A Microprocessor Based Green-Device for Analyzing Students' Classroom Attendance and Performance

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Abstract. Attending to classroom activities on time is the primary method in traditional educational institutions to conduct knowledge to students. This method of taking attendance is tedious and vulnerable to dishonesty. Our project goal is to develop clean devices using state-of-the-art biometric technology to make class-time more productive. Governing design factors of proposed system is privacy, security, mobility, and energy efficiency. Privacy and security is maintained by using an algorithm to maintain identity of a fingerprint without capturing any images. Mobility is enabled using Wi-Fi connectivity. Power efficiency is achieved by utilizing effective power management schemes. Based on our experience in CAPPLab, this device has potential of expansion into assisting organizations in managing security and privacy.

Introduction

It is well accepted that class attendance is important to successfully grasp the material covered and obtain a good grade in a traditional course offered in the universities [1][2]. Class attendance is the primary method in traditional colleges to conduct knowledge to the students. To improve class attendance rate, a continuous class attendance list needs to be maintained. Traditional method for taking attendance is tedious and vulnerable to dishonesty. Our project goal is to overcome these problems by building a prototype system using biometric expertise. Being inspired by the advancement in microcontrollers, we develop a solar-powered embedded device to facilitate bookkeeping of students' attendance and analyzing their progress. Information in this device is totally secure – algorithms are developed to maintain identifications of fingerprints without capturing any images. Wi-Fi and solar power technologies are implemented. We design, build, and implement a clean system with minimal money budget, while retaining ability to expand this architecture by allowing multiple devices access.

Discussion

Feasibility

Our preliminary research based on Zach Weiner's finding shown that class attendance is important [1], therefore taking class attendance list will keep students accountable. Traditional pen and paper media allows students to conduct dishonesty by proxy signature, and centralized attendance-taking consumes class-time. Therefore, we are motivated to develop a clean biometric device using advanced technology that is capable of improving teachers' productivity, students learning, and overall class performance.

Design

Using given budget, we built a device with simplicity and minimalism in mind. The key factors are a) ability to capture image without remembering the fingerprint image, b) ability for students to pass that device around in class, and c) sustain on battery pack for a day.

The mobile unit device consists of Fingerprint Scanner, Solar Cell, WiFly shield, LCD Display, and Microcontrollers. Figure 1 illustrates the internal connection of devices. The server unit utilizes Linux, Apache, MySQL and PHP. Extensions could be created for using the PHP code. To demonstrate this device, we created a monitoring application to allow monitoring attendance for a given class. For extensibility, implementation like blackboard self-reporting mechanism could be developed.

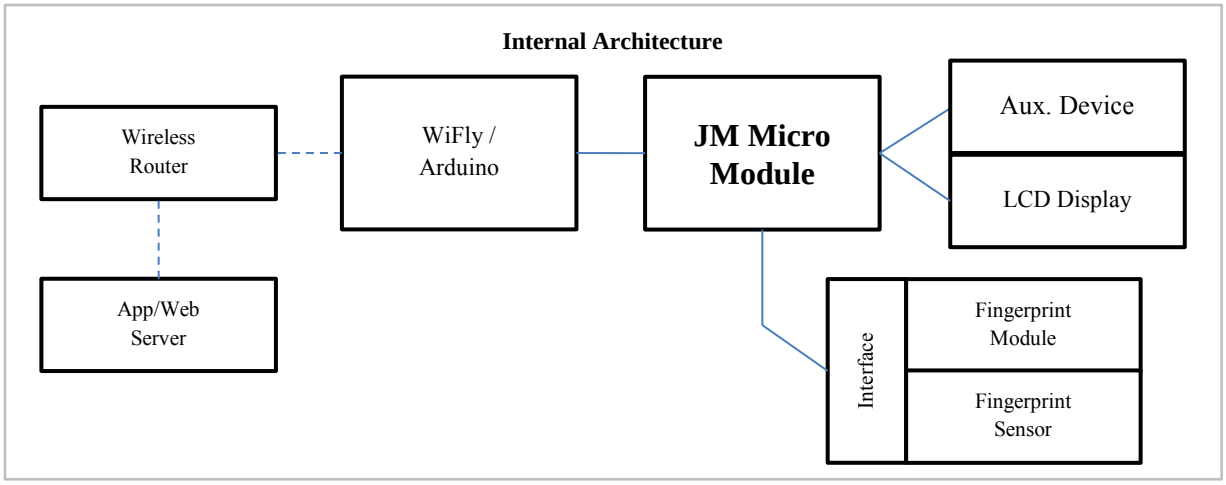

Figure 1: Internal Device Connection

Results

We have, preliminarily, implemented this device at WSU CAPPLab. Students' attendance data obtained during CAPPLab activities and demo sessions using this device is proven accurate without any security and privacy issues. For a 50-minute class with 50 students, our prototype device may save class-time up to 20% by taking attendance mutely. Proposed low-power device is power sustainable as it can efficiently function without re-charging for a period of 24 hours due to the power management scheme used [3].

Conclusion

A clean biometric prototype system is developed and implemented in CAPPLab which is capable of improving students' overall class performance. It has the potential of managing privacy and security at organization level. More research is needed to fully explore the complete usefulness of this prototype.

References

1) "To Attend or not to Attend Class, that is the Question" by Zach Weiner; Science in the Sky, 2011; http://scienceinthesky.com/2011/01/06/class_attendence/
2) "Skipping class in college and exam performance: Evidence from a regression discontinuity classroom experiment" by Carlos Dobkin, Ricard Gil, and Justin Marion; IDEAS (in the journal of Economics of Education Review), 2010; http://ideas.repec.org/a/eee/ecoedu/v29y2010i4p566-575.html
3) "CAPPLab Webpage" by WSU EECS, 2012; http://www.cs.wichita.edu/~capplab/