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Proposal for

Youth-Oriented Public Participation GIS

I. Summary

Since the mid 1990s, two closely related initiatives within the field of Geographic Information Systems (GIS) have sought to involve the public (and in particular marginalized populations) in GIS related data collection and analysis. Public Participation GIS (PPGIS)[1] and Participatory GIS (PGIS)[2] focus on encouraging local awareness of GIS, data collection and mapping technology in the interest of increasing knowledge and improving local public policy decision making. In support of this goal, this proposal seeks to bind together in collaborative partnerships a number of existing ideas, technologies and systems, to create a participatory geographic learning system for children based on GIS technology. The system will target the worlds most at-risk youth as its primary audience.

While at first blush the proposal may sound exceedingly ambitious, the majority of required components already exist and most of the difficult work has already been completed by others. The novel contribution of this proposal is to identify- and provide a feasible, specific plan for- a synthesized system that accomplishes a combined achievement beyond the scope of any of the existing constituent elements. The centerpiece of the project is a proposed partnership with One Laptop per Child (OLPC)[3], a non-profit organization aiming to provide laptop computers to the world's poorest children. Even though the project is relatively new it has already realized the hardware and a significant amount of software and has distributed over half a million 'XO' laptops around the world.[4] This proposal outlines in detail the concept of leveraging the highly compatible goals of PPGIS and OLPC as the basis for a synthesized GIS-based learning system delivered through the XO laptop. The below includes detailed lists of required components and partnerships as well as a project plan, schedule and budget.

II. Motivation

Public Participation GIS

In spite of the relative affluence of certain areas of the world, there are still many children living in emerging or impoverished areas who lack access to sufficient education. The focus of Public Participation GIS (PPGIS) is to provide GIS exposure and education to a variety of marginalized populations, in the hopes of providing them more understanding and a greater voice in local public policy decision making. A number of non-governmental organizations and non-profit groups have formed around these ideas and typically undertake modest regional or local projects focused on specific issues. Examples of such programs include the South African Mapping Project and the Aboriginal Mapping Network.[5] As a more light-hearted example, the New York restroom web site enlists the help of urban New York residents and visitors in mapping, rating and providing details about publicly available bathroom facilities around the city.[6]

PPGIS for Children

As a distinct PPGIS subset, some groups specifically cater to child/youth populations, such as the GIS4KIDS.com web site.[7] Such groups seek to improve the geographic literacy of children by involving them in interactive education and hands-on GIS data collection and utilization. Some of these efforts take the form of web-based GIS activities and games designed specifically for children, such as are found on the Kidzmap.com site. [8]

One Laptop per Child

Whereas PPGIS has been active for more than ten years, the One Laptop per Child organization is a relatively new non-profit group that began in the past 2-3 years. It's stated mission is to "...create educational opportunities for the world's poorest children by providing each child with a rugged, low-cost, low-power, connected laptop with content and software designed for collaborative, joyful, self-empowered learning."[9]

Free/Open Source Software

Another recent social trend that has significant bearing on the objectives of this proposal is the free/open source software movement. While factional devotees argue over the differences and nuances of the concepts of freedom and openness as they relate to software[10], collectively those involved in this movement are responsible for the proliferation of free, high-quality, collaboratively-developed software. The availability of such software is a key assumption in the OLPC project and similar altruistic efforts and weighs heavily into the recommendations outlined in this proposal.

Radio Frequency Identification

Radio frequency identification (RFID) is one part of the class of automated identification technologies that includes such things as barcodes and biometric readers. RFID systems are comprised of electronic RFID tags that are affixed to objects and function as transponders, sending radio signals back to RFID reading devices. The tags are printed with special printers and provide a significantly higher level of identification automation than is possible, for example, with bar codes, since the RFID readers do not require line of sight to tags in order to acknowledge and record them. [11]

Of particular relevance to this proposal is the interesting convergence witnessed in the past few years between RFID and GIS technologies, particularly through GPS-enabled RFID sensor networks that are currently being used to monitor such varied things as the movement of cattle[12] and wildlife[13], forestry consumption[14], school attendance[15] and even the condition of manhole covers[16]. The existence of extremely compact RFID tags make possible a range of remote sensing and spatially-related data collection techniques that would have been difficult or impossible in the past.

Convergence

The convergence of the above trends and technologies provide the primary motivational basis for this proposal.

III. Statement of Work

This not-for-profit project proposes the creation of an end-to-end geographic learning system for children that serves as a public participation GIS initiative and encourages hands-on participation in GIS data collection, analysis and interaction with simplified GIS software, activities and educational games. A specific design feature of the project is that it will emphasize the use of existing systems and technologies rather than creating entirely new ones. The key contribution of this effort will be the conception of the end-to-end system and the project management, strategic planning, coordination and relationship building required to bring together the various partners and components necessary to realize the project goals. The target audience for the project deliverable (i.e. the end-to-end system) will be the youth of marginalized and disadvantaged populations.

IV. System Description

The following is a high-level description of the system to be developed, tracing its use from end to end. Since the target audience is children, the system description is provided from the vantage of Mary, a fictitious child user. Further detail, descriptions and goals associated with individual components are covered in the "Project Goals" section.

So when the proposed system is complete, what exactly can Mary do with it?

Mary receives her 'XO' laptop and among many applications, it is equipped with a simplified GIS application interface. The reduced-feature application enables her to perform simple GIS tasks, such as importing and 'layering' data sets of interest from a library of previously uploaded spatial data specially formatted and prepared for use with the XO laptop. For example, Mary may choose to download rainfall data for her region, or agricultural crop data of the neighboring town, etc. With minimal instruction from her teacher she is able to download the data and use it in conjunction with other data to create rich, multi-dimensional geospatial maps.

Mary can also use a field data collection interface to participate in individual or group (class, club, community) oriented field collection of observation-based data. For example, during a nature hike one day she uses the simple interface to indicate a sighting of a certain species of flora or fauna. As Mary interacts with the data collection interface, she indicates a category for the data among the choices provided and adds any relevant notes. As she captures the entry at the point of observation, the on-board GPS device automatically records the location of the laptop and Mary's observation data is instantly geocoded. Periodically the data Mary has collected is uploaded wirelessly to a central server where it is cleansed, aggregated and merged with other relevant sources based on location and the category provided by Mary. This is a primary means that the system uses to build up its ‘library’ of downloadable map layers. In this manner, as more children work with XO laptops, more data will be gathered and made available to other children for use in their geography studies.

In addition to local projects, Mary’s teacher may engage other teachers and their students (in nearby regions or distant areas) for collaborative GIS projects as ‘sister-schools’. For example, if Mary is a warm weather climate zone, her teacher may choose to have Mary and her classmates collaborate with children in a colder region. They may choose to collect specific temperature data or animal sightings during the same period, following the same basic methodology, and then download each others’ data for specific comparison research. Again, as the user base expands, such possibilities become unlimited.

In a further extension of the PPGIS model, Mary and her classmates could also learn to manipulate the on-board RFID reader/tag programmer for more scientific data collection. In this scenario, the shipment of laptops to Mary’s school also comes with a number of small RFID tags (similar in size and weight to thick paper labels with adhesive backings) that carry tiny on-board sensors for temperature, light, humidity, sound, etc. Mary’s teacher can coordinate special field projects where the class initializes the sensor tags and then affixes them to nearby buildings, rocks, trees or other suitable objects. Periodically, the students can revisit the tag locations and use the on-board readers in their laptops to capture new data points. Once again, the on-board GPS device ensures that the data is geocoded at the point of collection. This scenario allows for the possibility of relatively robust, quantitative data collection by the children, which they can use themselves as well as upload for use by XO peers around the world.

Finally, as the XO laptops are meant to be fun and interesting in order to encourage children to explore and be inquisitive about learning, the GIS system will also include interesting game interfaces that incorporate cartography, GIS data and the GPS device into playful activities. A number of such location-based games are already being piloted in academic[17] and commercial[18] settings (for example, by mobile phone companies which are increasingly including on-board GPS capability in cellular telephone devices). One new game idea could leverage the mesh networking properties of the XO to define a local polygon that includes all the children in a class (or within a certain proximity) and records the relative positions of the kids from one another. This spatial data could then be scaled up and transposed on to the worldwide globe so that each child is assigned the country or region that falls closest to their projected position. The children could then download interesting data sets from those particular regions (about local wildlife, precipitation, sun raise/sun set, etc.) and report their findings back to the group as a 'representative' of that region. Naturally such studies may easily transcend geography and support research on world languages, foods, cultures and religions, history and politics, ecology and environmental studies, etc.

Another idea would be to encourage children to form email-based 'opposite pen-pal' relationships with children who are geospatially located on the exact 'opposite' side of the world, when feasible.

V. Project Goals

In this section we itemize the components required to complete the end-to-end system and indicate for each whether they can be supplied '**as is**' from existing materials, '**adapted**' through slight alterations of existing materials, or be built '**new**' by combining and creating materials as needed.

Hardware Components

Component	Status	Notes
XO laptop	as is	the laptop was designed for precisely such purposes and should not need to be adapted
on-board wireless card	as is	wireless card and mesh networking perfectly support intended uses
on-board GPS device	adapt	the current laptop configuration does not include a GPS device; proof of concept will be done using existing USB- model but production pilot will require switch to small form factor in-body design[19]
on-board RFID reader	adapt	same as on-board GPS[20]
RFID tags	as is	single-censor RFID tags already exist for this purpose

Software Components

Component	Status	Notes
simplified GIS package	adapt	heavy software development required to pare down the feature set of existing GIS packages
data collection interface	new	light software development required
data upload/download	adapt	light to moderate software development required
database map server	as is	utilize web-based interface to back-end database[21]
GPS device controller	as is	(i.e. the existing drivers for the device to be added)
RFID device controller	as is	(i.e. the existing drivers for the device to be added)
game software	new	moderate to heavy software development required
email/chat interface	as is	exists as part of the standard XO build
collaboration interface	as is (?)	presumed to exist as part of the standard XO build

VI. Project Plan (initial)

Timeline

A detailed project plan will be derived pending initial approval, but the following divides the project into distinct project phases with clear deliverables for each phase.

Phase	**Description of Work**	**Estimated Duration**	**Deliverable(s)**
1	establishing partnerships, feasibility study	1-2 months	signed letters of intent, feasibility study
2	proof of concept prototyping	2-4 months	working POC, approved
3	hardware acquisition, detailed software coding, system testing, field testing, production pilot	9-18 months	tested system, approved for release
4	initial production release	milestone	1.0 system launched
5	maintenance and support	ongoing	service releases and enhancements

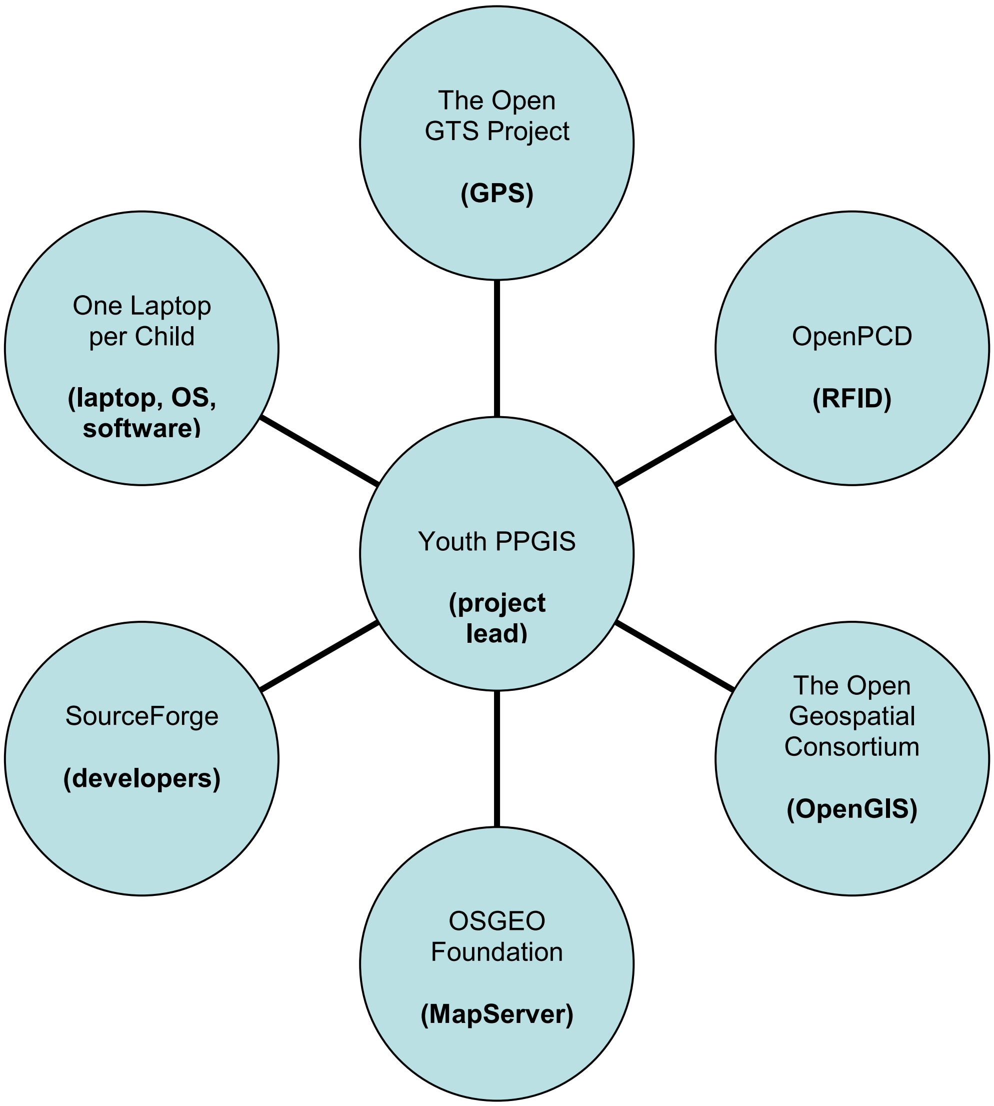
Budget

The below defines the basic budget parameters for the project. All project labor (project management, software development, design and analysis activities, marketing, etc.) is assumed to be provided on a pro-bono basis and is therefore not computed as an actual budgetary expense. Only underlined items are reflected as actual costs. The OLPC project is already underway and forms the basis for much of the effort associated with this project. Therefore, build/shipping/hardware costs folded in to the larger OLPC project are deemed outside the scope of this effort as it 'inherits' such from OLPC.

Phase	**Expenses**	**Anticipated Costs**
1	project management, analysis, travel	$ 2500.00
2	limited hardware acquisition, software mock-ups	$3000.00
3	hardware integration analysis, design, device acquisition, software coding, unit testing, system testing, user-acceptance testing	n/a
4	one-time launch related expenses, specialized marketing	$1500.00
5	maintenance releases, support server hosting	$500 (per annum)
	Estimated one-time cost through initial launch	$7500.00
	Estimated ongoing annual cost	$500.00

VII. Key Partners, Organizations

The following is a diagram of organizations expected to act as critical partners with a note below each indicating the area of anticipated collaboration.



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