NEW YORK CITY COLLEGE OF TECHNOLOGY
DEPARTMENT OF COMPUTER ENGINEERING TECHNOLOGY

EMT2461 Electromechanical Systems: Software Interface

Midterm Project Proposal

Of

Colored Line Tracking Mobile Robot

Comment [L1]: Score: 80/100

The proposal is well organized and finely written. It has most of the required technical contents. The description of the proposed project is clear. The preliminary design, the circuit and the code, shows the team has done some research. Gantt's chart is also included. But this proposal needs significant improvement.

Section: E356

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Introduction and Motivation

What is a line follower?

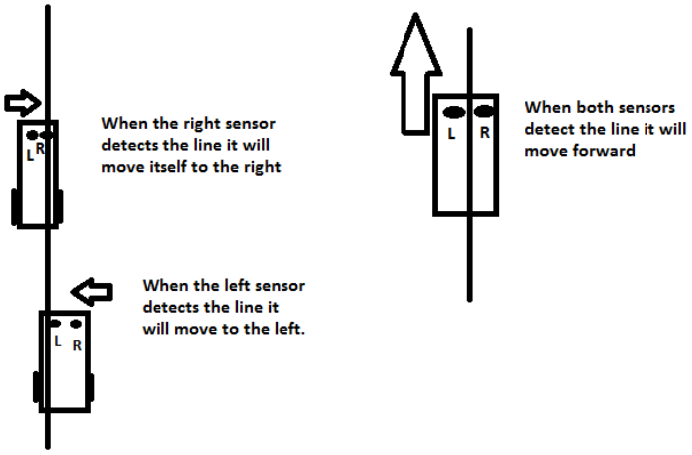
Line follower is an autonomous robot designed to follow a predetermined path (or line). The path usually a black on a white surface or vice versa. Using sensors to detect the line and maneuvers the robot to stay on course.

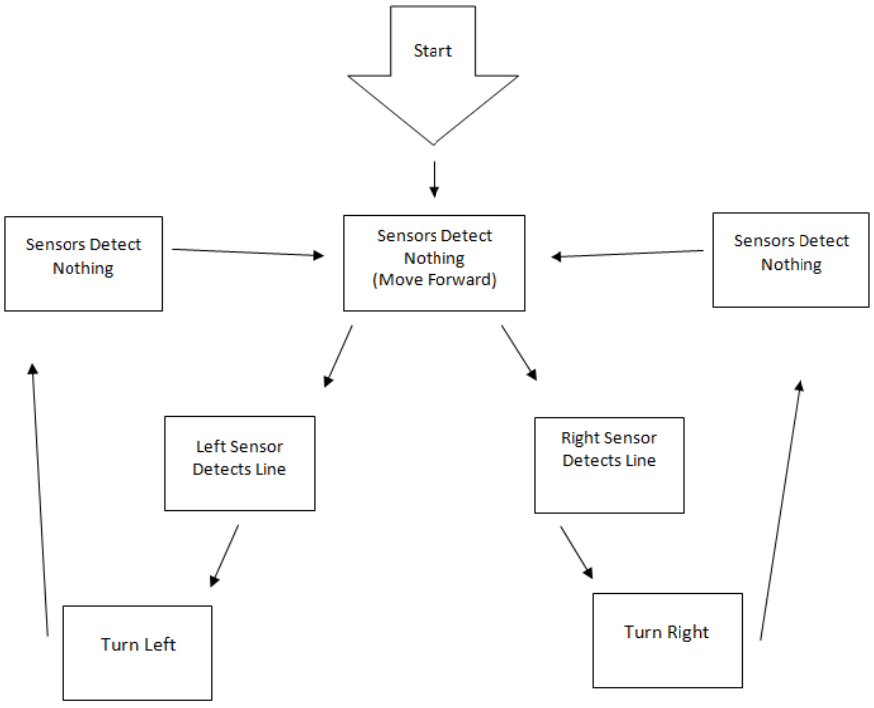
The path can be a simple black line with some curves or complex with sharp corners and even overlapping paths. The path for this project will be a basics loop. For now, the path will be similar to a horse race track, with some variation of arcs on the straight lines. The length of the whole path will be about 5-6 feet and width of the path itself will be about 1/2”-3/4”.

Comment [L2]: The description of targeted project setup is quite clear here!

(Can be subject to change.)

The path itself can be detected with an optical detector (or sensor). The Line Follower Robot will use photoresistor or known as Light Dependent Resistor (LDR) to sense the path and send the data to the Arduino and the DC motor speed will either increase or decrease in order to correctly navigate the path. For now, 3-4 sensors will be used to detect the path. With two sensors on either side of the path it will detect changes as the robot is in motion. When the path is in between the sensors, it moves forward. Right or left sensors detect the path and it will turn right or left respectively. First, sensors will be tested without extra light next to the photoresistors to see how they fair. Testing if the light from a room is enough to reflect light to the sensors. If the results prove promising, extra lighting may not be required.





Comment [L3]: This diagram is good. It clearly shows the action flow when the robot functions.

Parts:

- Arduino Uno
- 2 DC Brush Motors
- H-Bridge (L293D)
- Wheels
- Battery
- Wires
- 3-4 Photo Resistors
- Bluetooth HC-05
- Chassis
- Caster Wheel
- Breadboard
- Resistors

Comment [L4]: Need more details here: Brief description of the chosen parts, the reason that you choose these parts, and what subsystem/purpose they will be used for in your project!

Preliminary Design

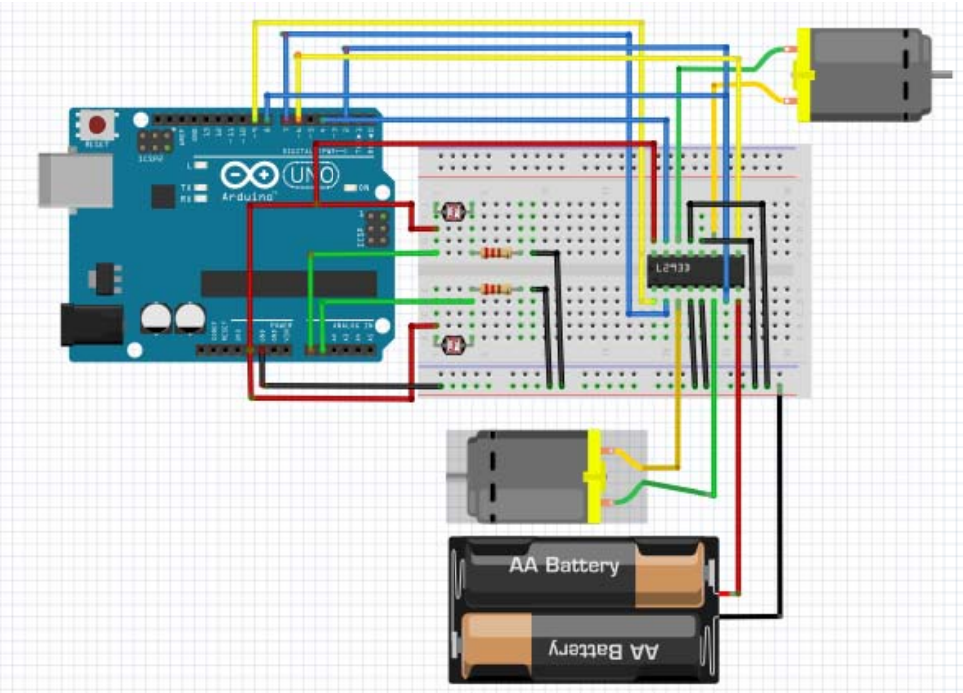
Wiring of the motor and sensors-

Comment [L5]: Need to include a preliminary system design! A wiring diagram of motor and sensor is just part of the system, not a design for the entire system.

A block diagram can be used here to show a preliminary system design.

After discussing a system design, then you can present any preliminary subsystem or subcomponent design you have, for example, the wiring schematic of the motor.

Comment [L6]: But in the following wiring schematic, it seems that no sensor is being used!



(Not final schematic.)

So far we have wired the motor and the sensors for the project. The motors are connected to the L293D IC-chip. The H-bridge drives the motors and is a way to drive them without connecting

them to the Arduino directly because it may blow it up and result in a delay in the project. The max amount of current the Arduino can provide is 200mA and that isn't enough to power everything were going to be using so we need an outside power source. You can use an H-bridge or transistor (BJT or MOSFET) to power the motors. The bipolar junction transistor can act as an amplifier which allows us to produce the current we need.

Preliminary coding

Comment [L7]: What this preliminary code is used for?

```
int enable1 = 9;
int input1 = 7;
int input2 = 2;
int enable2 = 6;
int input3 = 8;
int input4 = 4;
void setup(){
  Serial.begin(9600);
  pinMode(7, OUTPUT);
  pinMode(2, OUTPUT);
  pinMode(8, OUTPUT);
  pinMode(4, OUTPUT);
}

void loop(){
  digitalWrite(9, HIGH);
  digitalWrite(7, HIGH);
  digitalWrite(2, LOW);
  analogWrite(9, 170);

  digitalWrite(6, HIGH);
  digitalWrite(8, HIGH);
  digitalWrite(4, LOW);
  analogWrite(6, 170);
```

(Not final code.)

So far we got the code for the motor. In the code we setup the pins of the Arduino as an output to give the h-bridge and input. This input will be turned into a 1 or a 0 or in Arduino High or Low. We also set the PWM to the enable pin High to give the H-bridge a frequency to drive the motors at that speed we want. The speed will stay constant throughout. Once that is setup, you will be able to drive the motors and let it go forward. So far we've only got the motor code

Comment [L8]: It is better to explain the overall functionality of the code first. "Code for the motor"? What it exactly means? To control motor's speed or direction? How many motors to be controlled?

Also, it is absolutely necessary to place some explanation into the sketch as comments for corresponding line of code!

and working on the sensors. This is where we get most of the project done since the sensors is the major part since we got the h-bridge and motors running perfectly.

Potential modifications

-More complex track (loops and sharp turns)

-Adding LEDs to photoresistors

-Using a sensor array for more accuracy

-Moving backwards

-Controlling speed and direction from smartphone

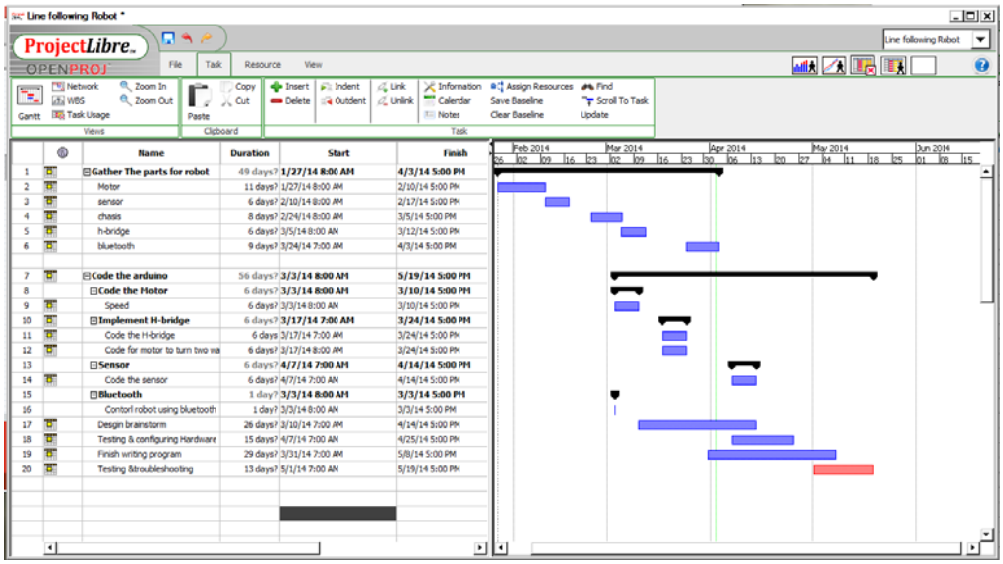
-Add LEDs as power indicator (ON, OFF)

-LCD (display speed and active sensors)

Project Timeline

Comment [L9]: Need to present Gantt Chart separately from the activity list! Showing a single screen shot that has both the list and the chart in parallel as in this figure makes readers not be able to view the chart detail clearly!

This project to build the line following robot will take about 4-5 months. We picked our project on January 27, 2014 and plan on working on it until May 19, 2014.



	Name	Duration	Start	Finish
1	Gather The parts for robot	49 days?	1/27/14 8:00 AM	4/3/14 5:00 PM
2	Motor	11 days?	1/27/14 8:00 AM	2/10/14 5:00 PM
3	sensor	6 days?	2/10/14 8:00 AM	2/17/14 5:00 PM
4	chasis	8 days?	2/24/14 8:00 AM	3/5/14 5:00 PM
5	h-bridge	6 days?	3/5/14 8:00 AM	3/12/14 5:00 PM
6	bluetooth	9 days?	3/24/14 7:00 AM	4/3/14 5:00 PM
7	Code the arduino	56 days?	3/3/14 8:00 AM	5/19/14 5:00 PM
8	Code the Motor	6 days?	3/3/14 8:00 AM	3/10/14 5:00 PM
9	Speed	6 days?	3/3/14 8:00 AM	3/10/14 5:00 PM
10	Implement H-bridge	6 days?	3/17/14 7:00 AM	3/24/14 5:00 PM
11	Code the H-bridge	6 days	3/17/14 7:00 AM	3/24/14 5:00 PM
12	Code for motor to turn two wa	6 days?	3/17/14 8:00 AM	3/24/14 5:00 PM
13	Sensor	6 days?	4/7/14 7:00 AM	4/14/14 5:00 PM
14	Code the sensor	6 days?	4/7/14 7:00 AM	4/14/14 5:00 PM
15	Bluetooth	1 day?	3/3/14 8:00 AM	3/3/14 5:00 PM
16	Control robot using bluetooth	1 day?	3/3/14 8:00 AM	3/3/14 5:00 PM
17	Design brainstorm	26 days?	3/10/14 7:00 AM	4/14/14 5:00 PM
18	Testing & configuring Hardware	15 days?	4/7/14 7:00 AM	4/25/14 5:00 PM
19	Finish writing program	29 days?	3/31/14 7:00 AM	5/8/14 5:00 PM
20	Testing &troubleshooting	13 days?	5/1/14 7:00 AM	5/19/14 5:00 PM

This picture above shows our plan/schedule on when we're going to get things done for the line following robot. This schedule can change depending on if we get the coding and the building aspect of it correct.

Here we highlight the subtasks that we plan to do through the timeline listed in the Gantt Chart. In the beginning we are going to gather the parts we need for the line following robot. The main items we need for the project are the Dc brush motors, H-bridge, Sensors (Photoresistor), and Bluetooth. Once we have the items, we are able to learn how to code them and start our design on how we want to design the robot. During the process of ordering the items, once we receive one item, we are going to try to code that item so we aren't falling behind schedule and allow us to focus on the other component when it comes in.

We are going to take it step by step to make sure one component of our project is working before we move on. This is because everything will have to be correct or else the entire robot won't function the way we want it to or in some cases not function at all. First we will get the motors to run since it's one of the most important parts of the line following robot. If it can't move then it isn't going to be able to follow a line. Next after the motors are done, we will code the h-bridge. The h-bride allows us to connect multiple motors together at the same time. It can also allow us to let the motor turn the opposite directions in case there is another color in the path that it doesn't recognize and take a different path. For example:

Once the robot reaches the color it will not take that path. Since we attached sensors the back portion of the robot we will use those sensors to follow the path instead and go the other way. The sensors will allow the robot to detect the line and continue following it with the motors. The caster wheel will assist the robot is there is any need to make any turns in the path. If there isn't a caster wheel then the robot will not be able to make sharp turns or turn at all.

After we code the sensors, motors, and the h-bridge we will move on to the Bluetooth. We will be using the HC-05 Bluetooth. The bluetooth will allow us to control the robot by using our phone using an app or any other device in which we can use bluetooth with. This is the final

part of the project is if everything goes well we will have a functioning robot. This will be overall around a 3 month project with the coding, testing, and troubleshooting.

Task Division

…. …. *(missed! Commented by Prof. Li)*

Comment [L10]: Task division among team members is missed here!

Conclusion

A line following robot may seem as a simple experiment but when you add multiple other modifications such as allowing it to move in the opposite direction, it can become difficult. The more complex the harder the project can get. A line following robots already have a couple of real world practical applications. These may include industrial automation, transportation of hazard materials or quantities of heavy machinery that would normally be harmful for humans, car parking, and transportation in hospitals for disabled patients.

Comment [L11]: The format of this paragraph is not consistent with the rest of the proposal.

References

http://arduino.cc/

http://en.wikipedia.org/wiki/Photoresistor

http://fritzing.org/home/

http://kile.stravaganza.org/projects/lego-robot-line-follower/images/lightsensor2diagram.jpg