Project Approvals:

Approval	Function	Signature	Date
Dr. Elizabeth DeBartolo	PRP Focus Group – ME		
Prof. George Slack	PRP Focus Group – EE		
Dr. Andreas Savakis	PRP Focus Group – CE		
Dr. James Vallino	PRP Focus Group – SE		
Prof. George Slack	Guide		

INTRODUCTION:

This document describes and serves as a template for preparation of a Project Readiness Package. The objective of the Project Readiness Package is to document customer needs and expectations, project deliverables (including time frame), budget, and personnel / organizations affiliated with the project. It will serve as the primary source of information for students necessary during Phase 0 (Planning) to develop a SD I plan and schedule including specific deliverables and due dates. The Project Readiness Package will also support Faculty evaluation of project suitability in terms of depth, scope, and student / faculty resources by discipline.

In this document, italicized text provides explanatory information regarding the desired content of the sections indicated by non-italicized, bold, capitalized headings. If a particular aspect of a section is not applicable for a given project, it is only necessary to indicate that by entering N/A (not applicable).

ADMINISTRATIVE INFORMATION:

Information regarding contacts, budgets, facilities, resources, regulatory or legal considerations, proprietary or specialized components, technologies or intellectual property associated with the project.

- Proposal Number: 1
- Project Name: Wandering Campus Ambassador Navigation
- Project Number: P11216
- Track: Vehicle/ Robotics
- Start Term: 2010-2
- End Term: 2011-3
- Faculty Mentors: Dan Phillips; EE, Ferat Sahin; EE, Wayne Walter; ME, Dr. Pratapa Reddy; CE.
- Faculty Guides: George Slack
- Customer organization and primary contacts - George Slack, Stan Rickel, Daniel Phillips.
  Funding organization – RIT Provost's Learning Innovations Grant and KGCOE EE Department.
- Project Family Overview (*1 Paragraph that provides a general description of the project in terms of background, motivation(s), customer(s), and overall objective(s).*):
  The Wandering Campus Ambassador is a robot-like system to raise awareness of self-sustaining energy and showcase student's creative and technical abilities. The idea is to create curiosity through a robot like device with a living, growing and self-sustaining plant. It will wander around in a nice, slow, autonomous fashion, searching out the best sun, water, fellow plants and friendly passers-by. Act as a great (yet very quiet) spokesperson/plant for the KGCOE MSD, CC&IS Software Engineering Senior Projects, CIAS Industrial Design Senior Projects and even the new sustainability programs being created at RIT. Just think what a great news story or You-Tube episode it would make. If you think along the environmentally friendly side a little, you could consider some replenishable power sources for both the robotic-like device and its plant which is not only along-for-the-ride but may guide the robotics' autonomous decisions in search of being able to sustain the plant (i.e. water, sun, temperature, food).

  Team will prepare for design competitions such as RITs annual IEEE Design Competition and Texas Instrument's campus design completion. This team may wish to partner with the Winter start team for the IEEE contest.

- Staffing Requirements:

Discipline (*number*)	Skills required (*concise*)
ME - 2	Integrate with P11215 Team members. This Fall start team has designed the following and this team will add reliability to their design. This team will join the P10215 to better understand their implementation and get a firsthand knowledge of the design and examine the areas where further design refinement is needed. This team will prepare the Robot for Image RIT event. Also, define a detailed Test Routines to uncover reliability issues. • Drivetrain features including Drive Transmission and Safety Issue. • Transport scheme needs to be evaluated. • Plant portion of the robot including water reservoir and dispensing.
EE-1 & CE-1 or EE-2 CE-0	Integrate with P11215 Team members. Gain familiarity with this year's design. Gain experience Beagleboard capabilities and then evaluate robot controls. This team will prepare the Robot for Image RIT event. Review P11215 Robot Applications and make recommendations on software architecture with particular attention to data needs and interface architecture. Review and integrate into their design and build plans. Begin the implementation process of debugging hardware and software as the integration process begins. As an example, characterize and evaluation the various robot sensors and output devices. As needed, integration of wiring, connectors and harnessing for a clean robot design. *(If time and budget permits, design and build a Test Stand using critical Robot components such as an MSP430, Beagleboard, sonar(s), and simulate analog and digital sensors. This will be a development platform for the SE team members as an on-going prototype platform and then the debugged software is loaded onto the Robot for further testing. There is a "mule" platform available or the test stand may be a bench top solution. Team to determine the best configuration.)*
SE-3 Assigned SEs: Joseph Stevens, Phillip Gibson, Dave Ladner	Integrate with P11215 Team members. This team will prepare for the Robot for Image RIT event. Those students will work on a multidisciplinary team with mechanical, electrical, and computer engineers. The students will follow the procedures used on the KGCOE Multidisciplinary Senior Design (MSD) projects rather than those used for Software Engineering's Senior Project. KGCOE MSD teams meet for project work and general discussions through most of the day on Friday. Teams will also usually meet, or team members will have individual activities on one or more days other than Friday. This works out that each MSD student is expected to work the same 10 to 15 hours per week that we expect of students in Software Engineering Senior Project.

1. Continuation, Platform, or Building Block project information (*Include prior project number and title and to what extent previous results are being incorporated*):

   P11215 Wandering Ambassador Phase III (2010-1, 2010-2).
   Refine and redesign mechanical, electrical and software functions.

   P10218 Robot Applications
   UML architecture/ class diagrams, HTML, PHP, JNI, XAMPP for Windows, RIT server interface, webcam, autonomous software, sonar sensor debugging, social media integration.

   P10217 Robot Integration and Field Testing
   Body shell build, wireless game pad, refined motor control software with motor encoders, motherboard PCB, power, upgraded, interface protocol documentation updated.

   P10215 Robot Locomotion and Plant Platform
   Shell design, frame, motors, motor drive train, plant, MSP430's for motor, plant and navigation sensors, plant electronics & MSP 430 software

   P10216 Robot Navigation Plant Platform
   Beagleboard, Java OS, I2C serial interfaces, GPS, accelerometer, wireless to remote server, initial autonomous software.

DETAILED PROJECT DESCRIPTION:

Since the mission of the project mission is to raise campus awareness of self-sustainability energy, the robot's portion of the project can act as a guardian to support the plant's growth needs as well as its own needs. That is, make maximum use of natural conditions by managing sun, shade, temperature, rain, and watering to allow the plant to grow and thrive and robot power to self-sustain.

Currently in the 2010 fall quarter, **P11215 Wandering Ambassador Project**, an MSD team is continuing to build the design and advance reliability and robustness from last year. During the winter quarter, your team, will integrate with the P11215 team and will deliver the navigation functions and continue the reliability. Your team will continue the work that was started by the initial team to deliver a robot that provides a minimal level of plant maintenance, and interaction with the environment. The software engineers on the team will be responsible for defining robust application programming interfaces for higher-level on-board processing, as well as, working in conjunction with the initial team during the winter term to expand the range of plant maintenance, environment interaction, and navigation functions that are available.

Since the software engineering students will integrate with the multidisciplinary team with students from the computer, electrical, and mechanical engineering disciplines, the project task partitioning should be reduced. The team members from the other disciplines will have responsibility for the mechanical and electrical aspects of platform operation.

Technical Constraints & Assumptions

Some technical constraints will be set by the work the two initial teams last year. Constraints that will most likely be set by the initial teams are:

- On-board processing power: dual core single board computer, Linux operating system
- Sensors and actuators for robot navigation and status, and plant support and status
- Prototype design of software interfaces to the robot navigation and plant support functions

Project Scope

The scope of the software aspects of this project will be explored by the team in conjunction with the students on the P11215 Fall Start team. The following software features most likely will be tasks within the scope of this project:

- Establishment of a development environment which allows software development to proceed before hardware is available and integrates with hardware.
- Full definition and implementation of software application programming interface to the robot navigation and plant support functions.
- By the start of the spring quarter, evaluate the test results and issues from the P11215 team, and create a plan to eliminate critical known software issues.
- Perform outdoor field testing, and debug software issues identified.

Continuation – MSD I Winter Quarter

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FRED has a wireless path to RIT's WIFI campus servers. There was limited success.

Autonomous Behavior:

Due to normal engineering design development cycles and reliability growth, the autonomous software was difficult to advance. Now with a more functional platform, better autonomous algorithms can be completed.

- Customer deliverables (*Customer requested milestones, progress reports, and expected product*):
  Customer: As per MSD design documentation requirements as listed on MyCourses. Files and documents will be storage on EDGE team site and SVN to manage file version control.
  Since this may be an on-going project, detailed CAD, software architecture, software comments, schematics, critical component specifications are essential.
- Customer and Sponsor Involvement (*Describe role of customer and sponsor in the project, planned participation in design and project reviews, etc.*):
  Sponsors: Dr. Phillips, Prof. Rickel and Prof. Slack will review formal, informal documents and presentations. Also, they will be available via emails and office hours with any specific questions.
  Guide: Prof. Slack. There will be Friday team activities with all team members.
  Team: Midweek team meetings should be implemented for general design needs and technology development. The general design needs should include issue identification, issue investigation, issue closure and individual progress against your plan.
  Individual: During the week and Fridays for project design and build.
- Regulatory requirements (*i.e. UL, IEEE, FDA, FCC, RIT*):
  RIT Campus Security.
- Project Budget and Special Procurement Processes (*Provide all budget details and processes associated with expenditures*):

  Since the finished project must perform reliably, major components should be integrated and not designed from scratch. The budget takes this assumption into account.

  The total robot grant is $1,000 and EE Dept to match with $1,000. This will support two team projects but the second team is predominately software so expenses may be minimal. There are typically 20% early prototyping component expenditures for component tryouts and 20% unanticipated expenses for redesign and components not anticipated in the Bill of Materials. This leaves approximately 60% of the money for the "official build" Bill of Materials which the team should not exceed. Many teams purchase from their BOM prior to the end of MSD I (Fall Quarter) and this is encouraged for technology evaluation. Since this is a rule of thumb your design expenses are certainly negotiable so if you can prove engineering value and/or negotiate the removal certain requirements. Therefore the team will need to manage budget limitations.

- Intellectual property (IP) considerations (*Describe any IP concerns or limitations associated with the project*):
  None. Student(s) interest and discretion.
- Other (*Describe potential benefits and liabilities, known project risks, etc.*):
  On-going world needs for sustainable energy solutions.
  This project may offer resume bullet points and interviewing discussion points.

DETAILED COURSE DELIVERABLES:

From the Course Deliverables and Timeline documents, extract general and discipline specific deliverables that are appropriate to the project. This should provide clear guidance to the students on what it expected.

- Review the course (located on MSD I MyCourses) deliverables (Grading Rubric) document and MSD I Timeline document. These are located on MyCourses/ Content under the Getting Started header. As needed, modify the proposed timeline to meet project needs.

- Establish discipline specific plans and then individual plans (including schedules, milestones and critical risks). Compile the discipline specific plans up to the Team Plan and evaluate for critical internal hand-off points and readjust the plan as needed. These plans will be maintained and updated as new information and any issues rise. A good Project Plan is usually outdated as soon as it is compiled so frequent adjustments are expected as the team's knowledge and experiences grow. Once there is a good working plan, the updates occur with relative ease and will serve as a critical device to recognize and then reconcile looming issues. A good engineering rule of thumb is that most technical tasks will take three times the effort as initially planned.

- Since the major effort is to integrate major components, early selection of devices may be achievable to aid in gaining hardware experiences and enable sufficient debug during early MSD II. That is, completion of all MSD I technical tasks as soon as possible knowing that significant knowledge and experience is gained during early prototyping and lab debugging.

PRELIMINARY WORK BREAKDOWN:

Describe the anticipated distribution of general tasks to be accomplished by project participants based on perceived skill set requirements. This should justify the requested skills and number of students from each discipline.

See **DETAILED PROJECT DESCRIPTION** previously listed in this document. Though each category is functionally organized, team members can apply to their discipline during the concept selection systems engineering process. The following are preliminary areas or tasks of recommended investigation.

- Review the course deliverables and deliverables timeline on MyCourses. Customize the timeline for team needs.
- Once the project's Needs and Specifications are "understood" by the team, the next task is to learn the technologies that make up the robot. This is not a small task and cannot be comprehended in a short period of time. Most if not all the information can be found on one of the four teams listed above. The robot hopefully will be running with gaming pad.
- Capture engineering specifications in one concise document. Use SVN as a change control mechanism and to enable ALL team members to update key documents in a real time manner. Communicate changes to team members via email.

GRADING AND ASSESSMENT SCHEME:

Describe how the grading rubric relates to expectations and deliverables. The impact of project enhancements and improvements from baseline should be clearly articulated.

Review Grading Rubric spreadsheet on MSD I MyCourses. The following offers a global view specific to this project. Please feel free to discuss specifics with your Guide well prior to grading of deliverable. This applies to team and individual tasks. Remember there is a 16% (two letter grade) team member differentiation. If there is a team member issue, then 16% differentiation does not apply and the team member will be consulted.

D/ F. Minimal concept development or key customer needs unaddressed, reliance on only a few ideas; evaluation process not defined or followed. Superficial understanding of the design is evident at either the system or subsystem level. Rationale for specific design decisions and tradeoffs is poorly understood, if at all. Many questions remain as to whether needs and specs will be met. Design Review was not held or was poorly executed: key subsystems were not reviewed, key issues were not addressed, little/no preparation or documentation.

C. Key customer needs were addressed but many were left unaddressed, or evaluation process was not followed. General comprehension of the design is evident but rationale for decisions is not solid and tradeoffs are not well understood. Technologies and devices were defined but limited or no prototypes of subsystems were built to evaluate customer-oriented criteria and competing products. Project was not fully functional in all subsystems. The built, debugged and tested (evaluated) was complete but marginal data.
Team demonstrated that some needs and specs will be met, but others require significant further analysis. Design Review execution was acceptable but was weak in one or more areas: breadth of participants, preparation, thoroughness, or documentation. Team generally did not use a re-iterative review and update of their previous design activities and documents for the purpose of maturing their knowledge and design. Team processes and documents were not evergreen or thus not updated.

B. Valid concepts were developed and most customer criteria were addressed. Competitive benchmarking was sketchy. Majority of technologies and devices were defined and prototypes of major subsystems were built at the system and subsystem level, and evaluated against customer-oriented criteria and competing products. Project successfully built, debugged and tested (evaluated).
Good understanding is evident of the design and rationale for most design decisions and tradeoffs. Team demonstrated that most customer needs and design specs will be met. Design Review execution was acceptable but was weak in one or more areas: breadth of participants, preparation, thoroughness, or documentation. Teams generally use re-iterative review and updated their previous design activities and documents for the purpose of maturing their knowledge and design. Team processes and documents were usually but not consistently evergreen and periodically updated.

A. Creative concepts were generated, reviewed with faculty and refined early in the project development. Critical technologies and devices were defined and prototypes of major subsystems were built at the system and subsystem level and evaluated against customer-oriented criteria and competing products during MSD I. Project successfully built, debugged and tested (evaluated) in MSD II.
Thorough and in-depth knowledgeable understanding is evident to your peers and faculty (verbal and written during weekly meetings and more formal sessions) of the design (system & relevant subsystems) and rationale for design decisions and tradeoffs. Sufficient evidence is presented to demonstrate that customer needs and design specs will be met. Throughout the life of the project, key analytical processes (i.e. Concept Review and various Design Reviews, Guide status meetings) were very well planned and executed with appropriate attendees. Teams generally use re-iterative review and updated their previous design activities and documents for the purpose of maturing their knowledge and design. As project design matures and assumptions updated, team processes and on-going engineering documents shall be maintained. This may require concurrent updates to more than one engineering document. All subsystems addressed and clearly documented key issues, notes and action items.

THREE WEEK SDI SCHEDULE:

List expected activities in the first three weeks. Highlight any project specific activities that may not be part of the generic course syllabus (e.g. customer visits).

Week 0/1: Enter MSD I MyCourses. Select **Content**, then documents within "**Getting Started**" and "**Week 1"** deliverables in preparation for Friday's status session.

Meet FRED (also called FLORA). Currently in the EE Senior Design Lab on the third floor. Team may want to put on the 4th floor. There are two modes: 1. Game Pad, 2. Semi autonomous operation. The two modes are changed by changing a Compact Flash chip on the Beagleboard. Define an Assessment Tool/ Process to begin defining the project needs. Assign team member roles and develop project plan.

Gain an understanding of what is expected of this team collectively and each member individually. As an example, get into the routine of progressing during the week. Develop and be prepared to present at the start of Friday. As an example of Friday work sessions: submit deliverables, presenting project results, report progress and get feedback and continually understand what you are being assessed against.

If not already, review team's EDGE website and then the four FRED's websites from last year. See EDGE instructions on MSD I MyCourses. Plan to learn Wiki edit and SVN for document repository and version control for EDGE repository needs.

Establish and concur to team member expectations (see Values and Norms on MSD I MyCourses):

- As an example, effort of 10 to 15 hours per week for preparation for Friday and Friday's activities is normal and expected. This is a "lab" course with very limited lecture requirements and homework. Your completion of engineering design activities and associated documentation should be considered equivalent to homework and lab reports.

- After the first few initial seminar and meetings, effort moves from team planning to more individual accountability and development. However, as the team's knowledge increases, be flexible to move into or out of tasks to balance work needs. That is, you may not predict task complexity or time involvement from initial planning but as your knowledge and experience grows, a more accurate prediction can be made. Volunteer to help other team members and please don't wait to be asked by the team lead.

- All issues both technical and personal must be raised immediately to the team and Guide. Make full use of emails and don't wait until the next meeting to raise an issue. Teams and individuals cannot make up for lost ground as in other courses.

- By end of Week 1 review MSD I MyCourses use "**Week 2"** deliverables. Each team member should understand Week 2 course requirements and mid-week completion expectations and team status.

Week 2: From MSD I MyCourses, use "**Week 2"** deliverables as a plan for preparation for Friday's status session.

Finalize customer needs, determine what types of robot and platform features that are needed, and begin compiling design specifications. This will prove be a critical and essential engineering document and as your knowledge and experience grows. Periodically revisit to ensure it matches your design plans. Continue robot benchmarking. Search technologies to be used in the final design. Remember, this is an integration project and minimizing "clean sheet" designs is recommended where possible. This does not minimize the need to clearly comprehend detailed specifications since these are needed for device selections.

If not already, generate and document design concepts for each of the different key components of the design. Hand sketched concepts should be captured in your individual project notebooks. These sketches will be referred to throughout the project. Concepts and ideas will grow as the team's knowledge grows.

By end of Week 2 review MSD I MyCourses use “**Week 3”** deliverables. Each team member should understand Week 3 course requirements. This same routine should be used throughout the quarter. Leave time to review team and individual plans update as needed. These may be changing significantly at the subsystem level so be sure the full team understands your updates since this may impact their design.

Week 3: Review your plans and update as needed given your knowledge is rapidly growing. Review needs and specifications with your sponsoring team (Prof. Slack, Prof. Rickel and Dr. Phillips). Be prepared to narrow your concepts to one or two per subsystem and system. Select design concepts for each of the different key components of the design. Again, the concepts should be captured in your individual project notebooks. Scan in and share with team even though they are in a different discipline. By now each team member should be totally versed in EDGE and SVN. Make full use of EDGE for document repository. For reliability of final design determine a “purchase” versus “design” of subsystems. If not already, propose the purchase or borrowing of **prototype hardware and software**. This early hardware and software will aid in proving the feasibility of your concepts. Setup a meeting with your Guide and Consultants to gain approval on these preliminary purchases. See Project Budget above for more details.

REQUIRED FACULTY / ENVIRONMENT / EQUIPMENT:

Describe resources necessary to support successful Development, Implementation and Utilization of the project. This would include specific faculty expertise for consulting, required laboratory space and equipment, outside services, customer facilities, etc. Indicate if required resources are available.

Category	Source	Description	Resource Available (*mark with X*)
George Slack	**EE**	**Guide.** *Will work closely with the team on an on-going basis to facilitate success.*	**X**
Wayne Walter	**ME**	**Guide and Consultant.** *Will provide ME robotics discipline technical support on as needed basis.*	**?**
Alan Riddig	**ID**	**Consultant.** *Will provide ID discipline to provide assistance in order to foster campus curiosity and support on an as needed basis.*	**?**
Pratapa Reddy	**CE**	**Consultant.** Though CE's will not be involved this quarter, Dr. Reddy was very involved in P10217 and P10218 and is very knowledge of the project's needs and technologies.	**?**
Ferat Sahin	**EE**	**Consultant.** *Will provide EE discipline technical support on as needed basis.*	**?**
James Vallino	**SE**	**Consultant.** Though SE's will not be involved this quarter, Dr. Vallino was very involved in P10216 and P10218 and is very knowledge of the project's needs and technologies.	**?**
Environment	**EE/ CE**	**EE Senior Design Lab and 4th Floor – Senior Design Area.**	**X**
	ME	**EE Senior Design Lab and 4th Floor – Senior Design Area.**	**X**
	ID	**EE Senior Design Lab and 4th Floor – Senior Design Area.**	**X**
Equipment			
	Test Equipment	**EE Senior Design Lab, Data Analyzer upon request.**	**X**
	Machining	***Contact Dr. Walters.***	
Materials		Several boxes of components from last year. All are in the EE Senior Design Lab but can be moved to the 4th floor.	
Other			