SCHOOL OF ENGINEERING
TAYLOR'S UNIVERSITY

PRJ 60103
Engineering Design and Communication

Team One
Fire Extinguisher Robot Proposal
Module Supervisor : Cheah Kean How

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Date of Submission: 4th May 2017

Return of student marked assessment tasks. Please check (√) the necessary column.

√	Electronically to the individual student via the University learning management system
	Collect during class, only by the student
	Collection from the school or a staff member upon presentation of their student ID card
	Collection from module coordinator, lecturer or tutor by prior arrangement

* For online assessment such as forum, quiz, test, survey and etc., return of students marked assessment tasks are published in TIMES.

CONTENT

Executive Summary

The key purpose of this project is to bring us together as a team to build a Robocar that can help extinguish a small fire. Moreover, the concept of this project is to see how well, we as a team, we can function. This project is where, we as a team, implement the Conceive, Design, Implement and Operate (CDIO) Initiative.

Firstly, as a team we drafted out a detailed Gantt Chart to lay down our weekly progression. This Gantt chart would last a course of 14 weeks, starting from the 27th of March until the 10th of July. This Gantt chart consists of 4 stages. Stage 1 is where Project Planning (Conceive) comes into place. We start by brainstorming for ideas and then decide as a group for the best design. We then list down the materials - such as perspex - components and parts we need. After gathering the amount of materials, components and parts, we looked for the cost of the materials needed from different vendors and drafted a budget plan to meet with our budget of RM400. Secondly, Stage 2 is Project Design (Design). This is where we finalise our design for our Robocar. We draft our first design for our Robocar then we try to upgrade the design to make it more cost saving, make the Robocar lighter and to meet the size requirements of the track. Thirdly, Stage 3 is Production (Implement). In this stage, we as a team start to purchase the materials construct the Robocar, assemble the parts, programming, prototype testing and the final checks 7 repairs of the Robocar. In addition, as a team, we help each other construct the base of the Robocar and construct the frame of the Robocar.

Finally, the last stage is the Roborace (Operate). This is where our team will be judged on our teamwork and capabilities to trust one another to make sure that our Robocar is designed, built and programmed well enough to accomplish the main task of this project.

Introduction

Due to the evolution of robotics in these few decades, most of the community in this world owns smart gadget and it is obvious that the robotic applications nowadays are developing in a fast pace. In the first semester of the Mechanical Engineering, every team are required to deliver a fire fighting robot car that is able to attain the necessary requirements for the project. In Engineering Design and Communication, teams are required to finished the proposal which consists 10% of the overall module assessment. We were assigned by our lecturer, Dr. Cheah Kean How, to complete the project.

During the Roborace, team will be evaluated or assessed based on how efficient the robocar is in terms of the line tracking and the extinguish of the fire. In the entire race, the robocar is required to move along the line tracking by using line tracking sensors and was programmed with the IR heat sensor to detect the heat when it reaches to the zone where there is need to extinguish the fire.

With that said, the robocar will be well-equipped with line tracking sensors, heat sensor, motor shield, arduino and also the lipo battery to power up the main source which are the arduino and motor shield. The robocar was built with 4 tyres instead of 3 to increase the stability of the car with perspex as the base.

In this project, there are limitations set by the module coordinator such as a budget for all teams to keep. These limitations will allow Engineering students to improve their thinking skills and develop project management skills which is needed in the future.

CONCEPT

CDIO is the theory that applies in the engineering field. CDIO consists of conceive, design, innovative and operate. This concept acts as a guide when engineers tackle and solve problems.

Stage C which is conceive stage, is a process which help us to brainstorm ideas to overcome the obstacles. We need to throw out as many ideas as we can and merge them together in order overcome the problems. For this proposal, the main idea is to design a fire fighting robot car. There are a few conditions that we need to consider such as the cost, safety, design of the body, efficiency of extinguish the fire and navigation of the line tracking.

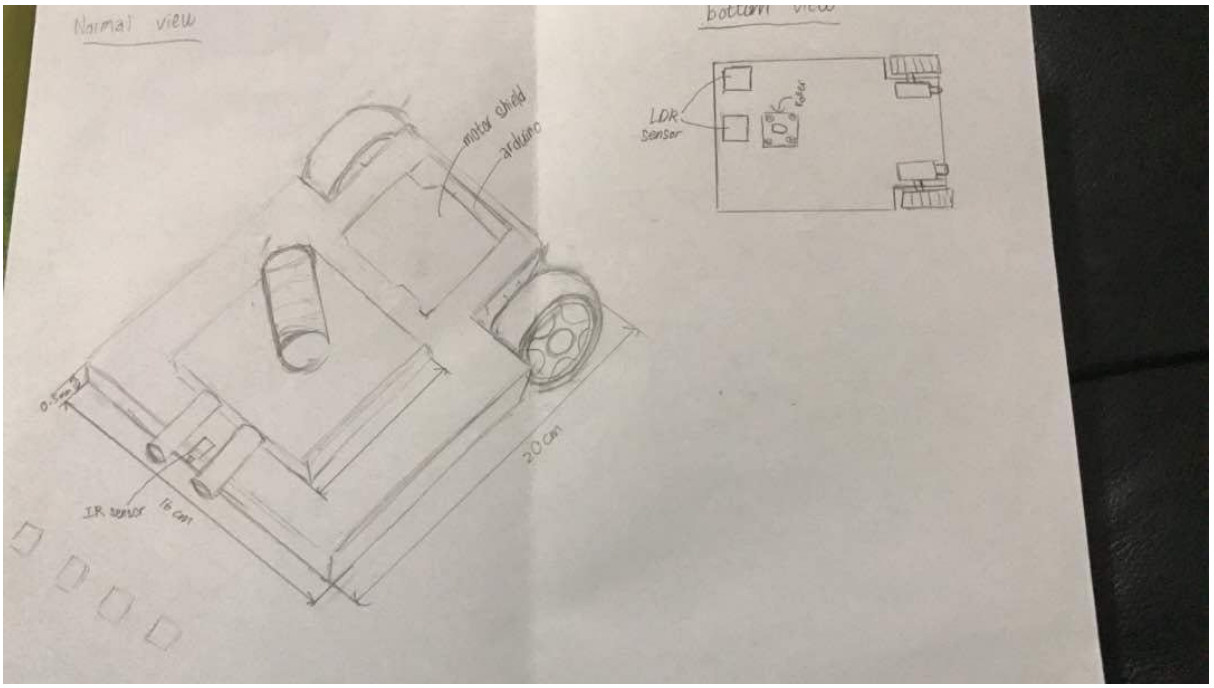
We started our project by brainstorming the design of the Robocar. The base that we used for our Robocar is perspex with 2 tyres attaching to the back and 2 rollers at the front. Arduino and motor shield acting as the main source of the Robocar and the light sensors will be placed at the front to detect the line track. For now, baking soda and vinegar will be used to produce carbon dioxide which is able to extinguish the fire.

After we had finalized our design, we merged our ideas and came out with 3 different types of design. Then, we rate the design by using decision matrix. The robot that will be selected to build is based on the highest score because it shows the most applicable to function as a fire-fighting robot. At a result, we chose the rectangular based, LDR sensor, baking soda and vinegar and 4 tyres as our final design.

Ideas/ Criteria	Ratings	Rectangular based, LDR sensor, Baking soda & Vinegar, 4 tyres	Square based, Ultrasonic sensor, Carbonate acid, 3 tyres	Circular based, Infrared sensor, Dry ice, 3 tyres
Cost	5			
Line Tracking	4			
Efficiency (Extinguishing fire)	3			
Design of the body	2			
Safety	1			
Total score				

METHODOLOGY AND DESIGN

- The body of the Robocar is engineered to accomplish the tasks required in the project.
- The base of the Robocar is designed in a rectangular shape which able to support an Arduino kit, a lipo battery and a hand-built tank used to store the chemical and substances to extinguish the fire.Most of the body parts are made out of perspex (Acrylic board)
- The body of the Robocar is constructed using recyclable materials such as Acrylic boards and plastic materials such as plastic bottle to reduce cost and hence maintain the budget of the project.
- Two 6V motor which is attached to a gearbox each will be used to rotate the wheel of the Robocar and a trolley wheel will be placed the middle part in front to allow the Robocar to turn easily.
- A hand-built tank will be placed above the Robocar which is used to store the substances to extinguish the fire. The substances we had chosen are the baking soda and the vinegar as it has the suitable concentration to able to extinguish the fire perfectly.
- Two line tracking sensor will be built by using Light Dependant Resistors (LDR) and will be placed underneath the Robocar to allow it to track the line accurately.
- An IR flame sensor is placed in front of the Robocar to detect the heat more sensitively.
- A 11.1V 1500Mah Lipo-rechargeable battery will be used to power up the arduino uno.


Normal view
motor shield
arduino
0.5cm
IR sensor
16 cm
20cm
bottom view
LDR
Sensor
Color

Budget Plan

Materials	Unit	Cost		
		Vendor 1 (Smart Ace Inc.)	Vendor 2 (My Robot Education)	Vendor 3 (Tamiya)
Yellow 6V DC Motor with Wheel	2	RM 20	RM 15.80	RM 18
Castor Wheel	2	RM 8	RM 5.80	RM 8
IR Flame Sensor	2	-	RM 9.00	-
Servo Motor MG995	1	RM 20	RM 18.90	RM 23.50
Project Board	1	RM 9	-	RM 15
Arduino Uno	1	RM 50	RM 29.90	RM 60
LDR Module	2	RM 12	RM 11.80	-
Motor Driver Shield	1	RM 50	RM 43.90	RM 60
Lipo Charger	1	-	RM 39.90	RM 41.80
Lipo Battery	1	RM 60	RM 49.90	RM 55
Total		RM 229.00	RM 224.90	RM 281.30

Gantt Chart

TASK NAME	WEEK/DATE													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	27/3	3/4	10/4	17/4	24/4	1/5	8/5	22/5	29/5	5/6	12/6	19/6	3/7	10/7
STAGE 1: PROJECT PLANNING (C)														
List and group ideas (Brainstorming)														
Finalize theme and materials needed														
Survey & calculate material cost														
Finalize proposal														
STAGE 2: PROJECT DESIGN (D)														
Design outline														
Configuration design														
Integrated design														
Detailed design														

STAGE 3: PRODUCTION (I)														
Purchase materials														
Construction of base														
Construction of frame														
Assemble parts														
Programming														
Prototype test														
Final check & repair														
ROBORACE! (O)														

LINEAR RESPONSIBILITY CHART

Leader: Eugene Gow Jun Yi

-In charge of setting up the meetings
- In charge of the progress of the project
- Demote tasks equally among members
- In charge of the assembling the exterior part of the Robocar

Technician: Zharif Nichol

- In charge of assembling the interior part of the Robocar
-In charge of the soldering and the wiring of every parts of the Robocar.
- In charge of the assembling of the car and electronics.
- Lead the testing of each mechanism of the car.

Secretary/Treasurer: Jasper Lim Leong Zhen

- In charge of collecting funds
- Oversee group expenses and maintaining the budget of the plan.
- In charge on doing survey and obtaining materials
- In charge of assembling the interior part of the Robocar
- Document group progress
- Record meeting logs and the topic discussed.

Programmer: Lim Min Yee

- Programme line tracking
- Programme the light sensor
- Programme the servo motor
- Calibrate the sensitivity of the IR flame sensor and programme it with the light sensor.