Department of Computer Science & Engineering
The University of Texas at Arlington

Project Charter
CSE 4316: Senior Design I
Summer 2016

Team Epsilon
SCARA

Thomas Zachry
Randy Thien Cao
Shayan Raza
Charlie Pan
Diane Chin

Revision History

Revision	Date	Author(s)	Description
0.1	6.28.2016	DC	document creation
0.2	6.30.2016	DC, TZ	first draft
1.0	7.08.2016	DC	final draft

CONTENTS

1 Vision **4**

2 Mission **4**

3 Success Criteria **4**

4 Background **5**

5 Related Work **5**

6 System Overview **5**

7 Roles & Responsibilities **6**

8 Facilities & Equipment **6**

9 Cost Proposal **6**
- 9.1 Preliminary Budget . . . 6
- 9.2 Current & Pending Support . . . 6

10 Documentation & Reporting **6**
- 10.1 Project Charter . . . 7
- 10.2 Product Backlog . . . 7
- 10.3 Sprint Planning . . . 7
  - 10.3.1 Sprint Goal . . . 7
  - 10.3.2 Sprint Backlog . . . 7
  - 10.3.3 Task Breakdown . . . 7
- 10.4 Sprint Burndown Charts . . . 7
- 10.5 Sprint Retrospective . . . 7
- 10.6 Individual Status Reports . . . 7
- 10.7 Engineering Notebooks . . . 7
- 10.8 Closeout Materials . . . 7
  - 10.8.1 System Prototype . . . 8
  - 10.8.2 Project Poster . . . 8
  - 10.8.3 Web Page . . . 8
  - 10.8.4 Demo Video . . . 8
  - 10.8.5 Source Code . . . 8
  - 10.8.6 Source Code Documentation . . . 8
  - 10.8.7 CAD files . . . 8
  - 10.8.8 User Manual . . . 8

1 Vision

To create SCARA, Selective Compliance Assembly Robot Arm or Selective Compliance Articulated Robot Arm, to methodologically arrange components by: category, size, weight, shape, color, or other criteria, items in a agile, expeditious, and optimum manner at or above industry standards.

2 Mission

Our mission is to use the following to produce a successful product: computer vision, efficient algorithms, and an economical physical design including lightweight and cost efficient materials as well as high strength alloys

3 Success Criteria

Success Criteria includes :

- A working SCARA that is as fast and accurate as industry standard or better.
- Ability to perform arithmetic decisions.
- Ability to utilize Computer Vision technology with precision and accuracy.
- Ability to perform all these tasks within the budgetary constraints and in scheduled time.

4 Background

The first SCARA robot was created as a revolutionary prototype in 1978, in the laboratory of Professor Hiroshi Makino, at Yamanashi University in Japan. The 4-axis SCARA was designed as no other robot arm at the time.

SCARA robots were introduced to commercial assembly lines in 1981 and still offer one of the best price/performance ratios regarding high speed assembly. The Japanese flexible assembly system, based on the SCARA robot, created a worldwide boom in small electronics production, creating products which drove the economy. [**?**]

5 Related Work

Discuss the state-of-the-art with respect to your product. What solutions currently exist, and in what form (academic research, enthusiast prototype, commercially available, etc)? Include references and citations as necessary [1].

Cartesian and six-axis robots, along with SCARAs, automate tasks to accelerate cycle times, increase throughput, and eliminate bottlenecks.

Cartesian robots, sometimes called gantry robots, are mechatronic devices that use motors and linear actuators to position a tool. They make linear movements in three axes, X, Y, and Z. Physical scaffolding forms a framework that anchors and supports the axes and payload. Certain applications, such as machining tightly toleranced parts, require full support of the base axis, usually the X axis. In contrast, other applications, such as picking bottles off a conveyor, require less precision, so the framework only needs to support the base axis in compliance with the actuator's manufacturer recommendations. Cartesian-robot movements stay within the framework's confines, but the framework can be mounted horizontally or vertically, or even overhead in certain gantry configurations.

Six-axis robots move forward and back, up and down, and can yaw, pitch, and roll to offer more directional control than SCARAs. This is suitable for complex movements that simulate a human arm - reaching under something to grab a part and place it on a conveyor, for example. The additional range of movement also lets six-axis robots service a larger volume than SCARAs can. Six-axis robots often execute welding, palletizing, and machine tending. Programming their movements in 3D is complex, so software typically maps the motion to a set of world coordinates in which the origin sits on the pedestal's first joint axis [**?**].

6 System Overview

Skeletal Body

- metal alloy tubing
- motorized or non-work platform

Arm articulated by stepper motors and/or servos.

For guidance and accuracy, using optical inputs i.e. cameras or optical sensors

I/O compatibility using dev board i.e. Raspb P, Arduino, Edison, etc.

Operator input through terminal

Manipulation of various objects carried out by suction.

7 Roles & Responsibilities

- Thomas Zachary - Scrum Master
- Diane Chin - Assistant, Scribe, Schedule Manager, Finance manager
- Randy Thien Cao - Version Control, Integration
- Charlie Pan - Inventory, Procurement
- Shayan Raza - Inventory, Procurement

8 Facilities & Equipment

Current Facilities:

- UTA Campus
- Senior Design Lab
- FAB Lab

Available Equipment:

- available uta assorted technologies
- desktop computers
- fablab machinery
- assorted team members contributions of tools and resources

9 Cost Proposal

We have 800 dollars set as our maximum budget for this project.

9.1 Preliminary Budget

Build Materials - 150 dollars
Tech Support - 650 dollars

- Board Support - 150 dollars
- Arm Articulation - 500 dollars

9.2 Current & Pending Support

Our current support is the 800 dollars provided by UTA.

10 Documentation & Reporting

In this section, you will describe all of the various artifacts that you will generate and maintain during the project lifecycle. Describe the purpose of each item below, how the content will be generated, where it will be stored, how often it will be updated, etc.

10.1 Project Charter

The charter gives the terms of reference, being able to outline roles and responsibilities, objectives, and identify stakeholders if any. It will be generated as a team effort. It has no need to be maintained as it is a one-time document, beyond revising drafts before it is due. It will be stored in GitHub team repository.

10.2 Product Backlog

The backlog is a prioritized features list, generated each sprint cycle with team input. It will be maintained on a daily, weekly, and cyclic basis. Stored in Leankit project tracking app.

10.3 Sprint Planning

Sprint planning is used to plan our tactics for each sprint and how to do so and what amount of time we should dedicate to doing so. It will be generated as a team effort at the beginning of each sprint and maintained (and stored) daily on the Leankit tracking app.

10.3.1 Sprint Goal

The sprint goal is out goal to achieve after each sprint time period. It will be generated at the beginning of each sprint cycle through team input. Progress will be maintained daily with workup to final production of the goal. Whether the goal has been achieved is agreed upon by each team member.

10.3.2 Sprint Backlog

The spring backlog is a list of tasks to be completed by the end of each spring. It will be generated as a team effort at the beginning of each sprint and maintained daily on the Leankit tracking app.

10.3.3 Task Breakdown

The task breakdown is a deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables. It will be delegated and agreed upon at the beginning of sprint cycles and team meetings. Tracked through Leankit and stored on the online repository.

10.4 Sprint Burndown Charts

The chart displays the remaining size of all stories in a sprint backlog that needs to be done. It will be generated at end of each sprint cycle, maintained after each and every cycle, and stored on the repository.

10.5 Sprint Retrospective

The sprint retrospective allows the team to review their progress during a spring and improve upon or learn from it during the next sprint. It will be generated at end of each sprint cycle, maintained after each and every cycle, and stored on the repository.

10.6 Individual Status Reports

These status reports allow individual team members to be reviewed and recieve input on how to improve their contribution. Done at each and every team meeting and stored in the Github repository.

10.7 Engineering Notebooks

Engineering notebooks allow professional documentation of the project development. Maintained at every thought by each member of the team at their digression.

10.8 Closeout Materials

Will be mechanical designs, code, mockups, protoypes, any documentations used to make the product, the and user manual. Generated as they are done at the time.

10.8.1 System Prototype

It will be the mockup before the actual building. Stored in Senior design lab.

10.8.2 Project Poster

The poster will aid in presenting the project and its features. It will be generated by the team stored in the senior design lab.

10.8.3 Web Page

The web page will aid in presenting the project and its features. It will be generated by and for the team.

10.8.4 Demo Video

The demo video will aid in presenting the project and its features. It will be stored on team webpage made by and for the team.

10.8.5 Source Code

The source code is needed to program the project to perform. All code including test code stored and maintained on team repository.

10.8.6 Source Code Documentation

The documentation will aid in context and readibility of the source code and record any necessary information as needed. Integrated in code and supporting documentation as well as maintained and updated as needed on the repository.

10.8.7 CAD files

These files can be used to analyze and mockup the project for simulation. If generated by team and used for testing purposes, will be stored on team repository and made available on team webpage.

10.8.8 User Manual

The user manual will aid a person in being aboe to use the final prouct. Created by, for, and about us made available on the webpage and stored on the repository.

References

[1] Kenneth S Rubin. *Essential Scrum: A Practical Guide to the Most Popular Agile Process*. Addison-Wesley Professional, 1st edition, 2012.