



## An IOT-Based Automation and Security System for a Residential Household

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### Introduction

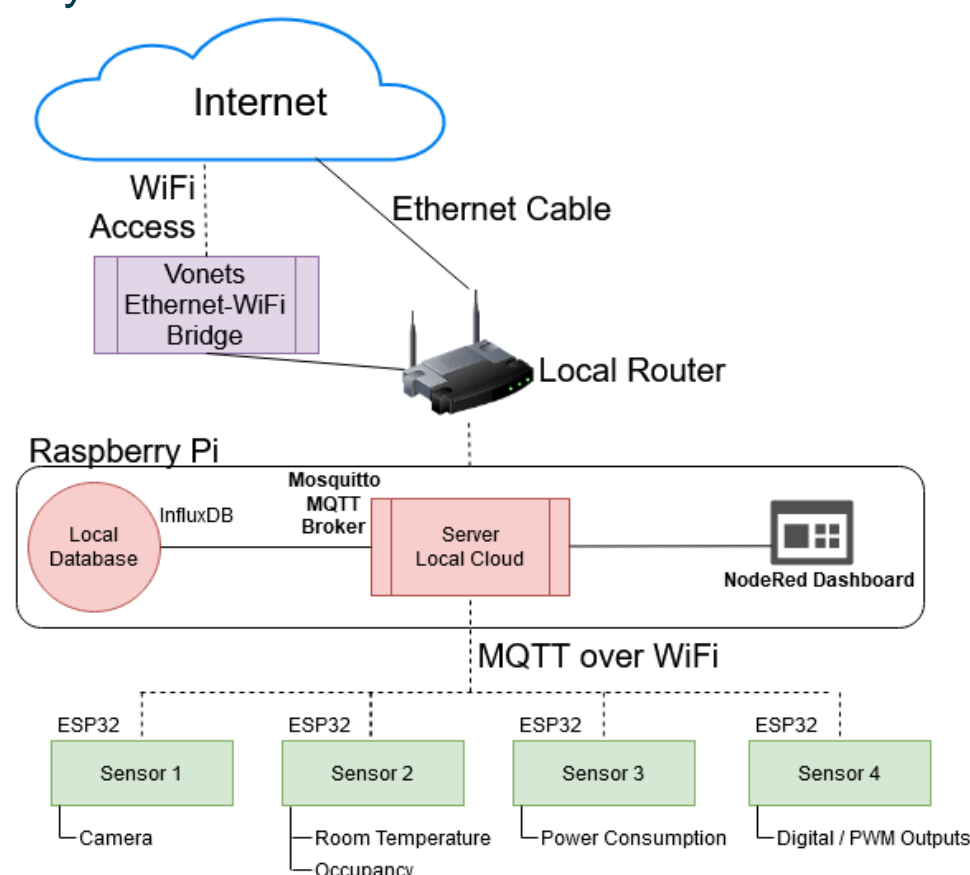
Presented is a data acquisition system for residential energy monitoring, security, and control. The system operates on 2.4GHz WiFi and allows the user access to measurement data via a “dashboard” web page. The dashboard is secured by a VPN and can be accessed from anywhere in the world.

### Methods

MQTT network is used for passing data between nodes, NodeRed, and dashboard webpage

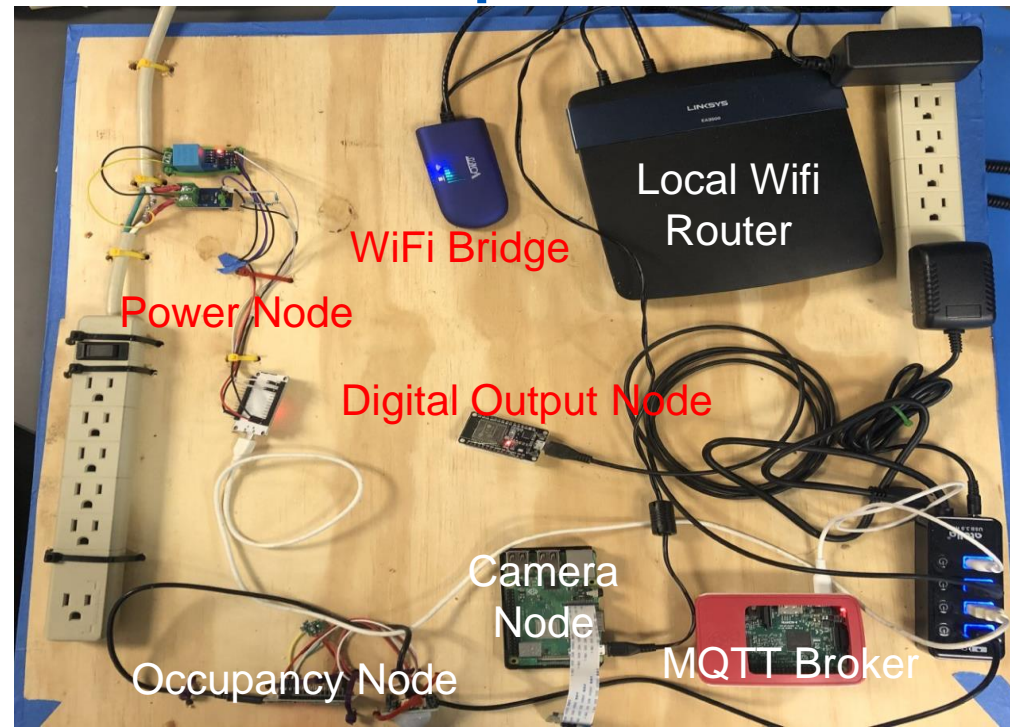
ESP32 nodes are employed for data acquisition and command actuation

Data can be saved for hours to weeks of history



Network Diagram of Home Monitoring System

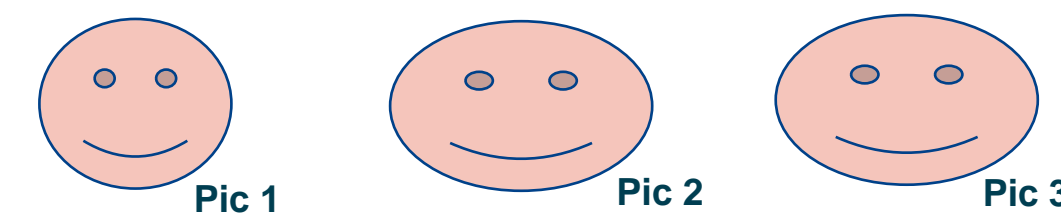
### Hardware Setup



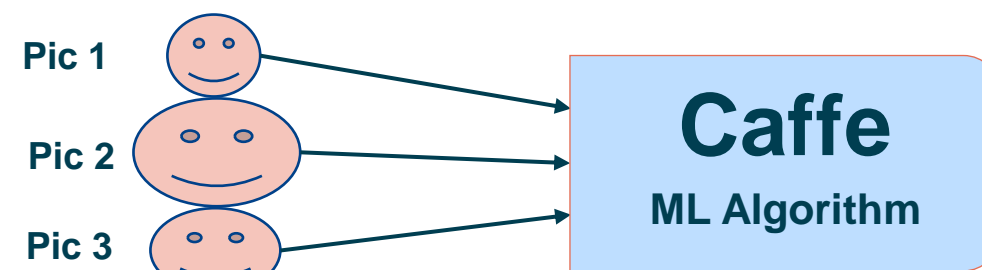
Total Cost: ~\$250

### Facial Detection Camera

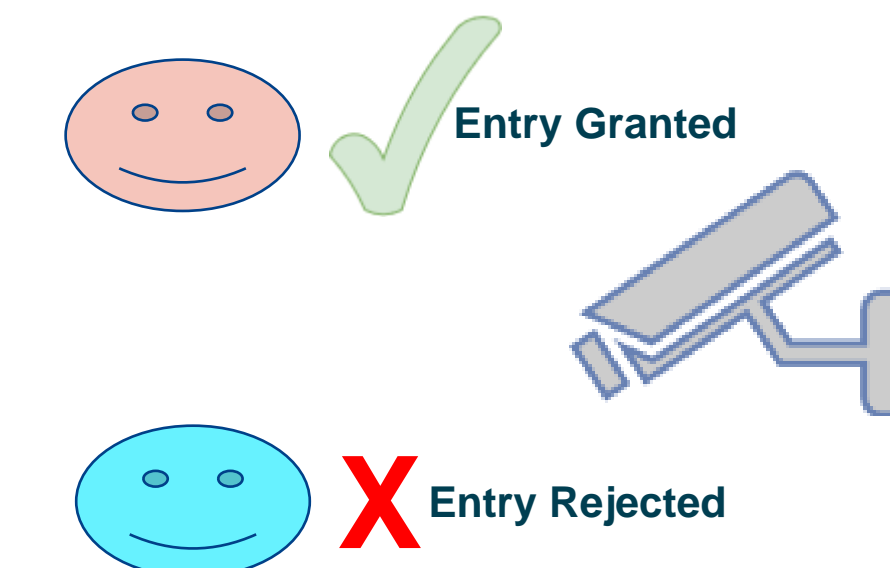
#### 1. Upload Authorized User Pictures



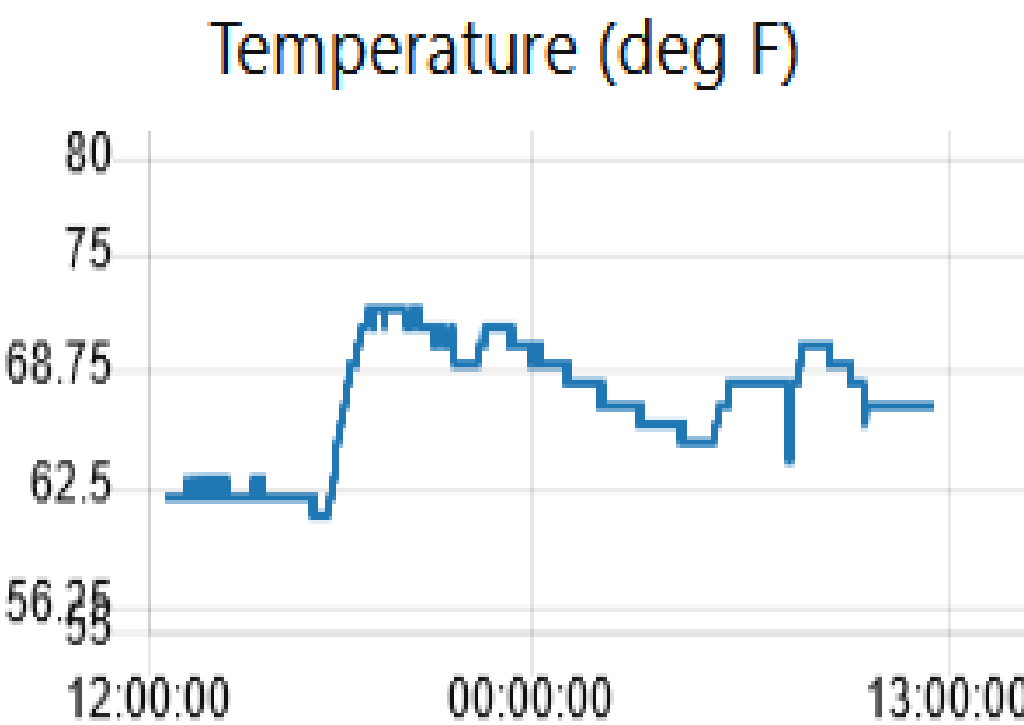
#### 2. Pre-training



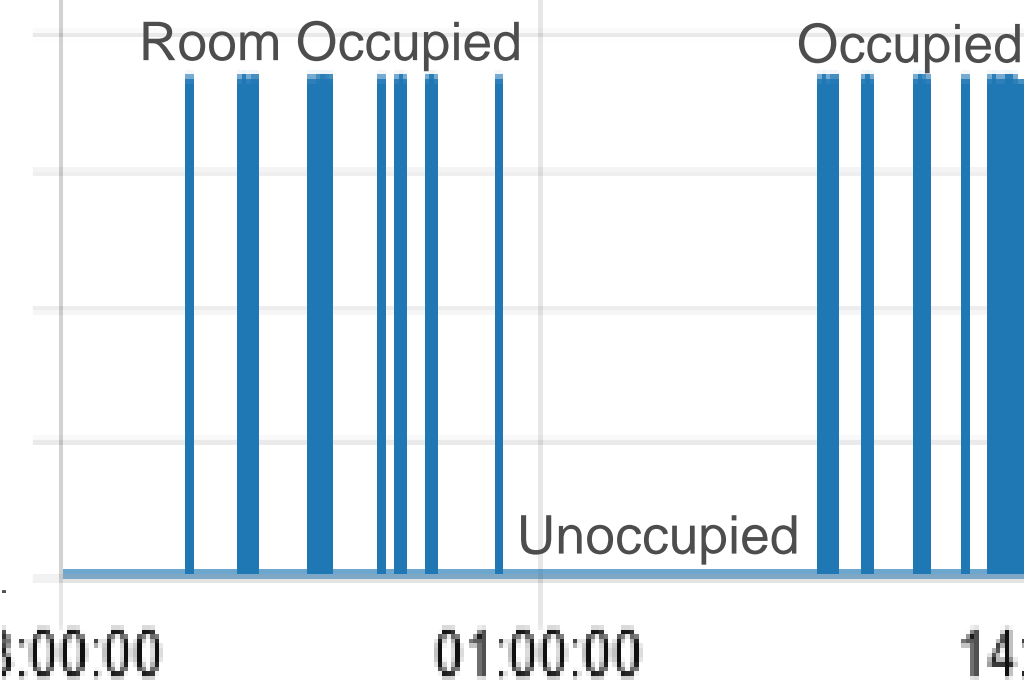
#### 3. Live-stream Classification



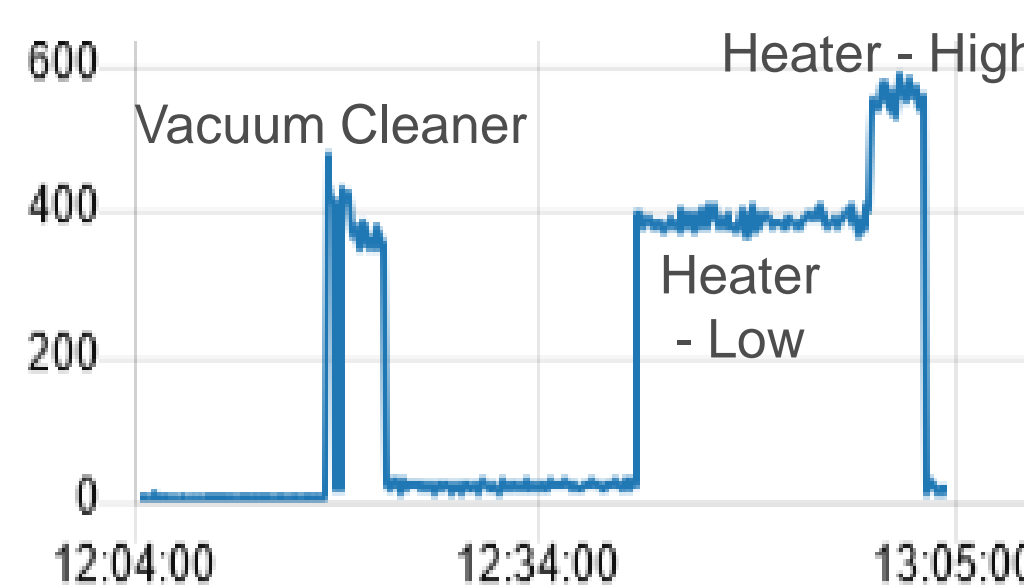
### Dashboard Measurements



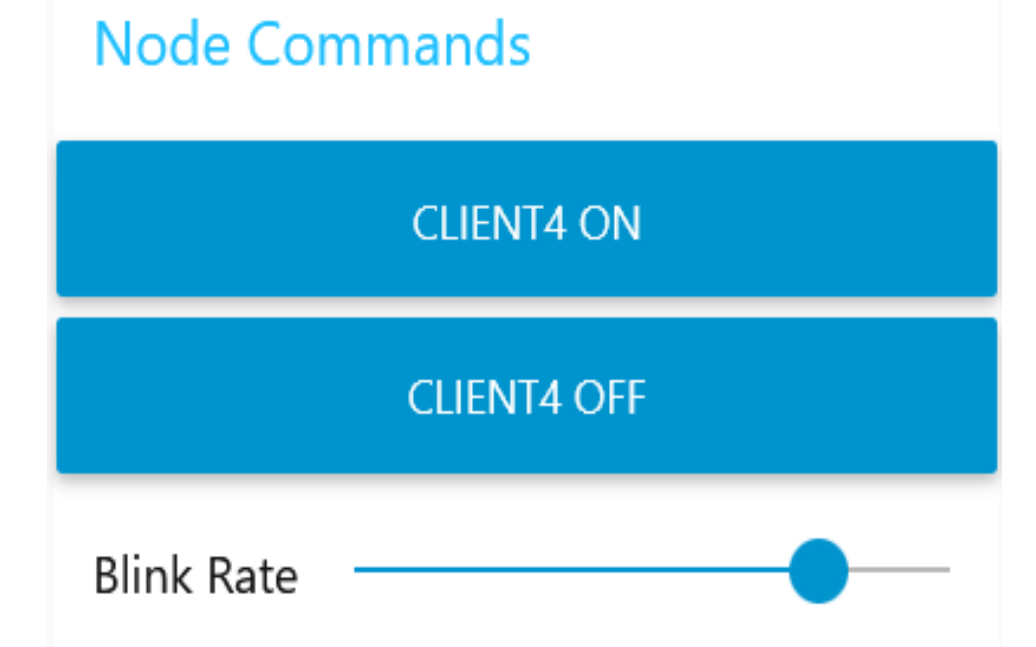
### Occupancy



### Power (watts)



### Dashboard Commands



### Conclusions

- A network infrastructure has been implemented, from “Node to Cloud”, that allows a homeowner to monitor energy consumption and door access.
- Electrical power, temperature, and occupancy can be measured for appliances in any room.
- Outside access can be monitored and commanded for the front door at any time.
- The system is readily expandable. Functionality (such as lights, controlled outlets, door locks, etc.) can be added by supplementary low-cost ESP32 nodes.
- Actions and commands can be logged by time to a local database. Data can be viewed and store for minutes, hours, days, or weeks.

### References

- C. Zet, M. Branzila, and C. Fosalau, “Sensor Network for Indoor Home Plants.” *2019 International Conference on Sensing and Instrumentation in IoT Era (ISSI)*, 2019, doi: 10.1109/iss47111.2019.9043658.
- P. Macheso, T. D. Manda, S. Chisale, N. Dzupire, J. Mlatho, and D. Mukanyiligira, “Design of ESP8266 Smart Home Using MQTT and Node-RED.” *2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS)*, 2021, doi: 10.1109/icais50930.2021.9396027.