

A Museum Monitoring Application Using PAQ Middleware

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Introduction

During the 2009 UNCC REU program, our team was tasked with gaining adequate background knowledge about persistent query networks and object preservation in museums and following that, the implementation of an application to monitor environmental aspects of a museum environment. This was to be achieved by using the PAQ middleware, an API developed to approximate a persistent query by using a sequence of one-time queries. The museum application was specifically chosen because of its abilities to demonstrate the benefits of utilizing the PAQ middleware in a socially relevant situation.

Background

Persistent query networks, in their current form, are not easily adapted for use with the multitude of situations that they seem suitable for. One of the reasons for this is that a true persistent query is typically a very taxing operation. The PAQ Middleware aims to solve this issue. The goal of our research was to understand why the PAQ Middleware is useful and then to show this through development of a museum monitoring application. Once developed, the application would serve as a baseline for future tests. We also tried to show that PAQ should be considered socially relevant because of its many advantages not only to the applications programmer but to the end user as well.



Figure 1: The Sun Microsystems SunSPOT

Research

- Museum object preservation
 - We found many shortcomings in the current system of object preservation in museums
 - Current systems are too expensive for deployment in many museums
 - Found ideal levels for objects preservation so that we could integrate them into our application
 - Most of the data collected at museums is not reflected upon, and this is one of the major problems with preservation
- Persistent query networks
 - When a persistent query is being made, the battery life of the network is compromised, PAQ solves this by simulating the results of a true persistent query through unique introspection strategies
 - We determined requirements for an introspection strategy that would be beneficial to our application and implemented it

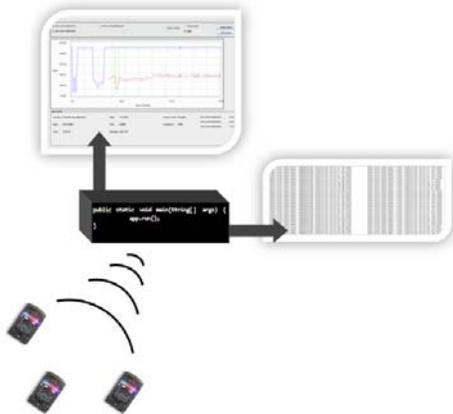


Figure 2: Application flow diagram

•Application implementation

- Decided to use the Sun Microsystems SunSPOT as our test hardware for the implementation (figure 1)
- Information was passed from the client run on each of the sensors to the application running on a base station per request of the base station
- The request was determined by the current introspection strategy
- Information is passed from the PAQ instance to an easy to understand GUI which allowed for real time monitoring of the environment (figure 3)
- If the values returned do not fall into accordance with the adaptation window, the system will adapt to another specified introspection strategy and also simulate actuators being utilized
- Once the values average out and fall within in the specified window once more, the system will revert back to the original introspection strategy
- Information is logged to a file of the user's choice so further adjustments can be made in the future that will further benefit preservation



Figure 3: PAQ GUI running

Impact

- **Because our implementation was successful, it can be said that the PAQ Middleware could be a very useful tool for the development of a persistent query application**
- **In developing this application, we have created a baseline that will allow us to test other applications**

Conclusions

Because our implementation was successful, it can be observed that the PAQ Middleware is a suitable development platform for its intended purpose. We were able to gain the background information needed, and then develop the application in the short amount of time we had. Our application can be used in a comparison with another in the future, someday proving if PAQ is superior to current methods.

Future Work

There are many things that we would like to still do with the PAQ Middleware in the future to ensure that it is a practical design platform. One of these things would be to get a real deployment of our system into a museum to gain insight on successes or shortcomings that PAQ will have in the real world. Another goal would be integrating actuators into our system so that they may control things such as an HVAC system in a museum if the environment needed adjusting. Also, we would like to test our application against another to ensure quantitatively that PAQ is a better choice.