

## Identify the need

~~Adapt the universal jamming gripper to fit FTC requirements~~  
~~Adaptive reverse engineering~~

Find a universal method to pick up small objects using this year's design challenge as an example

## Describe the need

### Customer needs

Pick up small objects

Place them in designated areas

Describe

## Existing approaches

UJG

Human hand mimic

## Constraints and requirements

Must fit FTC material guidelines (there's a lot)

## Important allowed parts

PVC anything

Rubber

## Important banned / not mentioned parts

Coffee grounds

Non-tetrix motors

Hose fittings

Non-tetrix battery packs

## Qualitative requirements / constraints

Strong enough to grab and lift an object

Must transport objects efficiently and quickly

Must fit FTC material guidelines (basically Tetrix only)

Can take the occasional violent blow

## Quantitative equivalents

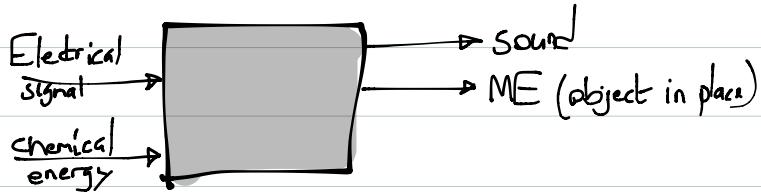
$\geq 3/0.257 g \times 9.8 \text{ m/s}^2$  (the force to lift  $\geq 6$  blocks)

100 points / 90 secs (if we want to crush the competition)

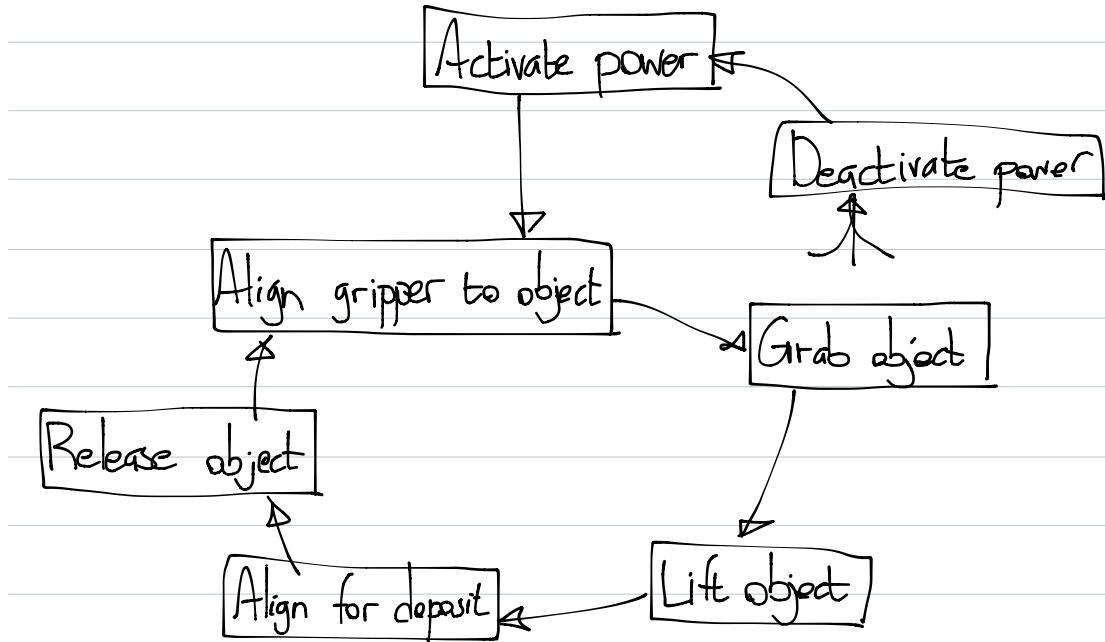
See rule book

Retain shape while under  $\frac{15 \text{ kg} \times 9.8 \text{ m/s}^2}{\text{cm}}$  of pressure  
(basically the robot resting on it)

## Black box model of an object transporter



## Functional model of a gripper



## How to make each function better

Align gripper to object

BIGGEST CONSUMPTION OF TIME - make auto-alignment

Grab object

Suction, gripper, object funnel

Lift object

Arm, sliders, conveyor belt

Align for deposit

Autonomous alignment

Release object

See grab object

## List of concepts

UJG (banned)

Bulldoze

Human-like hand

Teleportation

Throwing/catapult

Magnetism

Hook shot

Prongs

Conveyor belt

Claw

Scooping + hopper system

Suction

## Generate

## List of past/present objects

Blocks

Tubes

Racquet balls

Rings

Tennis balls

Crates

Rings again

Hockey pucks

Soft balls

## Concept grouping

### Conforms to object arrangement

UJG

Human-like hand

Teleportation

Magnetism

Hook shot

Scooping + hopper system

Suction

### Requires pre-alignment

Bulldoze

Prongs

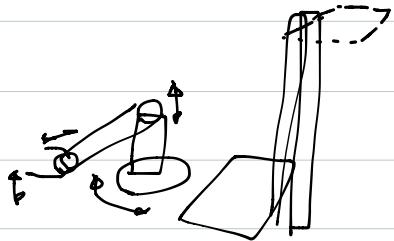
Conveyor belt

Claw

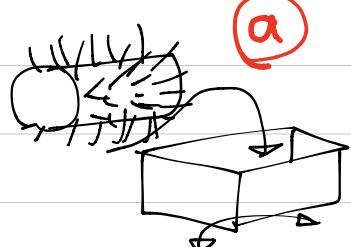
# Concept sketching

Intelligent arm + litter combo

①

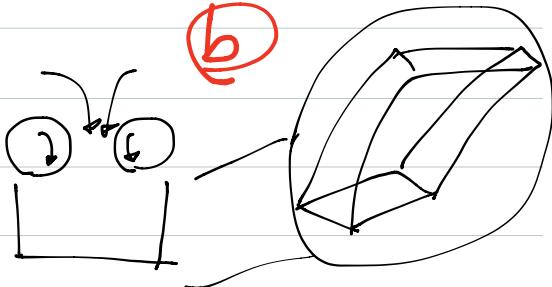


②

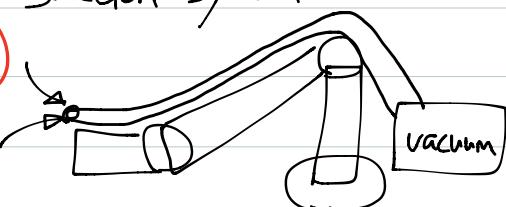


a

b



③



Suction system

## Pugh chart

	current design	①	ⓐ	ⓑ	③
Adaptability	+	+1	-1	-1	+1
Efficiency	0	0	+1	+1	0
Strength	-1	-1	+1	+1	0
Estimated cost	0	+1	-1	0	-1
Simplicity	-1	-1	+1	+1	-1
Power consumption	-1	+1	0	0	-1
Novelty	-1	+1	-1	-1	+1
Total	2	0	1	-1	

Idea 1 complies with the following objects nicely:

Blocks

Tubes

Racquet balls

~~Rings~~

Tennis balls

Crates

Rings again (on the floor)

Hockey pucks

Soft balls

For the above reasons I am choosing idea 1

## Embody

For auto-align to become a reality, Sensors will be needed

### Available sensors

Ultrasonic	Angle
Color	Barometric
Light	Color V2
Encoder	Force sensor
Compass	Gyro
Accelerometer	PIR
Sound	Magnetic
Touch	EOPD
Infrared	

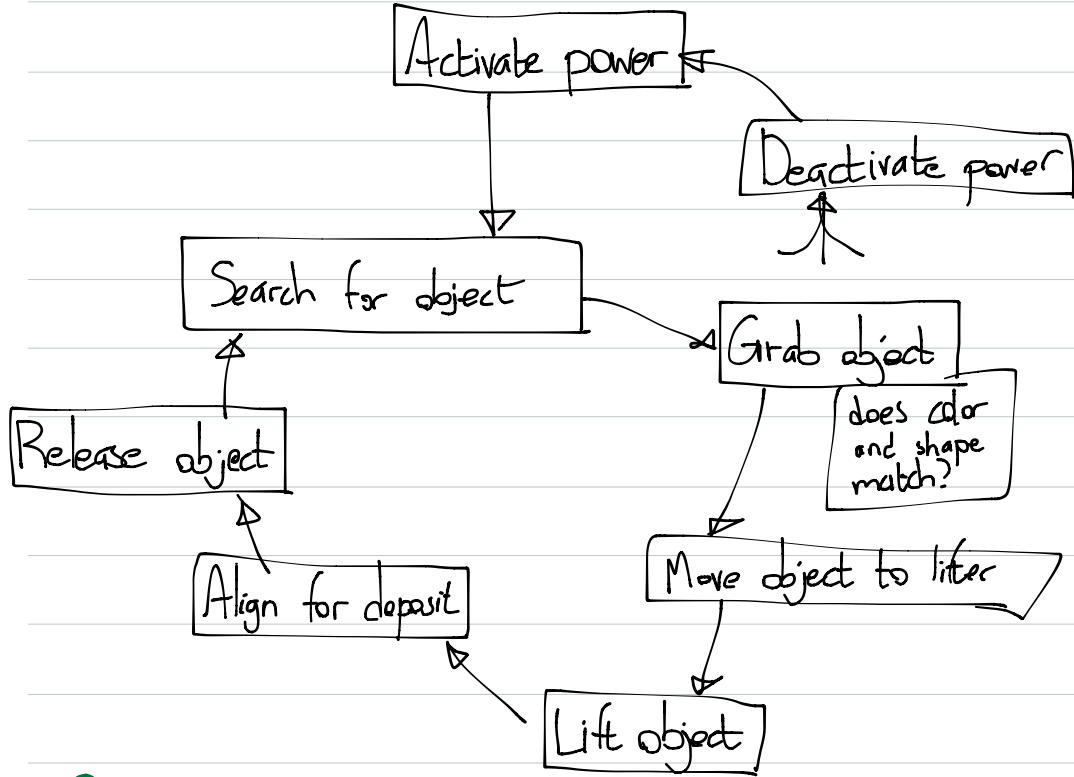
## Describe

New functional model for object detection system

### Common properties of objects

Color  
Contact  
Weight  
Shape

Blocks  
Tubes  
Racquet balls  
Rings  
Tennis balls  
Crates  
Rings again (on the floor)  
Hockey pucks  
Soft balls



Questions about sensors to find out:

Range of color sensor?

How much detail can ultrasonic detect?

To grab from robotics tomorrow:

Any sensor possible

Tetrix channels

Screws and bolts

Servos

A motor or two

Full controller-NXT-battery set up

Heat gun & plastic sheeting