

**ECE496 Project Proposal (Draft A)**  
**Tour Guide Robot**

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## **Project Description**

### Background and motivation

Museums play an important role in our society when it comes to education and entertainment [1]. However, the number of museum visitors in North America has been in a downward trend since 1982 [2]. Among all age groups, children and teenagers (below the age of 24) had the sharpest decline: -17% from 2012 to 2017 [2]. In fact, a survey was done as early as 2004 shows the elderly (above the age of 55) are becoming the largest population group (at 36%) among all museum visitors in Canada [3]. One of the causes of this phenomenon is the incompatibility of the youth's energetic nature and the slow relaxing environment of a typical museum: more and more young people find non-interactive recreations like going to a museum unattractive.

One solution to this problem is to reinvent the way people enjoy museum visits. Instead of walking around aimlessly from one exhibit to another. The museum can provide a tour guide in a predetermined path, creating a "story" for the visitor. And instead of the typical voice-over in your digital app, our solution can take the form of an automated tour guide, leading users around, telling the story along the way. This could both attract the attention of the youth and create companionship for the elderly. This tour guide would also support multiple languages and re-customizable paths based on the museum's desire.

### Project goal

The goal of this project is to design and build a working model of a personal guidance system that is capable of self-navigation, object avoidance and provides voice-over interactions. The design also has to meet the "Standards for community museums in Ontario [4]" to which it would provide service.

## Project requirements

ID	Project Requirement	Description
1.0	Movement	<b>Primary functional requirement:</b> Able to move forward at different speeds and come to a stop without manual input.
2.0	Input: 5V for powering the controller	<b>Subfunction:</b> The controller must be able to work with a low voltage battery
3.0	Obstacle avoidance	<b>Subfunction:</b> Robot must be able to detect obstacles in its path and stop and start at appropriate times so as to not collide cause damage.
4.0	Size: 50cm x 50cm x 150cm (length x width x height)	<b>Constraint:</b> The robot must not exceed this size to be able to path through doorways. This excludes additional components added to make the robot interactive e.g. outer shells.
5.0	Minimize weight	<b>Objective:</b> the lower the better. Weight will be traded off against other characteristics.

## Work Plan

### Feasibility Assessment

Skills and Resources:

1. Basic knowledge of programming in both software (C, C++, python) and hardware (Lego Mindstorm, Raspberry).
2. A workspace where we can build and test hardware components.
3. Ability to work efficiently together as a team. This should include proper delegation of work, timely completion of work and good communication within the team.

### Equipment:

1. A Lego Mindstorms EV3 miniature vehicle set.
2. A laptop with a GTX1660Ti GPU or above.
3. A Raspberry and its interfacing components.

### Credible Risks

1. There may be compatibility issues between different components due to the team's lack of experience working with them.
2. Project goal may be too ambitious and/or too complicated for the team to complete within the time limit.

### Mitigation Strategy

1. The team will incorporate new platforms/components only when necessary in order to reduce the overhead spent on learning the new platform/component.
2. The team has agreed on the core concept of the project being a guidance vehicle that leads the user from point A to point B. If at any point during the development, the project's goal becomes too far-reaching, the team can always fall back and aim for this concept.

## References

- [1] E. N. Arinze, "The Role of the Museum in Society - Public lecture at the National Museum, Georgetown, Guyana" 17-May-1999. [Online]. Available: [http://www.maltwood.uvic.ca/cam/activities/past\\_conferences/1999conf/batch1/CAM'99-EmmanuelArinze.GuyanaFinal.pdf](http://www.maltwood.uvic.ca/cam/activities/past_conferences/1999conf/batch1/CAM'99-EmmanuelArinze.GuyanaFinal.pdf). [Accessed: 18-Sep-2019].
- [2] "Art Museum Attendance," Humanities Indicators - A project of the American academy of arts & science, Aug-2019. [Online]. Available: <https://www.humanitiesindicators.org/content/indicatordoc.aspx?i=102>. [Accessed: 18-Sep-2019].
- [3] Heritage Information Network, "Survey of Visitors to Museums," Canada.ca, 30-Apr-2019. [Online]. Available: <https://www.canada.ca/en/heritage-information-network/services/web-interactive-mobile-technologies/survey-visitors-museums-web/results.html>. [Accessed: 18-Sep-2019].
- [4] Government of Ontario, "Standards for community museums in Ontario," Ontario Ministry of Tourism, Culture and Sport, 28-Feb-2017. [Online]. Available: [http://www.mtc.gov.on.ca/en/museums/museums\\_standards.shtml](http://www.mtc.gov.on.ca/en/museums/museums_standards.shtml). [Accessed: 18-Sep-2019].