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

SmartPark

Team Members:
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Victor Diaz
Gaurab Gautam
Braden Walters

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1 General Organization

1.1 Project Manager

The Project Manager for Sense is Oreoluwa Adebambo. She is responsible for ensuring that the group organization throughout the entire project is well coordinated. This will be achieved through extensive planning, delegation and assignment of tasks, setting meeting agendas, holding team members accountable and any other duties that may arise. The Project Manager is a Software Engineering major with a good background in Software Project Management and some language tools. In addition, she has experience with leadership in previous organizations and is hoping to pursue a Master’s degree in Engineering Management. It is for these reasons that Oreoluwa Adebambo was selected as Sense’s Project Manager.

1.2 Project Oversight

To maintain internal control, key tasks and areas have been delegated as follows: Product Designer, Documentation Coordinator, Hardware Architect, Integration Coordinator, Risk Manager, Software Architect, and Treasurer. Further roles will be assigned as necessary.

Overall project management and control is the responsibility of the team leader, Oreoluwa Adebambo. In addition to her responsibilities as team lead, Oreoluwa Adebambo is responsible for managing the project plan file and reviewing the team’s documentation.

Victor Diaz will serve as the Product Designer and the Hardware Architect. As the Product Designer, he is concerned with the overall design of the product and ensures the entire scope is monitored. Also, as the Hardware Architect, he will be responsible for the design and implementation of the hardware used by the system.

Gaurab Gautam will serve as both the Integration Coordinator and Risk Manager. As the Integration Coordinator, he will be responsible for managing the integration of all the components of the system in major deliverables. As the Risk Manager he is responsible for managing and identifying risks to the project.

Braden Walters will serve as the Software Architect and Treasurer. As the Software Architect, he will make high level design choices including coding languages and tools. He will also be responsible for keeping track of the budget as the Treasurer.

External oversight will be provided through both our team sponsor and Professor O’Dell. Our team sponsor, Ravi Kant, will ensure we meet his requirements and specifications. Monthly meetings will be held to update Ravi on the projects progress and any other areas of interest.

Professor O’Dell will ensure that the team is meeting Senior Design standards and requirements through individual and group status reports, as well as team-generated purchase orders.
1.3 Roles and Responsibilities

Oreoluwa Adebambo is the team lead and will exercise oversight over the team to ensure that the schedule set forth in the plan is being met. She will also review documents and delegate tasks as necessary.

Victor Diaz is the Product Designer and Hardware Architect. He is responsible for the overall design of the product and ensures the entire scope is monitored. He is also responsible for selecting the adequate hardware components necessary and the implementation of these components into the system.

Gaurab Gautam is the Integration Coordinator and Risk Manager. He is responsible for managing the integration of all the components of the system in major deliverables, and also responsible for managing and identifying project risks.

Braden Walters is the Software Architect and Treasurer. He will make high level design choices including coding languages and tools, and he will also be responsible for keeping track of the budget.

Further roles will be assigned as necessary.

1.4 Project Constraints

After our initial analysis, our team has determined there are three main project constraints.

The most significant constraint of our team is scheduling conflicts. All of our team members are extremely busy, so finding a time to meet is difficult.

Another constraint is the $800 budget. While we are not anticipating spending all of this, it is still something that could be a future constraint.

The last constraint is the total amount of time we have for the project. Our project must be completed by December 2014, and as such, certain features may be omitted to meet the deadline.

1.5 Project Assumptions

Based on what we know about our project, our team has made three assumptions.

The first assumption is that we will all be able to communicate effectively and meet all deadlines.

The second assumption is that all of our team members will be able to attend all meetings.

The third assumption is that once we have our concept finalized, no significant changes will be made.
### 1.6 Preliminary Schedule and Cost Estimates

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<thead>
<tr>
<th>Task</th>
<th>Date Due</th>
<th>Cost (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft SRS</td>
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<td>41</td>
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<tr>
<td>Project Plan Initial Draft</td>
<td>10 July 2014</td>
<td>5</td>
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<tr>
<td>Project Charter Initial Draft</td>
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<td>SRS Gate Review</td>
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<tr>
<td>Draft ADS</td>
<td>7 August 2014</td>
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<tr>
<td>Architecture Gate Review</td>
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<tr>
<td>Baseline ADS</td>
<td>5 September 2014</td>
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<tr>
<td>Draft Detailed Design Specification</td>
<td>23 September 2014</td>
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<td>Baseline DDS</td>
<td>6 October 2014</td>
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<td>Baseline STP</td>
<td>17 October 2014</td>
<td>5</td>
</tr>
<tr>
<td>Completed Prototype</td>
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<td>40</td>
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</table>
2 Scope Statement

2.1 Introduction

The purpose of the SmartPark system is to provide Valet Parking Managers and University students a solution to find parking spaces more efficiently. It will allow users to be able to localize parking spaces through a mobile or web application in a SmartPark enabled parking lot. The Valet Parking manager will be able to monitor the status of each parking node to check things such as battery level, network status, and parking status. SmartPark’s mobile application will also sync with a user’s calendar to be able to send a notification to the user which parking spot is available when they get near to their location, or the time nears.

2.2 Product Definition

The SmartPark system will come as a multiple piece installation. A parking sensor node will come for each parking space, repeater nodes, a gateway hub, and a server for processing.

The parking sensor nodes will consist of a vehicle detection sensor such as a Hall Effect Sensor, a microcontroller to execute our logic, and a transmitting device such as an antenna to send the sensor data to our repeater nodes or gateway hub depending on the distance to the hub.

The repeater nodes are a hardware device which its function will be to repeat the sensor data that is generated. These will only be used if we can’t get our parking sensor nodes to relay the data to our hub with no intermediary, if we cannot perform this task we will use a repeater to assist the nodes in relaying the data to our hub.

The gateway hub will be used as our connection to the internet. It will be a router that will be responsible for receiving the sensor data either directly from the parking sensor node or the repeater node. After it receives the data it will send it to the internet to our external server for processing. Our Android and web application will read this data to display it to the users.

The Android Application will assist with settings and the display of the available parking spots. Certain information is needed to help SmartPark give the best user experience. The SmartPark smart phone application will synchronize with the user’s calendar programmatically or will allow the user to enter the schedule they want the system to know. Once this is done SmartPark will be able to notify the user of parking spaces.

The user web application will have the same content as the Android Application but on a web page where users will be able to see available parking spaces in SmartPark enabled parking lots.

The web administration portal will be for Valet Parking Managers where they will be able to see the status of each node in their parking lot. It will show battery status, parking space, and availability status.
2.3 Intended Audience

The intended audience for the current scope of the project will be Valet Parking Managers and University students. Other audiences could include airports, cities, business owners, and retail shopping centers.
3 Cost Management Plan

3.1 Introduction
This section covers how the team will manage both financial and effort costs that will be involved in the development of this project. This plan will focus on strategies to stay within budget for both time and financial resources.

3.2 Project Budget
The team has been allotted approximately 6-7 calendar months to complete the project, as well as a budget of $800. If each member of the team works 3 hours a day for five days each week, the number of hours devoted to the project should be around 400 per person, or 1600 hours for the team. The budget and man hour estimate covers the duration of the project.

3.3 Cost Management
The team treasurer will be primarily responsible for managing the financial budget so that the team does not exceed the $800 allotment. The treasurer will be responsible for updating the team on where the current budget stands. The treasurer will keep a record of each financial transaction that is made and recalculate the remaining budget to reflect the transaction. Before any purchases are made, the team will consider the cost of the purchase and its importance to the overall project. Purchases will be made only with approval by the project manager.

3.4 Labor Management
To manage the costs of labor, the team will develop a Project Plan to assign and track the tasks that are necessary for completion of the project. The project leader will be the primary person in charge of managing the Project Plan. Tasks in the plan will include details such as assigned team members, planned start and end dates, actual start and end dates, and hours needed to complete the task. The Project Plan will help ensure that each team member is given an even amount of work, and that the tasks are assigned to the individual that is best suited for the task. The Project Plan will be initially created using estimates for completion dates towards the end of the project. The Project Plan will be refined as time progresses and more information is discovered. In addition, any issues that occur during the project will be managed and relevant tasks will be adjusted in the project plan.
4 Earned Value Management

4.1 Measurement of Earned Value

The Earned Value (BCWP) for each discrete task in our project plan will be measured based on the factors below:

- WBS (Work Breakdown Structure Task ID)
- BCWS (Budgeted Cost of Work Scheduled)
- ACWP (Actual Cost of Work Performed)
- % Complete

Before assigning a discrete task from our project plan, a BCWS will be assigned to the task. After the task is reviewed for completion during our team meeting, we will obtain the ACWP, and assign a value of 0 or 100 percent completed based on whether the task was completed or not. If the task is complete (100%), the BCWP will be based off of the BCWS. Otherwise, a duration of zero hours will be assigned. Each task that is assigned to a team member has a corresponding WBS ID. We will use this ID to reference the task when measuring its Earned Value.

Each unit of duration in our project plan – BCWS, BCWP, and ACWP – will be in man-hours.

4.2 Reporting Earned Value

A portion of one of our team meetings each week will be dedicated to reporting on earned value.

At the beginning of our meeting, we will collect from each team member, the following information for each task that they were assigned in the prior week or period: WBS ID, ACWP, Actual Start Date, Actual End Date, and % Complete.

Two possible courses of action can then be taken for each task:

*If the task reported on is complete:*

- The Actual Start and Actual Finish dates will be recorded for the task
- % Complete will be set to 100
- The ACWP will be recorded for the task
- The BCWP will be recorded as the BCWS for the task.
If the task reported on is incomplete:

- The Actual Start date will be recorded for the task, if started, or left blank if delayed.
- % Complete will be set to 0.
- The ACWP will be recorded for the task.
- The BCWP will be recorded as 0 hours.

At the end of the team meeting each week, the team leader will assign tasks from the project plan to be completed in the next week or period. For each task that is assigned to a team member, we will obtain the BCWS as well as the Planned Start and Planned Finish dates for the task. We will use this information during our next meeting to determine the Earned Value for the task.

4.3 Individual Status Reports

Prior to the lab period during the week in which our individual status reports are due, each team member will examine the project plan for the tasks they have worked on since the last individual status report. For each of these tasks, the team member will determine the Actual Start Date, Actual Finish Date (if task completed), the ACWP for the task, and the Earned Value for the task. In addition, each team member will use the project plan to determine which tasks they are to work on through the next period in conjunction with their assignments from the team lead. They will obtain the BCWS, Planned Start, and Planned Finish dates for those tasks. To facilitate and streamline the process for reporting on individual status reports, the project plan manager will email a spreadsheet to the team containing a list of all tasks completed the prior period as well as those tasks to be completed in the next period.

4.4 Measuring Performance

We will use two different ways to measure the performance of our team. The first indicator for measuring our performance is by generating a bi-weekly Earned Value graph to analyze our progress so far. The second indicator will be to analyze the SPI (Schedule Performance Index) and CPI (Cost Performance Index) for each major milestone/summary task we have listed in the project. We will use the graph to determine whether we are behind or ahead of schedule as well as determining if we are above or below budget. The graph will be generated in excel and will be graphed according to the following data points: BCWS, ACWP, BCWP. The SPI and CPI are computed automatically in our project plan. For each major milestone or task that has been completed, we will assess our performance thus far according to the following criteria:

- If SPI > 1, we are ahead of schedule.
- If CPI > 1, we are well within our budget.
- If CPI < 1, we are well over budget.
- If SPI < 1, we are well behind schedule.

Generally, a CPI and SPI above 1 is an indicator that we are performing well; if either number falls below 1, we will have to reassess our current schedule.
5 Scope Management Plan

5.1 Introduction
The scope management plan defines how the team will handle the project’s feature set. The plan includes building a clear definition of the product using the requirements listed in the System Requirements Specification document. The plan also includes methods on how the team will conform to or handle changed to the planned feature set.

5.2 Scope Definition
The scope of SmartPark will be defined using the requirements determined in the System Requirements Specification document.

5.3 Scope Management
The SmartPark prototype will be broken into multiple parts that will be reflected in the MS Project plan. Team Sense will strictly adhere to this plan to mitigate the chance of feature-creep as much as possible. Team Sense will also have weekly review meetings which will serve for the team members to update the rest of us on progress they have made. We will make each other accountable to assure that our work is staying within the scope of the project. When a component is completed it will go into a review process to assure that the completed piece is in scope before it is integrated into the prototype. If a component does not pass, it will need to be reworked to be reviewed again.

5.4 Scope Change Control
If a team member or sponsor feels the need for a change to be made to the feature set, there will be a change request process to follow. First a change request form will need to be filled. There will be several types of changes: feature modify, feature removal, and feature addition. Once this request gets filed, Team Sense will hold a Change Advisory Board (CAB) meeting to discuss the change request to make a decision on the best course of action for that change in the feature set. Lastly, the team will meet with the sponsor to gather their input. If the sponsor accepts the change, the feature set will be modified.
## 6 Work Breakdown Structure

<table>
<thead>
<tr>
<th>WBS</th>
<th>Task Name</th>
<th>Planned Start</th>
<th>Planned Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Senior Design 1</td>
<td>Mon 02-06-14</td>
<td>Tue 12-08-14</td>
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<td>Project Inception</td>
<td>Mon 02-06-14</td>
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<td>Determine Project Topic</td>
<td>Tue 10-06-14</td>
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<td>Secure Sponsorship</td>
<td>Thu 19-06-14</td>
<td>Sun 22-06-14</td>
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<tr>
<td>1.1.3</td>
<td>Setup Android Development Environment</td>
<td>Fri 20-06-14</td>
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<tr>
<td>1.1.4</td>
<td>Setup version control</td>
<td>Fri 20-06-14</td>
<td>Tue 24-06-14</td>
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<td>1.1.5</td>
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<td>Fri 11-07-14</td>
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<td>Mon 15-09-14</td>
<td>Fri 03-10-14</td>
</tr>
<tr>
<td>2.3.2</td>
<td>STP Second Draft</td>
<td>Fri 03-10-14</td>
<td>Mon 13-10-14</td>
</tr>
<tr>
<td>2.3.3</td>
<td>STP Baseline</td>
<td>Mon 13-10-14</td>
<td>Fri 17-10-14</td>
</tr>
<tr>
<td>2.2.1</td>
<td>STP First Draft</td>
<td>Tue 09-09-14</td>
<td>Thu 19-09-14</td>
</tr>
<tr>
<td>2.2.2</td>
<td>STP Second Draft</td>
<td>Thu 19-09-14</td>
<td>Thu 26-09-14</td>
</tr>
<tr>
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<td>STP Baseline</td>
<td>Tue 30-09-14</td>
<td>Tue 30-09-14</td>
</tr>
<tr>
<td>2.4</td>
<td>Implementation</td>
<td>Fri 22-08-14</td>
<td>Thu 07-11-14</td>
</tr>
<tr>
<td>2.5</td>
<td>Prototype</td>
<td>Wed 01-10-14</td>
<td>Fri 14-11-14</td>
</tr>
<tr>
<td>2.5.1</td>
<td>Prototype Development</td>
<td>Wed 01-10-14</td>
<td>Mon 20-10-14</td>
</tr>
<tr>
<td>2.5.2</td>
<td>Prototype Demonstration</td>
<td>Mon 20-10-14</td>
<td>Mon 20-10-14</td>
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<tr>
<td>Section</td>
<td>Event Description</td>
<td>Start Date</td>
<td>End Date</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>2.5.3</td>
<td>Prototype Discussion (Lab)</td>
<td>Mon 20-10-14</td>
<td>Fri 07-11-14</td>
</tr>
<tr>
<td>2.5.4</td>
<td>Prototype Preview</td>
<td>Mon 20-10-14</td>
<td>Fri 14-11-14</td>
</tr>
<tr>
<td>2.6</td>
<td>Team Meetings</td>
<td>Fri 22-08-14</td>
<td>Tue 02-12-14</td>
</tr>
<tr>
<td>2.7</td>
<td>Sponsor Meetings</td>
<td>Sun 24-08-14</td>
<td>Sun 09-11-14</td>
</tr>
<tr>
<td>2.8</td>
<td>Project Plan Updates</td>
<td>Sat 13-09-14</td>
<td>Thu 11-12-14</td>
</tr>
<tr>
<td>2.9</td>
<td>Individual Status Reports</td>
<td>Fri 22-08-14</td>
<td>Fri 21-11-14</td>
</tr>
<tr>
<td>2.10</td>
<td>Team Status Reports</td>
<td>Fri 05-09-14</td>
<td>Fri 21-11-14</td>
</tr>
</tbody>
</table>
7 Quality Management Plan

7.1 Introduction
The quality management plan will be used to determine an acceptable level of quality for the project. The quality standards will be based on requirements from both the customer and from within the team. This plan will focus on the different features that will be used to ensure that the level of quality is consistent throughout the project.

7.2 Software
The software for the various systems used in the project will be programmed following commonly recognized best practices of quality programming. By using comments, modular design, and meaningful variable and function names we will ensure that the code is easy to read and maintain. The source code will be developed using these principles:

- Detailed design
- Version control
- Peer reviews
- Unit testing

7.3 Hardware
Hardware for the SmartPark system will be purchased only after discussion with the team on its quality and relevance to the overall project. Discussing in this manner will help ensure that the best components are found to keep the overall project quality high. Each hardware component will be tested individually and as a complete system to ensure correct functionality and output.

7.4 Testing
Each part of the system will be unit tested to ensure proper functionality before final assembly. The tests conducted will be detailed in the system test plan. The hardware and software will then be tested together to ensure correct responses and outputs based on different inputs. Testing software in conjunction with hardware will help detect and fix issues that arise due to hardware/software integration. The completed system will then be performance tested to ensure it meets speed and accuracy requirements. If the system satisfies the criteria set forth by the team, it will be tested against the customer requirements to ensure acceptance by the customer.
8 Communications Plan

8.1 Introduction

As effective communication among team members is very important for the proper functioning of any team and the overall success of the project, we have come up with an effective plan for communication that will set us up for success. This plan includes both internal and external methods to regulate our lines of communication. Our plan will define how team members will communicate internally. It will also specify how we plan to communicate externally with our project sponsor, Ravi Kant, and our project supervisor, Mr. Mike O'Dell. Our communication plan will ensure that all team members stay on the same page throughout the project lifetime.

8.2 Internal Communication

8.2.1 Team meetings

The team will have two mandatory weekly meetings on Tuesdays and Thursdays at 5:30 PM. This will be our primary meeting where team members will discuss about the project progress, deliverables, future plans, risk assessment and control, and other project related issues. Our team has also decided that we will have an agenda for our weekly meetings. In addition, we will also have extra meetings assigned by our team leader if necessary.

8.2.2 Text

The primary form of communication is via text messaging. Our team has created a group chat using the GroupMe app, which will allow us to send and receive instant messages, and to ensure all members are up-to-date on any developments. GroupMe will be the primary and quick means of communication among team members. It will mainly be used to conduct informal communication, such as comments, inquiries, reminders, etc., regarding our project.

8.2.3 Video Conferencing

Our secondary form of communication is via live video conference calls. The team will be using Google Hangouts for this while reviewing documents and other deliverables.

8.2.4 Google Drive

Google drive will be used as a repository to store all project documents as well as the risk management database. All the team members will have easy access to Google drive to upload, edit and review project documents.
8.3 External Communication

8.3.1 Team status reports

The team will give a status report to our project supervisor Mr. Mike O’Dell, and fellow classmates at different intervals of the project based on the assignment schedule published on the website.

8.3.2 Sponsor Meetings

In order to keep our project sponsor informed about the major milestones of the project, we will arrange in-person meetings when it is possible. However, due to the unavailability of our sponsor to meet us in person on a regular basis, we will mostly conduct video conferences with our sponsor via Google Hangouts.

8.3.3 Email and Phone Calls

Email is the most easy and effective way to communicate with our project sponsor. Communication with the sponsor through emails is mostly done to send messages and documents to the sponsor in order to keep him updated with the progress of the project. The least frequently used means of communication to contact our project sponsor will be phone calls. We will only use phone calls in case of an immediate need for contacting our sponsor.
9 Change Management Plan

9.1 Purpose of Integrated Change Management Plan

Sense’s change management plan is to anticipate, analyze, and prepare for all changes that may arise throughout the development process. Sense has stressed the importance of managing change in the most effective and organized way to minimize the risks that will go into the project. We have identified several things that might change throughout the implementation of SmartPark.

While analyzing the product and the meetings we have had, one of the most problematic changes that may arise is a change in requirements. We can anticipate that at some point after our requirements are fully defined, Sense or our project sponsor might feel the need to change these requirements. In addition to changing requirements, we have also identified that a change in our work breakdown structure or project plan might occur at any given time. We have also discussed the different types of approaches we might take to implement SmartPark, either build the board ourselves or find a board that is ready to go. We may realize that the former might be too difficult to implement in the time allotted and have to switch to the latter to meet our deadline. We may also have to change our system design or architecture depending on what circumstances arise once we start implementation.

Sense has identified these as possible changes and we foresee others getting added to the list as the project progresses. For these reasons we have established a change review body that will include all members of Team Sense, sponsor Ravi Kant. Specifics on our change management plan can be found in the following sections.

9.2 Roles and Responsibilities

- **Project Sponsor** – Ravi Kant, as the sponsor for this project will have an active role in our change management plan. He will serve as the person in charge of change in our requirements specified in the SRS. Also, any changes that may affect the project will have to go through his review for final approval.

- **Project Manager** – The Project Manager will have a crucial role in the change management process. The Project Manager will receive all change requests and schedule a review meeting to address the change. She will also work with the risk manager to assess any risks that this change might bring in and assure that the change will keep the project within the scope. She will be our final decision on the approval of the change, acting on the recommendations from the team, sponsor, and project supervisor. The project manager will also be a source of changes to the requirements of the project.

- **Project Team** – Team Sense’s team members must report any anticipated or proposed changes to the rest of the team so that the change review process can begin. All team
members are included in the Change Advisory Board and will have involved roles in the change review process. In the meetings, all members are expected to voice their concerns regarding the change so that the Project Manager can make the best decision. Team Members, like the project manager and sponsor are able to propose changes to the project which will go through our change review process.

- **Other Stakeholders** – The Development Manager, Mr. Mike O’Dell has been identified as one of the project stakeholders as well. Mr. O’Dell may introduce changes to the course structure, project deliverables, deadlines, among other things up to his discretion. Team Sense may decide to consult with him if his changes have a high impact to our project.
As can be seen from the flowchart above, there are several paths that a change request can take. A change requestor must fill out a change request form and once it is complete it will be sent down to our Project Manager so she can schedule a CAB meeting. If the change affects our sponsor, Ravi will be included in the change process, if not we will not bother him with internal changes to the team. The team will then gather input and recommendations to either accept or deny the change. If the change is accepted we update the necessary documentation to reflect this change. If the change is denied then we discard it, but still document the change request form.
9.4 Change Identification, Documentation, Implementation, and Reporting

The change control form will contain certain pieces of key information: change requestor, change category, description of the change being requested, the reason for the change, and risks to be considered for this change. The request form must be completed and presented to the project manager before it is presented to the team.

After a proposed change is accepted, all affected documents, schedule items, and budget/cost items will be thoroughly documented by all members of the team in their engineering notebooks. The document master will then consult with the team to update the corresponding documents. Following these updates the project plan will be updated by the project manager if necessary. The change control officer will then catalog all approved change requests for the length of the project. A sample of our change request form can be found from this link:

http://www.projectmanagementdocs.com/project-documents/change-request.html
### Change Request

<table>
<thead>
<tr>
<th>Project:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change Requestor:</td>
<td>Change No:</td>
</tr>
</tbody>
</table>

#### Change Category (Check all that apply):
- [ ] Schedule
- [ ] Cost
- [ ] Scope
- [ ] Requirements/Deliverables
- [ ] Testing/Quality
- [ ] Resources

#### Does this Change Affect (Check all that apply):
- [ ] Corrective Action
- [ ] Preventative Action
- [ ] Defect Repair
- [ ] Updates
- [ ] Other

Describe the Change Being Requested:

Describe the Reason for the Change:

Describe all Alternatives Considered:

Describe any Technical Changes Required to Implement this Change:

Describe Risks to be Considered for this Change:

Estimate Resources and Costs Needed to Implement this Change:

Describe the Implications to Quality:

Disposition:
- [ ] Approve
- [ ] Reject
- [ ] Defer

Justification of Approval, Rejection, or Deferral:

### Change Board Approval:

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

8 August 2014 @ 2:59:00 AM

20 Change Management Plan
10 Risk Management Plan

10.1 Purpose of Risk Management Plan
Risk, in any project, is defined as something that causes “unexpected loss”. Risks may expose our project to go behind schedule or to go over budget. Because of this, it is very important to address risks that may prevent our project from being completed successfully within the allotted budget and time. The purpose of a risk management plan is to assess possible risks that may occur during project's lifetime and then control them. The risk management plan will identify risks, analyze them, prioritize them, create plans for dealing with them, resolve them, and constantly monitor the progress made towards risk resolution as well as be able to identify new risks when they emerge throughout the project's lifetime.

10.2 Roles and Responsibilities
• **Project Sponsor** – The project sponsor will be responsible for notifying the team with any possible risks that are identified. The sponsor can also assist the team in making plans for resolving risks by giving us some insightful advice.

• **Project Manager** – The project manager will be responsible for supervising project's progress throughout its lifetime. The project manager will also make sure that a risk management plan is in place and is actively followed throughout the project's lifetime.

• **Project Team** – The responsibility of the project team is to notify the team of any identified risks. All of the team members should actively participate in devising plans to address and resolve risks. The team will also notify the sponsor and the stakeholders about critical risks when they arise.

• **Risk Manager** – The job of the risk manager is to actively participate in the risk management process and also to follow the risk management plan. In addition, the risk manager is also responsible to track, document, and report risks throughout the project's lifetime.

10.3 Risk Identification
All the team members are expected to participate in the risk identification process. Once a risk is identified, it is the responsibility of the team member to notify the risk manager. The risk manager shall inform the team about the identified risk in the next team meeting for discussion and creation of a risk resolution plan. The job of the risk manager is to document the risk in sufficient detail for effective risk assessment and record it in the risk database.

10.4 Risk Triggers
The following events or performance characteristics are identified as risk triggers, which warn of the occurrence of risk events:

• Team member failing to attend the meeting (without justification)
Senior Design Documentation Library

- Lack of sufficient communication among team members
- Team failing to complete the deliverables on, or before internal due dates (schedule slip)
- Team not making steady progress on learning necessary skills (Test Plan, hardware, knowledge, research, etc.)
- Loss of team member's motivation and commitment
- Temporary loss or unavailability of a team member
- Having difficulty in finding hardware components under budget
- Unable to get hardware components delivered on time

10.5 Risk Analysis

The following risk assessment table was created using the identified risks by the team, the probability of loss, the size of the loss, and the risk exposure:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Probability of loss (%)</th>
<th>Size of loss (days)</th>
<th>Risk Exposure (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overly optimistic schedule for architectural design, detailed design and implementation</td>
<td>70</td>
<td>30</td>
<td>21</td>
</tr>
<tr>
<td>Inadequate system design</td>
<td>50</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Inadequate hardware skills</td>
<td>50</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>Requirements or developer gold-plating</td>
<td>55</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>Shortchanged quality (test plans and test execution)</td>
<td>55</td>
<td>15</td>
<td>8.25</td>
</tr>
<tr>
<td>Additional features added by the sponsor</td>
<td>10</td>
<td>25</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>68.75</strong></td>
</tr>
</tbody>
</table>

10.6 Risk Severity

This section prioritizes and lists the risks that are most likely to occur during the product development stages. It also evaluates the severity of the risks and lists the triggers that may cause the associated risk. It also describes the risk resolution plan that is necessary for mitigating or controlling the probable risks.
## Risk Management Plan

<table>
<thead>
<tr>
<th>Risk</th>
<th>Severity</th>
<th>Trigger</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overly optimistic schedule for architectural design, detailed design and implementation</td>
<td>1 – Critical</td>
<td>Schedule slip, time-consuming research, underestimating tasks difficulties</td>
<td>Add sufficient buffer time before each deliverable deadline. Address the risk in team meeting and revise and strictly follow project plan. Follow staged delivery implementation.</td>
</tr>
<tr>
<td>Inadequate system design</td>
<td>2 – High</td>
<td>Not doing enough research before designing the system, not revising and refining design</td>
<td>Research enough to acquire knowledge about bits and pieces of the system. Do thorough design reviews</td>
</tr>
<tr>
<td>Inadequate hardware skills</td>
<td>2 – High</td>
<td>Failed to learn hardware skills or not making steady progress on learning hardware skills required for project</td>
<td>Research and learn about hardware required to complete the project.</td>
</tr>
<tr>
<td>Requirements or developer gold-plating</td>
<td>3 – Medium</td>
<td>Adding complex and unnecessary features, using unproven or untested tools</td>
<td>Scrub complex requirements, control the feature sets, use proven technology</td>
</tr>
<tr>
<td>Shortchanged quality (test plans and test execution)</td>
<td>3 – Medium</td>
<td>Inadequate test plans, insufficient test execution</td>
<td>Allow time for QA activities such as creating test plans, conducting sufficient tests</td>
</tr>
<tr>
<td>Additional features added by the sponsor</td>
<td>4 – Low</td>
<td>Sponsor wants to add infeasible features and requirements</td>
<td>Discuss with the sponsor about the feature and explain its infeasibility under budget and time constraints</td>
</tr>
</tbody>
</table>

### 10.7 Risk Response Planning

For each risk that has been identified, analyzed and prioritized, there will be a strategy in place for eliminating the root cause of the risk or at least minimizing the effects of the risk to a level where it can be controlled and managed to ensure the project objectives are successfully achieved. Risk planning and resolution strategy will be a team effort; however, the risk manager will be responsible to present the risk to the team and lead the team to develop strategies for controlling or resolving it.
10.8 Risk Documentation and Reporting
The team will maintain a central risk management repository in our Google drive where risk information and mitigation strategies will be stored. The risk manager will be responsible for maintaining the risk repository. Any incoming risk information, analysis and resolution plans are to be firstly revised by the risk manager before it is stored in the repository. All the team members will have easy access to the risk management repository.

10.9 Risk Control
The team will be actively participating in the risk management process, led by the risk manager. As risks are identified, they will be addressed immediately. Firstly, the team will analyze and prioritize the risk. If the risk is categorized as a high priority risk, a risk management plan will be developed to control or resolve the risk. The team will also monitor the progress towards risk mitigation or resolution, and will be continuously working to identify new risks as they emerge. The risk manager will update the risk database as the risks are identified, analyzed and resolution plans are created. Periodically, risks from the database will be reassessed and reevaluated to monitor the progress made to control risks throughout the project’s lifetime.
11 Procurement Management Plan

11.1 Purpose of the Procurement Management Plan

The purpose of this plan is to describe the guidelines that the team will follow when obtaining any materials that may be necessary for the project. This plan will ensure that the team has a clear and effective way to acquire the resources necessary to complete the project. Team members will use this plan to ensure that we receive the goods and advice that best fit our needs.

11.2 Roles and Responsibilities

Below are the member roles associated with the project and their responsibilities.

- **Project Sponsor** – Ravi Kant will provide suggestions on what materials will be useful in creating a working product, as well as providing advice on how to produce a system with real-world applications.
- **Project Manager** – Oreoluwa Adebambo will be a part of all discussions on resources that need to be acquired. She will give the approval for the team to put in a purchase request to Mike O’Dell, for final approval.
- **Project Team** – The team will discuss any necessary components that need to be purchased based on research and suggestions from the sponsor. If the team determines a purchase is necessary, a request will be written to Mike O’Dell.
- **Project Stakeholders** – Stakeholders will be notified if any items are purchased.

11.3 Required Project Procurements and Timing

The procurement phase will begin as soon as the project requirements are finalized and design begins. During the procurement phase, the team will acquire all of the components necessary to ensure a smooth implementation phase. In case problems arise during procurement, the team will have alternatives secured for each component to ensure adequate resources are available to the team during implementation. In addition, the materials will be ordered ahead of schedule to account for any delays that may occur.

11.4 Description of Items/Services to be acquired

Items and services may be divided into several sections. For Software, the only resource that should be needed will be an account on Google Play in order to publish the Android Application. Each of the vehicle sensors will need to be equipped with a Hall Effect magnetic sensor, battery, durable housing, microcontroller, a network antenna, and repeater nodes if needed. A wireless router will be used to communicate with the parking sensors. A cloud-based server will be used to analyze data received from the sensors and distribute relevant messages to users via the app.
12 Project Closeout Report

12.1 The Purpose of Closeout Report
This section provides the closeout report of the project. The purpose of the closeout report is to verify that personnel, contract, administrative, and financial issues are settled, and that the project documents are archived and lessons learned are captured.

12.2 Administrative Closure

12.2.1 Were the objectives of the project met?
When we closeout the project, we will examine to see whether the project's objectives were fulfilled. Furthermore, we will compare the requirements specified in System Requirements Specification document and verify that if our final product provides most of the features mentioned in the SRS as high priority requirements. We will define that our project is a success if most of the high priority requirements were met, otherwise we will consider it as a failure.

12.2.2 Archiving Project Artifacts
All of the project documents will be stored in our project repository in Google Drive throughout the project’s lifetime. Besides, for future reference, we will also compile all the documents in a binder, including source code and design documents in a CD, and keep that binder in the Senior Design Lab. The following documents will be archived in the binder:

- System Requirements Specification
- Project Charter
- Microsoft Project Plan
- Architectural Design Specification
- Detailed Design Specification
- System Test Plan
- Purchase Requests
- Status Reports
- User Manual
- Meeting Notes

12.2.3 Lessons Learned
After the final project handover, our team will discuss, analyze and capture what problems we encountered, what mistakes we made, how we resolved the problems, and what important lessons we learned throughout the Senior Design course.
12.2.4 Plans for Post Implementation Review (PIR)

After we complete our product implementation and demonstration phase, we will conduct Post Implementation Review to assess whether the project met its desired objectives or not. We will evaluate the product's individual features with the corresponding requirement categorized as high priority requirements in the System Requirements Specification. In addition, the team will go through each acceptance criterion and examine the product's related feature to see if it meets to a satisfactory standard.

12.2.5 Final Customer Acceptance

After the completion of the product prototype, the team will meet the sponsor to decide whether the project has met its objectives. The sponsor will then compare all the acceptance criteria with the product's corresponding features, and decide whether he is satisfied with the features and the overall project implementation and the product prototype. If the sponsor determines that the product has met his requirements to an acceptable level, then we will start the next process. On the other hand, if the sponsor deems the project as a failure then we will discuss a possible resolution and create a future plan to improve the product to meet the sponsor's requirements standards.

12.2.6 Financial Records

All of the financial records will be archived in the project document binder. The financial documents, such as purchase orders and invoices, will be archived and provided in the final project closeout report.

12.2.7 Final Project Performance Report

Upon the completion of the project, the team will create a final project performance report that will summarize the project's scope, schedule performance, cost performance, quality achievements, and a review of the risk containment performance. In addition, the team will also analyze the use of the budget to create the product, and time spent during the project's lifetime. If there is a significant cost or schedule variance, the report will also address the causes for such variances.