SYST 798
Capstone Project Proposal

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MAGIC

Mobile Application for Geolocating Imagery and Collaboration

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1. PROJECT DEFINITION

PROBLEM DEFINITION

BACKGROUND

A study by ComScore shows that 45.5 million out of 234 million wireless subscribers in U.S. own a smartphone (1). Today's smartphones are multi-featured powerful computing devices. These devices can process and share digital information in an extremely efficient way in real live time; adding multi- functionality and a wide range of capabilities to these devices.

In 2009, smarthpones made up 17% of cell phones sold worldwide, that's expected to jump to 38% by 2014 (1). As this race for business dollars and a drive for new technologies, smartphones' capabilities grow rapidly and many companies are constantly working on developing new ideas. One of the few capabilities being researched and updated is the technology of geolocation of images taken by these smartphones. Nowadays, there is existing technology available that can be integrated to develop new picture geolocating features on these smartphones.

Some of the enabling technologies for geolocating purposes on these smartphones are the powerful cameras with tagging abilities that are been built-on the smartphones. Other capabilities that can be integrated on are: pixel mensuration to select specific pixels within the images; accelerometer and/or magnetometers to help identifying orientations; and certain photogrammetric algorithms such as multi-image triangulation can be incorporated for identification and image matching algorithms. The following diagram shows a sample of how these algorithms can be used for geolocation of multiple images.

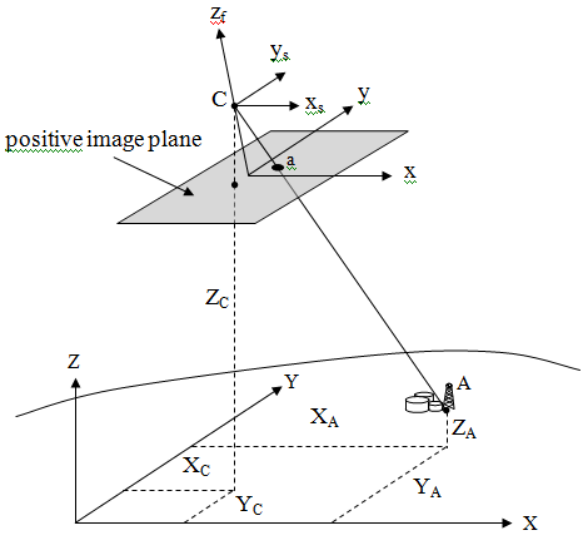


Figure 1: Example of Image Collinearity (2)

The competitive and aggressive competition for consumer and business dollars in this market foretells the future of computing. Many companies in this field are looking at various technologies to incorporate on these smartphones' platforms to enable an unthinkable number of capabilities.

PROBLEM STATEMENT

Currently in the market, smartphones are able to tag images with the GPS coordinates of the phones location and allow the photos to be viewed in several map applications. However, often the location of the camera is less informative or interesting than the location of what is in the image. Engineers at Integrity Applications Incorporated (IAI) noticed this capability is absent in the Smartphone application market. They have recognized a possible profitable need for a mobile application with the capability to determine the geographic location of objects within images taken by a mobile device.

The Mobile Application for Geolocating Imagery and Collaboration (MAGIC) Team will perform an analysis for IAI of the feasibility of developing a mobile application that will calculate the geolocation of objects within photographs taken by these smartphones and share the images and geolocation data across devices. The analysis's purpose is to help IAI decide which customer in this market will be the most optimal.

PROJECT OBJECTIVES

The objective of this project is to analyze the business opportunity for MAGIC and develop a business case detailing the results. one of the primary goals of the business case will be to identify and analyze potential users of the capability to perform multi-image geolocation of objects within smartphone imagery. The project will identify user requirements and the functional and physical architecture necessary to meet these requirements. The team will also perform a technical feasibility analysis to determine if current technology can meet user requirements and a business analysis to identify what investment is necessary to develop the capability and what potential market there is for the application. The project will take place during the spring semester at George Mason University. The team will create a business case, a technical analysis, and a system architecture in a final report and presentation.

DELIVERABLES

The team will deliver a final report covering all of the objectives along with the following deliverables:

- Business Case Analysis
    - Identify Potential Users
    - Cost-Benefit Analysis/ROI
- Concept of Operations
    - Use Cases
    - Activity Diagrams
- System Architecture

    - Functional Architecture
    - Physical Architecture
    - System Requirements Document
- Technical Feasibility Analysis
    - Geolocation Performance
    - Platform Performance
    - Networking and Collaboration Integration

2. **PROJECT SCOPE**

The business case will provide an analysis of the business space for this capability covering potential users, the potential markets for different platforms, estimated development costs and potential return on investment. The identification of potential users will be used to focus the application design on a few of the more similar and most profitable users and develop system requirements to meet these users' needs.

The user analysis will be the basis to develop a concept of operations for the application. Use cases, activity diagrams and other analytical tools will be used to develop the concept of operations. Additionally these products will be used to develop a functional architecture for the application. A generic physical architecture will also be developed with the functional architecture in a system architecture document. The architecture will also look to provide recommendations on data formats and methods to store and pass this new type of geolocation information.

A technical feasibility analysis will be done to compare the users' requirements to the current capabilities provided by one or more of the most popular smartphones currently available to consumers. This study will look to see if current smartphones are capable of achieving geolocation accuracies that will be relevant to user needs, and which phones on the market would provide the best capabilities. Additionally the study will look at current networking/collaboration services to identify those that might be able to support sharing and exchanging this type of data. If no suitable services are identified, the team will add this capability to the architecture to help define system requirement to provide this capability.

3. **PRELIMINARY REQUIREMENTS**

3.1 FUNCTIONAL REQUIREMENTS

3.1.a The MAGIC system shall calculate the location of an object within 2 or more images taken with a Smartphone.

3.1.b The MAGIC system shall store and process metadata from images taken via a Smartphone.

3.1.c The MAGIC system shall be able to display a map of an area where images have previously been taken.

3.1.d The MAGIC system shall be able to share object location information with other users of the system.

3.1.e The MAGIC system shall be able to interface with application systems via the internet.

3.1.f The MAGIC system shall interface with a central device for the purpose of data storage and distribution.

3.2 NON-FUNCTIONAL REQUIREMENTS

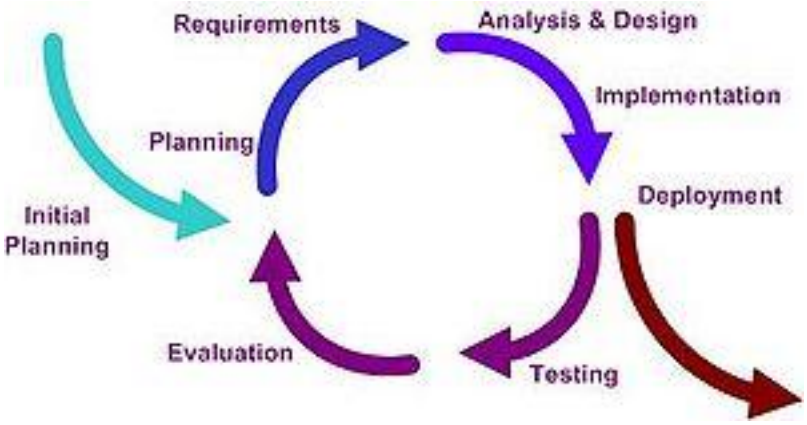
3.2.a The MAGIC system shall adhere to all user agreements for which the system is designed to interface with.

3.2.b The MAGIC system shall prevent unauthorized access to images stored on a user's Smartphone.

4. TECHNICAL APPROACH

To define the choice of solution that will be used within the project to deliver the business option selected from the Business Case, taking into consideration the operational environment into which the solution must fit.

The MAGIC team will take an iterative approach to developing the business case for the MAGIC application.



The first iteration will quickly 1) identify potential users, 2) develop their respective concept of operations, 3) perform a technical and feasibility analysis, 4) make a recommendation, 5) develop a CORE model for the recommendation, and 6) compile all findings into a first-iteration business case. All this will be done by the first Progress Report (10 March), but at a draft-level of quality. In the

process of performing the first iteration, the MAGIC team will learn what the 'rough-spots' are, and be able to plan the second iteration to accommodate them.

The second iteration will be complete in time for the second Progress Report (due 14 April); it will have built upon the results of the first iteration, and incorporated lessons-learned from the development process.

The third iteration will produce the final report (Business Case) and final presentation.

5. PROJECT PLAN

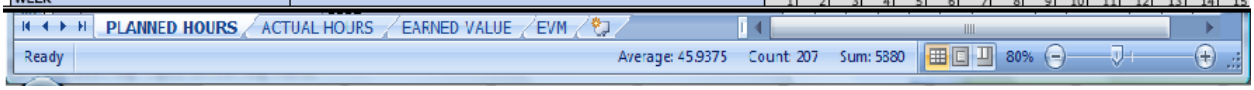
The MAGIC team will meet twice a week: virtually on Tuesdays from 5pm - 7pm, and in-person on Thursdays 5pm - 7pm. The Tuesday meeting will be joined by the Sponsor, Kurt Rogers, every other week.

The MAGIC team will

1. Log the hours they individually spent on tasks for the past week
2. Estimate the percent completion of each task before class on Thursdays. The hours and percent completion estimates will be used to track progress against the plan.
3. Initial roles will be divided on the last week of February, and each week tasking will be reviewed and updated.

MAGIC Project Tasks		JAN	FEB				MAR					APR				MAY
Tasks	Description	27	3	10	17	24	3	10	17	24	31	7	14	21	28	5
Project Definition Phase	Define the problem and project scope, and determine feasibility. Phase is complete when the Project Proposal is delivered.															
Problem definition presentation	Initial presentation delivered in class defining the purpose of the MAGIC project.		15													
Define initial tasks / hours / EVM plan	Forms the basis for Earned Value Management (EVM), and to be re-evaluated each phase. This spreadsheet is an initial draft.			15												
Problem definition / scope presentation	Presentation delivered to the class focusing on the scope of the project.			20												
Define preliminary requirements	Write primary requirements based on the described needs of the sponsor. This is part of the Project Proposal.			5	10											
Write a Project Plan	Describes how we (the MAGIC team) will operate (roles / responsibilities, interaction with sponsor, meeting-times, tools, etc)			5	10											
Write the Project Proposal	A class-deliverable to include the project definition, preliminary requirements, technical approach, expected results, and the project plan.				20											
Initial Iteration	Identify an initial set of users and use-cases; derive an initial system architecture and requirements flow-down; and perform an initial cost-analysis and ROI assessment. Ends with the 10 March Progress Reports.															
Update tasks / hours / EVM plan	Update the task-list and planned hours (this spreadsheet).					10	3	3								
Identify potential users	Identify a set of likely users of the capability. They will form the options described in the business case. This initial set of users will be re-evaluated (and probably de-scoped) during the 2nd iteration.					15	5									
Develop Concept of Operations	Includes use-cases and scenarios for the various options explored in the business case.					10	10									
Perform Technical Feasibility Analysis	Determine if the potential performance meets the needs of potential users. Perform trade study between various available platforms. Assess scope of networking / collaboration integration. Pick the recommended option to be modeled in CORE.						10	10								
Initial CORE Model	Define an initial functional and physical architecture in CORE; map requirements to physical / functional elements within the CORE model.						5	10								
Cost-analysis and ROI assessment	Estimate the development costs, and estimate the return on investment.						15	10								
Compile Business Case	Pull information from the concept of operations, the technical feasibility analysis, and others into an initial business case.					2	3	3								
Prepare the Progress Report	A class-deliverable presentation (~15 minutes). Will cover the Initial Iteration.							20								
Second Iteration	Update / down-select the set of users and use-cases; update the system architecture and requirements flow-down; update the cost-analysis and ROI assessment. Ends with the 14 April Progress Report.															
Update tasks / hours / EVM plan	Update the task-list and planned hours (this spreadsheet).								10	3	3	3	3			
Update the target users	Update and / or down-select the set of target users. These will form the basis for the options considered in the Business Case.								15	5						
Update Concept of Operations	Includes use-cases and scenarios for the various options explored in the business case.								10	10						
Update Technical Feasibility Analysis	Update assessment of whether the potential performance meets the needs of potential users. Update trade study between various available platforms. Update scope of networking / collaboration integration. Pick the recommended option to be modeled in CORE.									5	15	5				

MAGIC Project Tasks		JAN	FEB				MAR					APR				MAY
Tasks	Description	27	3	10	17	24	3	10	17	24	31	7	14	21	28	5
Update CORE Model	Update the functional / physical architectures, and requirement mapping based on the down-selected set of target users / use-cases.									5	5	15	10			
Refine cost-analysis and ROI assessment	Update development cost and ROI estimates.									15	15	10	10			
Re-compile Business Case	Pull information from the concept of operations, the technical feasibility analysis, and others into an initial business case.								4	4	4	4	4			
Prepare the 2nd Progress Report	A class-deliverable presentation (~25 minutes). Will cover the Second Iteration.											10	20			
Outbrief Preparation	Finalize all analyses and documents; meet with professor; dry-run the presentation; and deliver the final presentation.															
Set up web page	Set up the MAGIC Project web page													5	5	5
Finalize Concept of Operations														5		
Finalize Technical Feasibility Analysis														5	5	
Finalize CORE Model	Finalize the CORE Model, to include functional / physical architectures and requirements													5	10	
Finalize cost-analysis and ROI assessment	Finalize development cost and ROI estimates.													5	5	
Meet with professor	Prepare for and execute meeting with the professor to discuss progress and plan for final presentation													5		
Final Presentation Dry Run	Prepare for and perform a dry-run of the final presentation.													10	20	
Final Report (Business Case)	Prepare for and deliver the final report (due 2 May)													10	10	
Final Presentation	Prepare for and perform the final presentation.															30
TOTAL HOURS PER WEEK		0	15	45	40	37	51	56	39	47	42	47	47	50	55	35
CUMULATIVE HOURS		0	15	60	100	137	188	244	283	330	372	419	466	516	571	606
WEEK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15



The MAGIC team will use Use Cases, Activity Diagrams, Microsoft Visio and Vitech Core as the primary tools to perform the work. Teaming and collaboration for documentation will be done using Google Documents and the Team website.

6. PROJECT MANAGEMENT TEAM STRUCTURE

A chart /table showing who will be involved with the project.

Role	Named Individual(s)	Role Description
Executive	Kurt Rogers	Project eponsor and executive decision maker
Team Members	Jeff Carpenter Erika Rojas Mejia Dawin Wright Tom Haas	

7. REFERENCES

1. "30 Facts about Smartphones". http://www.baselinemag.com/c/a/Business-Intelligence/30-Fast-Facts-About-Smartphones-771839/
2. "Sensor Model Standardization: Frame Sensor Model Formulation" Document by SeiCorp Inc