THERMONITOR

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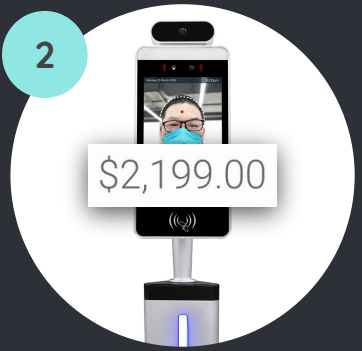
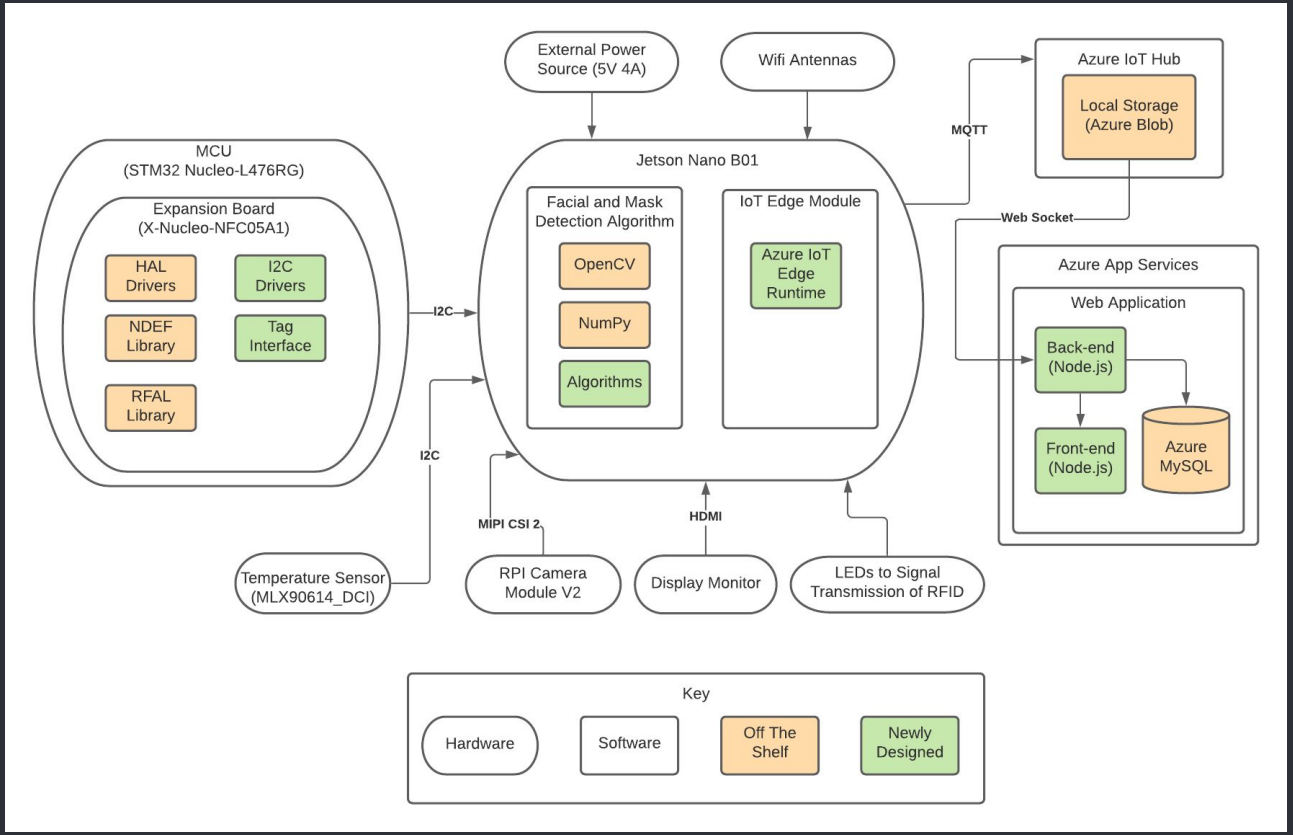
Team A6

Application Area

A safe and affordable way to provide temperature monitoring solution to large organizations with existing identification cards.



Block Diagram



Solution Approach

STM32 MCU: Processor for RFID

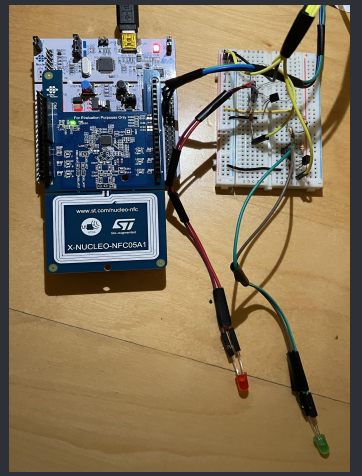
- Ultra low power
- I2C RFID transmission to Jetson Nano

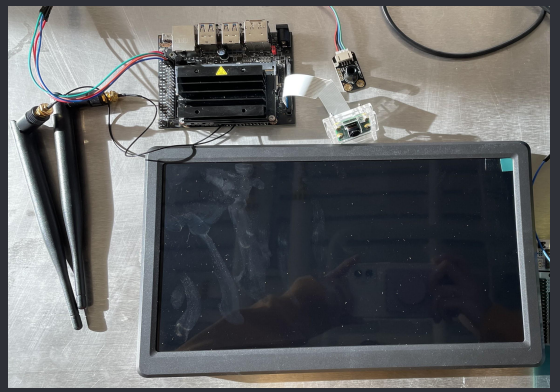
Jetson Nano: Core Processor

- LEDs signal successful transmission
- YOLOv3 object detection algorithm

Microsoft Azure: IoT Web App

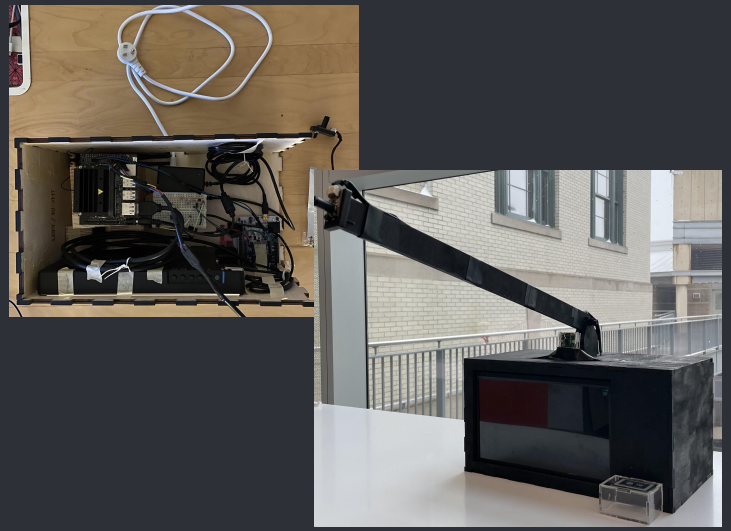
- IoT Hub for cloud gateway & message routing
- Azure Web Services for deployment & hosted database

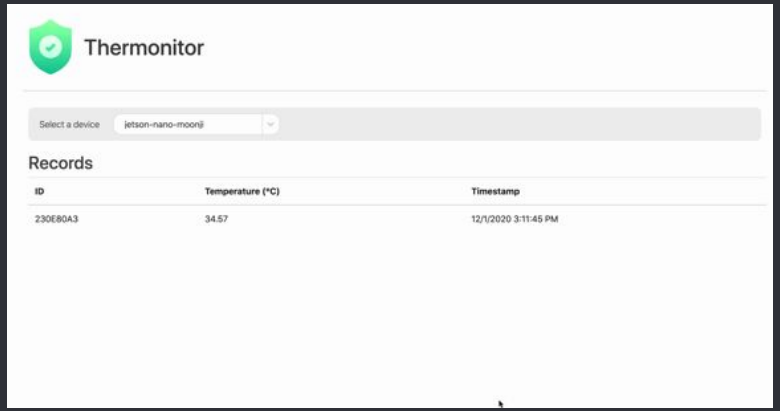




Complete Solution

Standalone product with single power cord that allows users to be identified through a RFID card. Identified users will then measure their temperature, which can be monitored in real time on a web application.





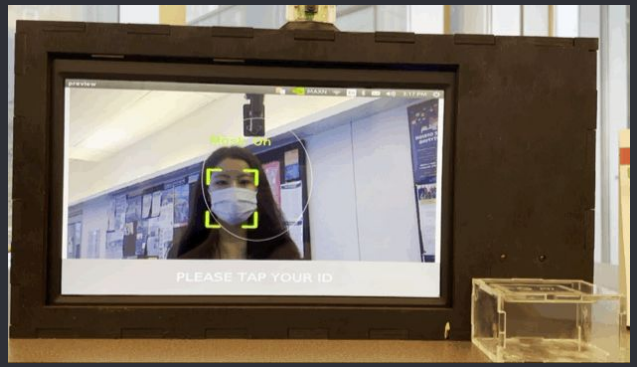
Design Tradeoffs

- **Getting rid of the wake-up signal**
  - Power efficiency vs. User experience and interface
- **Use of YOLOv3 instead of Haar Cascade**
  - Time efficiency vs. Complexity of detection
  - YOLOv3 is faster since analyzes entire image at test time
- **Lower output video stream resolution**
  - Performance (FPS) vs. video quality on display
  - Settled on 800x600 with 7 FPS

Metrics and Validation

Components	Expected Metrics		Actual Metrics	
RFID Scanner	99% accuracy		100% accuracy	
Facial/Mask Detection	85% face detection 5% false positive 1-2% false negative	95% mask detection 3% false positive 1-2% false negative	90% face detection <5% false positive <5% false negative	95% mask detection 40% false positive <5% false negative
	Output Video Stream: 10 FPS		Output Video Stream: 7 FPS	
Temperature Sensing	±0.2 degrees of error		±0.2 degrees of error	
IoT External Platform & Integration	100% message transfer rate User testing and feedback		100% message transfer rate Ease of use: 9/10 Overall Design: 10/10	

Face and Mask Detection



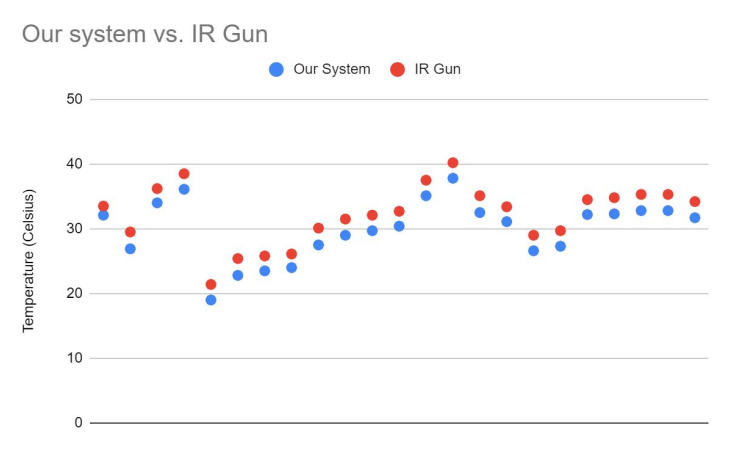
Mask On (95%)

Improper Mask (60%)

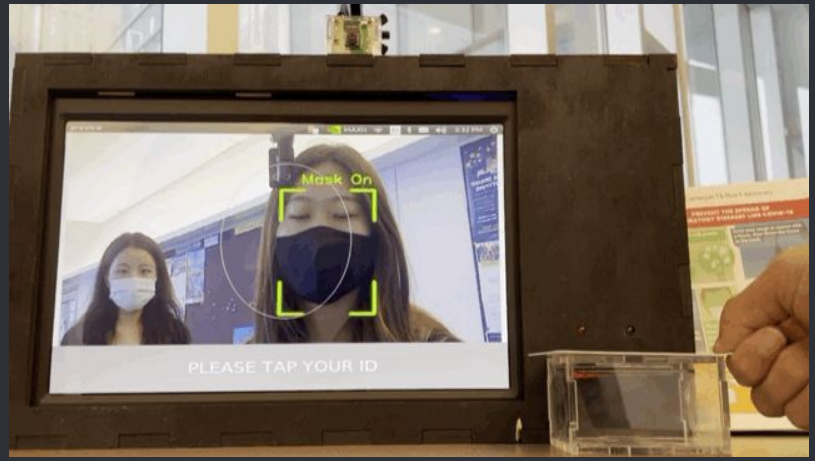
Mask Off (99%)

Multiple People in Frame

Temperature Sensing



- Average difference between readings: **2.4 ∘C**
- Calibrated our final reading by adding this offset



Failed Temperature > 38.0 ∘C

*was not actually sick 😷

RFID and IoT

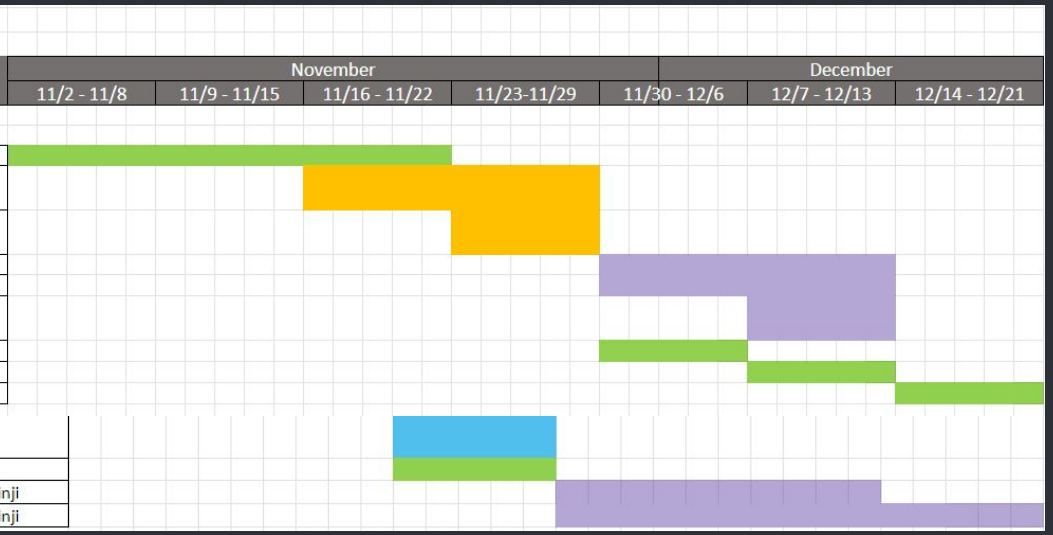
Unique ID associated with any type 4 or type 5 RFID/NFC tag is eventually sent to our web application, hosted on Microsoft Azure.

Conducted user testing with a survey on two metrics -- usability and overall design.

Project Management

Legend: Minji | Iris | Jiamin | Team | Iris and Minji

Milestone Descriptions		Member
Final Project		
	Integration of all the components	Team
	Enclosure Design	Jiamin
	LEDs to signal transmission success	Jiamin
	Push for facial/mask detection accuracy	Iris and Minji
	Finalize App/Website	Iris and Minji
	Database of RFID and ability to add/remove users	Iris and Minji
	Final Project Presentation	Team
	Blog Post + Final Video	Team
	Final Project Report	Team
	Message Transmission (Encryption and Decription)	Minji
	Design document	Team
	Temperature Sensor and I2C	Iris and Minji
	Facial/Mask detection accuracy	Iris and Minji



Lessons Learned

- Integration is difficult and time-consuming due to unexpected roadblocks
- Documentation is crucial
- Difficult to optimize existing libraries for specific hardware
- Set high goals
- Final product is really rewarding to see