PingPongBot

Team 03 CDR
Advisor: Professor C. Andras Moritz

Goal

- To create a system that will autonomously collect ping pong balls and can be started remotely.

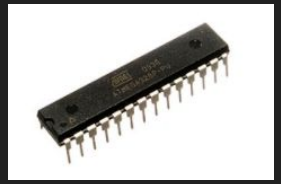
System Specifications & Testing Plans

System Specifications	Testing Plans Testing Field: 4m*6m indoor floor
• Accuracy: System should be able to collect 80% of the balls in the field • Efficiency: System should be able to collect 20 balls within 5 minutes	1. Randomly place 25 balls in the testing field, start the robot and test if it can collect 20 balls within 5 minutes, record number of balls and the collecting time 2. Test 10 times and find mean of number of balls and corresponding collecting time, consider a pass if can collect 19 balls in 5.25 minutes

System Specifications	Testing Plans Testing Field: 4m*6m indoor floor
• Capacity: System should be able to collect no less than 40 balls within one trail, that is a removable bucket which can hold up to dozens of balls ✅	3. Test the capacity of the inside container of the design by feeding balls in front of the prototype and wait for the balls to be sucked into the vacuum system. Record the maximum number of the balls (48)
• Remotely turn on: System should be turned on remotely ✅	4. Test if the system can be turned on remotely using bluetooth and accordnate app on a cell phone anywhere at least 6m away from the robot 5. Test at least 20 times, record result as T or F. Consider a pass if 95% of the results are T

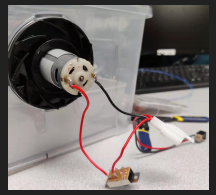
Hardware Components

ATmega328p



Chassis

Vacuum Motor



Vision Sensor Pixy2

Straight and Tilted Plastic Tubes

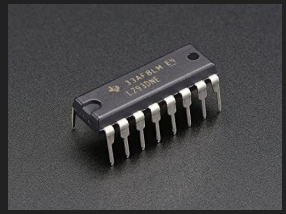
C-SR04 Distance Sensor

Wheel Motors

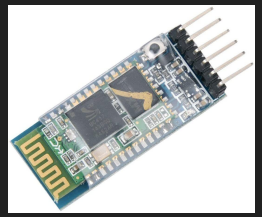
6V & 7.4V DC Batteries

G6E-134PL-US Relay

2 L293D Motor Drivers



HC-05 Wireless Bluetooth

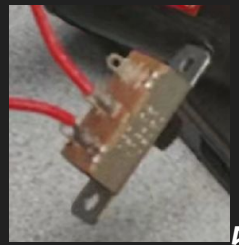


Plastic board

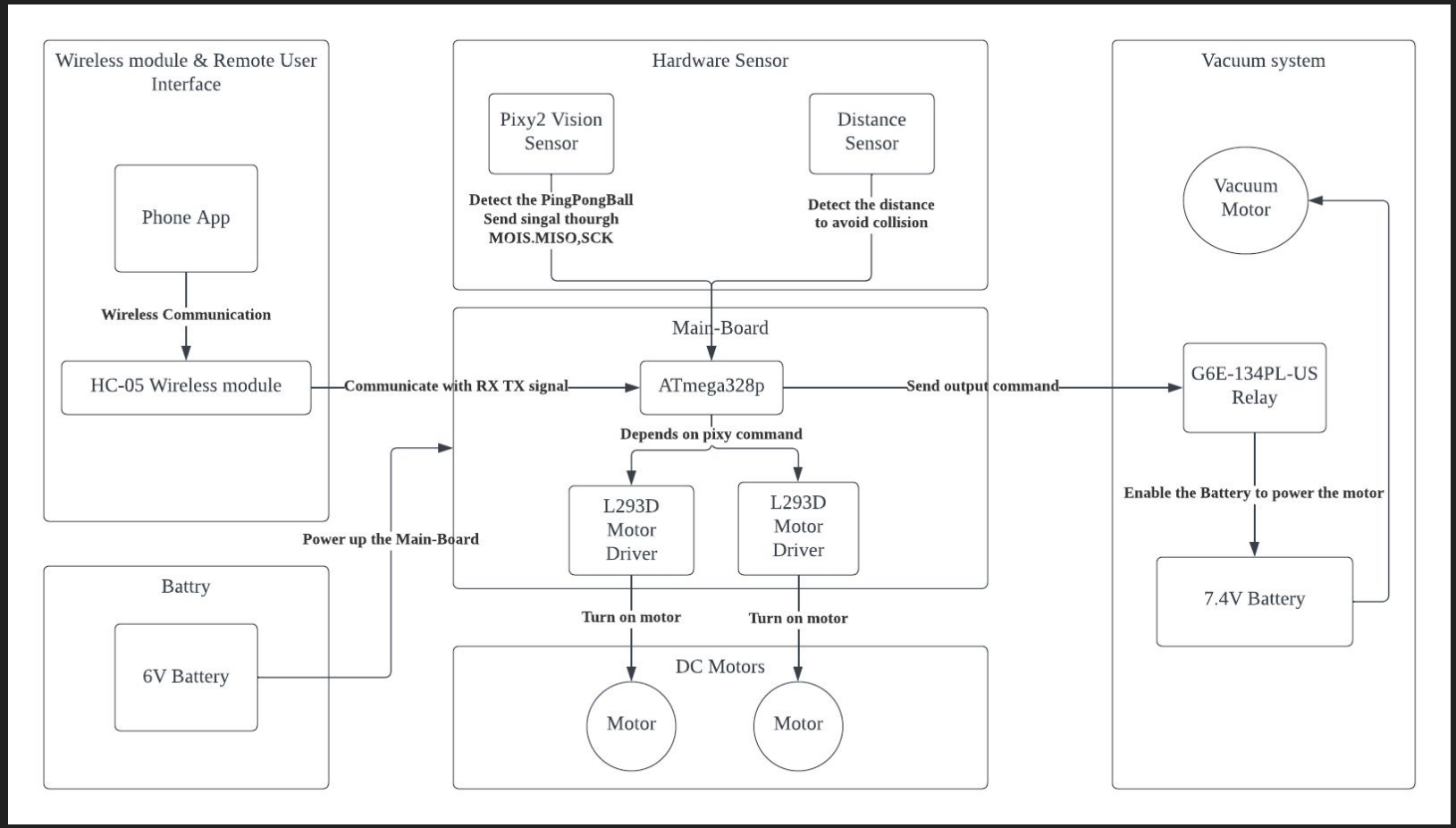
plastic Container

Inside Container

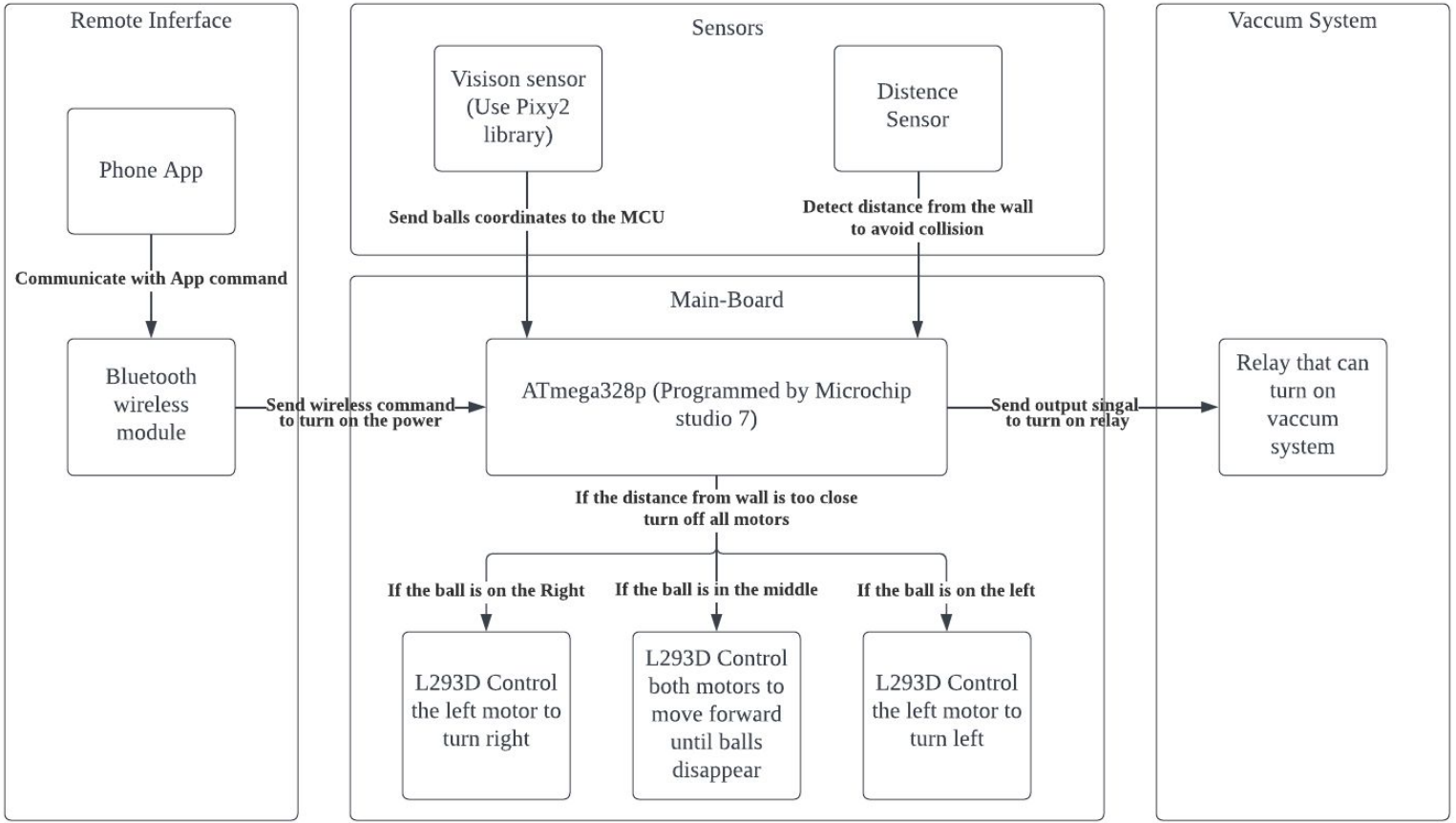
2-stage, six pin toggle switch



Hardware Diagram



Communications



Custom PCB

https://www.altium.com/viewer/

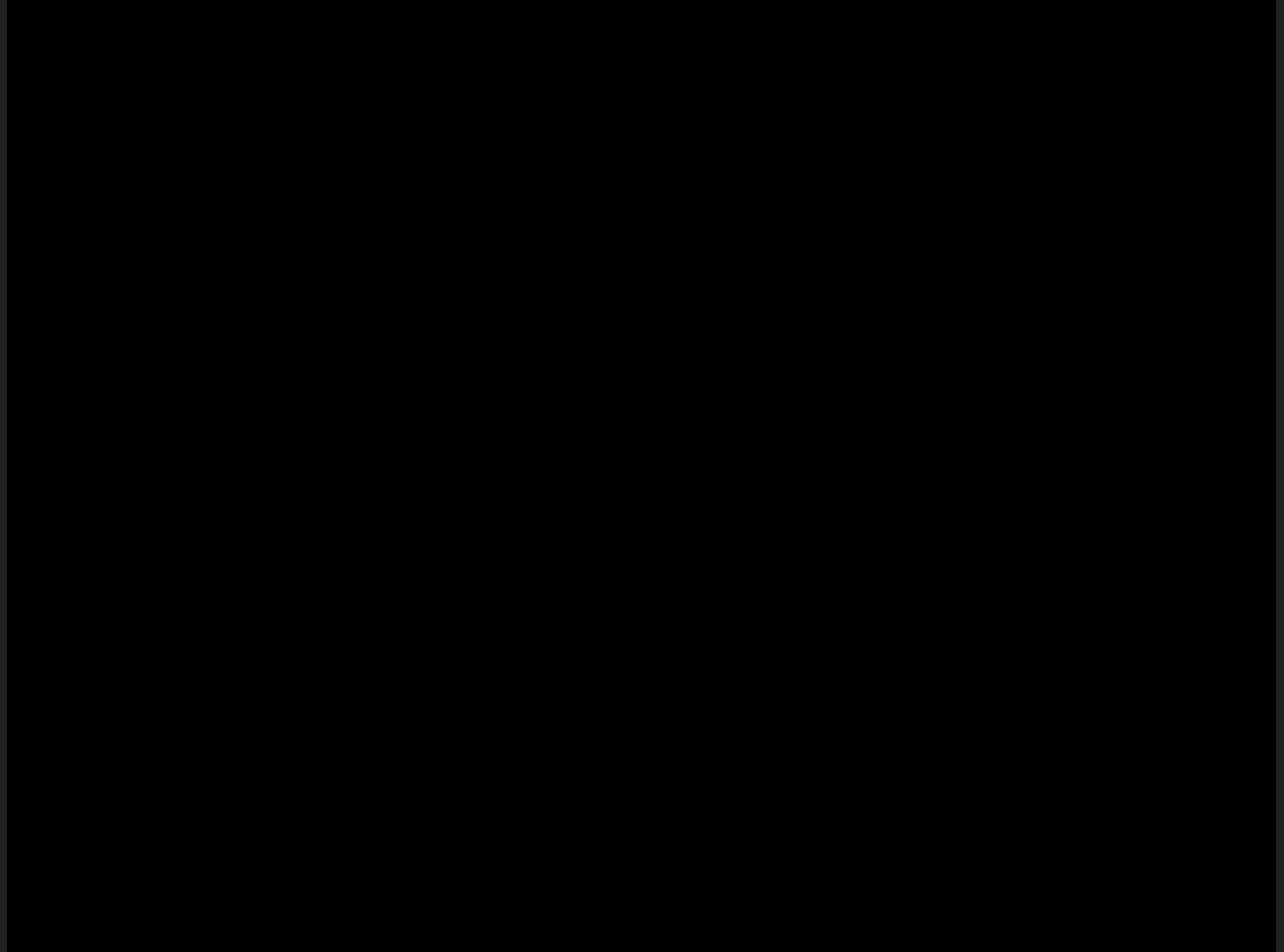
- Schematic and board layout are shown and explained
- Please see document of PCB in Slack Team03 Channel

Demonstration of Prototype

- Our Solderless breadboard with the Atmega328p chip didn’t work, because we haven’t successfully read ICE box signature while we plug in the Pixy2, we went back and used Arduino Uno for this prototype.
- The difference from MDR is instead of testing the Pixy2 vision sensor separately last time, we were able to add pixy2 to the prototype and let it tells the wheels where to go for picking the ball.

- Please see our demo video using the following link

https://drive.google.com/drive/folders/1K3PEp1gIkRH4MRca-F5K3wq5ni3rNVPH



FPR Plan

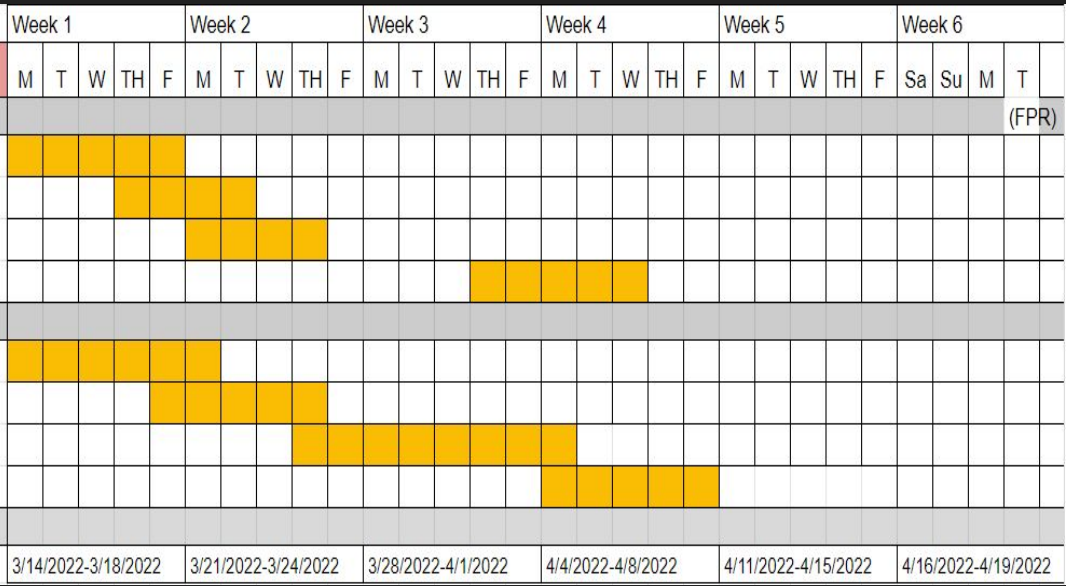
- Mean difference: A working PCB version of the system, remove Arduino board out of the system.
- Have the Solderless breadboard version work the week after Spring break. In the meanwhile, adjust the custom PCB accordingly, and order a second version.
- Test each system specifications according to testing plans at least 10-20 times. Refine the system or the algorithm until meeting the specification with an error less than 5%.
- Have a five-minute demo video as proof of a success completion of testing plan 1: collect 20 balls within 5 minutes (Page3). During FPR, go to the hall way and place 10 balls randomly on the floor and do a live demo of the prototype finding and picking up balls.
- Give documented test results of each testing plan, perform simple data analysis and conclude if the prototype meets each specifications.
- Plan for hardening the prototype. Connect everything on PCB and adjust the right angle of Pixy2 camera. Use shortest wire to make the circuit cleaner.Add distance sensors and program a obstacle avoidance system

Project Expenditures

Item	Projected Cost	Current Cost
Ping-pong Balls	$15	$14.99
Vacuum Pump	$50	$38.99
Pixy2 Vision Sensor	$60	$59.90
Early PCB Revisions	$110	$53.6
Final PCB Revisions	$100	N/A
6V & 7.4V Battery	$30	$27.24
HC-SR04 Distance Sensor	$20	$12.59
Motor	$25	$86.51
Robot Chassis(Wheels, Removable Basket, Plastic Tube)	$60	
Atmel-ICE Box Debugger	$200	$212
Self bought 16mHz crystal, FTDI to TTL Serial converter	$0	$16.94
Total	$700	$522.76

Gantt Chart

Task Name	Start Date	End Date	Team Member(s)
Hardware			
Breadboard Version of Prototype	3/14	3/18	Tao & Zhang
Implement pixy & distance sensor	3/17	3/22	Tao & Zhang
Second Version of PCB	3/25	3/27	Tao & Pan
Final Version of PCB	3/28	4/8	Pan & Zhang
Software			
Program motors, buletooth & pixy2	3/14	3/23	Tao & Zhang
Second Route Algorithms	3/18	3/26	Pan & Zhang
Finalize the Route Algorithms	3/26	4/4	Tao & Pan
Return to Base Algorithm	4/4	4/11	Tao & Pan



Team Responsibilities

Huiyu

Budget Lead

Design the Circuit of Vehicle Motor System

Program the Vehicle Motor System & Pixy Vision Sensor

Program Distance sensor

Program Path Routing Algorithm

Soldering Components

Xumeng

PCB Lead

Design and Revise PCB

Design and Test Bluetooth Control of Vehicle and Vacuum System

Design and Program Path Routing Algorithm

Perform Testing Plan

Mingrun

Team Coordinator

Design and Assemble the Main Board Configuration

Test and Revise Vacuum, Vehicle Motor System & Pixy Vision Sensor

Test Collecting & Basket Capacity

Perform Testing Plan & Result Analysis

Soldering Components

Q&A

Thank you for watching!