Magic Elevator Project Proposal

CSCI 4889: Machine Learning for Human Computer Interfaces

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Idea

Elevators are a curse and a savior. They enable us to save thousands of calories over a lifetime. However, waiting for them and riding them in an awkward silence is anything but exciting. The magic elevator will solve this problem: we will transform the ATLAS elevator into the most awesome elevator on campus. All that is needed is a little magic, more magic, and some engineering:

ATLAS Elevator | A Little Magic | More Magic | Some Engineering | Most Awesome Elevator on Campus

The elevator riders will summon the elevator with a wand, or with *their wands* through a group spell if there are multiple riders. Once inside the elevator, the riders will compete against each other: all riders execute a spell to select their requested level, and the magic elevator decides who performed the most accurate spell. As a reward, the magic elevator moves to this level first. Better start practicing those spells!

The elevator riders will benefit from an exciting elevator experience. We learned from feedback of previous elevator-related projects the most requested rider feature: a faster elevator. Unfortunately, we cannot speed up the elevator itself, but with the magic elevator, time will fly since the interaction will be so much fun!

A previous project on calling the elevator has already given insight on the feasibility of the magic elevator. Available hard- and software (solenoids, raspberry pi, OSC communication) makes remote control of the elevator possible. Machine Learning will provide the necessary personalization during the user experience.

Mission Statement

Our mission is to create a Harry Potter elevator experience. To summon and control the elevator, our magicians must cast spells with wands and sometimes work as a team (or as foe...).

Challenges to Overcome

Receive Permission

Before we can get started with this project, we want to receive facility management's permission to work on the elevator. This includes the non-destructive addition of a control terminal outside and inside the elevator. Also, limitations on the elevator during a 30 minute test phase will have to be taken into account.

Hardware Design

Building on the previous experiences with the magic elevator, this project will require more hardware. All four floors of the ATLAS building have to be accessible. The corresponding solenoids have to be ordered, wired and installed in a custom-made case. This time, the solenoids have to be stronger too, in order to actually press the relevant buttons. All hardware will meet building safety and accessibility codes.

User Experience

For the first time in this class, multiple users will have the option to interact in one game. This brings the challenge of having multiple input devices which must be coordinated and transformed into the right outputs. A seamless user experience is indispensable for

this application. Computation time and generalization are key. Additionally, the system must be end-user customizable. Users should be able to train the system to work well for them, i.e., accurately recognize their spells (when they cast them properly!).

Needed Technologies

It is anticipated that we need the following components for this project:

- Hardware:
    - Raspberry Pi 3
    - GiPo Relay Board with 4 relays
    - 4 Solenoids (previously the 5V was too weak; we will investigate a better mechanism)
    - Customized 3D case
    - 6 Microbits to build 3 wands (although Microbits are clunky, so we will investigate better mechanisms)
- Software:
    - So far all open source (Wekinator, Processing and Python 3 are already running on the Raspberry Pi)
- Language Tools:
    - oscP5 for communication
    - netP5 for communication
    - Processing.io for solenoid activation
    - WekiInputHelper for Feature Engineering

Proof-of-Concept in Week 10:

The proof-of-concept in week 10 has to show the feasibility of previous difficulties with the elevator interactions. On the hardware side, this includes the right setup for the solenoids that will press the elevator buttons (How are they mounted? Do they have enough force to press the button?). From a software side, the processing of 3 different wand inputs has to be proven. We will not show the full user interface at this point.

Risk to Failure

The risk of failure in this project is a reflection of the challenges to overcome. If we cannot get permission to work on the elevator, this project will not happen. Building a mock-up elevator out of cardboard would not come close to the user experience in the real, moving elevator, so we will not go there. Hardware-wise, we are confident we can unite engineering and computer science knowledge to overcome the challenges of implementation. The greatest challenge besides getting permission for this project would be the thought-out user experience. The elevator riders have to be able to collaborate and challenge each other in the skill of spell casting. The seamless integration of both interactions are crucial for success. In addition, all devices need to be controlled and powered wirelessly, since there are no outlets available inside the elevator.

Ethical Questions:

The magic elevator comes along with a manageable amount of ethical questions. First of all, the elevator may not be damaged or physically hacked in any way. The designers also have to ensure that at any given time, the users are able to overrule the system by physically pressing the buttons inside and outside the elevator. Our additions to the elevator should not in any way reduce the usability or accessibility of the elevator.

Ideally, all consoles that are added to the elevator can easily be removed by the users, returning the elevator to its original state.

Timeline:

Week	Phase	Goals	Deliverable
8	**Concept**	• Formulate user requirements (What is the best possible user experience / user story ?) • Brainstorm product concepts (How many “challenges” can be included?)	• Preliminary project proposal
9	**Planning**	• Revise proposal with feedback • Write user stories • Minimum Viable Product (MVP) building (feature extractors, ML, actuators, UI)	• Revised proposal • Living github repo
10	**Design & Development**	• Extend MVP to full prototype • Learn new technologies (e.g. replace microbits by smaller sensors) • Iterate through ideas → code → data according to the lean startup methodology	• Changelog.md • Youtube Link
11		Spring Break	
12 13 14	**Design & Development**	• Extend MVP to full prototype • Learn new technologies (e.g. replace microbits by smaller sensors) • Iterate through ideas → code → data according to the lean startup methodology	• Changelog.md • Youtube Link
15	**Deadline**	• Final Report • Project Polishing	• Final Youtube Video • Readme

Bibliography:

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