Asian Journal of Engineering and Technology Innovation

ISSN : 2347-7385

REVIEW ARTICLE

Received on: 20-02-2014
Accepted on: 10-03-2015
Published on: 15-03-2015

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Conflict of Interest: None Declared

Sherlock: Monitoring Sensors' Broadcasted Data to Optimize Smartphone Environment

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ABSTRACT

In this era, context-awareness has become of vital importance for a wide range of mobile and pervasive applications on smartphones. Whereas human-centric contexts (e.g. indoor or outdoor, at home or in office, while driving or walking) have been thoroughly researched, to study the phones' perspective (e.g. on table or sofa, in pocket or bag orhand), many attempts have been made. We refer these immediate surroundings as micro-environment, usually few millimeters to few centimeters. In this work, we aim to design and implement Sherlock, a micro-environment sensing platform that automatically records sensor hints and characterizes the micro-environment of smartphones. This platform runs as a background process on a smartphone and provides subtle environment information to upper layer applications via programming interfaces. Sherlock is a unified framework which covers the major cases of phone usage, placement, position, rotation and interaction in practical uses with intricate user habits. As a longstanding running middleware, Sherlock achieves both energy consumption and user friendliness. We prototype Sherlock on Android operating system, and systematically evaluate its performance with sensors' collected data. The proposed system attempts to achieve low energy cost, quick system deployment, and competing sensing accuracy.

Keywords: Micro-environment, context awareness, phone usage, placement, attitude, interaction, daemon process.

Cite this article as:
Apurva Bhosale, Abhijit Kale, Neha Sanas, Sherlock: Monitoring Sensors' Broadcasted Data to Optimize Smartphone Environment. Asian Journal of Engineering and Technology Innovation 03 (06); 2015; 01-03.

INTRODUCTION

In mobile systems, context-awareness is a computing technology that incorporates information about the current environment of a mobile user to provide more relevant services to the user.Almost every smartphone has multiple built-in sensors which broadcast data continuously. Use of this captured sensors' data in applications is limited. But the sensors' data can be manipulated and used effectively to provide multiple privileges to user.Given accurate micro-environment information to a platform, a phone can adapt its behaviour automatically and properly.The framework covers the majority of phones' states, and consists of 3 core modules: Phone placement detection, Phone interaction detection, Back surface material detection.Phone placement refers to the location of a smartphone along with its user, and we consider the situations of in bag, in chest pocket, in pants, or in hand. Phone interaction referswhether a user is interacting with his smartphone. In Back surface material detection, it analyses the hardness of the surface that touches (or holds) the phone.Collecting specific micro-environment information from the sensors and giving it to the middleware layer for analysis and on that account, adapt behavior of the Smartphone automatically and precisely.

SCOPE

The data broadcasted by sensors is not utilized effectively and efficiently in the conventional applications. This data can be utilized to make useful applications in security and smartphone optimization.

RELATED WORK DONE

In "Mobility Change-of-State Detection Using a Smartphone-based Approach"[1] published in 2010, authors G. Hache, E.D. Lemaire, N. Baddou have presented a smartphone-based approach to mobility monitoring for people with physical disabilities. The BlackBerry-based system is clipped to the person's belt. A smartphone integrated with an accelerometer could detect changes from static or dynamic movement (i.e.starting to walk, standing still, slowing down). In this paper, authors proposed a smartphone-based approach with the device worn on the pelvis, since this is a common location for wearing a phone and applied signal processing and analysis to extract accelerometer signal features and to detect a user's change-of-state. The system provides detection of static/dynamic and postural changes with high accuracy, monitoring person's mobility state, taking photograph when the person's change of state is detected.Limitation of this paradigm is that, although the algorithm detects the changes-of-state due to postural change, this approach was not evaluated for its accuracy to classify the postures. Methods might not be precise enough to classify all postures. Also the problems occur when the smart-phone based wearable system is worn around the hip. It can cause false positives during sitting and lying due to the holster's free movement, the leg pushing on the device, the person's belt location, and sitting angle. This approach only uses accelerometer and does not control the fixation and location of the wearable device.

In "SenGuard: Passive User Identification on Smartphones Using Multiple Sensors" [2] published in 2011, authors Weidong Shi, Jun Yang, Yifei Jiang, Feng Yang, Yingen Xiong have proposed SenGuard, a user identification framework that enables continuous and implicit user identification service for smartphone as user identification and access control have become a high demand feature on mobile devices. It extracts sensor modality dependent user identification features from captured sensor data and performs user identification at background. SenGuard invokes active user authentication when there is mounting evidence that the phone user has changed. SenGuard uses four sensor modalities namely voice, location, multitouch, and locomotion. In this paper, the authors have designed and evaluated an implicit mobile user identification system which implicitly and continuously verifies a mobile user. An individual sensor may yield poor identification accuracy. However, combining the output of multiple sensors together can dramatically improve user identification accuracy. When the system finds that the actual physical user has changed, it invokes the traditional active user authentication process that explicitly asks the user to authenticate oneself. Accelerometer based user identification is triggered when user is walking; while voice based user identification is in place when human voice is detected around the phone. The system provides the result from preliminary studies using captured mobile sensor inputs validates the promises of SenGuard as a continuous and implicit user identification solution. The system is feasible to implement a non-intrusive and continuous user authentication system based on sensor data intercepted from normal user-smartphone interaction. It is a critical component of a complete mobile user authentication solution with a purpose to attain better useable security through balancing security and user friendliness.

PROPOSED SYSTEM

Automatic Call Picker:

In this module the proximity sensor is used. Application will verify open and close conditions of proximity sensor. Suppose mobile is in the pocket or in closed environment, then proximity sensor will be in closed condition. Application should not allow receiving a call at that time. Close-Open-Close condition at that time will be examined by the application. If mobile is in an Open environment then user will pick up the call for Open-Close condition of proximity sensor.

Pressure Sensor used for Security and safety:

In this module, pressure sensor is used to measure the pressure on a single point on a screen. If the pressure is greater than the threshold pressure specified by user, application will send the alert to the configured numbers in an application.

GPS and LBS for mobile security thief detection:

In this module, GPS and LBS along with front camera are used for the thief detection. If a person attempts to access the phone more than three times, then front camera will automatically capture the person's photo meanwhile sending the location of phone through GPS or LBS.

Sensing environment and killing background processes for battery saving:

In this module, application identifies the surface where mobile is placed using surface values. The surface values are given by Environment, Metal Detector and Magnetic Field Detector sensor. If application finds that mobile is not in use, then it will terminate the running processes to save the battery. Once mobile is back to active mode, processes will be started automatically.

Back material detection:

In this module, application identifies the soft surfaces by using metal detector sensor. If user gets a call while the phone is placed on the soft surface and mobile is in vibrate mode then in that case application will switch on the ringer mode so that user can understand the call is coming.

Flash sensor for Morse code generation:

In this module, application generates Morse code using flash sensor. User has to type a word that he/she needs to send to another user. Flash will blink according to the word typed.

Switch off light in closed environment:

In this module, application checks if the phone is in closed environment like in bag or pocket with the help of proximity sensor. As no light is required in closed environment, this will save the battery.

CONCLUSION

In this paper, we present the design of Sherlock and discuss various scenarios of phone usage and interaction. It is a simple yet practical platform for micro-environment sensing for smartphones using built-in sensors. By this we will be able to achieve low energy consumption, security, theft protection and hence provide added smarter features to smartphones.

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