THE DAWSON GROUP

An analytical approach to road de-icer choice

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Background

As an experiment the Dawson group reached out to TRU with a computer science project for the capstone course. After a successful first project resulting in the hiring of a student who worked on the project Dawson group decided to propose another project TRU and it was picked up by a group of students.

The proposed project involves the Dawson Road Maintenance (DRM) team taking a more analytical approach to decide the correct solution that should be applied to a road during the wintertime. This will look to be achieved by using an IoT device to give information of the road temperature and look at the weather forecast to help upper management make judgements from a central office

The approach that we will be taking is a stationary node system where an IoT device is contained in an enclosure and set in the ground. From there 3 modules will be used, a temperature sensor to detect air, surface and sub-surface temperatures, a GPS module to keep track of locations in the event a node is moved, and a radio module to send data from the IoT device to the central office. In the event of the devices being too remote we can look to add more nodes that just extend the radio distance.

Project Objectives

1. Create an IoT device to collect the temperature of the road, ground, and air.
2. Receive data from the field to a central collection node.
3. Reduce material cost in wasted de-icer being incorrectly applied to the roads.
4. Manufacture an enclosure to contain the entire device.

Project Scope

In Scope

- Develop an IoT device to collect information
    - GPS module
    - Temperature sensor
    - Raspberry Pi Brain
    - Radio communication module
- Code a way for the sensors to collect information and sleep in between uses.
- Data send and receive points.

Out of Scope

- Integration with PowerBI / visualization software
- Machine learning to predict conditions using data

Project Deliverables

- IoT pricing and options
- IoT prototype
- IoT Documentation
- Program that interfaces with IoT device and collects data
- Coding documentation
- Testing accuracy of ground or road temps
- Develop enclosure to hold the device
- Final documents

Benefits Expected / Measures of Success

- Accurately collect data out in the fields with sleep timings to save battery life.
- Lower material cost as the amount of wasted material is lessened by the additional information.
- Data collected at the central point to be added to a database.

Project Team

The project will be handled by a team of IT students. Doug Walch will act as project lead with Alex Frison adding input, providing documents, coding and research as delegated by Doug. Contacts within Dawson Group are Brian Eshpeter as main project overseer and Daniel Fernandez as the main contact for the team.

Reporting and Meetings

The team hopes to meet at least once a week with team members in the Dawson Group to update progress and take input based on where the project is.

Reporting Activity	Frequency	Attendees	Description
Weekly Scrum meeting	Weekly	Doug Alex Kiran Daniel Brian	Review where we are in project process, how deliverables are coming, blockers that are impacting the team, questions, findings, and success stories.

Approach

This project will take a 4 phase approach

- Phase 1: Initial set-up
- Phase 2: Field Testing
- Phase 3: Enclosure design
- Phase 4: Iteration and final documentation

Phase 1 – Initial Set-up

In this initial set-up phase we are going to collect hardware and wire it all together. We will also code the sensors to collect data from the given sensors and display the information in a controlled environment.

Phase 2 – Field Testing

With the initial set-up complete we will look to build out the field functionality. With this we will be looking to test the sending of data from a node at Dawson group to TRU and having that data be collected by a central node. We will also augment the programs timing so that it can run remotely off battery for approximately a year at a time.

Phase 3 – Enclosure design

With a proof of concept competed run we will look to design a 3d printed enclosure for the device that can house all the equipment.

Phase 4 – Iteration and final documentation

With a completed idea we will continue to iterate on the design to try and solve any short comings that appeared in any previous phase and we will look to finalize documentation.

Project Costs

Project costs are going to be dependent on the hardware chosen and the method that we choose to use in order to collect the data. Should we choose to go with the side of the road method we will have to include the cost of putting the sign out in the hardware. There also could be the cost of adding another device to read the results from the IoT device in the truck.

Hardware:

- Raspberry Pi or similar boards: $100 - $300

- Temperature sensor: $10 - $30
- Wireless Transmitter: $15 - $50
- GPS module: $20 - $50

Total: $145 - $430 per IoT device