Formal Report
IMDL Spring 2016
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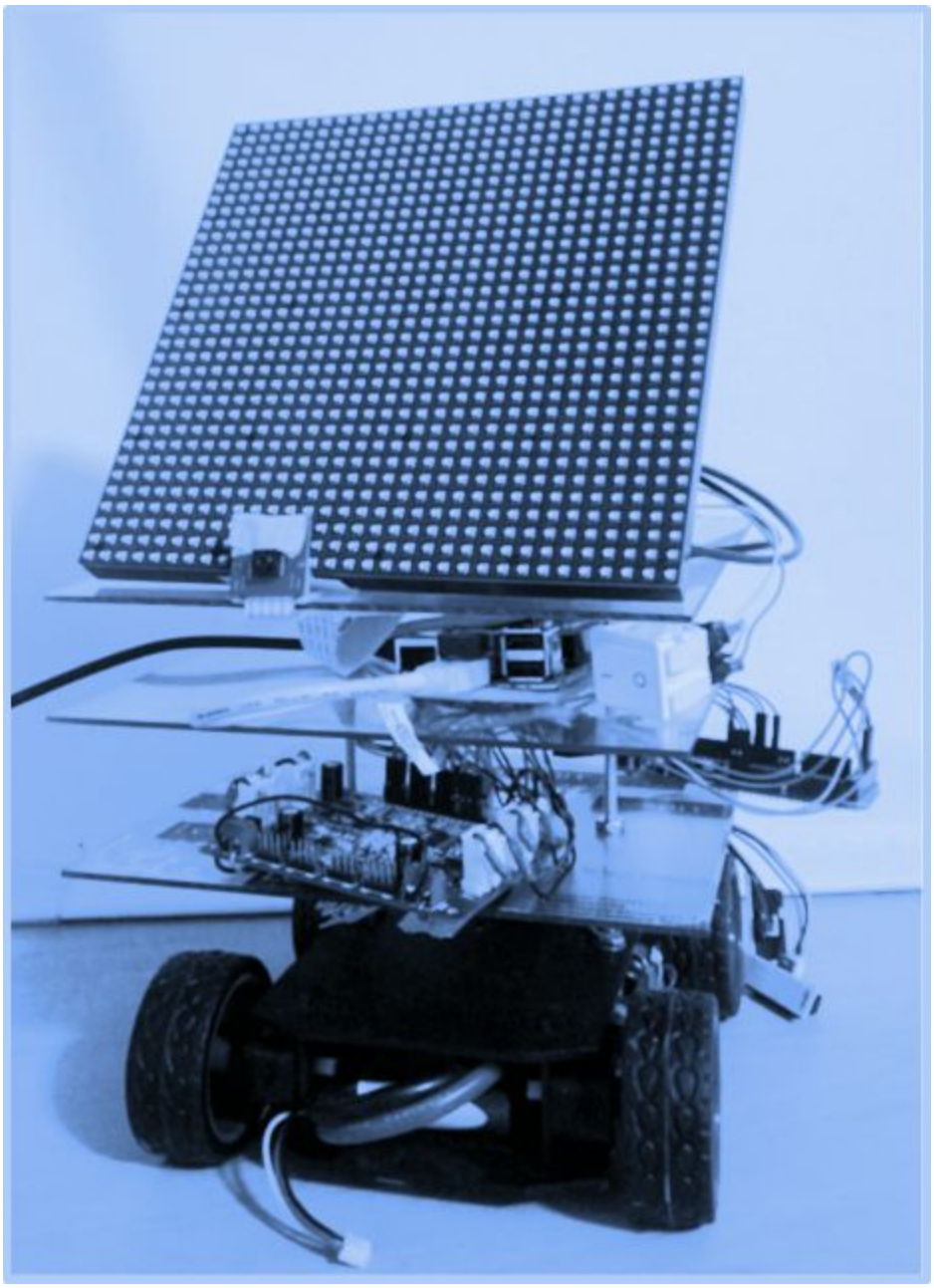
PB99



“Party-bot like it’s 1999”

Table of Contents

(To be edited.)

Abstract

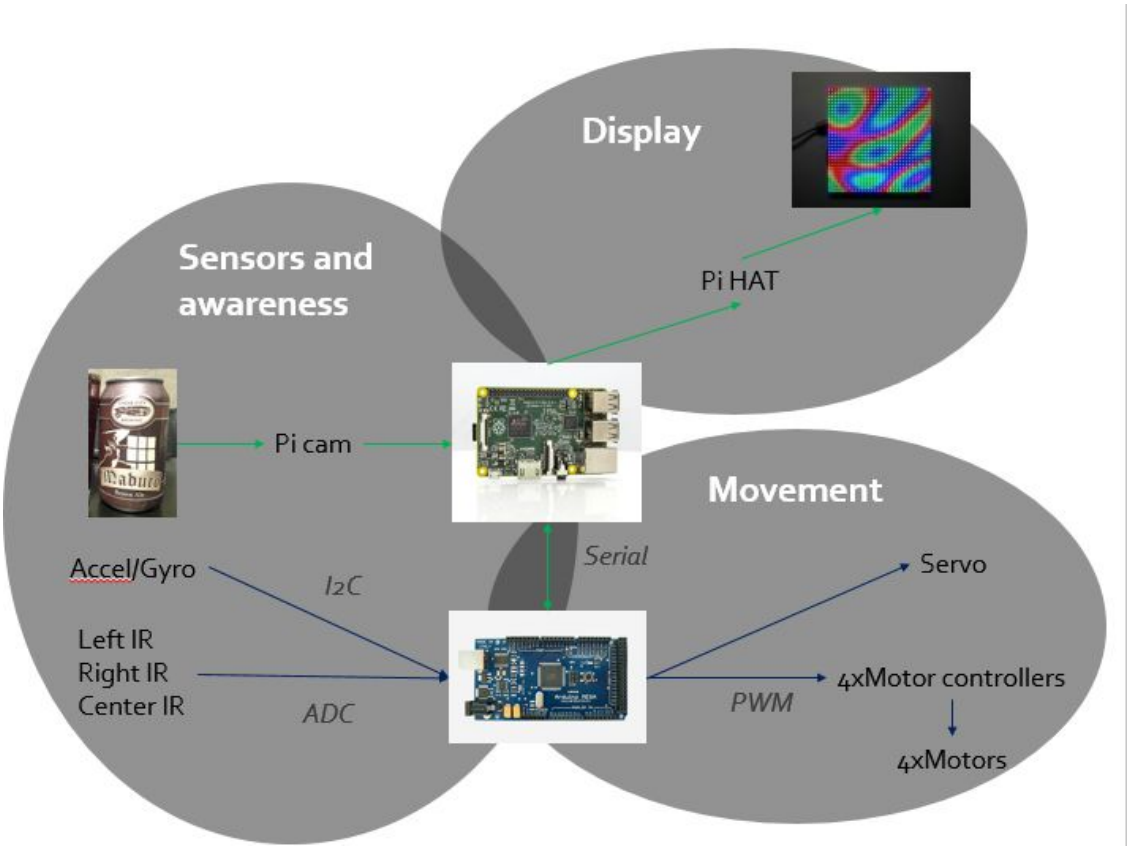
The purpose of PB99 is to *autonomously convey emotion* through its movement and bright LED array. PB99 will be able to move through a room and avoid obstacles, and recognize beer with its camera. PB99 consists of a head and body. The head is equipped with an LED array and camera, and the body houses electronics that sit atop a mobile base.

While PB99 roams around, some unique actions can be triggered based off of its past actions. For example, if PB99 takes a lot of turns it will spin a little extra to convey confusion. Another example would be if PB99 activates its rear bump sensor multiple times, it will shake its head in frustration.

With the camera, PB99 will be able to recognize three different objects (all of them beers). Upon recognizing an object, one of three reactions will be assigned to it: 1) Excited, 2) Disgusted, 3) Approval. A combination of movements and LED displays will convey these reactions.

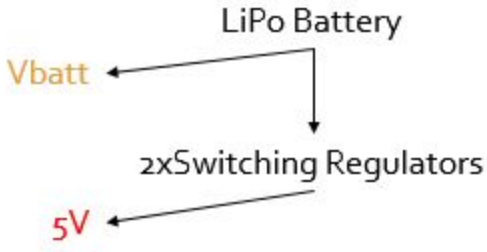
Integrated System

Communication



Power

Powering the electronics is simple enough. The motor controllers require Vbatt (7.4V), all other electronics require 5V. The LiPo is 2S at 5800mAh. The regulators drop the voltage to 5V, 5A. One regulator is solely dedicated to the Raspberry Pi and LED array, and the other powers everything else.

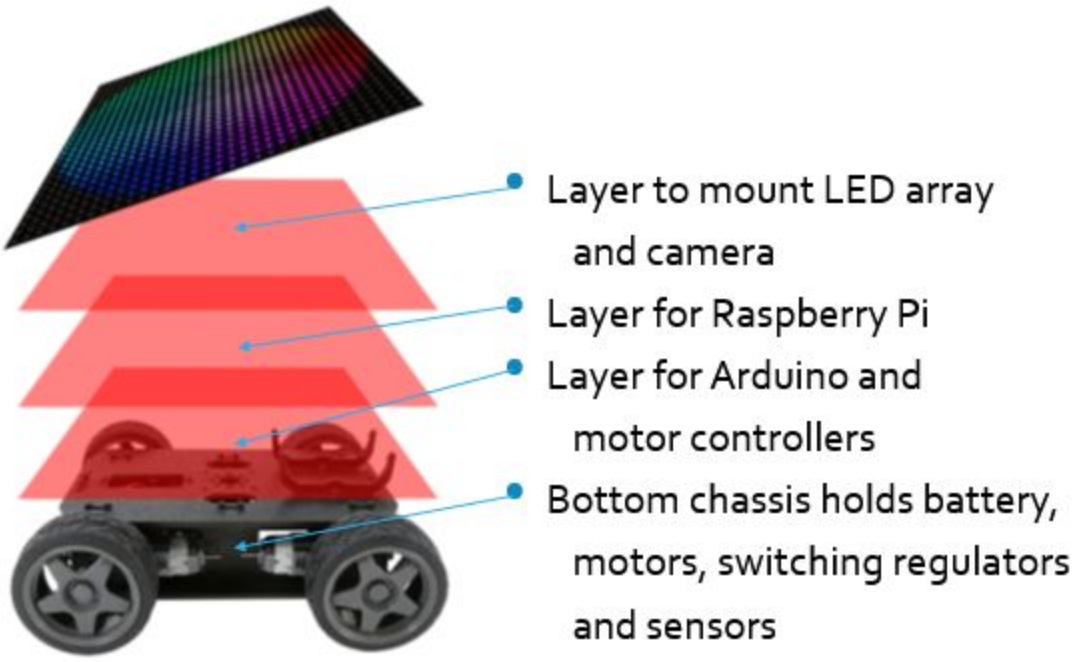


Mobile Platform

Structure

PB features a layered design to achieve the mounting of all the electronics in a small area. The layers are organized with low level, heavier components (such as the battery, motors) placed at the bottom, and higher level lighter components (such as the LED array and

Raspberry Pi camera) placed at the top. Layers are fixed with threaded metal rods, bolts and washers.



Actuation

The DC brushed motors receive amplified PWM signals from motor controllers. The 4 wheels are able to move PB forward, backwards, and rotate left/right. The servo motor receives PWM signals from the Arduino and rotates the head left/right.

(Detailed test data to be added.)

Sensors

The following is a list of sensors with their purpose, and specification tests.

- Pi Camera
    - LED array glows brighter / dimmer based off video feed brightness
    - Used to send frames to be analyzed by OpenCV algorithms for beer recognition
    - Invokes several different beer recognition states
- 3 axis accelerometer / gyroscope
    - LED array display changes based off of acceleration and orientation
    - Extreme values of acceleration / orientation invokes a confused behavior state
    - *(Detailed test data to be added.)*

- Front and back bump sensor
    - Number of front / back bumps are recorded
    - When bump amount exceeds a tolerance, an angry behavior state is invoked
    - *(Detailed test data to be added.)*
- Left, right, and center IR sensor
    - Used to avoid objects to the left and right
    - Center sensor used to avoid drops and edges of terrain, or really small objects
    - *(Detailed test data to be added.)*

Behaviors

PB will have several behavior states that change based off of what PB remembers about it's own movements in combination with data received by sensors. Listed below are a few states PB may enter (more states will be added as time allows).

- Roaming
    - Moves forward at a normal speed
    - Avoids obstacles
    - LED array illustrates movement and neutral mood
- Curious
    - Sits still, with some curious head actuation
    - Uses camera to analyze frames for beers
    - LED array illustrates calculations
- Disgusted
    - Shakes head, reverses, rotates 180 degrees and speeds away
    - LED array displays disgust
- Excited
    - Spins as fast as possible with some head actuation
    - LED array explodes with color
- Approval
    - Moves forwards and backwards slowly
    - LED array displays a thumbs up picture
- Disapproval
    - Moves backwards slowly, shakes head
    - LED array shows muted, slow moving colors

Results

(To be added.)

Conclusion

(To be added.)

Appendix

(To be added.)