

EE106A/206A / BIOE125
Project Proposal Template
Fall 2017

1 Contact Information

Name	SID	Email
Haofan Wang	3033483641	haofanwang@berkeley.edu
Jingjun Liu	3033483513	liujingjun@berkeley.edu
Jiarong Li	3033483511	jiarongli@berkeley.edu
Neal Sanghvi	26356177	neal.sanghvi@berkeley.edu

2 Abstract

Our project is about how to teach Baxter play Sokoban game which is a type of transport puzzle, in which the player pushes boxes or crates around in a warehouse, trying to get them to storage locations. First we control the camera to capture the environment and locate the position of boxes and walls, then we will control Baxter through keyboard or gestures to move or push the exact box as we want, if we carry a forbidden moving direction, we will receive warning from Baxter, step by step, finally, Baxter can push the box to a position we desired.

3 Project Description

- Goals: Control Baxter robot to play Sokoban using either the arrow keys on a keyboard or gesture control.
- Criteria: Teach Baxter rules of Sokoban, warn us when rules are violated, and have it be able to play the game. If it has reached the destination, it will stop.
- Interesting: Robot is playing a game! Future implications: robot gaming in general automated, more complicated
- Sensing, Planning, Actuation: We use camera to sense the environment which is a map here, and gestures later. Camera will locate the position of our box and walls. Then, we will write code to teach Baxter the rules of Sokoban, and how to move to a given position, Baxter will have its own understanding of Sokoban, which means that even Baxter acts according to our inputs, but it knows that whether we input a forbidden command or whether we have finished this game. After receiving feedback of camera and keyboard inputs, Baxter will move its arm and act according to input information.
- Similar Groups: Robots have played games before, chess, etc.

4 Tasks

1. **Build the robot.** Baxter already built
2. **Code the robot.** We will program the robot using Python and ROS.
 - (a) **Part1** Design the map (start with fixed and then move on using AR tags)

- (b) **Part2** Transform the camera frame to the table frame
- (c) **Part3** Teach Baxter rules of Sokoban, when some threshold value is eclipsed in some node, then Baxter complains:(1)Cannot push two boxes at once,(2)Cannot push box past barrier,(3)Stop when arrive in destination.
- (d) **Part4** Add function of gesture recognition,replace keyboard inputs with gestures input which is captured by camera.
- (e) **Part5** In order to fit more complex world,teach Baxter to play itself given any admissible initial map.We use gestures as starting signal,Baxter play itself,and stop when it arrive in destination it believes.

5 Milestones

Here, list your milestones and when you plan to achieve them. You may either list them out (task by task, with corresponding dates) or create a [Gantt chart](#).

6 Assessment

- How to assess: Whether Baxter can play the game as we expected,for example,Baxter can always push the right box to the position we command.That is to say we successfully achieve realistic goals below.The desired goal is optional.
- Realistic goals: Baxter can play it according to keyboard commands.
- Desired goals: With gestures control, Baxter play according to gesture commands rather than keyboard inputs.Then,let's go deeper,Baxter can play itself.Given any consistent initial map,without any input such as keyboard or gesture,Baxter can act according to its own algorithm.

7 Team Member Roles

- Haofan will be in charge of whole project,and he will write the code of Part3 to part5.His backgroud is in artificial intelligence and computer vision.He has taken courses about algorithms and image processing,and he is taking CS188 and EECS127 besides EECS106A this semester.He is good at utilizing the camera to understand the environment.
- Jiarong will be in charge of Part3 and Part5. His background is in electronic engineering, and he is experienced in image processing and have rich research experience in this filed.
- Jingjun will be in charge of Part1 and Part2.His background is in mechanical engineering.He is familiar with ROS and experienced in building the map using AR tags.Especially,he is good at Dynamic of robotics.He will assist Haofan and Jiarong controlling the arm of Baxter when coding.
- Neal will assist Jingjun to finish Part1 and Part2,and after that,he will devote himself to help Haofan and Jiarong write and check the code.He is unfamiliar about Robotics,but he is eager and excited to do it.

8 Bill of Materials

8.1 Use of Lab Resources

Item	Quantity
Baxter	1
AR tags	10
Table	1

8.2 Other Robotic Platforms

You may already have access to other robots, via a lab you work in (or a quadcopter hobby). If you plan to use them, please list them here. (If you plan to use your lab's hardware for the project, make sure to clear it with the PI first!)

Item	Quantity	Owner/Location

8.3 Items for Purchase

For new items you want to purchase, please include the price, desired quantity, a website where they are available for purchase (e.g., McMaster, Misumi, Amazon), and justification for why they're necessary for your project. For more expensive items, you will need to justify why you are unable to use hardware that is already available in the lab. Keep in mind the limited budget.

Item	Quantity	Price	Website	Justification

9 Other

This section contains all additional information necessary to convince us that *a)* you are equipped to complete the project you propose, and *b)* you have thought specifically about your project implementation. This section is optional, but some things you might mention include:

- ROS packages you'll need (with pointers to relevant websites);
- preliminary code structure/skeleton; and
- mechanical designs/drawings/sketches of your project.