Roll Call to Auto All: A Bluetooth and Cloud approach to Classroom Attendance

Kevin Aiken, kaiken3@student.gsu.edu
Advisor: Dr. Ashwin Ashok, aashok@gsu.edu

Computer Science

MCPS | Mobile Cyber Physical Systems Lab

STEM CURE

Introduction & Motivation

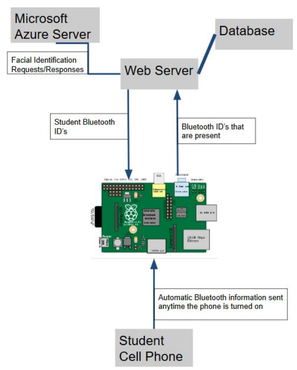
- Multiple drawbacks to manual attendance taking
  - Consumes class time
  - Signature based attendance can be forged
  - Professors often forget to take attendance
- Goal: mark attendance automatically
- According to PEW Research Center 100% of 18-29 year olds surveyed possess a cell phone[1]

Approach

- Survey for students' cellphone's Bluetooth addresses using a small computer
- Manage attendance through an online portal
- Optionally validate through the use of facial recognition

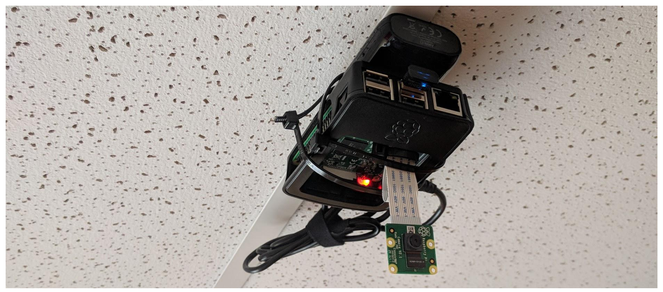
Design

- System Components:
  - Raspberry Pi 3
  - USB Class 2 Bluetooth Adapter
  - Camera Module
  - Web Server
  - Azure cognitive services facial recognition

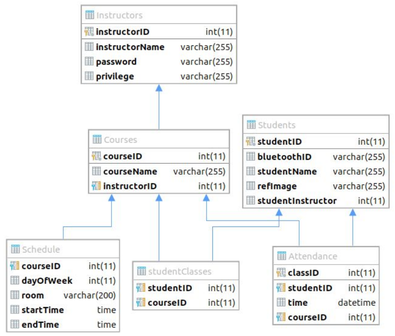


- Range
  - 10 meters radius around the device[2]
  - Multiple devices can be used for larger areas
- Survey begins 15 minutes after class begins
- Student names, Bluetooth addresses, and optional reference photos are stored in a relational database

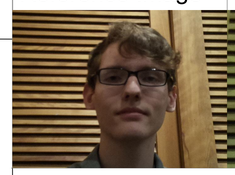
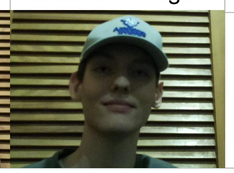
Example Device Placement



- Relational database design allows a web portal to be used to manage attendance

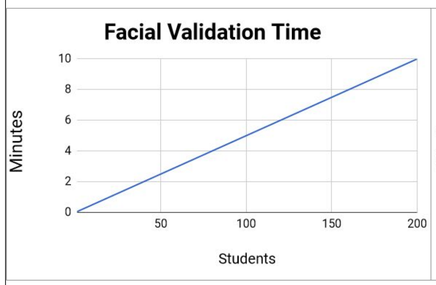


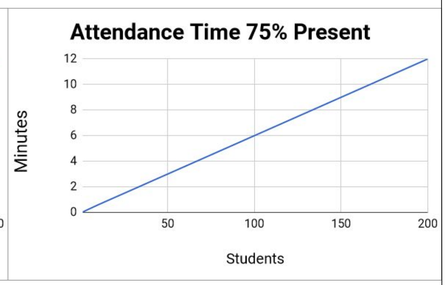
- Device auto enables when a course is scheduled to take place within the device's classroom
- Microsoft Azure can be used to validate attendance results via biometric facial recognition

Cropped Reference Image	Cropped Validation Image	Confidence	Result
		.5008	pictures are of the same person

Results

- Time requirement:
  - 2 seconds per present student
  - 10 seconds per absent student
  - 3 seconds per facial identification





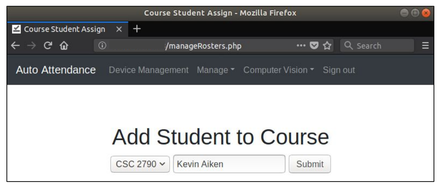
- Field trials indicate high accuracy within the specified 10 meter effective radius of the device

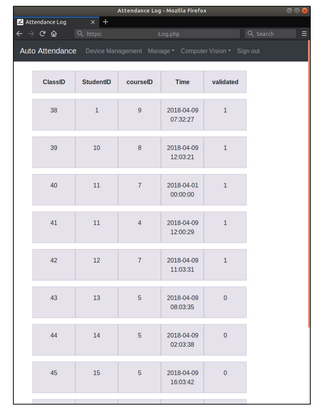
Field Trial Results

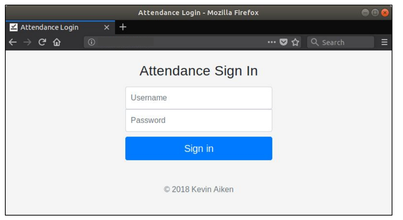
Number of Students in Course	Students with Enabled BT Devices	Students Marked Present	Students Validated by Facial Recognition	Time taken (seconds)
5	5	5	5	28
5	5	5	0 (validation off)	7
5	4	4	4	17

Conclusion

- A system of attendance-taking devices could cover attendance for a potentially unlimited number of classes and students
- A method is needed for collecting student's Bluetooth addresses
  - A possible solution is a simple app for transferring addresses to the database
- Trials with CS Department tutoring sessions are planned to take place soon







References

1. **Mobile Fact Sheet**, PEW Research Center, Jan 2018
2. E. Dahlgren, H. Mahmood, **Evaluation of indoor positioning based on Bluetooth Smart Technology,** Chalmers University of Technology, Göteborg, Sweden, June 2014