Research In Motion

Technical Research into Potential Methods of Determining Mobility of a Cellular Phone to Restrict Distracted Driving

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Application to Driver Safety

The dangers of mobile phone use while driving are of major concern. Many governments throughout the world are imposing restrictions on the use of mobile phones while operating a moving vehicle.

Typically, policymakers have banned vehicle operators from texting or talking on a phone while driving, with the exception of hands-free modes for texting or talking.

The goal of these laws is to prohibit vehicle operators from manually texting or talking on a handheld phone while driving. Our method could help assist vehicle operators to comply with the law.

Our technical research is aimed at developing solutions giving the best user experience for mobile phone users while helping address the safety issue.

RIM Research Into Potential Solutions

- Based on measuring radio channel parameters
- Does not require any changes to the network
- No extra current and no impact on battery life
- Works well in complex environment
- No additional component and minor change to radio code
- Can be used for activating BT or GPS in a moving vehicle
- It is for detecting mobility and not for measuring speed

RIM Research Into Potential Solutions

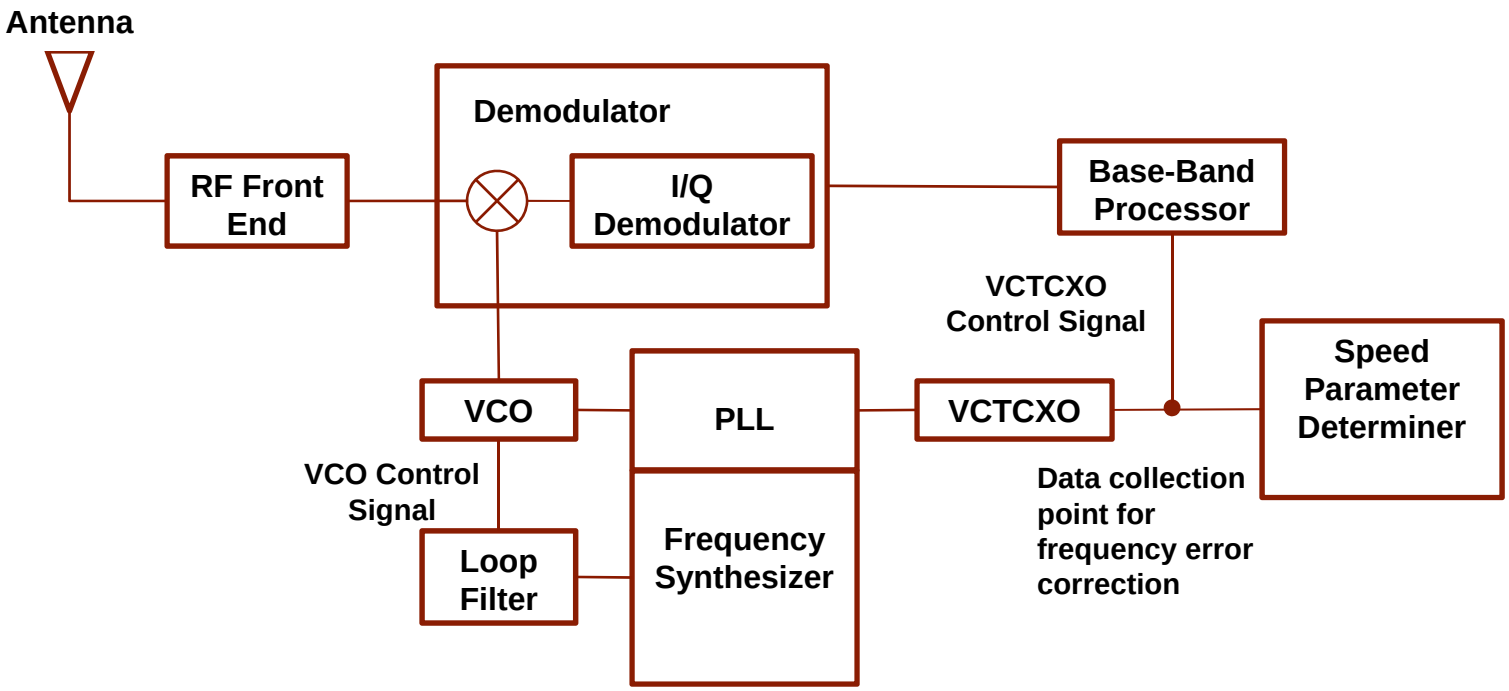
- Research focused on using paging channel information
- Monitoring paging channels is a requirement for all cell phones
- On typical network, the duration of the paging channel is 500 ms
- Doppler (frequency offset) is already available in the mobile
- It is combined with RSSI measurement, which is also available
- Test results, 80% accurate in city and urban roads
- 70% accurate on intercity highways
- Less than 1% fall positives
- Testing was done on GSM network and others are in development

Other Potential Technical Solutions

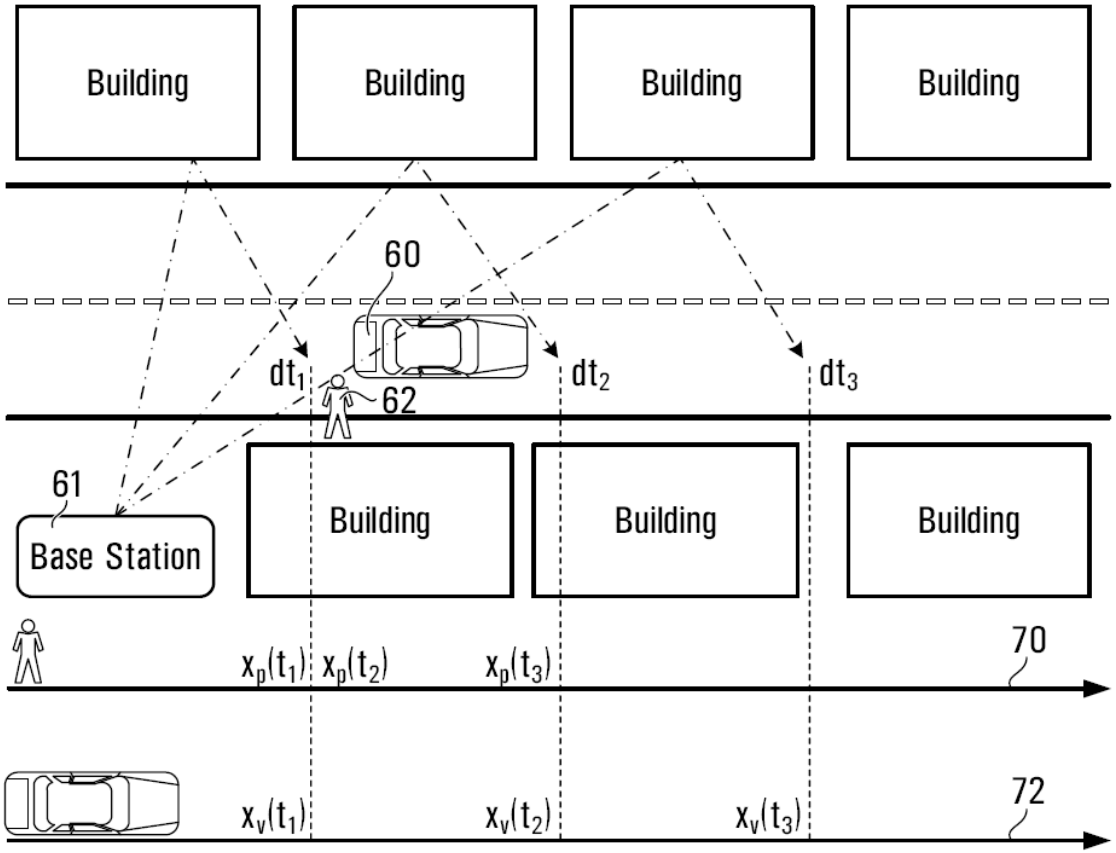
- Global Positioning System
  - Higher processor current, 40 mA
  - Not good coverage in canopy regions
  - Accurate estimation of speed in most regions
- Gyros/Accelerometer
  - Lower current, but will affect battery life
  - May not be accuracy on speed estimation
  - Lower cost and smaller component
- Proximity sensors in vehicle
  - High current such as in BT with auto synchronization
  - Need modification to automobiles
  - Accurate estimation of speed

Determining mobility

Automatic Frequency Control (AFC) for a typical radio receiver



Determining mobility



Works well in good multipath environment

60: Vehicle speed > 15 km/h

61: Serving Base Station

62: Pedestrian

Determining mobility

The relationship between frequency error of Δf and speed.

$$\Delta f = \frac{\Delta v}{\lambda}$$

For example, if the possible frequency accuracy of the system is 0.4 ppm, then at 900 MHz, the frequency error will be +/-36 Hz. The possible worst case frequency error of a stationary mobile is 72 Hz over one second period. Since the frequency measurement is updated every 0.5 seconds, the error will be 36 Hz and this will correspond to a speed of

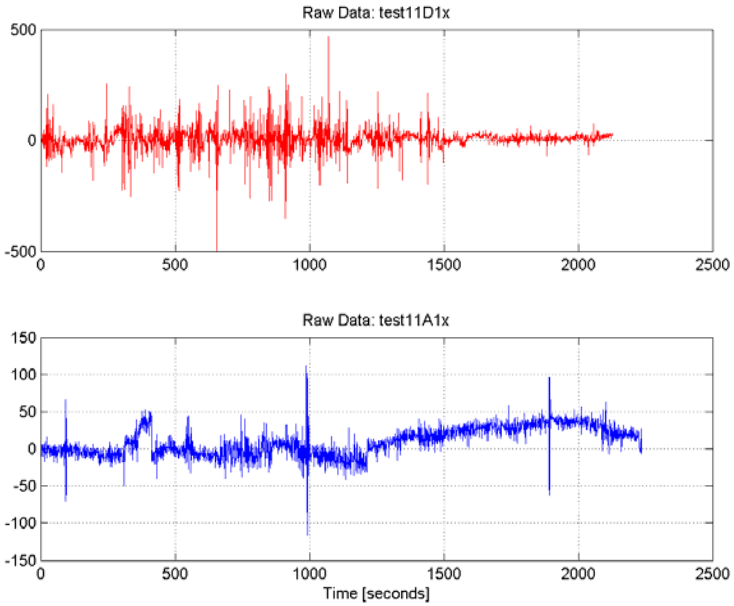
$$v = \frac{\Delta f}{f}(3e8)(3.6) \quad km/h$$

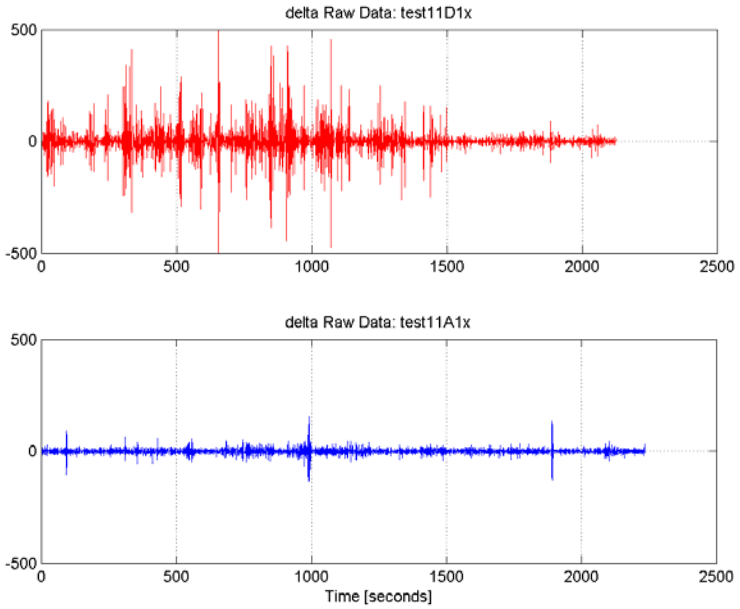
$$v = \frac{36}{0.9e9}(3e8)(3.6) = 48 \quad km/h$$

The above calculation is based on absolute accuracy of the frequency. However, if one were to look only at the difference in values between successive measurements, then the speed estimation can be in the range of 10 to 15 km/h.

Determining mobility

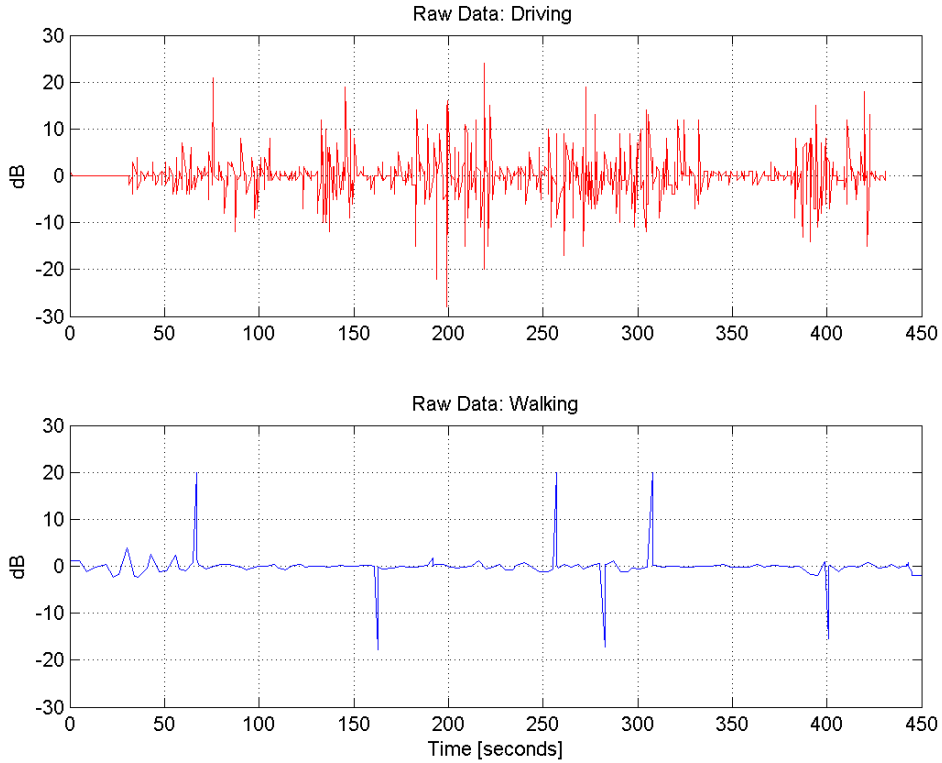
AFC Measurement on GSM network





Determining mobility

RSSI Measurement on GSM network

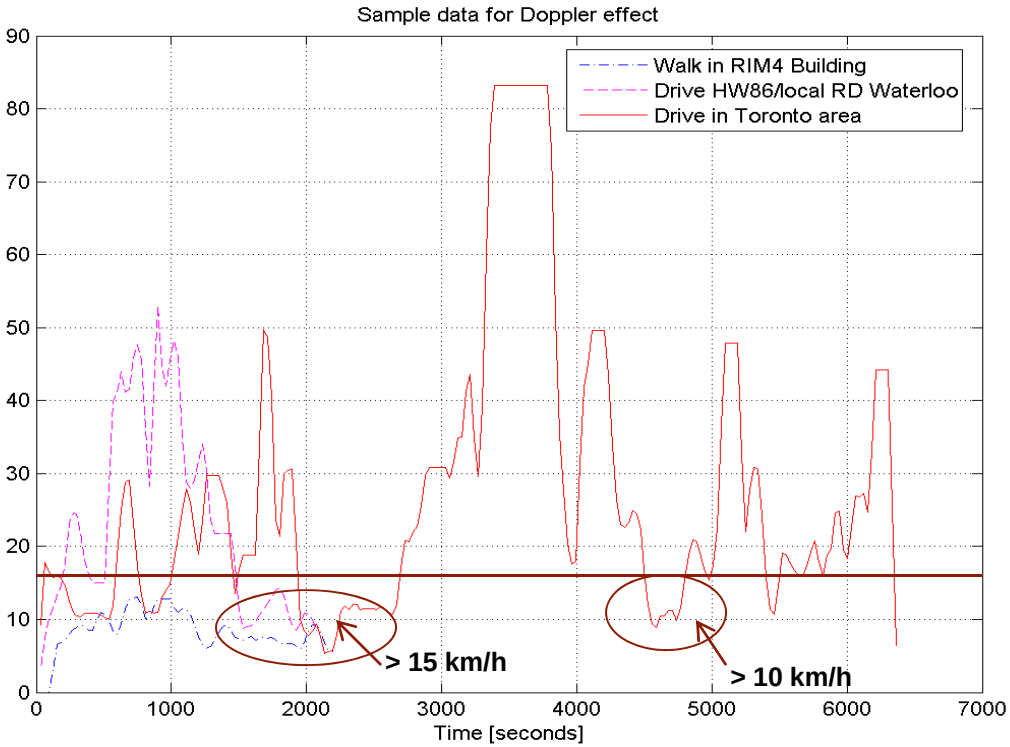


RSSI measurement was used mainly to fix false positives.

It reduces the false positive, however, it will have an impact on accuracy of the mobility estimation.

Determining mobility

Examples with AFC



For a typical drive from Waterloo to Toronto Downtown

Total travel time: 6300 seconds
Locking feature not activated: 800 seconds

The percentage error: 12 %

Worst case observed in intercity HW is 30%

Worst case observed in city and urban area is 20%

Potential options for driver and passenger

Based on this method, a locked screen could come up when the mobile phone detected it was in a moving vehicle.

In order to allow passengers in the vehicle to use their mobile phone freely, there could also be an option to disable locking for a set duration of time.

- The time and duration of the disabled period would be recorded in the handheld.
- For enterprise users, such as corporate or government users, this information could be sent in a message and logged in the BlackBerry Enterprise Server.
- This information could also later be made available to law enforcement if needed.

Potential option for underage users

Devices given to underage users could be configured to prevent disabling the locking feature, expect for emergency communications (phone, SMS or email).

For example, clicking the “Ignore” command could pull down a menu with a preset phone number for emergency dialing (e.g., 911 in the U.S.).

Other possible configurations

Hands-free operation permitted

- To activate Bluetooth to enable hands-free operation or GPS for speed estimation
- To activate voice command mode, text to speech and speech to text
- To activate the speaker of the mobile unit for hands-free operation
- To activate proximity sensors in vehicle with set duration for more accurate speed estimate

Hands-free operation NOT permitted

- To disable all alerts such as email, text message and phone
- To activate proximity sensors in vehicle with set duration for more accurate speed estimate

Conclusion

- RIM supports the FCC's goals of finding ways to limit distracted driving caused by mobile phones
- RIM has been conducting research in the hopes of developing technical solutions that complement legal restrictions on mobile phone use while driving
- RIM's research is focused on technical solutions providing the best mobile phone user experience