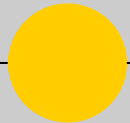


MP1 Design Review Presentation



Abhishek Patel

Zarir Hamza

THE CAMS

Classroom Attendance Monitoring System

DATE: October 28,
2017

*Team Member 1 - Zarir
Hamza*



*Team Member 2 - Abhishek
Patel*



Problem Addressed

- ⦿ Instructors take up valuable class time to take attendance
- ⦿ No guarantee that at any given time, instructor is aware of the attendance of all students
- ⦿ Especially important during emergency situations



The Idea

- Solution is to use strategically placed cameras at the main entryway of classroom in order to take attendance of students entering and leaving classroom
- Automatic process with real time updates that can be viewed by administrators
 - Save time and efficient



Applications

- Currently using one camera which requires single file line in order to detect students leaving one by one
- Potentially in the future, process can be more streamlined with an array of cameras with crowds of students



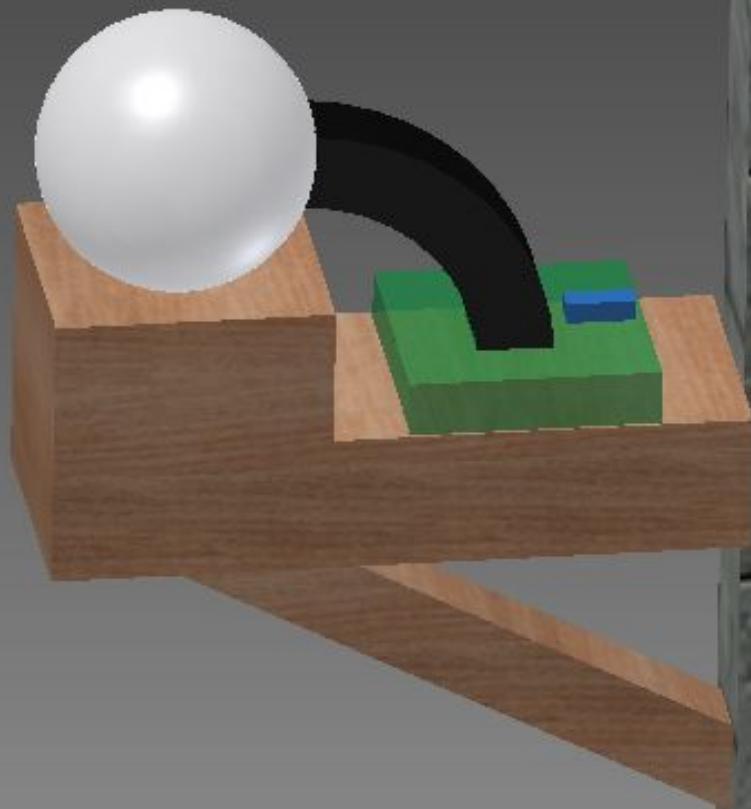
End User Customers

- Target large schools and colleges
 - Any place with a room with regular visitors
- Currently our customer is Dr. Russo to be used in the Academy



Feature Specifications

- ⦿ Real time updates on website with list of students
- ⦿ Camera with facial recognition that differentiates between students
- ⦿ Guarantees list of students can be viewed at any time marking them as “in class” or “out of class”





Patent Search

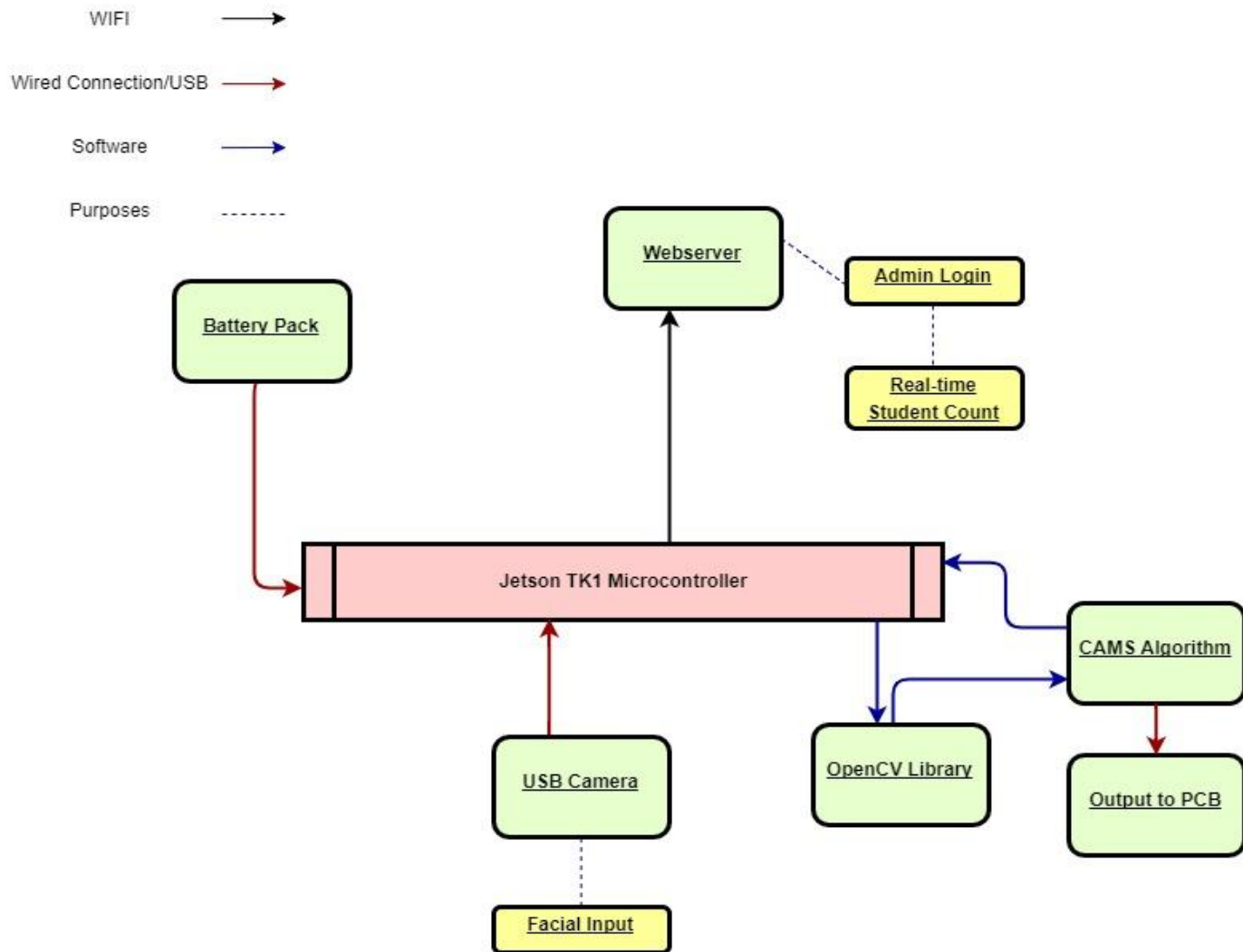
- ⦿ No exact matches
- ⦿ Closest Match:
 - Smart Doorman
 - Patent #9,786,107
 - “detecting the presence of one or more guests at an entrance to a residence and comparing the presence of a guest to one or more profile parameters”
- ⦿ Very Different from our product, <20% overlap



Concurrent Engineering

- ◉ Computer Engineering
 - Machine Learning
 - OpenCV
- ◉ Electrical Engineering
 - Send pulse to LED for facial recognition
 - Serial Communication
 - Send information over WIFI
- ◉ Civil Engineering
 - Shelf to hold camera and microcontroller
 - Calculate stress points and size to support load

Block Diagram





Block Diagram Functional Descriptions

- Battery Pack – Allows Portability
- USB Camera – Takes Video Feed to send to Microcontroller
- Jetson TK1 – Extra Processing Power
- CAMS Algorithm – Picks frames to process
- OpenCV – Recognizes faces in selected frames
- Webserver – Easily allows for attendance to be checked
- Output to PCB – LED indicator of Facial recognition state



Design Specifications

- Jetson TK1
 - OpenCV Library, image processing
 - NumPy Library, computational processing
 - Linux OS, easily usable
- USB Camera
 - Full HD Pictures, Good in low lighting
- Battery Pack
 - Portability, system can be mounted to doors



Mechanical Specifications

- 6'x4' Makeshift Plywood "Wall"
- 3D Print Packaging Design
 - -(9"x3"x8") Shelf to hold Camera
 - -(5"x5"x2") Box to hold Jetson TK1
 - Mounted on top of Camera
- Hinge to hold shelf to wall



Team Responsibilities

Zarir

- Processor side with Jetson
- PCB
- Packaging

Abhishek

- Facial recognition with Camera
- Website
- Integration



Milestones

MP1

MP2

MP3

MP4

OpenCV Facial Recognition

Camera with Laptop

Jetson with Camera

Jetson with Webapp



Deliverables

Planned Deliveries for each marking period

MP1 OpenCV Demo	MP2 Jetson Processing
MP3 Webapp	MP4 Jetson with Camera

Gantt Chart



“

A vertical grey line extending downwards from the bottom of the yellow circle.



2017

2018

Name

October

November

December

January

February

March

April

May

June

Research Cameras

Order Parts

Install Software

Facial Recognition - Ope.....

Facial Detection - Open...

Image Filtering - OpenCV ...

Camera Integration with

NVIDIA Jetson TK1 Setup ...

NVIDIA Jetson TK1 Integ... ..

Testing Phase of Facial

CAMS Algorithm - Progr... ..

Collection of Data to Ex... ..

Revisions to Testing Pha... ..

Sample WebApp

Testing Phase 2

Revisions to Testing Pha... ..

PCB Design

PCB Creation

Testing Phase 3

Revisions to Testing Pha... ..

Packaging Design

Final Test

Final Revisions

Final Video





Cost Analysis

Budget: $\$150 \times 2 = \300

Costs:

Jetson TK1 Microcontroller: ~\$129

Camera: ~\$60

Wall Plywood: ~\$20

Other Costs: ~\$30

Shipping: ~\$20

WIFI Dongle: ~\$30

Expenditures: **\$289**



BOM Analysis

Item No.	Part No.	Reference	Primary Source	Secondary Source	Description	Lead Time	Cost	Order Status
1	1	M	NVIDIA	Amazon	Microcontroller	10 Days	\$129	None
2	1	C	Amazon	Best Buy	USB Camera	7 Days	\$60	None
3	1	W	Amazon	Best Buy	WIFI Dongle	7 Days	\$30	None
4	1	P	Home Depot	Lowe's	Plywood (6'x4')	5 Days	\$20	None



Risk Factors

- Camera Issues
 - Lighting
 - Direction Changes
- Human Error
 - Moving too quickly



Contingency Plans

- ⦿ **IF** OpenCV is not compatible:
 - Alternative Computer Vision (CV) Libraries
 - SimpleCV
 - VXL (Vision X Library)
 - PIL (Python Imaging Library)
- ⦿ **IF** Camera Issues:
 - Continuous Flash (Buy Nanolights)
- ⦿ **IF** Human Error:
 - Send error message to teacher/principal/administrator



Testing Strategies

- Board Testing
 - I/O Pins
 - HDMI/WIFI/Bluetooth connection strength
- Functionality Testing
 - Camera with Jetson
 - Response time
- Data Testing
 - Server requests/WIFI connectivity



Issues

Open

- None

Resolved Issues:

- Number of Cameras
(resolved to be 1)
- Placement of Cameras
(resolved at doorframe)



Resource Requirements

- Hardware
 - USB Camera – capture images of students' faces
 - Jetson TK1 Microcontroller – use images to recognize faces
 - Plywood – “Wall” to hand camera from
- Software
 - OpenCV – image processing
 - NumPy – computation for image arrays
 - Python – foundation of OpenCV

References

NVIDIA (Jetson TK1)

NVIDIA Website (www.nvidia.com)
for information about TK1
Microcontroller

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Acknowledgements

Mr. E. Paterno

Middlesex County Academy for Science,
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Technologies