PetrolWatch: Using Mobile Phones for Sharing Petrol Prices

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Price dispersion of homogeneous goods is widely prevalent in our economy. For instance, on 18 January 2008, around 9pm, two service stations in Roseville, Sydney, that are less than 1 km apart, were selling unleaded fuel at 1.359 and 1.439 Australian dollars per litre. Consumers who have access to the pricing information can benefit economically (e.g., a 5.5% saving in the above scenario). Several websites such as `GasBuddy`, `motormouth`[1] enable consumers to compare fuel prices. However, the fuel price information is collected manually, by volunteers or employees, which is cumbersome, error-prone and not up-to-date. In this demo, we will demonstrate the operation of our *PetrolWatch* system [2], [3], which automatically collects fuel prices using camera phones. This is the first instance of applying participatory sensing [1] in sharing consumer pricing information.

Our system is implemented as a client-server program and has two principal modes of operation: (i) fuel price collection and (ii) user query. The fuel price collection is completely automated and only requires the camera phone to be mounted on the dashboard, with the camera lens pointing towards the road. Our system automatically triggers the mobile phones to photograph the roadside fuel price boards when they approach service stations. Sophisticated computer vision algorithms are used to scan these images and retrieve the fuel prices. To deal with a non-structured environment, and to reduce computer vision complexity, it relies on the GIS database and GPS location to know the service station brand and uses the fact that each brand uses a specific color for its price board. The metadata (location coordinates, brand and time) are extracted and stored separately. The images and fuel brand data are passed on to the image processing engine, which is implemented on the mobile phone. The first step detects the existence of a fuel price board. For each fuel brand, we employ a tailored color thresholding that can capture regions within the images, having a color scheme similar to the fuel brand price board. In certain situations, surrounding objects in the image may have colors resembling the board, e.g.: the blue sky may be similar to the Mobil price board. In this case, we use post-processing techniques to narrow the search. We use the price board dimensions to exclude some of the candidate regions selected by color thresholding. This is further refined by comparing the color histogram of all candidate regions with that of a sample price board image. The image is cropped to contain only the board, and normalized to standard size and resolution. We convert the color image to binary and use connected component labeling to extract the individual numeral characters. A Feedforward Back propagation Neural Network algorithm is used to classify the digits. The extracted prices are uploaded to the server and stored in a database, linked to a GIS road network database populated with service station locations. The server updates fuel prices of the appropriate station if the current price has a newer timestamp. History is also maintained to analyze pricing trends.

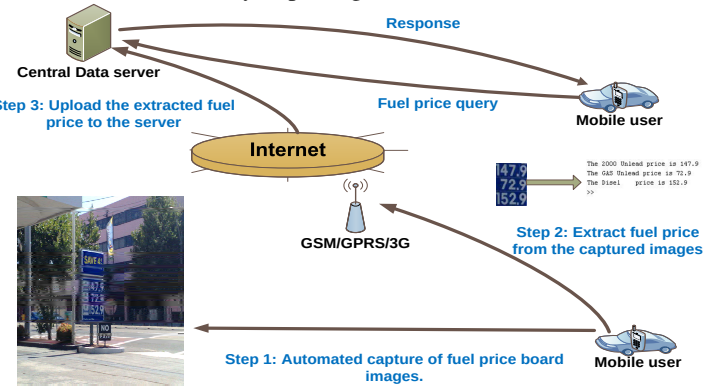

Fig. 1: System Architecture

The PetrolWatch client software is implemented in Java ME. We used the open-source JJIL imaging library [2] for implementing the computer vision algorithms. A fully functional prototype was tested on a Nokia N95 mobile phone. Based on 60 images, our system achieves a hit rate of 75.4% for correctly detecting the fuel price board from the image background and reads the prices correctly in 86% of them.

REFERENCES

[1] A. Parker et al., "Network System Challenges in Selective Sharing and Verification for Personal Social and Urban Scale Sensing Applications" in *Proceedings of the 5th Workshop on Hot Topics in Networks (HotNets-V)*, November, 2006.

[2] Y. Dong, S. S. Kanhere, C. T. Chou and N. Bulusu, "Automatic Collection of Fuel Prices from a Network of Mobile Cameras", in *Proceedings of the 4th IEEE International Conference on Distributed Computing in Sensor Systems (DCOSS 2008)*, June 2008.

[3] N. Bulusu, C. T. Chou, S. S. Kanhere, Y. Dong, S. Sehgal, D. Sullivan and L. Blazeski, "Participatory Sensing in Commerce: Using Mobile Camera Phones to Track Market Price Dispersion", in *Proceedings of UrbanSense08, in conjunction with ACM SenSys 2008*, Nov. 2008.

[1] `http://www.gasbuddy, http://www.motornouth.com.au`

[2] `http://code.google.com/p/jjil/`