Team A2

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Add your 12 slides after this slide… [remember, 12 min talk + 3 min Q/A]

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Make sure to cover:
- Use Case
- Requirements
- Solution Approach
- Testing, Verification and Metrics
- Tasks and Division of Labor
- Schedule

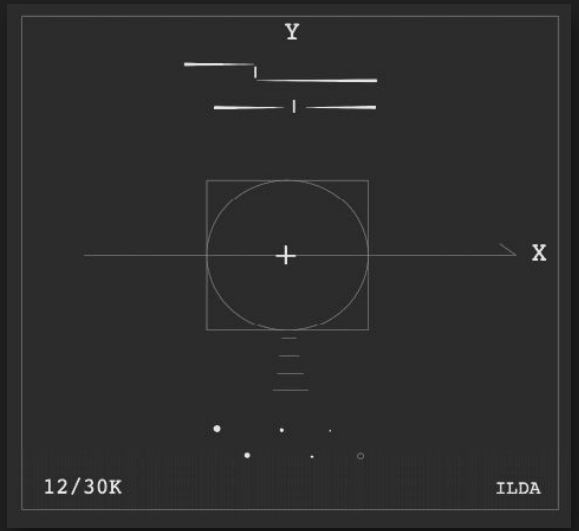
LaSEEr

Laser Display with Edge detection

Use Case

Requirements

- The system shall be able to draw a minimum of 10 frames per second.
- The system shall be able to use a camera feed as an input.
- The system shall be able to draw the ILDA 12k or 30k test patterns with greater than 90% accuracy.
- The safety subsystem shall never allow the laser to persist in an unsafe state for more than 100ms.
- The laser shall be visible in a brightly lit room and should have a minimum projection area of 5’x5’.

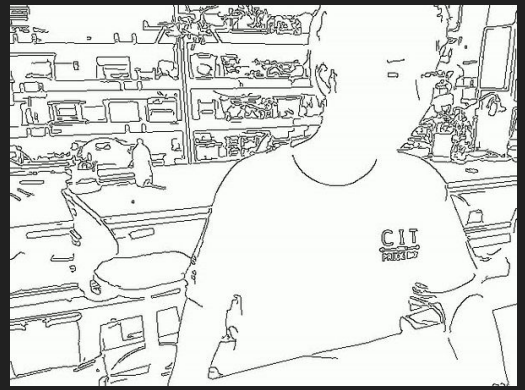


ILDA Test Pattern Technical Committee

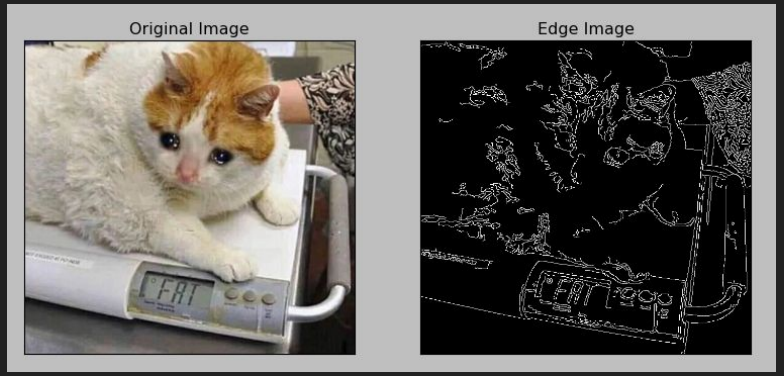
Solution Approach

Camera to Frames

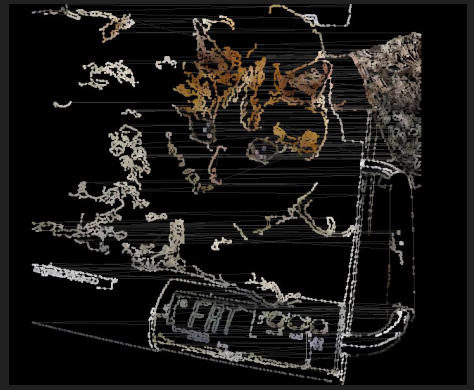
- Decided to use Raspberry Pi 4 for the platform.
- Don’t want to waste time writing camera driver.



Frames to Coordinates



Camera Feed + Canny Edge Detection



ILDA Format (.ild)

DAC

- Need to create voltage offsets to control the galvanometer.
- Also need to be able to dim the lasers.

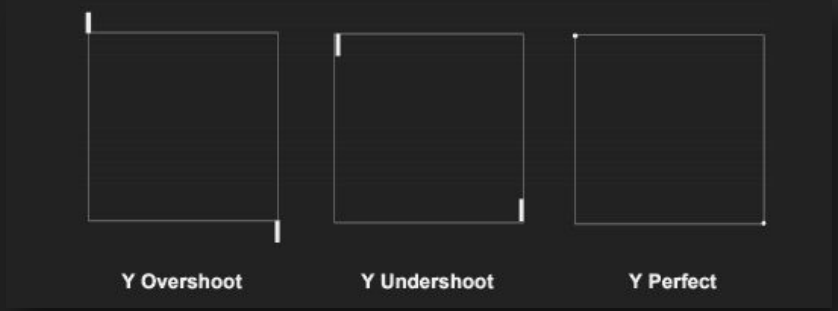
Why not just use onboard RPi DAC?

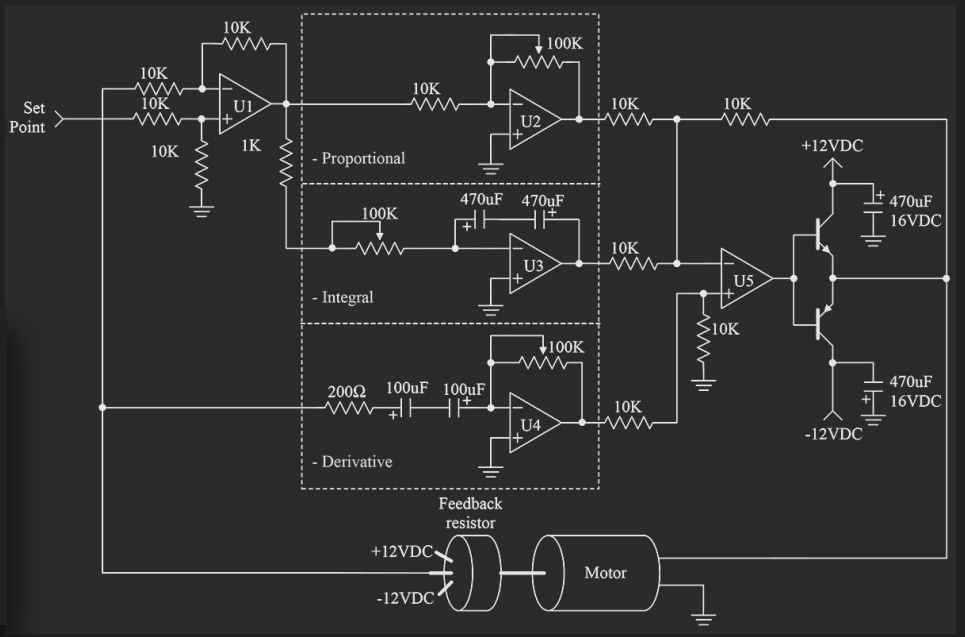
- DC Blocking

mouser.com

PID

- Plan to do this with analog circuits.
- Minimize processing power.
- Also it’s a fun challenge.





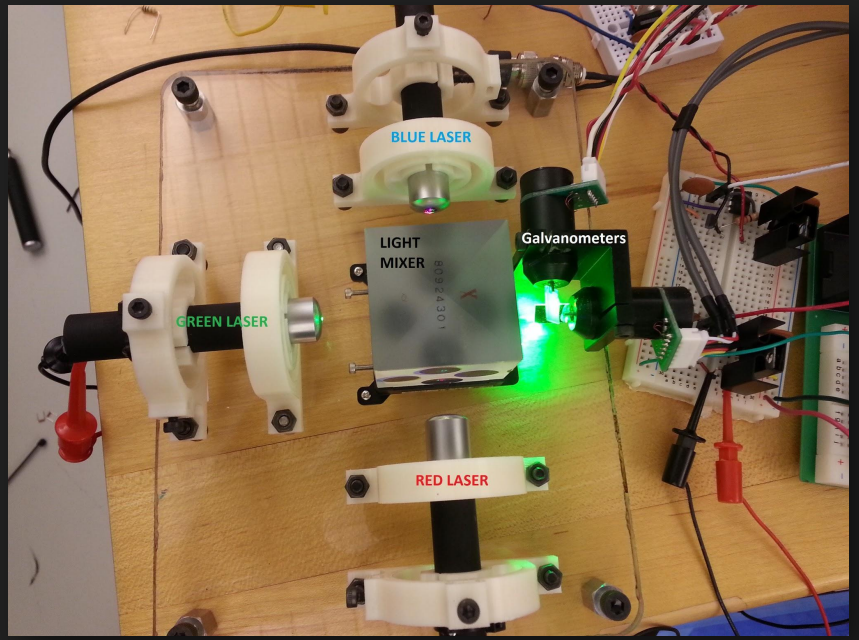
https://www.nutsvolts.com/magazine/article/the_pid_controller_part_1

ILDA Test Pattern Technical Committee

Laser Setup

- Red, green, and blue color lasers combined with a light mixer cube.

- Galvanometers with mirrors for X and Y axis used to project laser to screen.



Safety Subsystem

- Emergency power cut-off switch for lasers.
  - Lasers can easily be damaging to eyes.

- Monitoring for laser power draw and galvanometer movement.

Testing, Verification and Metrics

- Edge Detection and Coordinate Creation
  - Testing pipeline with sample video, images with different edge density
  - Verify that system can process 640x480 video at 10fps and if not properly downsize the content

- Hardware and Lasers
  - Use ILDA test patterns prepared for various points per second ratings for testing
  - Verify that our hardware is able to run galvanometers at 20K points per second speed without overheating

Tasks and Division of Labor

- High level Software - Enes (50%), Eliana (50%)
- Low level Software - Enes (50%), Eliana (50%)
- Hardware - Jake (80%), Enes (10%), Eliana (10%)
- Flexibility to help as needed

Schedule

Task ID	Work Breakdown Structure	Planned Start	Planned Finish	Workload (Plan)	Workload (Actual)	In Charge	Progress
1	**Design Test Boards**			25			7.2%
1_1	**Design Schematic**	2019/09/09	2019/09/13	11			16.4%
1_1_1	Design Parts	2019/09/09	2019/09/13	3		Jake	0.0%
1_1_2	Flesh out schematic	2019/09/09	2019/09/13	6	2	Jake	30%
1_1_3	Design Review v1	2019/09/13	2019/09/14	2		Eliana	0.0%
1_3	**Board Layout**	2019/09/13	2019/09/17	7		Jake	0.0%
1_3_1	Layout Board	2019/09/13	2019/09/16	5		Jake	0.0%
1_3_2	Design Review v2	2019/09/16	2019/09/17	2		Eliana	0.0%
1_4	Add 3D Models to Board	2019/09/16	2019/09/18	3			0.0%
1_5	**Order Boards**	2019/09/18	2019/09/29	3			0.0%
1_5_1	AllPCB	2019/09/18	2019/09/29	1			0.0%
1_5_2	Parts for boards	2019/09/18	2019/09/25	2			0.0%
1_6	Buffer	2019/09/30	2019/10/04	1			0.0%
2	**Modify Boards**			10			0.0%
2_1	**Evaluate Test Boards**			10			0.0%
2_1_1	Solder Boards	2019/10/05	2019/10/07	2		Jake, Eliana	0.0%
2_1_2	Debug Test Boards	2019/10/08	2019/10/09	6		Jake, Eliana	0.0%
2_1_3	Sim Problem Solutions	2019/10/09	2019/10/10	2			0.0%
3	**Software**			32			37.5%
3_1	**Edge->ILDA pipeline**	2019/09/01	2019/09/16	13		Eliana	69.2%
3_1_1	Initial openCV testing	2019/09/01	2019/09/09	4	4	Eliana	100.0%
3_1_2	Contour -> ILDA + Colour	2019/09/09	2019/09/14	5	5	Eliana	100.0%
3_1_3	VideoStream Combine	2019/09/14	2019/09/16	4		Eliana	0.0%
3_2	**Video Stream->Edge**			19			15.8%
3_2_1	Initial Video capture	2019/09/01	2019/09/09	1	1	Enes	100.0%
3_2_2	Edge Detection on stream	2019/09/01	2019/09/09	2	2	Enes	100.0%
3_2_3	Performance test on RPI4 for images	2019/09/09	2019/09/14	3	2	Enes	0.0%
3_2_4	Performance test on RPI4 for video streams	2019/09/14	2019/09/18	3	0	Enes	0.0%
3_2_5	Parameter optimization for edge detection	2019/09/19	2019/09/23	10	0	Enes	0.0%
3_2_6	Smoothing method research	2019/09/24	2019/09/28	0	0	Enes	0.0%
3_2_7	Smoothing method test	2019/09/29	2019/10/04	0	0	Enes	0.0%
4	**Low Level Software**			26			0.0%
4_1	**C->DAC Interface**			26			0.0%
4_1_1	Initial Research, Testing, Coding	2019/09/16	2019/09/21	7		Eliana	0.0%
4_1_2	Project Structure for Pipeline Py->C	2019/09/22	2019/09/27	7		Eliana	0.0%
4_1_3	RaspiPi Drivers for DAC	2019/09/28	2019/10/01	6		Eliana or Enes	0.0%
4_1_4	RasPi Drivers for Camera	2019/10/01	2019/10/05	6		Eliana or Enes	0.0%