**Budget Proposal for Roadie**

Sponsor

**Electrical, Computer, Software & Systems Engineering at Embry-Riddle Aeronautical University**

Released 7 October 2014

**Are We There Yet?**

# **Revision History**

|  |  |  |
| --- | --- | --- |
| Date | Reason for Change | Version |
| 1 October 2014 | Initial Draft | 0.1.0 |

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# **Introduction**

## **Purpose**

The purpose of this document is to provide the customers of Roadie with a preliminary budget as well as the selection process and justification for the items included in this budget. The justifications include analytical processes in the form of decision matrices and qualitative processes in the form of written justification. The quantitative and qualitative methods are backed by requirements traceability and risk analysis for the parts listed in this document.

## **Scope**

This document is intended to provide a monetary budget as well as justifications for each item. Core components, with a price of $20[**REF TO RUBRIC]** or higher are included in this document. The document contains the high-level design of Roadie as well as a description of the subsystems and functional description of Roadie. The sole purpose of the document is to provide the reader with an idea of the monetary costs involved in the creating of Roadie.

## **Team Information**

|  |  |
| --- | --- |
| Name | Role |
| Brian Powell | Team Leader |
| Michael Philotoff | Software Configuration Manager |
| Alex Senopoulos | Testing Leader |
| Brian Sterling | Development Leader |

# **Functional Decomposition of System**

Roadie is broken down into six main subsystems: (1) the Simon Carabiner subsystem, (2) the pocket Etch-A-Sketch subsystem, (3) the Rubik’s cube subsystem, (4) the playing card subsystem, (5) the line following subsystem and (6) the communications and coordination subsystem. The division of these subsystems is illustrated in **Fig. 1**.



**Fig. 1**: Division of Roadie into six subsystems.

The communication and coordination subsystem relays information to each of the challenge subsystems (line following, Simon carabiner, pocket Etch-A-Sketch, Rubik’s cube and playing card). As each of the challenge subsystems completes it task, it relays data back to the communications and coordination subsystem. These subsystems are further divided by functionality to create the high-level architecture as described in Section 2.1.

## **High-Level Architecture of System**

The system architecture of Roadie is designed in a layered approach, depicted in Fig 2 below, in order to better divide the work being done and to aid in the conceptualization of the system design.



Fig : High level description of the systems in Roadie.

The applications on the communications and coordination system in the form of feedback from the sensors (reflectance and camera) is translated by the middleware (software) to the physical communications means. From here, the arm subsystem and the movement subsystem are directed by the communications and coordination system in order to do complete the challenges. From there, middleware in the form of software is used to talk to the applications. In this instance, the application on the arm side represents the challenges (Simon Carabiner, pocket Etch-A-Sketch, Rubik’s cube, picking up a playing card), with the movement application being line following. As Roadie progresses along, it continues to send feedback from the movement system and the arm system to the communications and coordination system so that Roadie may understand what exactly is happening.

## **Decomposition of Communications and Coordination**

Fig 3 below, better illustrates the communications that occur amongst the systems in Roadie.

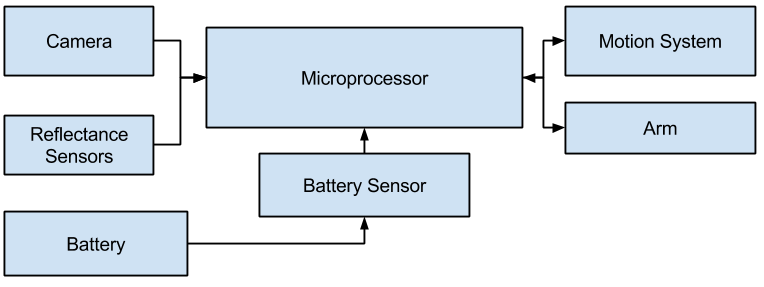


Fig : Decomposition of communications and coordination system for Roadie.

As the figure shows, the camera, the reflectance sensors and the battery,(via the battery sensor), provide input to the communications and coordination system. From here, the communications system sends commands to both the arm and motion system so that they will be able to complete their individual tasks. As the arm and motion systems complete their tasks, they relay feedback back to the communications and coordination system for further guidance.

# **Requirements Traceability**

The following requirements refer to those in Roadie System Requirements Specification (SRS) 1.0.0-2014, Revision 18 September 2014. Each requirement is identified by its corresponding number in the SRS. This ID is then followed by the requirement text as well as an explanation of how each part will fulfill said requirement.

# **Glossary**

The glossary contains definitions of words and phrases used throughout this document.

|  |  |  |
| --- | --- | --- |
| Entry | Definition | Aliases |
| Align | The system will position itself so the appendages can properly reach the challenges. |  |
| Autonomous | Undertaken or carried on without outside control [2]. |  |
| Bad state | Any state that is not the line following state or the challenge state. |  |
| Challenge State | The state in which Roadie is completing one of the four challenges. |  |
| Challenge Zone | The 1ft. x 1ft. areas where each of the challenges will be played along the course. |  |
| Competition Area | The competition area is the plywood board where the competition is being held on. The system must maintain contact with the board at all times. |  |
| Course Round | A span of five minutes during which the system is expected to complete the 4 challenges [1]. |  |
| Pocket Etch-A-Sketch | The pocket Etch-A-Sketch is a popular children’s toy with two knobs to move the cursor up and down as well as left and right. For the competition, the specific version of the pocket Etch-A-Sketch being used is SKU:FD79DD3F from Toys R Us online [7], and can be seen in **Fig. 10.** |  |
| Finish Line | The finish line is the ending point of the competition. It is the point where the Scotch Blue Painter’s Tape comes to the final “T” shape on the course [1]. It is marked as FINISH in **Fig. 7**. |  |
| Good state | Either the line following state or the challenge state. |  |
| Institute of Electrical and Electronics Engineers | “IEEE is the world's largest professional association dedicated to advancing technological innovation and excellence for the benefit of humanity” [4]. That being said, IEEE is not only composed of electronic and electrical engineers as the name might suggest. Other types of members include computer scientists, software developers and even some doctors. | IEEE |
| Line Following State | The state in which Roadie is following the Scotch Blue Painter’s tape located on the competition area. |  |
| Obstruct | SoutheastCon rules state that the system cannot obstruct any obstacle [1]. |  |
| Playing Card | Information on the specific playing cards is still pending, thus, [TBD]. |  |
| Rubik’s Cube | The Rubik’s Cube is a puzzle game that achieved popularity in the 1980’s. For the competition, the specific version of the Rubik’s Cube being used is SKU:DAD09D9E from Toys R Us online [6], and can be seen in **Fig. 9.** |  |
| Scotch Blue Painter’s Tape | Scotch Blue is a brand of painter’s tape produced by the company 3M. For the competition, the specific model of painters tape being used is SKU: 958999 from Home Depot [8], and can be seen in **Fig. 11.** | Guidance Tape |
| Simon Carabiner | The Simon Carabiner is another version of the game, Simon, which is an electronic version of the children’s game “Simon Says”. For the competition, the specific version of Simon being used is SKU:226CE810 from Toys R Us online [5], and can be seen in **Fig. 8.** |  |
| SoutheastCon | SoutheastCon is the annual IEEE Region 3 Technical, Professional, and Student Conference. The conference includes technical sessions, tutorials, and exhibits. Additionally, various challenges and competitions are held for students to demonstrate their technical knowledge and understanding.“IEEE Region 3 encompasses the southeastern United States and includes the states of Alabama, Florida, Georgia, areas of Indiana, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and the country of Jamaica” [3]. |  |
| Starting Area | A one foot by one foot area on the competition area marked by Scotch Blue Painter’s tape [1]. |  |
| Usable Condition | SoutheastCon rules state that the playing card must be left in a usable condition [1]. |  |

# **Acronyms and Abbreviations**

|  |  |
| --- | --- |
| Acronym | Meaning |
| AWTY | Are We There Yet |
| ECSSE | Electrical, Computer, Software & Systems Engineering |
| ERAU | Embry-Riddle Aeronautical University |
| IEEE | Institute of Electrical and Electronics Engineers |

# **Appendix A**

This appendix includes a diagram of the competition course as well as pictures of the individual challenges the system must complete. Also included is a picture of the tape that will designate the line the system must follow.

## **Competition Course**

The course, as shown in **Fig. 6** below, shows the rough outline of the track the system will follow, as well as what a challenge station would look like.

**Fig. 7** Competition course for SoutheastCon[1].

## **Simon Carabiner**

The Simon Carabiner, as seen in **Fig. 7** is the specific Simon game that the system will play.



**Fig. 8:** The exact Simon Carabiner to be used during competition [5].

## **Rubik’s Cube**

The Rubik’s Cube, as seen in **Fig. 8** is the specific Rubik’s Cube that the system will play.



**Fig. 9:** The exact Rubik's Cube to be used during competition [6].

## **Pocket Etch-A-Sketch**

The pocket Etch-A-Sketch as shown in **Fig. 9** is the specific pocket Etch-A-Sketch the system will play.



**Fig. 10:** The exact pocket Etch-A-Sketch to be used during competition [7].

## **Playing Cards**

[TBD] The playing cards will be updated with an appropriate picture once there is a specific set listed in the competition rules.

## **Scotch Blue Painter’s Tape**

The Scotch Blue Painter’s Tape as show in **Fig. 10** is the exact painter’s tape that will be used to designate the line the system must follow.



**Fig. 11:** The exact painter’s tape to be used on the course [8].

# **References**

[1] IEEE Nova Southeastern University. (2014, September 7). IEEE SoutheastCon 2015 Student Program - Hardware Competition. Retrieved September 7, 2014, from IEEE SoutheastCon 2015: http://www.ewh.ieee.org/reg/3/southeastcon2015/StudentProgram.html

[2] Rembold, U., & Fatikow, S. (1997). Autonomous Microbots. Journal of Intelligent and Robotic Systems, 19(4), 1.

[3] SoutheastCon. (n.d.). Retrieved September 13, 2014, from http://www.ewh.ieee.org/reg/3/southeastcon/

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[7] Pocket Etch A Sketch - Red. (n.d.). Retrieved September 16, 2014, from http://www.toysrus.com/buy/etch-a-sketch-doodle-pro/pocket-etch-a-sketch-red-5163-2395954

[8] 3M 0.94 in. x 60 yds. Painter's Tape-2090-24J at The Home Depot. (n.d.). Retrieved September 16, 2014, from http://www.homedepot.com/p/ScotchBlue-0-94-in-x-60-yds-Painter-s-Tape-2090-1J/100085823