Amar Bhatt, Rasika Kangutkar
Principles of Robotics (EEEE-685) - Project Proposal

Objective:
Controlling a differential drive robot's path movement using a remote mapping interface. Using a camera that will view the workspace of a physical robot, a user will be able to draw any path on a remote application that the robot will follow in the environment.

Introduction:
Using MATLAB's interface for Serial Communication, a robot's movements will be controlled using an Arduino Uno. A user will be able to draw any path, and the robot will follow it based on commands it receives from the MATLAB interface. The robot will have fiducial markings on it so that the camera in the environment over the workspace of the robot can track its movements and direction to send as feedback to the path following software. This system will update the current trajectory as the robot follows the given path. OpenCV will be used to track fiducials on the robot to detect position and direction and be used as feedback for the control algorithm. MATLAB will be used to send movement commands to the robot as well as allow the user to draw any path for the robot to follow.

Equipment:

Item	Product	Quantity	Description	Cost
Robot	4WD Differential Robot	1	Main chassis for robot locomotion	PROVIDED
Bluetooth Module	HC-06	1	Used for wireless connection from MATLAB to robot	$7.00
Microcontroller	Arduino Uno	1	Used to control robot	PROVIDED
MATLAB	Student Version	1	Used to create interactive GUI and main software for interfacing camera and serial	FREE
OpenCV		1	Used for tracking	FREE
Fiducials		1-4	Used for tracking	FREE
Camera		1	To view robot workspace, feedback to control algorithm	$35.00

Systems:

Hardware (4WD Robot)

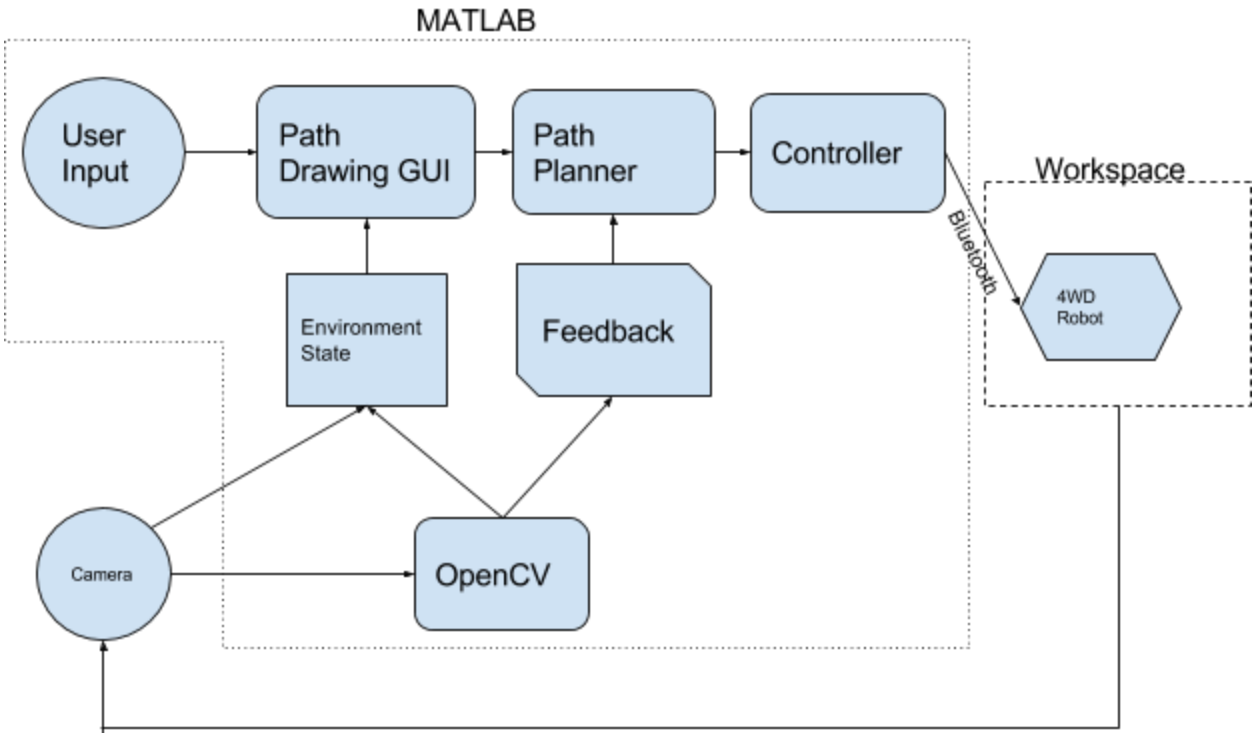
1. Chassis
2. Arduino Uno
3. Tracking Fiducials
4. HC-06 Bluetooth Module

Software (MATLAB)

1. Path Drawing GUI
2. Path Planner
3. Controller
4. Feedback Loop

Feedback (Visual)

1. Camera
2. OpenCV



Procedure:

1. Camera is set-up to view a bird's-eye view of workspace (6’ x 4’)
2. Robot is placed within workspace
    a. Robot has fiducials mounted to the top of it
3. Using OpenCV an image (current environment state) is generated that locates the robot
    a. Determines pixel to environment mapping based on fiducials
    b. Waits until robot is found
4. Feed annotated image to Path Drawing GUI
5. User is able to draw any path within this GUI over the annotated image provided
6. This path is then fed to the path planner
    a. The robot is homed to the first point it needs to be at
    b. The robot is oriented to face next point
    c. The planner goes point by point sending move commands to the controller
        i. Different threshold parameters are used to help with accuracy and path completion
    d. The planner takes in feedback from OpenCV on how well the robot is following the path and makes appropriate adjustments
7. The robot completes the desired path and awaits the next path