BAE SYSTEMS AND NAMIG

In conjunction with UniSA and the City of Salisbury

presents the

2010 C2C SWAT INDUSTRY PROJECT

SUBURBAN WETLANDS ACQUISITION TELEMETRY SYSTEM CHALLENGE

Introduction

It is estimated that 70% of wetlands in South Australia have been destroyed since European settlement. Natural wetlands were once a significant component of fresh water environments across the Adelaide Plains. Before European settlement swamps and marsh areas (known as the Reed Beds), once spanned an area from Glenelg to Port Adelaide. Water travelling down the River Torrens was filtered through the Reed Beds before dispersing north into the Port River or south into the Patawalonga and the sea. These areas were altered during the early 1900's when many natural wetlands were filled in to create dry land for housing, and water flows were redirected through constructed channels and drains.

Urban development, such as the construction of roads, houses, car parks, shopping centres and businesses, has increased the amount of stormwater runoff in our cities and suburbs. Hard surfaces absorb very little rainfall so stormwater gutters, channels and drains were developed to move stormwater runoff as quickly as possible from our neighbourhoods to rivers and the sea. As a result, pollutants such as litter, nutrients, faeces, silt, dirt, oil, and leaf litter flows unfiltered into the Patawalonga, Torrens and Port rivers and Gulf St Vincent.

As we have developed a greater understanding of the importance of wetland environments and the roles they can play in urban areas, catchment water management boards and local councils have worked together to construct and conserve urban wetlands. Artificial wetlands provide solutions to a number of water issues including flood control and stormwater pollution management. Urban wetlands beautify urban areas and also provide habitat and safe havens for native animals and plants.

Urban wetlands have been constructed throughout metropolitan Adelaide to improve the quality of urban runoff (stormwater). Wetlands retain this stormwater for long periods of time so that natural filtering processes can occur before it is released back into rivers and stormwater drains. For example, the water flowing through the Warriparinga wetland is diverted from the Sturt River. It is retained in the wetland for approximately ten days before being released into the Sturt drain which carries it to the Patawalonga Lake . Stormwater that has travelled through a wetland is much cleaner. Wetlands improve water quality by processes such as sedimentation, nutrient uptake and the destruction of pathogens through ultraviolet radiation.[1]

Urban wetlands are a complex ecosystem of plants and animals and are easily disturbed by humans and natural factors and it is important to monitor the health of the wetlands to keep the wetlands effective.

1. Background

There are a number of programs already existing which monitor the health of wetlands. The Suburban Wetlands Acquisition and Telemetry System (SWAT) proposal requires a different approach because a majority of the existing programs only sample water at the wetlands at fixed locations. This has the limitations that water watchers must be able to physically get to the sample point and can only see the sample at those fixed locations. This project aims to create a vehicle which can be

[1] http://www.waterwatchadelaide.net.au/index.php?page=our-local-wetlands

directed to a specific location, conduct some water sampling and map and log the data for further analysis.

2. Objectives

The objectives of the challenge are to:

- Evaluate which vehicle would be best suited to this type of environment.
- Design and implement a control mechanism for the vehicle.
- Design and implement data logging for position and water sample values.
- Ensure that any solution has a minimal environmental impact.
- Develop a test environment to demonstrate the capability.
- Present the data collected from the vehicle in a variety of forms.

3. Environment

The SWAT capability has to operate in urban wetlands environment. Urban wetlands are typically a mix of land and water (depending on rainfall) and are generally considered environmentally sensitive with many animals using these areas as breeding and nesting areas. Any solutions must have as small an impact on these areas as possible.

It is expected that the vehicle would be launched from a secure dry land base station location (ie water's edge, board walk or jetty) and would have to move under its own power to a specified location, sample the water and then either move to the next location or return to a base station.

4. Implementation

The implementation is the development of a physical vehicle and base station capable of measuring and recording water quality.

The designing of the solution will require the evaluation of various vehicle types (car, boat, helicopter, hovercraft etc), various water sampling techniques, remote control mechanisms for the vehicle and data storage and presentation techniques. These evaluations will need to be highly cognisant of the environment they will be operating in.

It is expected that a test environment will be developed to simulate the terrain that the vehicle might be operating in.

A solution meeting all of the options identified in the Requirements Scorecard Matrix may not be able to be developed in the time allocated, therefore the students need to pick what requirements they feel they can meet and develop.

5. Requirements

The final solution must meet as many of the requirements listed in the Requirements Scorecard Matrix as possible. Each requirement has a number of sub categories each with a weighting attached to it (the higher the number the higher the importance of that requirement.). Each solution will be judged out of 10 against how well the solution achieved each requirement. The judgement will then be multiplied by the weighting factor to produce the final weighted score.

eg Requirement 1 has a weighting of **2** and the solution scored a **6** out of **10**.

The final weighted score is **2x6 = 12**.

eg Requirement 2 has a weighting of **4** however only scored a **4** out of **10**

The final weighted score is **4x4 = 16**.

Even though the solution did not score as well on Requirement 2 overall it earned more points because it was seen as more important/difficult.

Students are to determine which requirements they are going to try and achieve. Typically the higher the weighting the more difficult it is to achieve.

6. Testing

Before the solution is used in a real urban wetland it is to be tested in a simulated environment(s). Each component of the solution should be able to be demonstrated in the test environment(s). The final evaluation will most likely occur in the test environment. The test environment should be able to be moved for the final demonstration indoors or an alternative environment developed for the final expo.

7. Project Assessment

The solution will be assessed mainly in the following two equally weighted categories:

- **Operational Effectiveness – How well the requirements were met.** This will be assessed via the Requirements Scorecard Matrix.
- **Use of Systems Engineering Practices – How the requirements were met.** The team should provide evidence that the system was developed using a systems engineering approach. The team leader needs to deliver a 10 minute presentation on “How the solution was developed.” The presentation should cover project planning, approach, lifecycle model, requirements management, design methodology, implementation, testing and lessons learned.