LDS by LaserTech
Lawn Defense System

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Agenda

- Company Overview
- Introduction and background of LaserTech Systems
- Business Case and Costs
- Competition Products
- Technical Cases
  - Motion Detection
  - Laser Module
  - Mechanical Integration
- Risk Analysis and Management
- Self Reflection and Beta Phase Planning
- Conclusion
- Demo

Company Personnel and Roles overview

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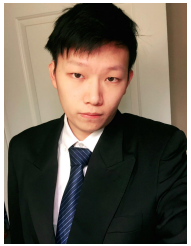

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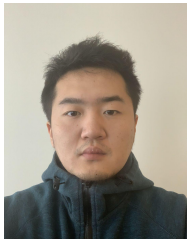

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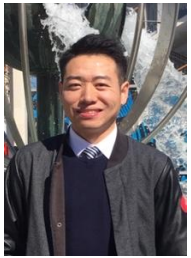

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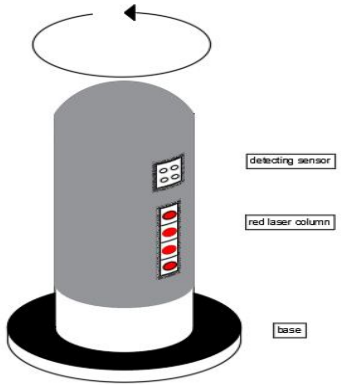
Introduction of LaserTech

- In Vancouver area, Home yards are being damaged by crows
- Crows peck the grass roots for foods - grub chafers
- Costs ~ $500 to fix the 15’ x 15’ lawn
- Advanced Crow expel technology needs to be developed
- A laser system will be developed to repel the crows



Business Case and Costs

Costs for the product is in the following:

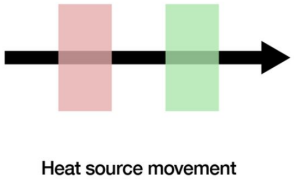
Materials Fees/Unit	$150
Labour Fees/Unit	$35
Marketing Fees/Unit	$10
Total Cost/Unit	$195
Sale Price/Unit	$260

Competition Products

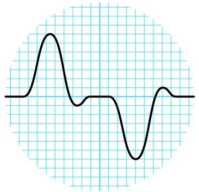
- Garden Owl furnish ($45)
  - Pros: Cheap, easy-to-access
  - Cons: Fixed in place, not compact, not effective
- Sonic Bird Repel ($70)
  - Pros: effective
  - Cons: More costly, high frequency noise is harmful to animals and human around houses

Technical Case (Motion Detection Module)

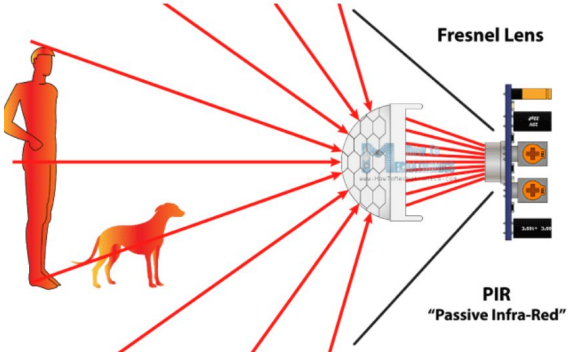
- PIR motion detector
  - Two slots in it, each slot is made of a special material that is sensitive to infrared radiation, which is caused by movement
  - The module also consists a specially designed cover named Fresnel lens, which focuses the infrared signals onto the pyroelectric sensor



Heat source movement

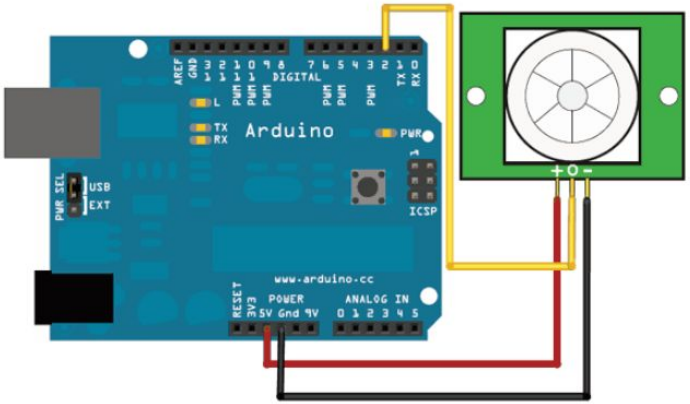


Output signal



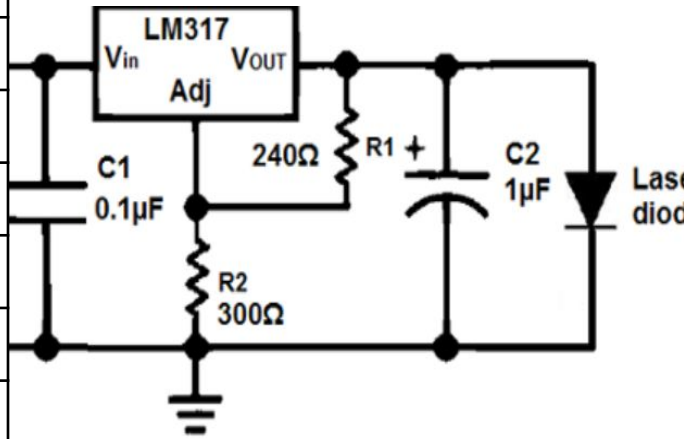
Technical Case (Motion Detection Module)

- ❏ Used Arduino to control the motion detection module
- ❏ PIR generates a 3.3V digital output signal when motion detected
- ❏ Arduino receives PIR signals
- ❏ Arduino generates a signal to control the laser beam module



Technical Case (Laser Module)

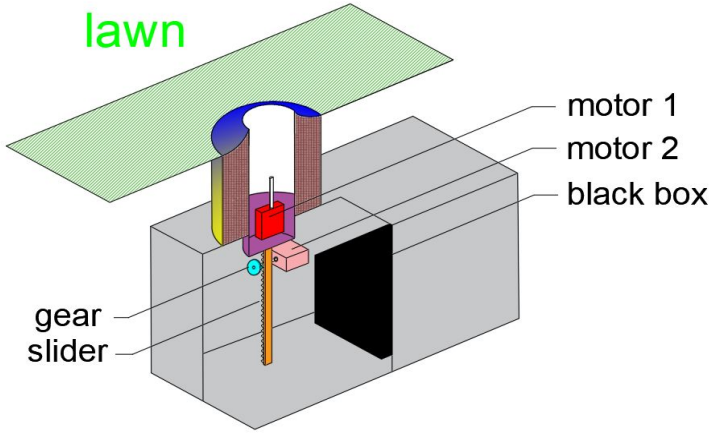
Manufacturer	Quarton Inc.
Class of Lasers	Class 2
Manufacturer part Number	VLM-650-02G LPT
Wavelength	650nm
Input voltage	2.6V~5V
Current Rating(Amps)	35mA
Power(Watts)	1mW
Package/Case	Cylinder(10.5mm Dia)



Technical Case (Mechanical Integration)

Two Main aspects :

- ❏ Rotational movement (Portable): it provides a rotational motion that rotates the laser module 90 degrees
- ❏ Vertical movement (Optional): it provides a motion can lift the laser module up to ground
- ❏ Power will be supplied with household AC and transformer
- ❏ Can be installed both above or under the ground

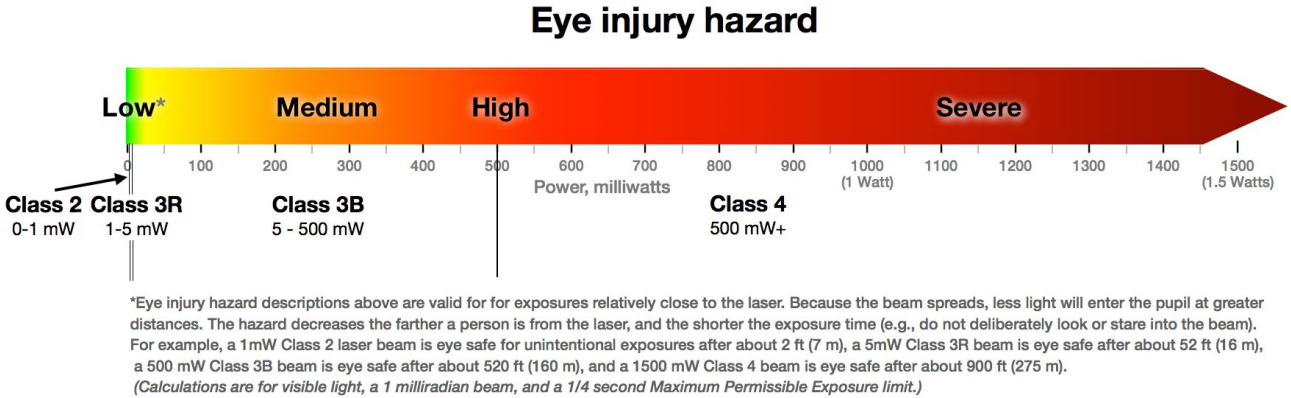


Risk Analysis

- The laser system is designed to be waterproof above or below ground
- MPE (Maximum Permissible Exposure) control
- The laser will be harmful if shoot at people’s eyes or skin

Risk Management

- ❏ Use plastic waterproof insulating packaging to seal the system
- ❏ Use Class 2 laser beam, which is safe to use
- ❏ Extend 30 cm above ground to avoid possible exposure to humans
- ❏ The system can be unplugged when necessary



*Eye injury hazard descriptions above are valid for for exposures relatively close to the laser. Because the beam spreads, less light will enter the pupil at greater distances. The hazard decreases the farther a person is from the laser, and the shorter the exposure time (e.g., do not deliberately look or stare into the beam). For example, a 1mW Class 2 laser beam is eye safe for unintentional exposures after about 2 ft (7 m), a 5mW Class 3R beam is eye safe after about 52 ft (16 m), a 500 mW Class 3B beam is eye safe after about 520 ft (160 m), and a 1500 mW Class 4 beam is eye safe after about 900 ft (275 m).
(Calculations are for visible light, a 1 milliradian beam, and a 1/4 second Maximum Permissible Exposure limit.)

Adherence to Standards

The LaserTech is a system including laser design and control system. The entire system complies to the ISO 60825, 31000, and 21600:

- ISO 60825-1 refers to information on the safety of use of the laser applications
- ISO 31000 refers to risk management for protecting users
- ISO 21600 specifies the composition, basic principles, preparation process, general requirements, detailed requirements, publication and application requirements, and management requirements of mechanical product digital manuals

Self-Reflection

- We learn from each other throughout the semester
  - Make best use of each member's skill sets in the following beta-phase implementation
- We learnt the classification of laser beam
  - Use Class 2 to avoid permanent harmfulness to others
- Software Tweaking
  - Motion detector lacks sustainability and precision
  - OpenCV and deep learning project can improve useful life and precision
- Hardware Tweaking
  - Use arduino to drive the motors properly
  - Use transformer to supply the device

Beta-Phase Planning for ENSC 440

- Software
  - Improve the motion detection module with OpenCV using deep learning project
- Hardware
  - Improve the structure with 3D-printing
  - Improve our power supply with household outlet instead of battery
- Integration
  - Integrate the laser module, motion detection module, and mechanical module

Conclusion

- LaserTech can effectively repel crows to save homeowners money
- LaserTech is a cost-effective and unique product in the market
- Ideal Coverage of the protected area is 15X15 square feet lawn

Acknowledgements

We would like thank the Professor Craig and the TAs for continuous support and answering our questions, the guadiances was important for the decision making of our project, in this course we have learned a lot about team working as professional engineers.

Laser Test Demo

https://www.youtube.com/watch?v=IFjEasKYfSw

https://www.youtube.com/watch?v=Nz3xr4G6Xlg

Motion Test Demo

https://www.youtube.com/watch?v=nJ-WkPGTkGI

Q&A