ECE4884 / 4007 Project Summary

Project Title	Autonomous Multi-robot Mapping System
Team Members (names and majors)	Xxx Xxxxx, EE Yyy Yyyyy, CmpE Zzzzz Zzzz, EE Aaa Aaaaaa, EE Bbbb Bbbbbbbb, CmpE
Advisor / Section	James Hamblen / L01
Semester	Fall 2007
Project Abstract (250-300 words)	Our project is to produce two working prototypes of an autonomous multi-robot mapping system for the U.S. Military. This is to fulfill the need of the U.S. Military to be able to accurately map urban warfare areas. The current robots that the U.S. Military uses for this function are too expensive and have too many functions. Our multi-robot mapping system will focus solely on mapping terrain and will be cheaper at an estimated price of $3,000 per robot. The advantages of our multi-robot mapping system are the lower cost and expandability of our system. The lower cost comes from our use of cheaper parts. The expandability is the ability to add additional robots to our mapping system. Additional robots lead to increased accuracy in mapping areas and also faster mapping of terrain. The benefits of the product to the company are shown in the profit analysis. Assuming the sale of 1000 units over a period of five years, our product will bring in a 26.1% profit margin and increase profits by $781,835. Factoring in our products focus on expandability, the sales of our product could easily be higher. By the end of our design and development stage, the team will produce two working prototypes of robots for our autonomous multi-robot mapping system. These will be fully functional and be able to create accurate two-dimensional maps of flat terrain. Two prototypes will be produced in order to demonstrate the accuracy, speed, and expandability of our mapping system to potential customers.

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List **codes** and **standards** that significantly affect your project. Briefly describe how they influenced your design.	- SPI: needed in order to interface sensors to Phidgets board - USB: needed to interface Phidgets board to eBox, our design needed to work with Phidgets drivers to operate the sensors - IEEE 802.11: for wireless communications from robot to robot, and robot to command station - RS-232: standard for connector from eBox to iRobot Create robot
List at least two significant **realistic design constraints** that applied to your project. Briefly describe how they affected your design.	- Cost: limited budget of $400 forced us to not to use laser rangefinder, less sensors, and to use a servo to rotate our sensors - Time: could not build and design our own robot - Range of Sensors: our robot would have to get closer to objects to map, so we have to consider this in our mapping algorithms. The range also makes our robots take longer to map. - Accuracy of sensors: forced us to use two types of sensors to take measurements.
Briefly explain two **significant trade-offs** considered in your design, including options considered and the solution chosen.	- Compass Sensor vs. GPS: the GPS was not accurate enough, and is very inaccurate indoors. GPS also costs more. The Compass Sensor was cheaper and gave us an accurate reading on our heading. - Laser Range Finder vs. Ultrasonic/Infrared Sensors: The Laser Range Finder is more accurate, but one range finder costs more than our whole budget. Ultrasonic and Infrared sensors are cheaper and accurate enough.
Briefly describe the **computing aspects** of your projects, specifically identifying **hardware-software** tradeoffs, interfaces, and/or interactions. *Complete if applicable; required if team includes CmpE majors.*	- The inputs are: ▪ Distance measurements from IR and sonar rangefinders ▪ Status from other sensors on-board the Create robot ▪ Location, and mapping data from other robots (i.e. sets of distance measurements) - Outputs are: ▪ Drive commands (speed, direction) to the Create robots ▪ The main goal is organizing these distance measurements around a common point of reference. This task is best handled with software. - Relative Location Software vs. GPS Absolute Location: We are using software to create a map based on the robots relative location , instead of using GPS to give us the absolute location along with other sensor measurements.