



Facial Detection Snack Launching Robot





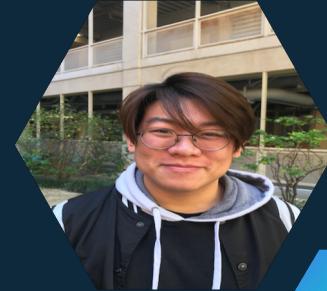
Team Buffalo

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Project Introduction





Problem Statement

- Run out of food while watching TV
 - Miss some parts of the Movies
 - Diverts attention away from the entertainment
- Want to have food while working with laptop
 - Get your fingers dirty
 - Get your laptop dirty





Solution Overview

Robot that recognizes the human

Determine distance and trajectory

Orient launcher to correct state

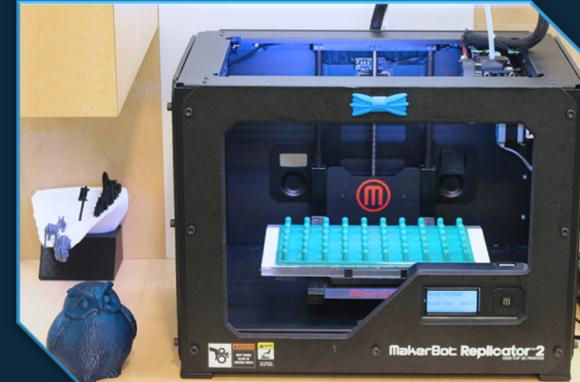
Load and fire the snack





Motivation

- Improve the quality of life of the user
- The next step to having a TV remote
- Create robot that is inexpensive to construct
- Available for others to build and improve





Project Breakdown



Four Main Parts



Facial
Detection

Distance
Determination

Trajectory and
Robot State
Determination

Launching
Mechanism





Related Work

- Lacked Human-Robot Safety
 - Fixed trajectories
 - Require Human Guidance



The “Cooler Cannon”





Related Work



- Not easily accessible
 - High cost
 - Difficult to reproduce

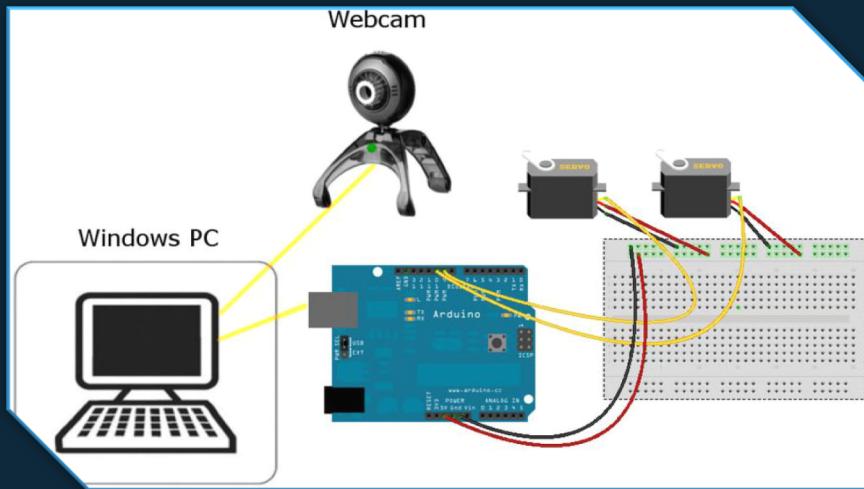
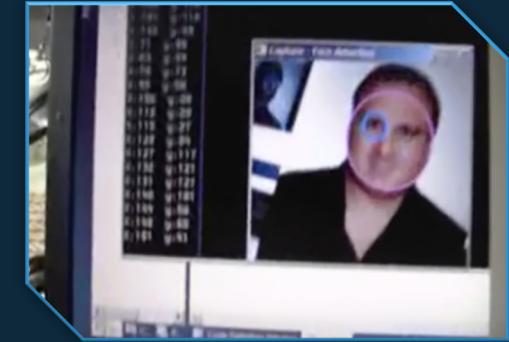
The “Beer Throwing Robot”





Facial Detection 😊

1. Detected face
2. Finding center of the detected face
3. Aiming the Webcam to the center of the face
4. Calculate out the distance





Sensor Fusion


- Webcam Selection

Logitech C270
HD 720p
(\$19.99)



Logitech C615
HD 1080p
(\$31.99)



Logitech C922
HD 1080p
(\$67.89)

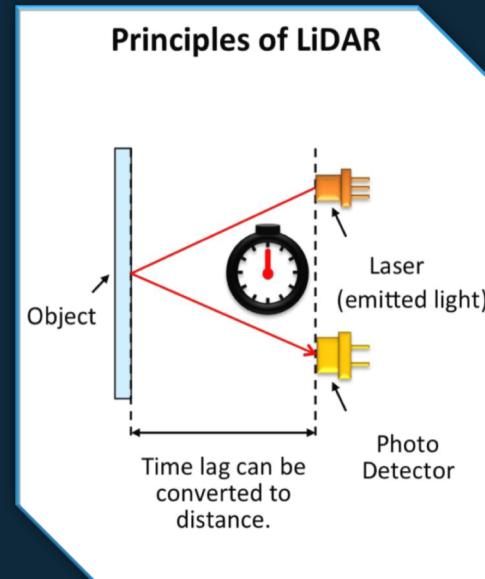


Sensor Fusion



- Lidar Sensor

- Advantage:
 - Accurate
 - Small limitation on operating environment
 - Low cost
- Challenge:
 - Sensitive to angular changes
 - Dependence of the surface



$$Distance = \frac{Speed\ of\ light \times Time\ of\ Flight}{2}$$



Trajectory & Robot State Determination



- Vertical trajectory limit
 - Most residential ceilings 8 feet
- Determine Rotation Angle ϕ
- Determine Launch Angle θ
- Determine Launch velocity



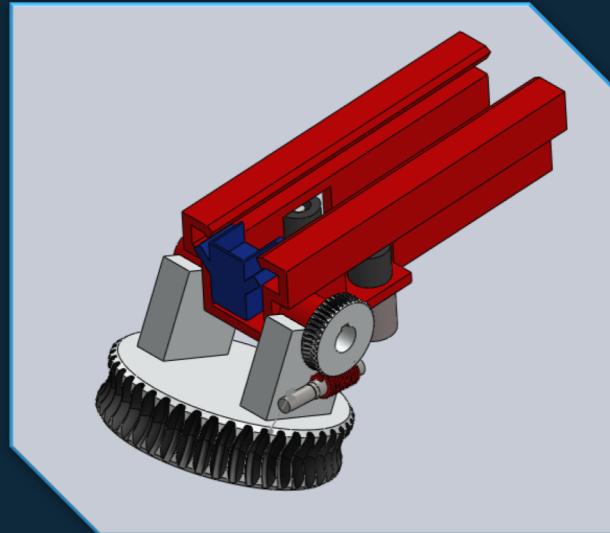


Launcher Design



- Model v.1.1

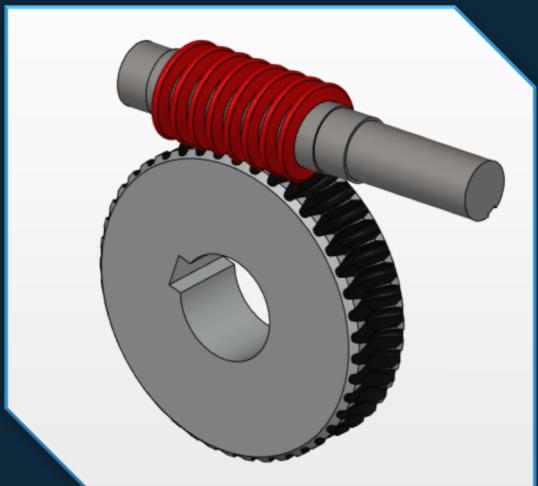
- Rotate in ϕ and θ directions
- Load one piece at a time
- Accelerate launch wheels
- Launch cart



3D CAD Prototype of Launcher



Rotation



- Worm drive on base
 - potentiometer for position reading
 - Stepper motor
 - High torque, low speed
 - Worm drive on launcher rail
 - Stepper motor - Accurate movement
 - Motor drivers controller with Arduino
 - 12 volt, 2.4 Amp
- 



Snack Loading ⏲

- Set snack due to budget limitations
 - Lemonheads
 - Can expand to more with increased time and budget
- Stored above launch cart, ready to load
- Loaded one at a time via corkscrew





Launch

- Launch Cart
 - Rest out of reach of launch wheel
 - Bump into wheels via electromagnet
- Launch Cart Accelerated by launch wheels
- Hits stop, snack continues on trajectory
- Wheels stopped, launch cart returns



3D CAD Prototype
of Launch View





Project Milestones





Milestone

- Week 1
 - Finalize Mechanical Launcher Design
 - Spec and order Lidar Sensor
 - Select and order webcam
- Week 2
 - Spec and order motors, motor drivers, and power supply
 - Model lidar sensor reading to actual values





Milestone

- Week 3
 - Detect face and find center point
- Week 4
 - Complete 3D print and assembly of mechanism
 - Complete model relating distance to a desired trajectory





Milestone

- Week 5
 - Test and verify motors and drivers
 - Week 6
 - Command Arduino to move webcam to desired position
 - Integrate lidar sensor into launcher
- 



Milestone

- Week 7
 - Model launcher input to desired trajectory
- Week 8
 - Initial integration of facial detection, distance finder, trajectory and state calculation, and launcher





Milestone

- Week 9
 - Demonstrate that system works, even if with a few bugs or problems
- Week 10
 - Demonstrate final, working system, as intended





Bill of Materials



Parts List 💰

Parts / Materials	Estimate Cost
Lidar sensor	\$39.90
Logitech C615 Webcam	\$31.99
2 * stepper motor	\$25.99
2 * stepper motor driver	\$9.89
servo	\$3.01
2 * BLDC motors & 2 * BLDC motor drivers	\$29.98
electromagnet	\$8.50
Total	\$149.26



Summary

Fully automated snack launcher with facial detection

Commercial Purpose: convenient and low cost

Education Purpose: accessible material for teaching robotic system



Acknowledgements

CAD

- ❑ YaDo. “Worm Gear.” GrabCAD, 21 Feb. 2019.

Facial Detection

- ❑ Instructables. “Face Detection and Tracking With Arduino and OpenCV.” Instructables, Instructables, 30 Oct. 2017.
- ❑ “OpenCV Library.” OpenCV Library, opencv.org/.

Related Projects

- ❑ Knox, Pamela. “Beer Throwing Fridge.” YouTube, YouTube, 23 May 2007.
- ❑ personalbeerrobot. “Personalbeerrobot.” YouTube, YouTube.
- ❑ Videos - Cooler Cannon, www.coolercannon.com/videos.htm.



Acknowledgements

Sensors and Parts

- DrewTalks. “Logitech C615 VS C920 Side by Side Comparison.” YouTube, YouTube, 14 Oct. 2017.
- “‘Eyes’ for Autonomous Mobile Robots - ‘3D LiDAR’ Enables 3D Detection of Distances with Wide Angle of View | Panasonic Key Technologies.” Panasonic Newsroom Global, 4 Oct. 2017.
- IndianConsumer, Ur. “Logitech C270 HD Webcam Unboxing & Review by Ur Indian Consumer.” YouTube, YouTube, 9 June 2016.
- “LIDAR System (Light Detection And Ranging) Working and Applications.” ElProCus, 7 Dec. 2017.
- Khan, Zak. “Stepper Motor, Brush Dc, and Brushless Motors.” Motion Control Tips, 22 July 2015.



Thanks for listening

