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

Chronos
Environmentally Responsive Smart Clock

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1 General Organization

1.1 Project Manager

The Project Manager for team Chronos is Jorge Zavala. Jorge was selected as Project Manager by the course supervisor Mr. O’Dell and ratified unanimously by all team members. He is currently pursuing an undergraduate Computer Engineering degree from the University of Texas at Arlington. He has a diverse technical background in areas such as embedded systems, digital logic circuitry, circuit theory, object-oriented programming, and more. In addition to these and other technical competencies, he also displays an openness and willingness to listen to and support his teammates. The team selected him as Project Manager based on these and other qualities.

The Project Manager’s duties will include maintaining the project plan, organizing meetings and setting meeting agendas, mediating any potential team member disputes, assigning individual tasks to members of the team, assigning roles and responsibilities to team members, and providing overall direction for the team.

1.2 Project Oversight

1.2.1 Internal Controls

The Project Manager will control the internal structure of the team by delegating well defined roles and responsibilities to his fellow teammates and providing a set of standards that clearly indicate what is expected of each member. Team members will report to the Project Manager on a weekly basis to update him on the status of any individually assigned tasks. The standards by which our team will uphold all assignments will be clearly communicated and reemphasized throughout the duration of the project.

The Project Manager will utilize the project plan to ensure that the team proceeds as scheduled and to track, maintain, and document the numerous group and individual tasks at hand. Only the Project Manager will have the authority to alter the project plan. However, all team members will have input on the tasks that need to be included in the plan.

Team meetings will officially be held on the Monday and Thursday of every week, although these days are subject to change as member schedules change. The Project Manager will set the agenda for each meeting and will be updated on the status of individual and team deliverables. The purpose of these meetings is to provide all team members with a basis for direct communication of anything pertinent to the project.
All major team deliverables and documents will be kept on Google™ Drive, on a team thumb drive, and on member’s individual computers. The Document Master will oversee all major document revisions and handle the merging of individual sections for each deliverable. The Project Manager will ensure that all members participate in the creation, completion, and reviewing of these major team deliverables.

1.2.2 External Controls

The team will adhere to various forms of external control measures put in place by the project supervisor, Mr. O’Dell. These measures are put in place to ensure that our team is following the course guidelines and to provide a mechanism for the progress of the team to be reported to Mr. O’Dell. The following are the most pertinent forms of external control that affect the team.

**Team Status Reports:** The team status reports are conducted in accordance with the course calendar. These reports include any and all completed tasks, relevant team updates, and other important information that the team wishes to disclose to the project supervisor. A PowerPoint presentation will be created for each status report and all team members will present the report to our colleagues and the project supervisor.

**Individual Status Reports:** Individual status reports will also be completed in accordance with the course calendar and the project supervisor, Mr. O’Dell. These reports are completed on an individual basis by all members of the team and turned in during the course lab period. The reports are to include any tasks that an individual member of the team worked on since the time of the previous status report.

**Gate Reviews:** Throughout the course of the semester, several team gate reviews will be conducted. These reviews provide our team with an opportunity to present our latest major team deliverable to our colleagues and the project supervisor. The purpose of these reviews is to demonstrate that our team is prepared to move on to the next phase of the development model. Ultimately, the project supervisor will decide if our team is ready to continue to the next phase.

In addition to the external control measures imposed by the project supervisor, the project sponsor, Dr. Brezeale, will provide the team with certain requirement guidelines and input to ensure that the team stays within the scope of the project.
### 1.3 Roles and Responsibilities

<table>
<thead>
<tr>
<th>Team Member</th>
<th>Role</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jorge Zavala</td>
<td>Team Leader, System Integrator</td>
<td>- Manage Project Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Delegate Tasks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Change control manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Oversees Module Integration</td>
</tr>
<tr>
<td>Shane Hanlon</td>
<td>Document Master, Hardware Lead</td>
<td>- Merge document sections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Document formatting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Hardware Integration</td>
</tr>
<tr>
<td>Cristobal Rodriguez</td>
<td>Application Developer, Quality Assurance Lead</td>
<td>- Lead Android App development</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Perform unit, component, and overall system testing</td>
</tr>
<tr>
<td>Benjamin Cahill</td>
<td>Application Developer, UI/UX Designer</td>
<td>- Aid in Android Application dev</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Design application look and feel</td>
</tr>
<tr>
<td>Alex Salazar</td>
<td>Resource Procurement, Product Packaging Lead, Cost Manager</td>
<td>- Order and obtain needed components</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Updating Project Cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Designing product housing</td>
</tr>
<tr>
<td>Darin Brezeale</td>
<td>Project Sponsor</td>
<td>- Provides feedback relating to project requirements</td>
</tr>
<tr>
<td>Mike O’Dell</td>
<td>Project Supervisor</td>
<td>- Oversees Project and checks status of team</td>
</tr>
</tbody>
</table>

In addition to the roles described above, all team members will take active participation in other common tasks such as document and presentation development, implementation programming, etc.
1.4 Project Constraints

The team has identified and documented several constraints that could potentially influence the timing, cost, resources, and/or the quality of the product. These constraints, along with their potential impact, are described in detail below:

- **Limited Time**: The project duration will be limited to approximately 7 months. In addition to this, our Detailed Design phase, System Test Plan phase, and Implementation phase will be shortened due to the length of time of the summer semester. This limited amount of time could negatively influence the team’s ability to stay within schedule.

- **Limited Budget**: The project budget consists of a maximum of $800 to spend on any necessary resources or equipment. This constraint limits the scope of the types of resources that the team can purchase and impacts important implementation decisions.

- **Other Coursework**: Several members on the team are full time students attempting to balance the workload of several courses. This inhibits our ability to allocate larger amounts of time to the product we are developing. Team members may become unavailable due to the magnitude of the work for other courses. Many of our team members also have part-time jobs that further complicate the issue. These constraints could affect the team’s ability to deliver quality work on-time.

- **Limited Knowledge**: The team has limited knowledge in several of the technologies associated with our product. Many of us have not worked with specific API’s or microcontrollers that are necessary to the success of our project. This constraint could hinder the team’s ability to complete the product in the most efficient way possible.
1.5 Project Assumptions

The team has identified several assumptions that could have future implications on the successful development of the product. These assumptions are enumerated below:

- **Team Effort**: All team members will provide their best effort in completing assigned tasks and will complete their tasks in a timely manner. The quality of individual deliverables to the team will meet the minimum standards set by the team beforehand.

- **Member Retention**: All current team members will remain a part of the team throughout the course of both Senior Design I and Senior Design II. In other words, no team member will drop either of these courses.

- **Technology**: We assume that there are methods to interface the various hardware and software components necessary to successfully complete the project. For example, the team assumes that there is a way to communicate calendar data via Bluetooth™. These types of assumptions pose the greatest risk to our project and will be elaborated on in more detail in the risk management section of this document.

- **Team Meetings**: We assume that we will be consistently meeting at least twice a week on Mondays and Thursdays to discuss key project related topics. We also assume that we will not lose our focus in these meetings as they are a critical part of our team organization.

- **Good Communication**: The team assumes that there will be good communication between all members, the project sponsor, and the project supervisor. We also assume that the channels of communication that we are using will continue to remain open for the duration of the project.
## 1.6 Preliminary Schedule and Cost Estimates

### Preliminary Project Schedule (Phase I)

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Due Date</th>
<th>Cost (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRS Initial Draft</td>
<td>2/27/14</td>
<td>89</td>
</tr>
<tr>
<td>Project Charter Initial Draft</td>
<td>3/6/14</td>
<td>76</td>
</tr>
<tr>
<td>Project Plan Initial Draft</td>
<td>3/6/14</td>
<td>12</td>
</tr>
<tr>
<td>Requirements Gate Review</td>
<td>3/25/14</td>
<td>54</td>
</tr>
<tr>
<td>Architecture Design Specification Draft</td>
<td>4/24/14</td>
<td>102</td>
</tr>
<tr>
<td>Baseline Project Charter</td>
<td>5/2/14</td>
<td>8</td>
</tr>
<tr>
<td>Baseline Project Plan</td>
<td>5/2/14</td>
<td>20</td>
</tr>
<tr>
<td>Architecture Design Gate Review</td>
<td>5/8/14</td>
<td>62</td>
</tr>
</tbody>
</table>

### Preliminary Project Schedule (Phase II)

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Due Date:</th>
<th>Cost (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Architecture Design</td>
<td>TBD</td>
<td>41</td>
</tr>
<tr>
<td>Detail Design Specification First Draft</td>
<td>TBD</td>
<td>117</td>
</tr>
<tr>
<td>Detail Design Specification Gate Review</td>
<td>TBD</td>
<td>75</td>
</tr>
<tr>
<td>Baseline Detail Design Specification</td>
<td>TBD</td>
<td>25</td>
</tr>
<tr>
<td>System Test Plan First Draft</td>
<td>TBD</td>
<td>140</td>
</tr>
<tr>
<td>Baseline System Test Plan</td>
<td>TBD</td>
<td>20</td>
</tr>
<tr>
<td>Implementation</td>
<td>TBD</td>
<td>241</td>
</tr>
</tbody>
</table>
2 Scope Statement

2.1 Purpose

The purpose of this product is to provide users with a device that displays useful information for their day in one single place. The smart clock will display information that is relevant to the user’s morning routine in order to accelerate the process and help with time management. Useful user information, such as weather updates, pre-set event updates, or traffic updates, will be displayed on the smart clock’s display to provide assistance throughout the day. The alarm feature will also help judge when it is best for the user to wake in the morning.

2.2 Product Definition

The smart clock product will come as a single device with an Android™ application to communicate with it.

The smart clock device will consist of a single LCD screen where important information to the user is displayed. It will display the time, the date, the temperature, the weather, and notifications that the user selects. The display will show the inside as well as the outside temperature based on where the user sets their location to be. The weather will be displayed as a background graphic that gives a general idea of what the outside climate is like. For example, displaying clouds and rain for a day where the forecast is rain.

Notifications being shown on the main display will range from updates that are prevalent to the area where the user lives to important events on the user’s calendar. The events on the calendar are set by the user but can be synced to the smart clock in order for them to be displayed. The alarm feature of the smart clock will help determine when it is best to wake the user in the morning so that they have sufficient time to get ready to leave for their destination. The smart clock will be able to learn over a period how long it takes the user to do their morning routine in an effort to help make sure they are not late leaving their home.

The Android™ application will assist with settings for the smart clock as well as help the user set alarms. Certain information is needed for the smart clock to perform optimally such as the user’s location, their work or school, as well as the need to be synced with their calendar. The Android™ application is what the user will use to set their location such as home address or city. The user can also set their destination in the Android™ application which would be either their work place or school. Once the user has filled in information on their calendar they can synchronize it here with the system so the smart clock can display certain events on the main screen.
2.3 Intended Audience

The intended audience for this product is morning commuters, who will use the smart clock to ease their morning process and make sure they are not late getting to where they need to go. Using the information that is displayed on the main screen, the user will have all of the useful information they need to know about their morning or day. Another audience for this product would be tech-savvy individuals who appreciate an all-in-one device that displays useful information that is personalized to them.
3 Cost Management Plan

3.1 Purpose

The cost management plan will help ensure that the team will not exceed the allocated amount of $800 for the project budget. The plan will also help the team manage the time constraints for completion.

3.2 Project Budget

The team has been given approximately 6 to 8 months to complete this project. If each person allocates 10 to 15 hours per week, then this is about 240 to 480 man hours over the time span. As a collective 5 man team this is about 1200 to 2400 man hours over the 6 to 8 month period. The team has also been given a budget of $800 to spend on materials for the project. The cost management plan will ensure the team does not exceed the allotted budget.

3.3 Cost Breakdown

Based on the team’s initial research on material cost of items that will be needed, the team has found that the project will need an estimated amount of $484. This is an approximate figure that we expect to change over time, but since the team is far from the $800 budget, there is a lot of room for deviations. The initial breakdown of costs is shown below.

<table>
<thead>
<tr>
<th>Part (x2 of each)</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microcontroller</td>
<td>$70.00</td>
</tr>
<tr>
<td>LCD Screen</td>
<td>$149.98</td>
</tr>
<tr>
<td>Temperature Sensor</td>
<td>$5.98</td>
</tr>
<tr>
<td>Light Sensor</td>
<td>$16.00</td>
</tr>
<tr>
<td>Wi-Fi Module</td>
<td>$23.90</td>
</tr>
<tr>
<td>Bluetooth™ Module</td>
<td>$10.30</td>
</tr>
<tr>
<td>DC Power Supply</td>
<td>$69.98</td>
</tr>
<tr>
<td>USB Speakers</td>
<td>$17.98</td>
</tr>
<tr>
<td>Radio Transceiver</td>
<td>$20.00</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>$100.00</td>
</tr>
<tr>
<td><strong>Total Cost:</strong></td>
<td><strong>$484.12</strong></td>
</tr>
</tbody>
</table>
The parts that are shown in the initial breakdown are not final and the team has left room for different options on some parts, such as the choice between a Raspberry Pi and an Arduino for the single-board microcontroller.

3.4 Labor Management

The team will measure the labor that goes into the project by using earned value management. The measurements will be calculated by finding the budgeted cost of work scheduled (BCWS), actual cost of work performed (AWCP), and the budgeted cost of work performed (BCWP). These values are calculated and then put into the Microsoft project plan by the team’s leader. The man hours that the team has estimated at this point are between 1200 and 2400 for the span of the 6 to 8 month long project. These numbers are just an estimate at this time and most likely will change as time goes on.
4 Earned Value Management

4.1 Purpose

The purpose of earned value management is to show a measurable amount of how much work the team puts into a specific area of the project. Earned value management can also show how the team is progressing on the project. It shows the planned work for certain criteria, how much time was allocated for that task, and compares it to how much time it took to complete those criteria. By using this method the team can check their progress and see if we are performing well or falling behind. Knowing this, the team can determine if there are any problems so we can fix these issues, stay on schedule, and the project can be completed on time.

4.2 Earned Value Components

Every task that needs to be done will be put in the Microsoft project plan and will have these following earned values associated with them. Earned value will be used to give the team an overall idea of what the status of the project is. All of these values are in man-hours.

- **Budgeted Cost of Work Scheduled (BCWS)**
  - How much work was planned for a certain task

- **Actual Cost of Work Performed (ACWP)**
  - How much work was actually performed completing the task

- **Budgeted Cost of Work Performed (BCWP)**
  - The value that was earned completing the task
4.3 Cost Performance Index and Schedule Performance Index

The Cost Performance Index (CPI) is a way to measure how efficient the team is at performing the work. The CPI is a ratio between the BCWP and the ACWP. The Schedule Performance Index (SPI) is a way to measure if project deadlines are being met. The SPI is a ratio between BCWP and BCWS. Based on the ratios that are calculated we can make changes to the way work is delegated or identify possible problems. If the ratios are above 1.0, we know that everything is progressing smoothly and perhaps we can divvy up more work among the team. If the ratios are below 1.0, we can assess whether any changes to the plan or work reassignment is necessary.

- **Cost Performance Index (CPI)**

  \[ CPI = \frac{BCWP}{ACWP} = \frac{Earned Value}{Actual Work} \]

  If CPI > 1.0 = good performance

  If CPI < 1.0 = poor performance

- **Schedule Performance Index (SPI)**

  \[ SPI = \frac{BCWP}{BCWS} = \frac{Earned Value}{Planned Value} \]

  If SPI > 1.0 = good performance

  If SPI < 1.0 = poor performance

4.4 Status Reports

The team meets at least twice a week in person and during these meetings members talk about their performance on the tasks they are assigned. Team members let the team leader know how much time they are spending on each task and the team leader records those values in the Microsoft Project plan. This will allow the team leader to know how well the project is coming along and see if the team is being efficient at performing work as well as measuring if project deadlines are being met.
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 changes to the planned feature set.

5.2 Scope Definition
The scope of the product will be defined using the requirements put forth in the System Requirements Specification document. Since the System Requirements Specification document is relatively vague in places, the team will also have to provide some input as well. Using both sources, the team will define a clear feature set and use that to complete the project.

5.3 Scope Management
The prototype is broken up into sections in the MS Project plan. By tackling each section one-by-one the feature set is much less likely to be altered by unnecessary feature creep. The team will also use team meetings to do quick reviews of each member’s progress to make sure the development is in scope and nothing is missing or added. Sections will be given a thorough review upon completion and will require each member of the team to sign off before it can be integrated into the prototype. Sections that do not pass will need to be reworked and reviewed until they are satisfactory to the team.

5.4 Scope Change Control
If the team, a team member, or sponsor feels a change needs to be made to the feature set, there will be a process in place to do so. First, a change request needs to be filed. There will be three types of changes: feature modify, feature removal, and feature addition. After the request has been filed, the team will meet and discuss the change request. The team will make a decision together on the best course of action regarding the request. Lastly, the team will meet with the sponsor to retrieve their input or discuss options. If the sponsor accepts the change, the feature set will be appended.
6 Work Breakdown Structure

6.1 Purpose

The work breakdown structure is following a hybrid waterfall method dividing the work into multiple phases. The first phase is Senior Design I. In this phase the team will be doing most of the documentation for the project including the System Requirement Specification, the Project Charter, and the Architecture Design. The second phase consists of finalizing the Architecture Design and researching technologies integral to the product. In the last phase Senior Design II, the team will submit the Baseline Architecture Design, create the Detail Design Specification document, the Test Plan, and finish up the prototype.

6.2 MS Project Work Breakdown Structure

Below is a portion of our current MS Project plan.

<table>
<thead>
<tr>
<th>WBS</th>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Phase I</td>
<td>77 days</td>
<td>Thu 1/23/14</td>
<td>Fri 5/9/14</td>
</tr>
<tr>
<td>1.1</td>
<td>Getting Started</td>
<td>12 days</td>
<td>Thu 1/23/14</td>
<td>Fri 2/7/14</td>
</tr>
<tr>
<td>1.2</td>
<td>Requirements Specification</td>
<td>32 days</td>
<td>Mon 2/10/14</td>
<td>Tue 3/25/14</td>
</tr>
<tr>
<td>1.2.1</td>
<td>SRS Initial Briefing</td>
<td>1 day?</td>
<td>Mon 2/10/14</td>
<td>Mon 2/10/14</td>
</tr>
<tr>
<td>1.2.2</td>
<td>SRS First Draft</td>
<td>14 days</td>
<td>Mon 2/10/14</td>
<td>Thu 2/27/14</td>
</tr>
<tr>
<td>1.2.3</td>
<td>SRS Gate Review Phase</td>
<td>18 days</td>
<td>Thu 2/27/14</td>
<td>Mon 3/24/14</td>
</tr>
<tr>
<td>1.3</td>
<td>Project Charter</td>
<td>60 days</td>
<td>Mon 2/10/14</td>
<td>Fri 5/2/14</td>
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<tr>
<td>1.3.1</td>
<td>Charter Initial Briefing</td>
<td>1 day</td>
<td>Mon 2/10/14</td>
<td>Mon 2/10/14</td>
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<td>1.3.2</td>
<td>Charter First Draft</td>
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<td>Mon 2/10/14</td>
<td>Thu 3/6/14</td>
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<td>1.3.3</td>
<td>Charter First Draft Presentation</td>
<td>8 days</td>
<td>Thu 3/6/14</td>
<td>Tue 3/18/14</td>
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<td>1.3.4</td>
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<td>1.4</td>
<td>Microsoft Project Plan</td>
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<td>Mon 2/10/14</td>
<td>Fri 5/2/14</td>
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<td>1.4.1</td>
<td>Project Plan First Draft</td>
<td>19 days</td>
<td>Mon 2/10/14</td>
<td>Thu 3/6/14</td>
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<tr>
<td>1.4.2</td>
<td>Project Plan First Draft Present</td>
<td>9 days</td>
<td>Thu 3/6/14</td>
<td>Tue 3/18/14</td>
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<td>1.4.3</td>
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<td>Fri 3/21/14</td>
<td>Fri 5/2/14</td>
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<td>1.5</td>
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<td>Mon 4/7/14</td>
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<td>1.5.2</td>
<td>ADS First Draft</td>
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<td>Mon 4/7/14</td>
<td>Thu 4/24/14</td>
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<tr>
<td>1.5.3</td>
<td>ADS Gate Review Phase</td>
<td>11 days</td>
<td>Thu 4/24/14</td>
<td>Thu 5/8/14</td>
</tr>
<tr>
<td>1.6</td>
<td>Project Meetings</td>
<td>62 days</td>
<td>Mon 1/23/14</td>
<td>Tue 5/5/14</td>
</tr>
<tr>
<td>1.6.1</td>
<td>Team Meetings</td>
<td>62 days</td>
<td>Mon 1/23/14</td>
<td>Tue 5/5/14</td>
</tr>
<tr>
<td>1.6.2</td>
<td>Sponsor Meetings</td>
<td>67 days</td>
<td>Thu 2/6/14</td>
<td>Fri 5/9/14</td>
</tr>
<tr>
<td>2</td>
<td>Phase II (May Intersession)</td>
<td>1 day?</td>
<td>Mon 5/19/14</td>
<td>Mon 6/1/14</td>
</tr>
<tr>
<td>2.1</td>
<td>Finalizing ADS</td>
<td>1 day?</td>
<td>Mon 5/19/14</td>
<td>Mon 6/1/14</td>
</tr>
<tr>
<td>3</td>
<td>Phase III</td>
<td>52 days</td>
<td>Mon 6/2/14</td>
<td>Tue 8/12/14</td>
</tr>
<tr>
<td>3.1</td>
<td>Detailed Design Specification</td>
<td>1 day</td>
<td>Mon 6/2/14</td>
<td></td>
</tr>
</tbody>
</table>
## Work Breakdown Structure

<table>
<thead>
<tr>
<th>3.1.1</th>
<th>First Draft</th>
<th>1 day</th>
<th>Mon 6/2/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.2</td>
<td>Final</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>3.2</td>
<td>Test Plan</td>
<td>1 day</td>
<td>Mon 6/23/14</td>
</tr>
<tr>
<td>3.2.1</td>
<td>First Draft</td>
<td>1 day</td>
<td>Mon 6/23/14</td>
</tr>
<tr>
<td>3.2.2</td>
<td>Final</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>Prototype</td>
<td>46 days</td>
<td>Mon 6/2/14</td>
</tr>
<tr>
<td>3.3.1</td>
<td>Android Application</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>3.3.2</td>
<td>Smart Clock</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>3.4</td>
<td>Final Wrap-Up and Delivery</td>
<td>6 days</td>
<td>Tue 8/5/14</td>
</tr>
<tr>
<td>3.5</td>
<td>Team Meetings</td>
<td>46 days</td>
<td>Mon 6/2/14</td>
</tr>
<tr>
<td>3.6</td>
<td>Sponsor Meetings</td>
<td>1 day</td>
<td>Mon 6/2/14</td>
</tr>
<tr>
<td>3.7</td>
<td>Android Research</td>
<td>1 day</td>
<td>Mon 5/19/14</td>
</tr>
<tr>
<td>3.8</td>
<td>Hardware Research</td>
<td>1 day</td>
<td>Mon 5/19/14</td>
</tr>
</tbody>
</table>
7 Quality Management Plan

7.1 Introduction

The purpose of the quality management plan is to define a set of guidelines that can be followed to ensure that all requirements listed in the System Requirements Specification document are met. This plan outlines the actions that will be taken by the team in order to preserve the quality of all components of the product.

7.2 Documentation

All written documents will be sent via email to the Document Master as well as to the other members of the team for review. The Document Master will then format and place what was received into a draft of the formal written document. The team will review the sections together to make any and all changes to the document before being placed in the official document. The team’s individual engineering notebooks will be used to record pertinent information related to the project.

7.3 Software

The software created for the smart clock and its accompanying application will be well documented and thoroughly tested. We plan to have a standardized process for creating methods and a proper template for documentation. To aid this, the team will be breaking the software up into modules for easier code reviewing and testing. A centralized location will be designated to hold all source code so that it can be accessed by all team members simultaneously. Some type of version control system will also be implemented and kept up to date.

7.4 Hardware

The hardware components that will be required for the product will be discussed by the team before they are purchased. After the components have been approved by the team, they will be ordered. When the components are delivered, they will be tested before being included in the prototype. After the component has been attached and implemented in the prototype, it will again be tested to ensure that it is functioning properly.
7.5 Test Plan

A test plan will be developed for each individual hardware and software component of the smart clock and its Android™ application. Each component will be tested against the functionality and requirements listed in the System Requirements Specification document. As each component is integrated into the prototype they will again be tested for functionality. The prototype will also undergo a rigorous set of tests to gauge its performance and reliability.
8 Communications Plan

8.1 Introduction

Communication is a key component in developing an effective and coherent team. A communications plan will help to guide the team by providing clear definition of all possible forms of contact. The plan consists of details regarding internal and external communication. The plan also contains various forms of communication between members and the sponsor.

8.2 Internal Communication

8.2.1 Team Meetings

The team has decided to meet at least two days a week in order to keep everyone updated on progress being made towards current tasks. We have lengthy meetings on Mondays and Thursdays. After our lab sessions on Friday we meet shortly and touch base on what we need to discuss with the sponsor as well as assign the work for the next week. If a member cannot attend the meeting, all details will be sent to that member via Email.

8.2.2 GroupMe

GroupMe is the main source of communication between all the members of the team. This is a mobile application that allows group messages to be sent and received quickly. There is also a feature to access the group chat through a text messaging system which allows all of our members to be in constant communication with one another.

8.2.3 Google+

Since some members of the team are commuters, at times it is difficult for them to travel and attend every meeting in person. The video chat feature of Google+ allows those members to attend group meetings remotely and participate in any important decisions.

8.2.4 Email

Email is used to send copies of documents to one another for a form of peer review before being placed in an official document.
8.3 External Communication

8.3.1 Sponsor Meetings (Dr. Brezeale)
Official sponsor meetings usually occur on Fridays, after the team has met and created an agenda for the meeting. Meeting times with the sponsor are subject to change depending on what is required.

8.3.2 Email
Email is the most effective way to communicate with the sponsor. Copies of all documents are sent to the sponsor in order to keep them up to date on current progress.

8.3.3 Project Supervisor (Mr. O’Dell)
The team will keep in constant communication with the project supervisor. Updates will be provided in multiple forms such as team status reports, individual status reports, and gate reviews.
9 Change Management Plan

9.1 Purpose of Integrated Change Management Plan

The purpose of our team’s change management plan is to anticipate, analyze, and prepare for any and all changes that may arise throughout the development process. Change is an inevitability that our team came to terms with in these earlier stages of development. There have been many products and processes that failed because they neglected to take into consideration and adequately prepare for change. Our team has stressed the importance of managing change in an effective and controlled manner to minimize the risks involved with our project. We have also identified several key factors that may change throughout the duration of the project.

Perhaps the most problematic change for our team is a modification of the product requirements. We have anticipated that at some point after our requirements are fully specified, the team or the sponsor may need to alter the nature of some of these requirements. Furthermore, we have also accounted for a change in the project plan at any point in time. It is possible that we may fall behind schedule and have to alter the project plan to accommodate this change. We have also discussed the possibility for a change in the types of technologies that we plan to use. We may realize later that we can’t use a specific platform or API and therefore must resort to another form of implementation. We may also need to change the architecture or design of our system due to unforeseen circumstances.

Our team has discussed and analyzed not only the previously described changes, but others as well. We have established a change review body that consists of all members on the team, our sponsor, and the project supervisor. More specifics on our change management plan can be found in the following sections.
9.2 Roles and Responsibilities

Listed below are the various stakeholders and their roles with respect to the change management plan.

- **Project Sponsor**: The sponsor for this project, Dr. Brezeale, will have an active role in our change management plan. He may serve as a source for changes in regards to the customer requirements established within our System Requirements Specification document. In addition to this, any considerable changes that will or may affect him in any way will require his approval.

- **Project Manager**: The Project Manager will play a pivotal role in anticipating and preparing the team for any potential changes that can greatly affect the project scope. He will serve as the principal change control and approval officer, acting on the recommendations and input from his fellow team members, the sponsor, and the project supervisor. He will alert the team of any foreseeable and considerable changes and prepare contingency plans for such changes. The Project Manager, like the sponsor, may also be a source for changes to any aspect pertaining to the project.

- **Project Team**: The team will also be an integral part of the change control process. All 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 control body and will take active roles in the change review process. All members will voice their concerns with any proposed changes and give recommendations to the change control officer. Any team member may also propose changes to any aspect of the project.

- **Other Stakeholders**: The Project Supervisor, Mr. O’Dell, is also a project stakeholder that has been considered in our change control model. He may introduce changes to the course structure, project deliverables, deliverable deadlines, and other course related aspects as he sees fit. The team may also choose to consult him in the event of any high-impact changes.
9.3 Review and Approval Process

The diagram below illustrates a high level organizational view of our team’s change management review and approval process.

As can be seen from the flow chart above, there are several key steps in the change review process. First, a change must be introduced by any of the previously mentioned sources of change. The change initiator must fill out the change request form included later in this document and present it to the change control officer (the Project Manager in this case). The change control officer will present the requested change to the rest of the project team at the next scheduled meeting. If the potential change affects the sponsor, then he will be included in the deliberation. This is done to avoid harassing the sponsor...
with changes internal to the team that have no noticeable effect on him. The team will collectively decide whether to accept or deny the requested change. If the change is accepted, its details will be thoroughly documented and any necessary updates to documents will be done.

9.4 Change Identification, Documentation, Implementation and Reporting

The change control form will contain four key pieces of information: the name of the change initiator, the description of the change, the reason for the change, and all documents, people, or parties affected by the change. The request form must be completed and presented to the change control officer 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 respective engineering notebooks. The document master will update all of the necessary team documents accordingly. Following these updates, the Project Manager will update the project plan if necessary. The change control officer will then catalog all approved change request forms for the duration of the project. A sample change request form can be found below. The sample form was taken directly from: [http://office.microsoft.com/en-us/templates/change-request-form-TC010380453.aspx](http://office.microsoft.com/en-us/templates/change-request-form-TC010380453.aspx).
# Change Request Form

<table>
<thead>
<tr>
<th>Sponsor Name</th>
<th>Change #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name</td>
<td>Date Submitted</td>
</tr>
<tr>
<td>Requested By</td>
<td>Date Reply Due</td>
</tr>
</tbody>
</table>

**Description of Change:**

**Justification:**

## Effect on Schedule, Deliverables, and Project Cost

<table>
<thead>
<tr>
<th>No.</th>
<th>Deliverable / Item</th>
<th>Revised End Date</th>
<th>Net Change, Hours Increase or (Decrease)</th>
<th>Net Change, Cost Increase or (Decrease)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Totals*

<table>
<thead>
<tr>
<th>Revised Project End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Change Control Officer Approval:**

<table>
<thead>
<tr>
<th>Signature</th>
<th>Title</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10 Risk Management Plan

10.1 Purpose of Risk Management Plan

A risk management plan is a safety net. Its purpose is to keep the project alive in the event of a mistake or unforeseen problem. Having a risk management plan in place allows the project to move forward without fear of total catastrophic failure.

However, the plan does not eliminate or identify all risks that may come up during the course of the project; it would be virtually impossible to do so. Since the possibility of some risks is inevitable, having a plan in place will allow the team to make decisions quickly on how the risk should be mitigated. With an effective risk management plan in place, it makes the project just that much more feasible to complete.

10.2 Roles and Responsibilities

Each stakeholder has a role in the risk management plan. The following describes how each one plays their part in the plan.

- **Project Sponsor**: Primarily used for direction with regard to risks. The team can collaborate with the sponsor to help create solutions for risks that arise. The sponsor can also identify risks on their own and pass them on to the team.

- **Project Manager**: The Project Manager is in charge of making sure the project is completed on time and within scope. This also entails keeping in contact with the risk manager and ensuring the risk management plan is being enforced.

- **Project Team**: The primary function of the team is to identify risks as they see them. Once reported, the team can meet and discuss the impact of the risk.

- **Risk Manager**: The Risk Manager is in charge of following the risk management plan and keeping all known risks up to date.

10.3 Risk Identification

The team will continuously be on the lookout for risks while progressing through the project. The quicker a risk can be identified, the quicker it can be resolved. This is important because we are on a limited time schedule and any delay could potentially be costly. Upon locating a risk, the team member will notify the Risk Manager. The Risk Manager will add the new risk to a list to be discussed at the nearest meeting time with the rest of the team. Depending on the severity of the risk, the sponsor may be involved.
10.4 Risk Triggers

Risk triggers can come in all forms and each has their own degree of impact to the project. While it’s still early in the project, a few triggers are listed below.

- Team members not showing up to meetings
- Not keeping the sponsor in the loop as development moves on
- Suppliers don’t deliver a piece of hardware on time
- Team members not finishing their assigned work on time
- Lack of hardware or software knowledge
- Communal documentation editing
- Lack of team communication

10.5 Risk Analysis

The following list outlines a few risks that the team has come up with along with their projected impact on the project.

<table>
<thead>
<tr>
<th>Category</th>
<th>Risk</th>
<th>Probability (%)</th>
<th>Cost (Days)</th>
<th>Risk Exposure (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team</td>
<td>Lack of Android™ knowledge</td>
<td>60</td>
<td>14</td>
<td>8.4</td>
</tr>
<tr>
<td>Sponsor</td>
<td>Requirements spiral out of control</td>
<td>75</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>Team</td>
<td>Outside coursework</td>
<td>100</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Team</td>
<td>Assumptions about component interfaces</td>
<td>40</td>
<td>18</td>
<td>7.2</td>
</tr>
<tr>
<td>Team</td>
<td>Disorganization of source code and documents</td>
<td>20</td>
<td>14</td>
<td>2.8</td>
</tr>
<tr>
<td>Team</td>
<td>Underestimation of task durations</td>
<td>50</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>45.9</td>
</tr>
</tbody>
</table>
10.6 Risk Severity

The following list takes the risks listed in section 10.5 and prioritizes them based on how likely they are to occur. Also listed are the steps to mitigate the risk and what the trigger of each risk is, so action can be taken as soon as it is noticed.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Priority</th>
<th>Resolution</th>
<th>Trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assumptions about component interfaces</td>
<td>High</td>
<td>Thorough research and experienced consultants</td>
<td>Lack of component specification knowledge</td>
</tr>
<tr>
<td>Lack of Android™ knowledge</td>
<td>High</td>
<td>Tutorials and Android™ research</td>
<td>Starting on the application without the knowledge</td>
</tr>
<tr>
<td>Underestimation of task durations</td>
<td>Medium</td>
<td>Pad deadlines and estimate high</td>
<td>Overconfidence when dealing with the unknown</td>
</tr>
<tr>
<td>Requirements spiral out of control</td>
<td>Medium</td>
<td>Negotiate with sponsor on a set of requirements</td>
<td>Sponsor piles on additional requirements</td>
</tr>
<tr>
<td>Outside coursework</td>
<td>Low</td>
<td>Spread the work amongst other team members</td>
<td>Other courses assign work</td>
</tr>
<tr>
<td>Disorganization of source code and documents</td>
<td>Low</td>
<td>Establish central source and document control early on</td>
<td>No central repository</td>
</tr>
</tbody>
</table>

10.7 Risk Response Planning

To mitigate risks successfully, planning is necessary to prepare for their arrival. The Risk Manager will lead the charge by formulating a risk elimination strategy, but the rest of the team will not be far behind. Risk response planning needs the entire team to participate in order for it to be effective. Once imposed, the plan will allow the project to move forward while controlling and subjugating risks. The following are a few steps that will be part of the risk response plan:

- **Identify Risks** – Before a risk can be analyzed and a solution can be developed, the risk must be known.
- **Risk Analysis** – Once a risk has been identified, the team can discuss its impact and priority.
- **Brainstorming** – The team will brainstorm to try and create solutions or workarounds to high priority risks.
10.8 Risk Documentation and Reporting

Risks will be documented in an Excel spreadsheet and will be kept up to date by the Risk Manager. The spreadsheet will be openly available to the team at all times and the sponsor upon request. The Risk Manager will also be in charge of accepting risk notifications by the team members or sponsor.

10.9 Risk Control

The team has meetings at least twice a week and new risks will be addressed at one of them. Keeping risks as a topic frequently will keep each team member on the lookout for them. After each meeting the Risk Manager will update the risk documentation with new information attained during the meeting.
11 Procurement Management Plan

11.1 Purpose of the Procurement Management Plan
The purpose of the procurement management plan is to define a set of guidelines that will be followed when acquiring components necessary for the project to be completed. Having a set of guidelines will ensure that all purchasing decisions will not be taken lightly due to a limited budget. The plan also specifies the various roles and responsibilities of the individuals involved in the procurement process.

11.2 Roles and Responsibilities

11.2.1 Project Sponsor
The Project Sponsor, Dr. Brezeale, will have an active role in this project by providing the team with suggestions on items to be used on the product. He may also provide the team with reference materials related to the project.

11.2.2 Project Manager
The Project Manager will be responsible for making all of the final decisions regarding the purchases necessary for completing the construction of the product. The component choices will then be passed on to Mr. O’Dell for approval and ordering.

11.2.3 Project Team
The team will be responsible for researching all of the possible components that will be needed on the project. The entire team will then have to make a decision on which components are necessary and approve them to be sent to the Project Manager.

11.2.4 Project Supervisor
The Project Supervisor will review all order requests and approve or deny them as he sees fit. If approved, the component will be ordered and then delivered to the team once it is received.
11.3 Required Project Procurements and Timing

The procurement phase of this project begins after the System Requirements Specification Gate Review has taken place. By this time, a list of all the necessary components and a source by which to obtain them should be well documented. This will ensure that all of the necessary components will be ordered and received as soon as possible. Acquiring the components as early as possible is vital to keep on schedule during the implementation phase of the project.

11.4 Description of Items/ Services to be acquired

The list below enumerates several of the key components that we believe will be required to complete this project.

- Microcontroller (Arduino, Raspberry Pi, etc.)
- LCD Screen (7” or larger)
- Temperature sensor
- Light sensor
- Wi-Fi module
- Bluetooth™ module
- Speakers
- DC power supply
- FM radio transceiver
- Android™ phone
12 Project Closeout Report

12.1 Purpose

This section is intended to provide closure on the final project. The development team and sponsor will meet to discuss any outstanding tasks that may need to be done, and will also gather all documentation for the project to discuss any variations in the cost management plan or variations in the other documentation.

12.2 Administrative Closer

12.2.1 Were the objectives of the project met?

When closing the project, the development team and the sponsor will evaluate the product to determine if it was a failure or a success. In order to get an unbiased conclusion, we will need to compare each requirement from the System Requirements Specification document to the actual features of the smart clock. The number of the high priority requirements that we did not meet will determine how successful we were, and will be mentioned in the close out report.

12.2.2 Archiving Project Artifacts

All documents will be stored in the Senior Design Document Library. They will also be stored as hard copies to keep in the Senior Design Lab in the form of a single binder for easy access along with a CD containing all source code for the project. The following documents will be saved:

- System Requirements Specification
- Project Charter
- Purchase Requests
- Architecture Design Specification
- Detailed Design Document
- MS Project Plan
- Status Reports
- System Test Plan
- Financial Record
- User Manual

12.2.3 Lessons Learned

At the end of the project the team will gather to discuss what our best practices were and what we wish we had done differently. We will also focus on what we learned from the completion of the project.
12.2.4 Plans for Post Implementation Review (PIR)
After the project is finalized, the team and the sponsor will meet and compare each requirement stated in the System Requirements Specification document with the smart clock’s actual features to determine if it is a success or failure. In order to do this, we will follow the acceptance criteria as defined in the System Requirements Specification document. This process will be provided in the closeout report.

12.2.5 Final Customer Acceptance
After the prototype has been finalized, the sponsor will be contacted for a meeting to verify which of the requirements that he agreed upon were implemented in a satisfactory manner. If the sponsor decides the smart clock has been completed to his standards, then we will move forward with the presentation phase. If he decides that the smart clock is not ready for its debut, a future plan will be created to make the product reach that standard of completeness.

12.2.6 Financial Records
All purchases will be documented and archived. Physical proof of purchase documents provided by the vendor will also be archived. All archived purchase documentation will be provided in the final closeout report.

12.2.7 Final Project Performance Report
After the project is completed, the development team and the sponsor will summarize the project’s scope management, schedule performance, cost performance, quality achievements, and review the risk containment performance. We will also discuss the use of the budget we were given and the reasons for costs or schedule variances. After all parts have been summarized, they will be compiled into one final report.