

DT228 - Project Proposal Form 2015/2016

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Project Title: Real-time Tracking of Nodes In a Wireless Sensor Network	
Summary: <p>The aim of this project is to track and record the locations of nodes in a Wireless Sensor Network over a period of time. The purpose of this application is to track a player's position on a pitch over the course of a match. Depending on the sensor technology used, other metrics such as G-forces and player direction may also be recorded with the purpose of evaluating players' performance.</p> <p>The first part of the project consists of creating and setting up a Wireless Sensor Network and establishing means of communications between both nodes in the network and the outside world.</p> <p>In the second stage of the project I aim to find a reliable and consistent way to track the exact position of a node in the network over a period of time. In this stage other possible metrics for recording will be determined.</p> <p>The final stage of this project is to display the collected information in a useful manner. I propose that collected data will be sent from the WSN to a server, stored, processed and made accessible to users through a web interface.</p>	
Background (and References): <p>Constructing Wireless Sensor Networks has become possible due to the improvements made in the required technologies. Reduced chip size, power consumption and costs have all greatly helped in making WSNs viable. (1)</p> <p>Wearable Sensor's have become popular in with professional sports teams in recent years. Sports analytics allow teams to measure the performance of their players and the effectiveness of they're tactics. Such information can give teams the edge over their opposition and help achieve better results. (2)</p> <p>With these points in mind, I believe it is both feasible and viable to create a WSN to aid the gathering of information to perform sports analytics.</p>	

Proposed Approach

There will be three main stages in my approach to building this application.

- Researching and Design of the system
- Implementing the system
- Testing and Evaluating the system.

I will be using an Iterative approach while designing this system. This will allow me to iteratively release working code and implement improvements as I progress further through the project.

Research and Design

There are several parts of this project which will require research. Below I have split these up and highlighted factors of importance.

Wireless Protocol - Determine which wireless protocol to use to implement the WSN. Options are 6lowpan, Bluetooth Low Energy or Zigbee. Protocol features of importance are range, energy consumption and communication abilities.

Wireless Sensors - Find suitable sensors capable of communicating using the chosen wireless network protocol. It is important that the sensors be small in size and lightweight.

Base Nodes - While these may be the same sensors as above, at least one base sensor will be required to communicate with an internet connected computer.

Web Back-end - An application server & database will be required to process and store the collected information. Processing of data may be done locally on the machine connected to the base node using an MQTT server. The processed data will then be sent to a database for storage and use in the front-end.

Web Front-end - Building of a web accessible application to display the collected data in a manner which is clear, concise and of relevance to the user. The aim of this front-end application is to be primarily functional, with additional features added as time permits.

Implementation

-Stage One- Hardware Implementation & Systems Initialization

The primary outcome of this stage is to establish communications between all of the pieces of hardware in the project. This requires the building and programming of the WSN with the goal of establishing how nodes will communicate, know who they are communicating with and how they should send their information to the base nodes.

With the primary outcome of setting up and configuring the WSN complete I will then need to establish communications between the base node or nodes and a database. This will require creating a database to store the data with an application capable of putting data into it.

-Stage Two- Data Generation & Calculation

The primary outcome of this stage is to create an algorithm which can reliably calculate sensor location from the retrieved data, relative to both the base nodes and other nodes. This will require finding a suitable means of measuring the distance between nodes. With the distance found between nodes, a form of Triangulation may be used to determine their exact positions. Triangulation of a node's location can be calculated based on measurements of the distance to three separate nodes at a point in time.

Once a capable algorithm has been created to establish a node location it will be used on a stream of data to track that node over time.

-Stage Three- Developing a User Interface

This stage will focus on creating a means of displaying the data to the system's users.

-Testing & Evaluation-

Testing will be carried out on an ongoing basis but an added emphasis towards the completion of the project. I propose to take a Test-Driven approach to coding which will ensure that all code works as is intended.

Upon completion of the system's implementation I intend to test my system in the real world to evaluate its performance and feasibility.

Deliverables

Hardware Implementation

A working Wireless Sensor Network which demonstrates the ability to track a sensor node.

College

Interim Report & Presentation
Project Report & Code Submission

Technical Requirements

-Development-

Hardware To Create A WSN which must contain a minimum of the following.

- One Sensor Node
- Three Base Nodes
- An internet connected computer
- A Database
- A Web Server
- Laptop

For the purposes of development a web server, database may exist on the development machine.

-Deployment-

Requirements are as above but a permanent server will be required for the database and website.

References

- (1) H. Karl, A. Willig, Protocols & Architectures for Wireless Sensor Networks: 13 2005
- (2) P. Dizikes *Six keys to sports analytics* MIT News: 2005