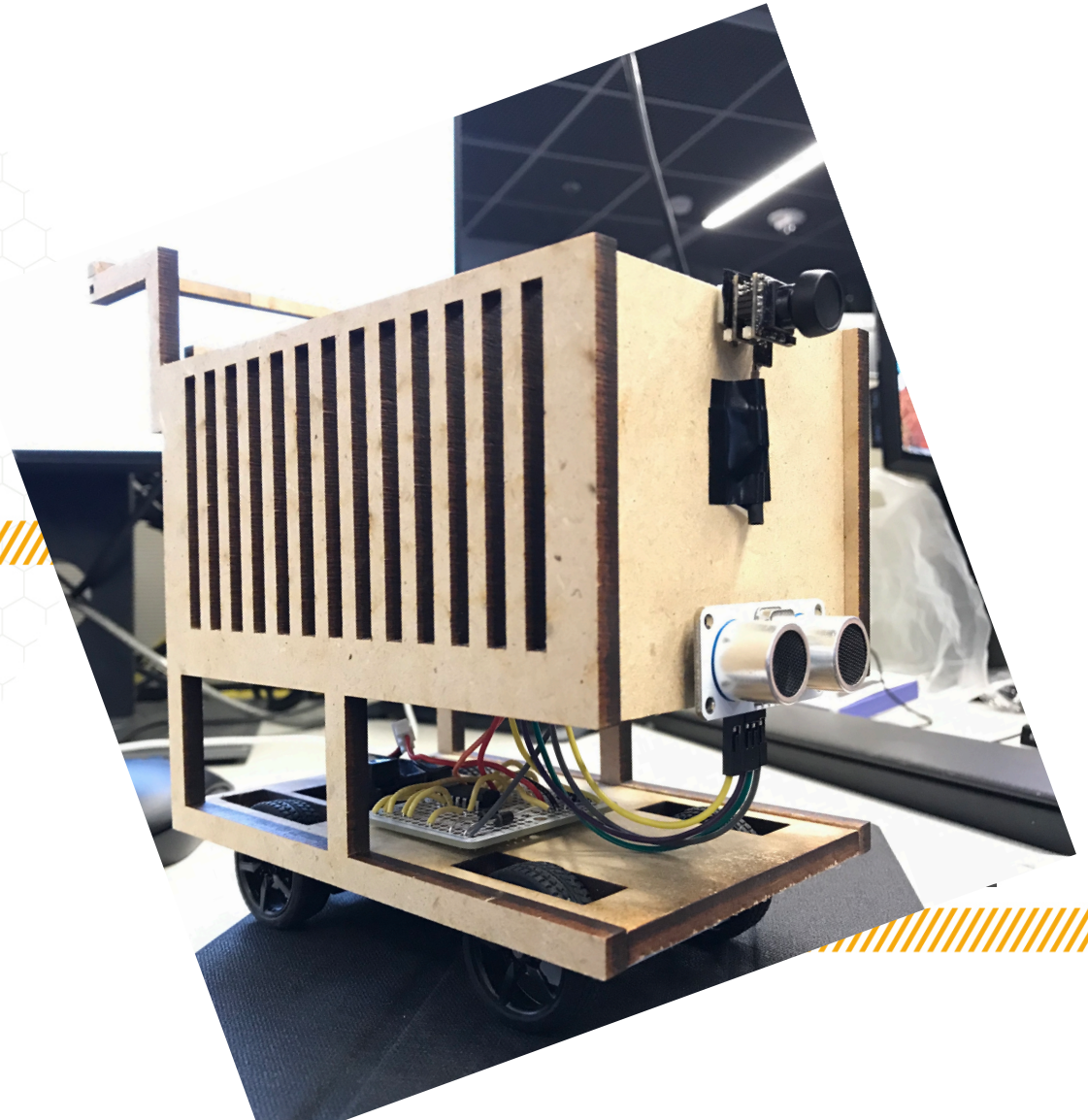
OBJECT RECOGNITION SYSTEM WITH MOBILITY



SEONG WOOK CHOI
EUN CHANG PARK

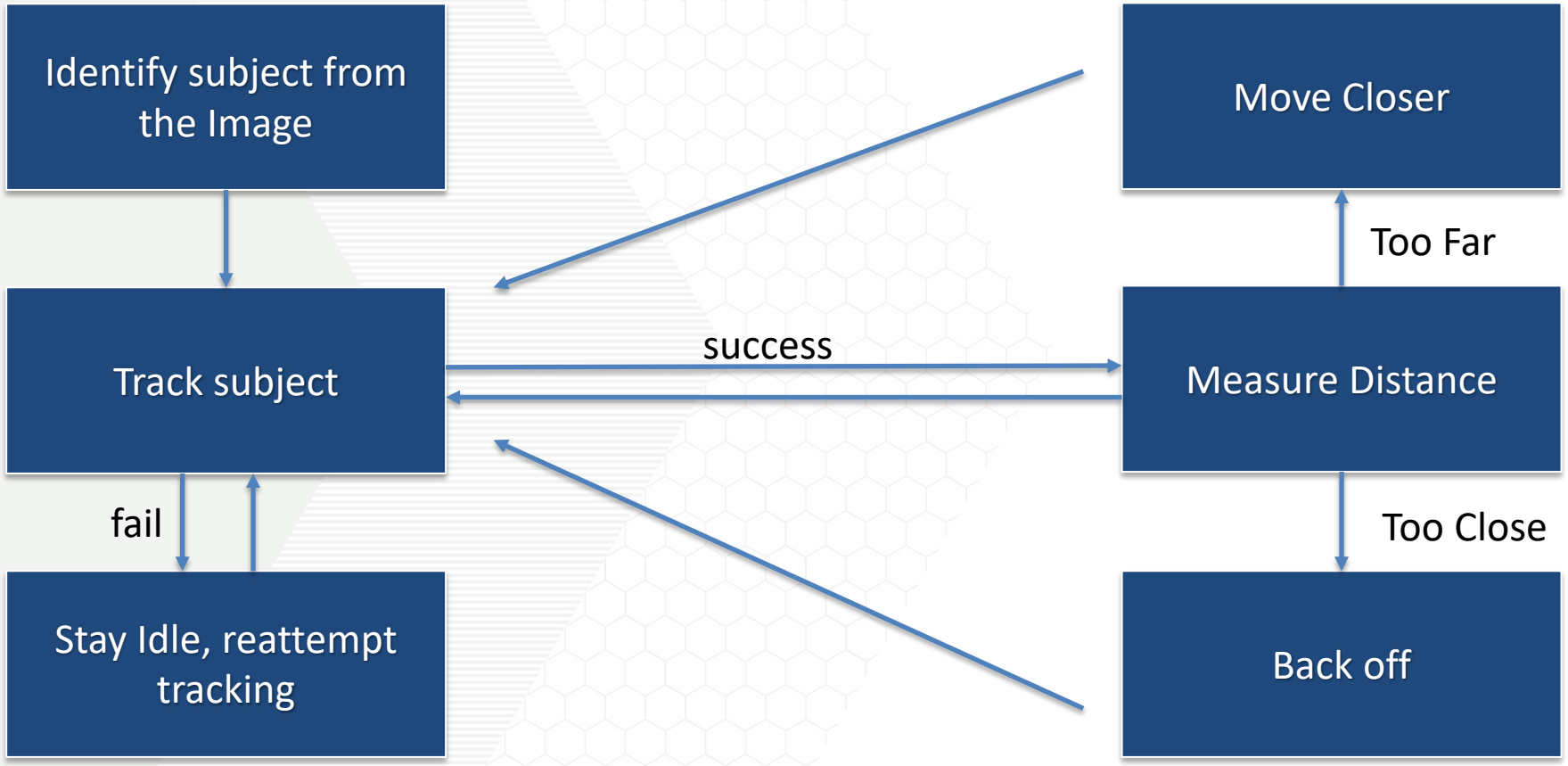
MOTIVATION

- Allow more convenient way to maneuver wheeled objects such as shopping carts and strollers.
- Eliminate the need for individuals to keep their hands on the objects at all times.
- Reduce accidents that occur from careless mistakes.

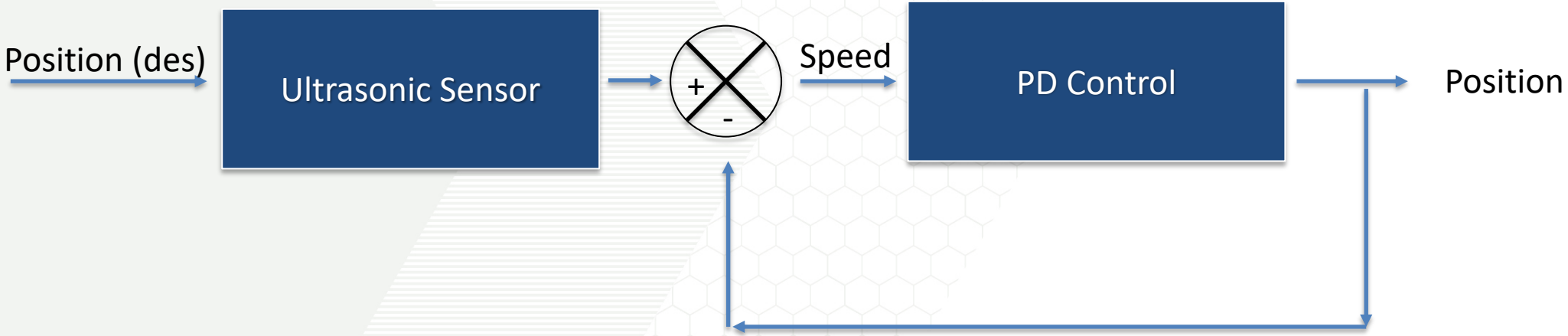
GOALS / PERFORMANCE REQ

- Create a four wheeled system to recognize and follow an object while maintaining a constant distance from the subject.
- Implement object tracking algorithm to recognize and follow a set object.
- Implement a system where the distance maintained can be varied.
- Differentiate forward and backward movement through the use of a sound system.

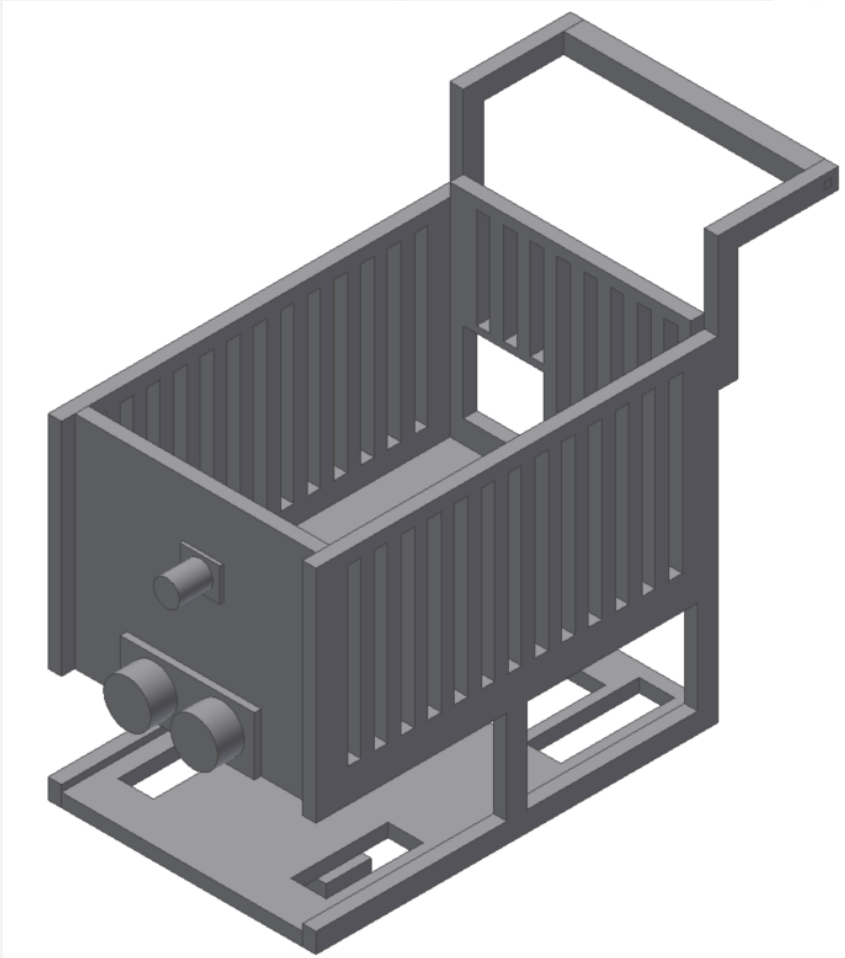
SYSTEM OPERATION



PD – POSITION CONTROL



MECHANICAL LAYOUT



- Outer mechanical design is based on the real world shopping cart.
- All of the outer component is manufactured with laser cutting using MDF wood board.
- Ultrasonic sensor and camera is placed in front of the miniature shopping cart to obtain measurements.

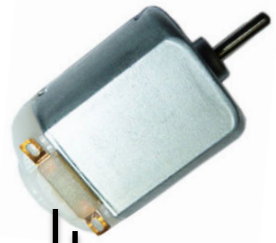
CIRCUIT DIAGRAM

Wireless Receiver

OpenCV Image Tracking

HC-SR05
(ultrasonic sensor)

M1N10
(motor)



MSP 432

P 2.6 & P 2.7
Trigger & Echo

P 1.2 & P 1.3
Serial Comm

P 2.4 & P 2.5 PWM output

H-bridge

TI L293DNE

P 4.4

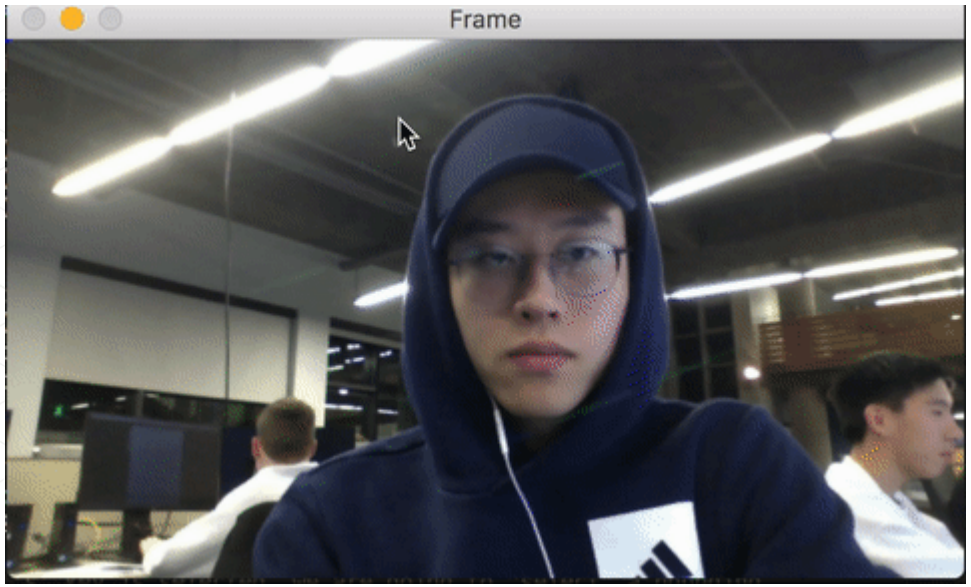
3.3V Battery

PAL Mini VTX 600TVL Camera

VMA319(buzzer)

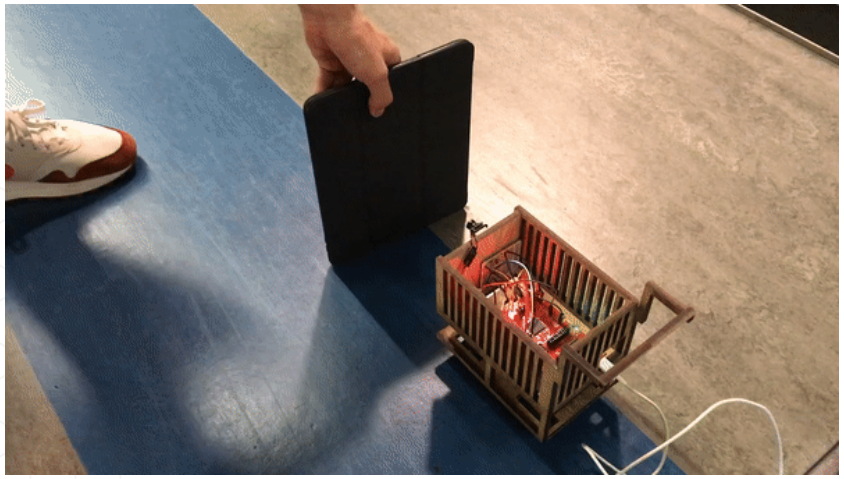
OPENCV OBJECT TRACKING

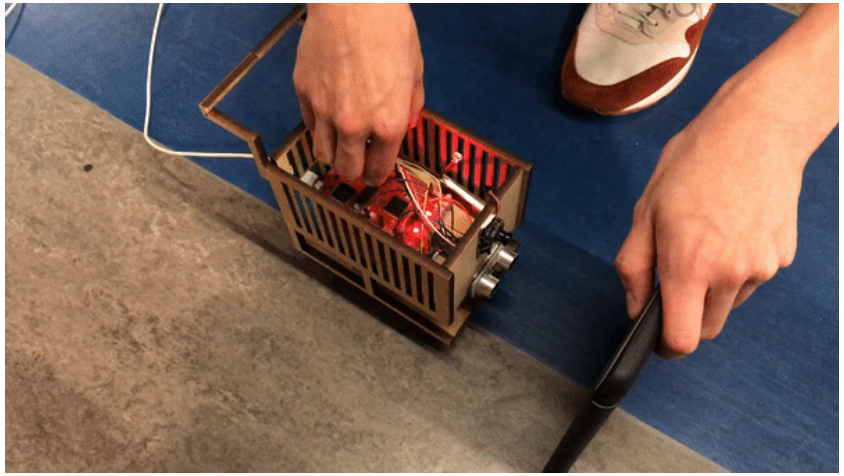
- OpenCV (Open Source Computer Vision Library) was used for object tracking in this project.
- Out of many available tracking algorithms, Kernelized Correlation Filters (KCF) was used due to its advantages in recognizing occlusion, and stability.



RESULTS

- Successful implementation of every proposed goals
- PD control implemented successfully
- PD control not as accurate due to cheap motor (starts abruptly to overcome static friction)
- Camera resolution low – causes problems in tracking object





CHALLENGES

- Using two separate coding languages to communicate with one another (Python and C)
- Calibrating the Motor so that it would not overshoot – PD control
- Implementing PWM along with other interrupts and input/output pins
- A delay in the image when it is transmitted from the camera.

FUTURE IMPROVEMENTS

- Motor with smaller dead-zone (can overcome static friction better) for more accurate control of position.
- Camera with better resolution and less delay for more accurate object tracking.
- Implement extra actuators for 2-DOF system.
- Wireless connection or embedded system to transmit the data from object tracking processor to the MSP.

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