SHS. The entire cross slide sub system is made from aluminum, either 10mm aluminium plate or 30 series aluminium t-slot extrusions. Aluminium was chosen because a lighter (but still stiff) cross slide allows for faster operations.
- Ball screws, linear rails and stepper motors where used for the motion components.

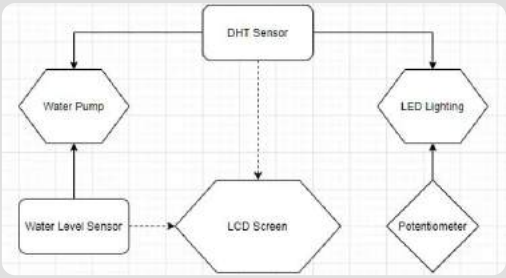
SKILLS USED/DEVELOPED

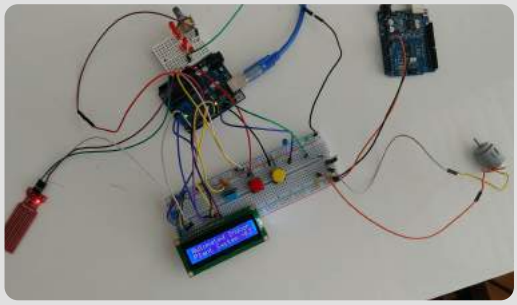
- CAD Design
- Mechanical Assembly
- Welding
- Testing and Validation of systems

Plant Monitor

UNI PROJECT (COMPLETED)







PROJECT OUTLINE

This was the final project for one of my Mechatronic subjects at University. The brief was to use at least 3 of the electronic components given in a kit, from this I decided to construct a plant monitoring system. This would measure the soil moisture and temperature and then water it based on these levels.

PROJECT DETAILS

- The components used where a 32 digit display, dc motor pump, moisture + temperature sensor, water level sensor and an Arduino Uno.
- Everything was programmed in VS Code using the Platform IO plugin, which allows for direct programming of embedded systems.
- The system actually worked really well, it would pump water from a reservoir/tank to the plant when certain set threshold parameters were crossed, which could be changed with the integrated buttons and potentiometer.

SKILLS USED/DEVELOPED

- Mechatronic Design
- C++ Embedded Systems
- Wiring & Breadboarding

Echo²

HSC D&T MAJOR WORK (COMPLETED)

PROJECT OUTLINE

This was the major work for my HSC Design & Technology subject. It was an idea that I found interesting at the time, which was over the ear headphones where each earcup could detach and become a portable speaker. My work achieved a band 6 and received a nomination to the Shape 2018 exhibition.

PROJECT DETAILS

- The project was completed over the course of my final year of high school. It consisted of constant reporting, designing, tinkering and testing.
- The design went though multiple prototypes, however the final one consisted of a 3D printed chassis, that used neodymium magnets to detach the earcups.
- All of the electronics were designed and soldered together by myself. Each earcup contained an all-purpose speaker, a loud-speaker, amplifier, Bluetooth and batteries.
- The Bluetooth modules connected the earcups together so that they would play music in sync.
- In Headphone mode they had a battery life of 6 hours, and 2 hours in speaker mode.

SKILLS USED/DEVELOPED

- CAD Design
- 3D printing
- Testing and Validation of systems
- Soldering & Wiring