

A Smart Driver Monitoring System Using Android Application and Embedded System

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Abstract—This paper proposes a new integrated driver monitoring system. The system is combining a smartphone App and an embedded controller to build a smart controlling and monitoring system. Nowadays smartphones are equipped with many useful built-in sensors. Moreover, embedded controllers are able to be connected to various analogue and digital sensors. In the proposed system a Bluetooth module is used to exchange data between the smartphone, the embedded controller and the built-in and external sensors. The system is a comprehensive monitoring device for employee driver performance. Moreover, it guarantees full privacy protection. The system was tested in real modes.

Index Terms—Smartphone, Android, Bluetooth, Embedded Systems.

I. INTRODUCTION

Employee monitoring systems are increasingly used by many companies nowadays. These systems allow company administrators/managers to monitor and supervise their employees from a central location. Employers are usually concerned about employee's performance, legal liability, trade secrets and other security concerns. Besides to the closed-circuit television (CCTV) which is also known as video surveillance, many companies are involved in internet monitoring in the workplace [1]. Some companies use employee monitoring software programs [2] [3]. Such programs are installed on company computers to allow managers to take screenshots and monitor Emails, applications used, and even what keys were pressed.

With the development of the smartphones, similar monitoring systems are available for company mobile phones [4] [5]. This development allows companies to monitor even mobile employees like field employees or drivers. Additional data can be recorded from smartphones like employees' phone call details as well as actual conversations. Many smartphones are equipped with global positioning system (GPS) sensors which allows employee position tracking. Advanced programs can save and analyze an automatic log for all kinds of acquired data.

These actions and programs actually affect employee satisfaction due to privacy issues [6]. Such software however resembles spyware and can be misused. To gain satisfaction of

both employers and employees, comprehensive monitoring systems with privacy protection aspects are needed.

II. BACKGROUND AND LITERATURE REVIEW

Android is an operating system (OS) based on the Linux kernel and currently developed by Google. It is designed primarily for touchscreen mobile devices such as smartphones and tablet computers. These devices are becoming popular nowadays and most of them are equipped with many useful sensors. The list of sensors includes: accelerometer, gyroscope, magnetometer, proximity sensor, light sensor and GPS sensor. Android has the largest installed base of all operating systems as surveys of 2015 showed [7]. Android Apps are developed in Java programming language using the Android software development kit (SDK).

Researchers and developers are recently using android devices for powerful controlling applications. Many platforms are designed to be run on Android devices. These platforms ease the accessibility to the smartphone built-in sensors and the communication with other devices and sensors. The platform applications include robot operating [8] [9] [10], home appliances remote controlling [11] [12] [13], security [14], safety [15] and industrial systems [16].

In [17], authors propose a monitoring system which allows managers to watch and interrupt all incoming and outgoing calls, texts and multimedia messages. Managers can also monitor their employees' location and access a history of where they have been. Moreover, managers receive SMS alerts if the employee is going outside an approved geographical zone or if he/she is receiving texts or calls from unapproved numbers. The system is not providing any privacy protection as managers can view the entire call history of the corresponding employee with the help of the cloud service. Moreover, although the managers can track the position of the employee at any time, they cannot have any idea on the work performance. This system does not use any controller. The only processing unit in this system is the smartphone itself. This may lead to high resource consumption.

The structure of most of the above systems consists of a smartphone which communicate with a controller. The controller is usually connected to various input and output devices like sensors, motors, liquid-crystal-displays (LCD),