**2013-2014 UC Berkeley Master of Engineering**

**Capstone Project Proposal**

**Overview:**

The Capstone Project, a 5-unit Maser of Engineering course requirement, integrates core leadership coursework with a student’s engineering concentration. Capstone Project teams range from three to ﬁve students, drawn from the cross-disciplinary engineering cohort, to apply diverse knowledge and skills to actual industry problems, identiﬁed by faculty or industry partners. The Fung Institute for Engineering Leadership within the College of Engineering provides capstone cohort support and curriculum integration.

**Capstone Sponsor Information:**

Please read the following instructions and requirements before submitting your proposal. In order to be considered, this document must be completed in full. By submitting this proposal, you agree to its inclusion in the *UC Berkeley Master of Engineering Capstone Project Portfolio* for the 2013-14 Academic Year. Use of links, diagrams and images to illustrate your project is encouraged. Example projects can be found here: <http://funginstitute.berkeley.edu/programs/capstone-projects>

**Timeline for submission and important deadlines:**

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| --- | --- | --- |
| **Year** | **Dates** | **Activity** |
| **2013** | **March** | **Capstone Project Call for Proposals** |
|  | **By April 1** | Submit a one-sentence description of your project idea. |
|  | **By May 1** | **Full Project Proposals due**  Please use the proposal form supplied. |
|  | **May-July** | **Proposal Review –** screening for skill set and objective fit with incoming M.Eng. class**.** |
|  | **July-August** | **Student Project Exploration**  Industry advisors should be available for questions and interview screening of students during this time. |
|  | **August 12-31** | **Capstone Team Selection Process, Sponsor and Faculty office hours** |
|  | **September 1-12** | **Capstone Final Match:** Notification no later than Sept 12 |
|  | **Early December** | **Fall Student Poster Session** |
| **2014** | **Early May** | **Spring Student Poster Session** |
|  | **May 1-17** | **Final Student Presentations and Deliverables** to Industry & Faculty Advisors |

If selected for the 2013-2014 Capstone Project Portfolio you will be responsible for sponsoring and adhering to the terms you outline below. **As the Capstone Sponsor, please *initial* the following requirements by which you are agreeing to the following:**

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Provide a point person from your organization to advise the capstone team on a regular basis and throughout the whole duration of the project

Supply all necessary tools, software, and/or data necessary to do the project in a timely manner

Ensure the project has achievable deliverables that fit into a 9-month timeframe

Provide clear objectives for both the technical and business-related challenges of the

project

By signing below you are indicating that you completed this form to the best of your knowledge and are agreeing to all the requirements of UC Berkeley’s Capstone Project Program as listed above.

We look forward to working with you!

Name: Faraz Mirzaei Title: Senior Engineer

Email: fmirzaei@qti.qualcomm.com Phone: (408) 533-9732

Signature or Initials:

Date: 4/29/2013

*Questions?* Contact Beth Hoch hoch@berkeley.edu or 510-664-4587

**Proposal Form (please complete all sections):**

|  |  |
| --- | --- |
| **Project Title** | Crowdsourcing of traffic monitoring and accident reduction/prevention using smart phones |
| **Industry Partner**  Company Name, Department, and Website | Qualcomm |
| **Problem**  (Describe the industry problem your project addresses in 100 words or less.) | Monitoring vehicular traffic in highways requires underground touch sensors and radars. Installation and maintenance of these sensors is very expensive. Additionally, if sufficient number of these sensors were available on highways, their information could be sent to cars to alert them of slow moving patches of traffic and thereby avoiding accidents. This potential is not currently materialized due to sparse installation of such sensors and a lack of real time communication between sensors and vehicles.  In this work, we will address these two problems by using camera of dash mounted smart phones. |
| **Technical Challenge**  (Highlight the technical challenge of the problem in 100 words or less) | Developing a solution that reliably works in a cell phone with limited computational power, both in days and nights, requires addressing the following challenges:   * Night Time: Detection and tracking of vehicle tail lights, brake lights, and pavement markings in real-time, and inferring the speed of traffic based accordingly. * Day Time: Differentiating optical flow (i.e., apparent motion) of surrounding cars and the background road, and determining the speed of surrounding cars based on that. * Communicating the speed of surrounding traffic to a server, and sharing the information with other users of the system. |
| **Objective**  (In 100 words or less, use bullet format and ensure objective is practical for a 9 month project) | Development of an android app for use on dash-mounted smart phones in cars that performs the following actions:   * Estimation of the level of ambient light. * Determining relative speed of surrounding objects using computer vision techniques appropriate for current ambient lights. * Detecting approaching objects/obstacles with unsafe speed or clearance, and alerting user. * Communication of the traffic flow in the road where the car is driving to a server.   Development of a geographical database server for receiving traffic information from active apps. |
| **Project Illustration (Optional)**  Include websites, videos, diagrams or images to help students understand your project |  |
| **Open or Closed Model – Please check one:**  Open Model (Public collaborative and may use university lab equipment) or Closed Model (Virtual internship, private, with faculty liaison)  \* Please list the necessary equipment, software or data that is needed and will be provided to the team. | Open Model/Public collaborative  **Tools and Equipment that will be provided include:**  Android phones  Publicly available computer vision libraries for use on smart phones  Link:  <https://developer.qualcomm.com/mobile-development/mobile-technologies/computer-vision-fastcv> |
| **Ideal Team Size**  (We prefer teams of 4 students, unless otherwise specified) | 4 Students |
| **Departments Accepted**  (Choose from CEE, EECS, IEOR, ME, MSE, NE. Indicate ideal team makeup and technical concentrations desired, i.e.  “1 CEE ; 1 EECS; 2 IEOR”) | EECS |
| **Specific Skills Required**  (i.e. *C/C++/C#, Python ,CAD, Robot Kinematics, MATLAB, Excel Financial Modeling, etc.*)  The more detail provided here the better team match you will receive. | C++, Java, Android Development, Python, SQL, Geographic Databases, familiarity with sockets and network/internet programming.  Basic understanding of computer vision techniques (recommended).  It is not needed for each team member to be proficient in all subjects. It would be sufficient if the team together covers the required qualifications. |
| **Coursework**  (Indicate any recommended/required prerequisite/co-requisite classes) | Senior undergrad or introductory graduate level course in computer vision and image processing (recommended) |
| **Industry Advisor(s)**  **Name, Email, Phone Number**  \*If this is a closed model an Industry Point Person from your organization is required for the duration of the project and must be available to advise the team on a regular basis and provide all necessary resources | Faraz Mirzaei  [fmirzaei@qti.qualcomm.com](mailto:fmirzaei@qti.qualcomm.com)  (408) 533-9732 |
| **Faculty Advisor(s) or Academic Liaison**  **Name, Department, and Email**  \*If this is an open model the Faculty Advisor or Academic Liaison is the primary party responsible for the advising and guidance of the capstone team, including providing all the necessary resources | Prof. Avideh Zakhor’s research is closely related to this project  [avz@eecs.berkeley.edu](mailto:avz@eecs.berkeley.edu)  (510) 643-6777 |