Automated Smart Blinds

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What Are Automated Smart Blinds?

- Fully Automated Blinds
- Controlled By Web Interface
- Numerous Custom Settings
- Settings Can Be Changed Web
 Interface



Why is this important?



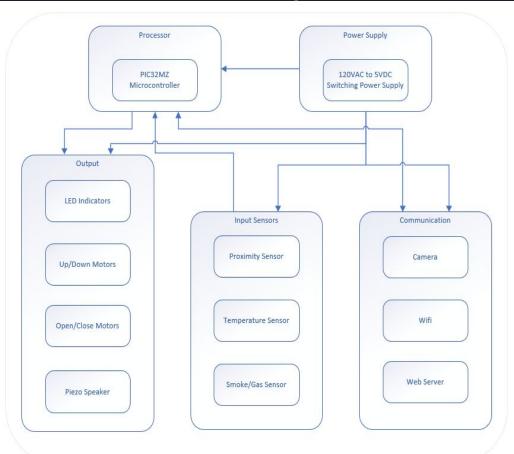
- Next Step In Smart Houses
- Help For Disabled Individuals
- Security



How it works

- Multiple Sensors
 - Temperature
 - Proximity
 - o Smoke/Gas
- Settings like time of day/night
- User input via web interface

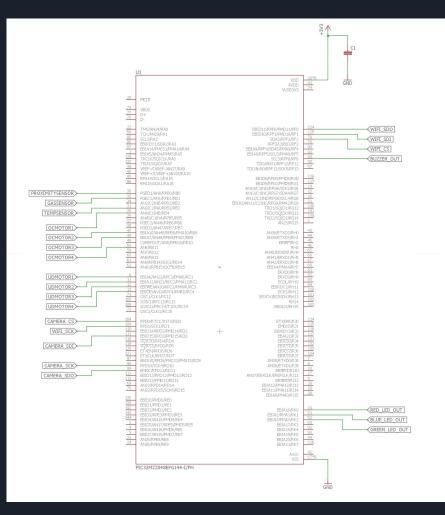
Overall diagram



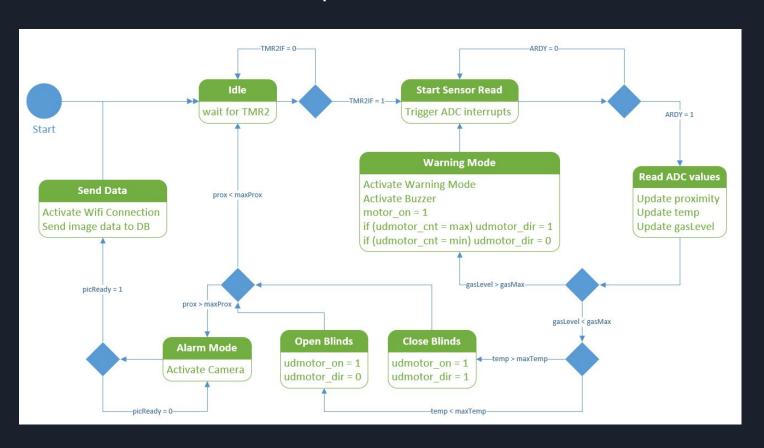
Processor



- 200 Mhz main clock speed
- 2Mb of program memory
- 6 SPI modules 2 needed
- 5 I2C modules 1 needed
- 12-bit ADC with with 48 inputs 3 needed
- 120 I/O Pins 12 needed



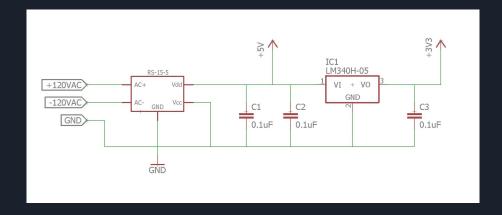
Processor RTS Loop



Power Supply

- RS-15-5 5V, 3A Switching Power Supply
- LM340H 3.3V Linear Power Regulator

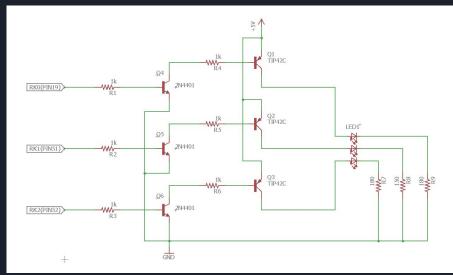




LED Indicators

- High Power 5050RGB LED
- 2-stage power amplification
 - Voltage amplification
 - o Current amplification

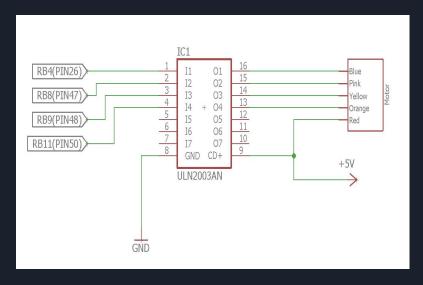




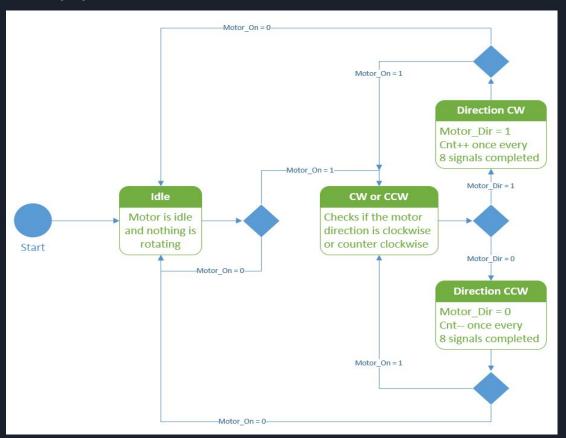
Stepper Motor (up/down and open/close)

- 5V DC
- 4-Phase
- 5-Wire
- ULN2003 Driver Board
- Pull in Torque 34.4mN.m (120Hz)
- 8 signals repeated 64 times for one full revolution

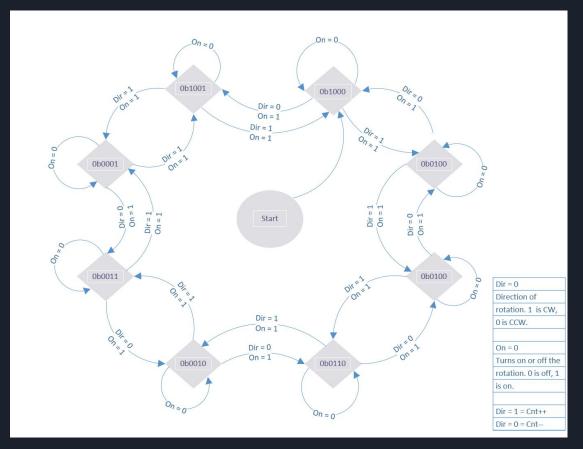




Stepper Motor State Machine

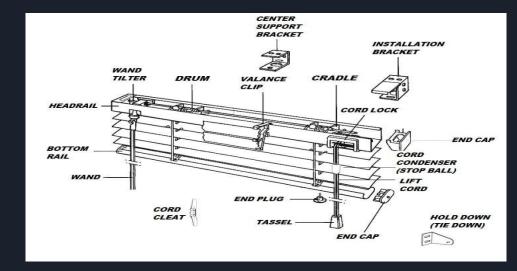


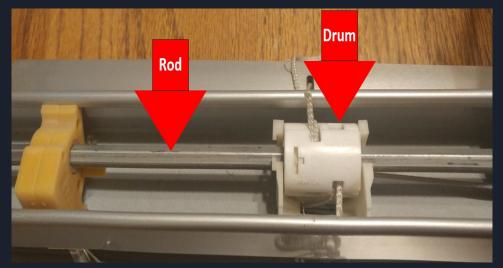
Stepper Motor State Machine



Blinds

- Operated at the top of the blinds
- Motors attached to the Tilt Rod and String

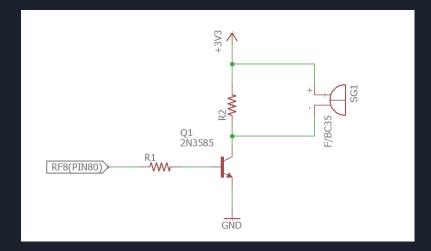


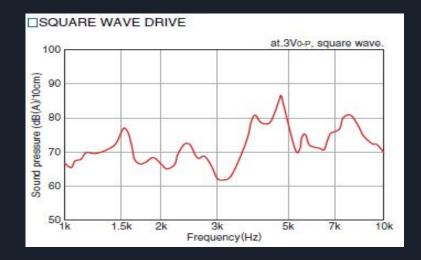


Speaker



- 5V Analog Output
- Using Timer Interrupt for 4kHz
- Provides 70 dBA

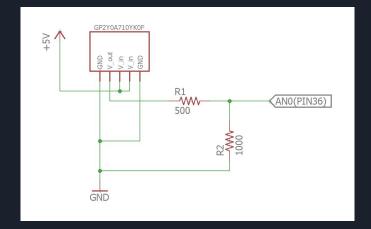


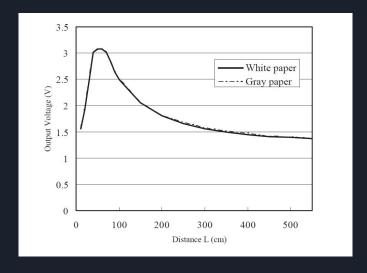


Proximity Sensor



- 5VDC input, 5V Analog output
- Using ADC0 at 21Mhz sample rate
- User Programmable warning detection radius
- Reactivity

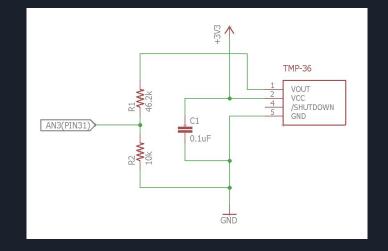


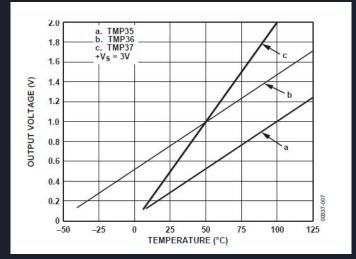


Temperature Sensor



- 3.3V Analog Output
- Using ADC3 at 21Mhz sample rate
- Celcius to Farenheit conversion circuit
- Reactivity

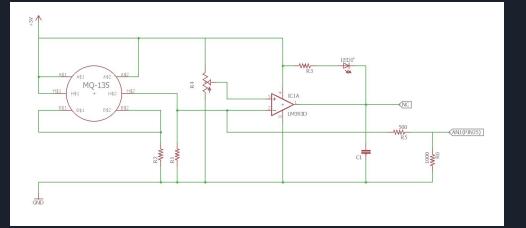




Smoke/Gas Sensor



- Detects harmful levels of NH3, NOx,
 alcohol, Benzene, smoke, CO2, etc.
- Using ADC1 with 21Mhz sample rate.
- Reactivity for different gases.



Camera



1. Wi-Fi

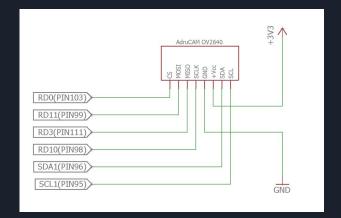
- a. **SOLUTION** ArduCAM-M-2MP is optimized version of ArduCAM shield Rev.C, and is a high definition 2MP SPI camera
- b. WHY Plenty of documentation. Limited time to research.

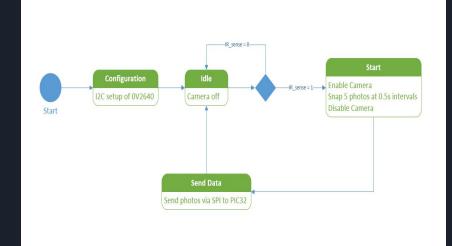
c. PROS

- i. UXGA image mode for 1600 x 1200 pixel images
- ii. I2C protocol to configure
- iii. SPI interface to receive data

d. CONS

- i. Image capture speed limited by image size
- ii. Two communication protocols to configure on PIC





Communications (Hardware)

1. Wi-Fi

- a. **SOLUTION** IEEE 802.11, (b/g/n) standard specifications. TCP/IP Stack
- b. WHY Current Trend in IoT is to used WiFi. Stretch goal to incorporate video streaming. Also, couldn't find a bluetooth module to support video application in enough time before initial parts had to be ordered. We knew all End-User devices could connect to a local network.
- c. PROS
 - i. Scalability
 - ii. Connectivity can be connected to remotely via internet
- d. CONS
 - i. Cost vs RFID, Bluetooth
 - ii. Power vs RFID, Bluetooth
- e. TEST Arduino, SAMD21

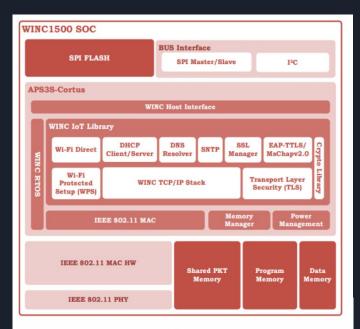
Communications (Software)

- 1. User Interface
 - a. **SOLUTION** WISA(Microsoft Windows, Microsoft IIS, Microsoft SQL, ASP.NET(4.6.1) Stack
 - b. WHY A lot of options and documentation
 - c. PROS
 - i. Team members are all Windows users and familiar with visual studios, C, C++,C#
 - d. CONS
 - i. Expensive
 - ii. Heavy
 - e. TEST
 - i. Unit tests/Data logging

Wifi - Module

1. Wi-Fi

- a. ATWINC1500 MR210PB (uses AP838 Cortus 32 bit 40 MHz CPU executes the Winc firmware.)
- b. Very heavily documented
- c. WINC1500 WINC host driver software is a C
 library which provides the host MCU application
 with necessary APIs to perform necessary WLAN
 and socket operations.





Wifi - Module

WLAN API

This module provides an interface to the application for all Wi-Fi operations and any non-IP related operations.

Socket API

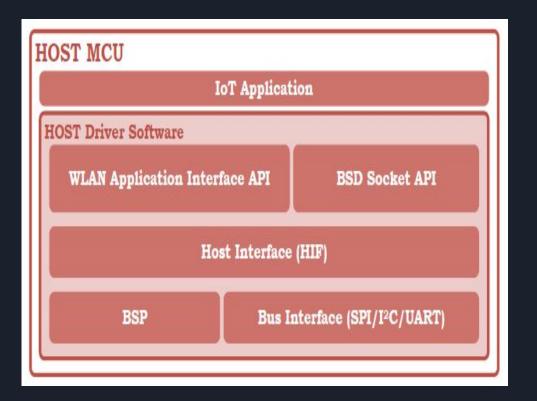
This module provides the socket communication APIs that are mostly compliant with the well-known BSD sockets to enable rapid application development.

Host Interface (HIF)

The Host Interface is responsible for handling the communication between the host driver and the WINC Firmware.

Board Support Package (BSP)

The Board Support Package abstracts the functionality of a specific host MCU platform.



User Interface Module

Tier 1 - User Interface

- a. Software Running on windows 7/10 (OS of Stack)
- b. GUI The team all works on Windows laptops and uses Iphones and Android(OS of GUIs)
- c. C# Web Front End





User Interface Module

Tier 2 - Business layer

- a. Microsoft Internet Information Services
- b. Visual Studios, C#
- c. Web Services
- d. Real-Time (Signalr)





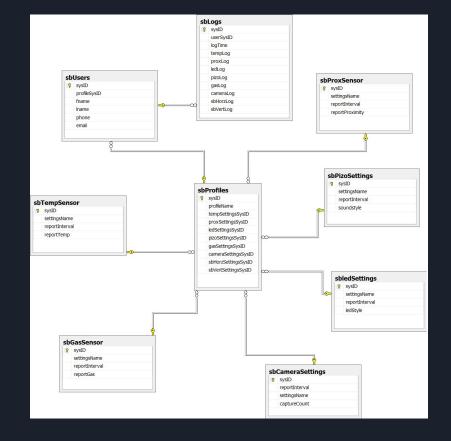




User Interface Module

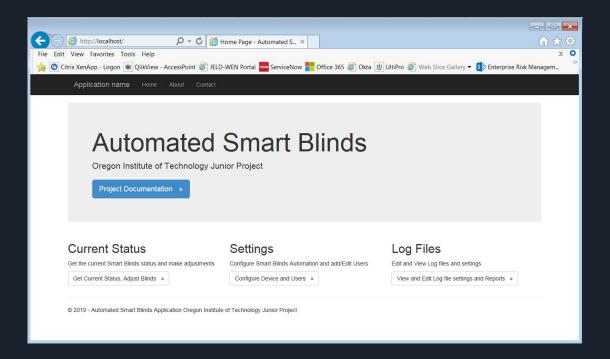
Tier 3 - Database

- a. Microsoft SQL Server
- b. RDBMS
- c. Handles data manipulation by exposing views and stored procedures
- d. Manages data integrity





User Interface Demonstration

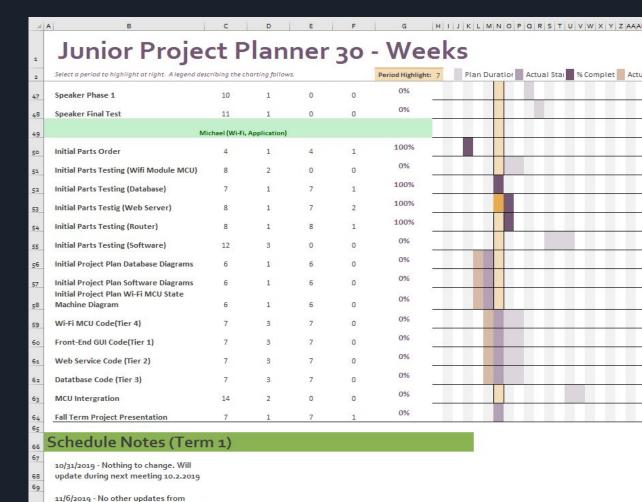


Cost

Estimated total cost	\$19,529.27
Estimated parts/packaging cost	\$259.27
Engineering/labor cost	\$19,200
Outsourced contract cost	\$0, if needed \$5000

Schedule

- Gantt Chart
- Updated during team
 meeting starting 2nd Term
- Annotations and brief status updates are included in chart
- Schedule scratchbook



Project Planner

Sheet2

Problems and Control

Control for managing the group is done via a "Three Strike" policy. If a member fails to meet their deadlines for project sections or communication receive a strike. Accumulation of three strikes can result in being removed from the group.

Issues with submodules code or hardware are given a one week all-hands review before seeking outside help.

Conclusion

- Full Automated Smart Blinds is the next part for Smart houses.
- Potential Market Growth
- Helping Advance Technology for everyday individuals.

References

Data Sheets Used

- PIC32-HM7144 User's Manual
- PIC32 Datasheet
- RS-15 SPEC Power Supply
- 5V 4 Phase 5 Wire Stepper Motor & ULN2003 Driver Board
- Piezoelectric buzzers PS series
- Sharp GP2Y0A710K0F Proximity Sensor
- Low Voltage Temperature Sensor Data Sheet TMP35/36/37
- o MQ-135 Gas Sensor Technical Data Sheet
- ArduCam-M-2MP Camera Shield User Guide
- ATWINC15X0 Wifi Controller Software Guide

Images Used

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