The Digital Doorman

ECE 511, Group 5

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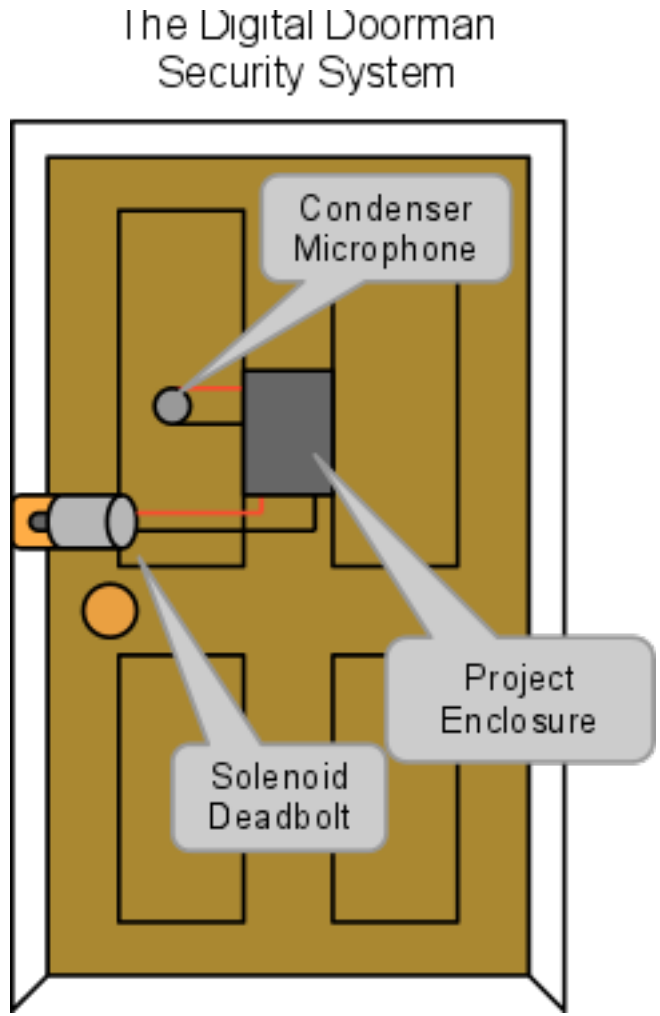
The Digital Doorman

Never again be locked out of your home!

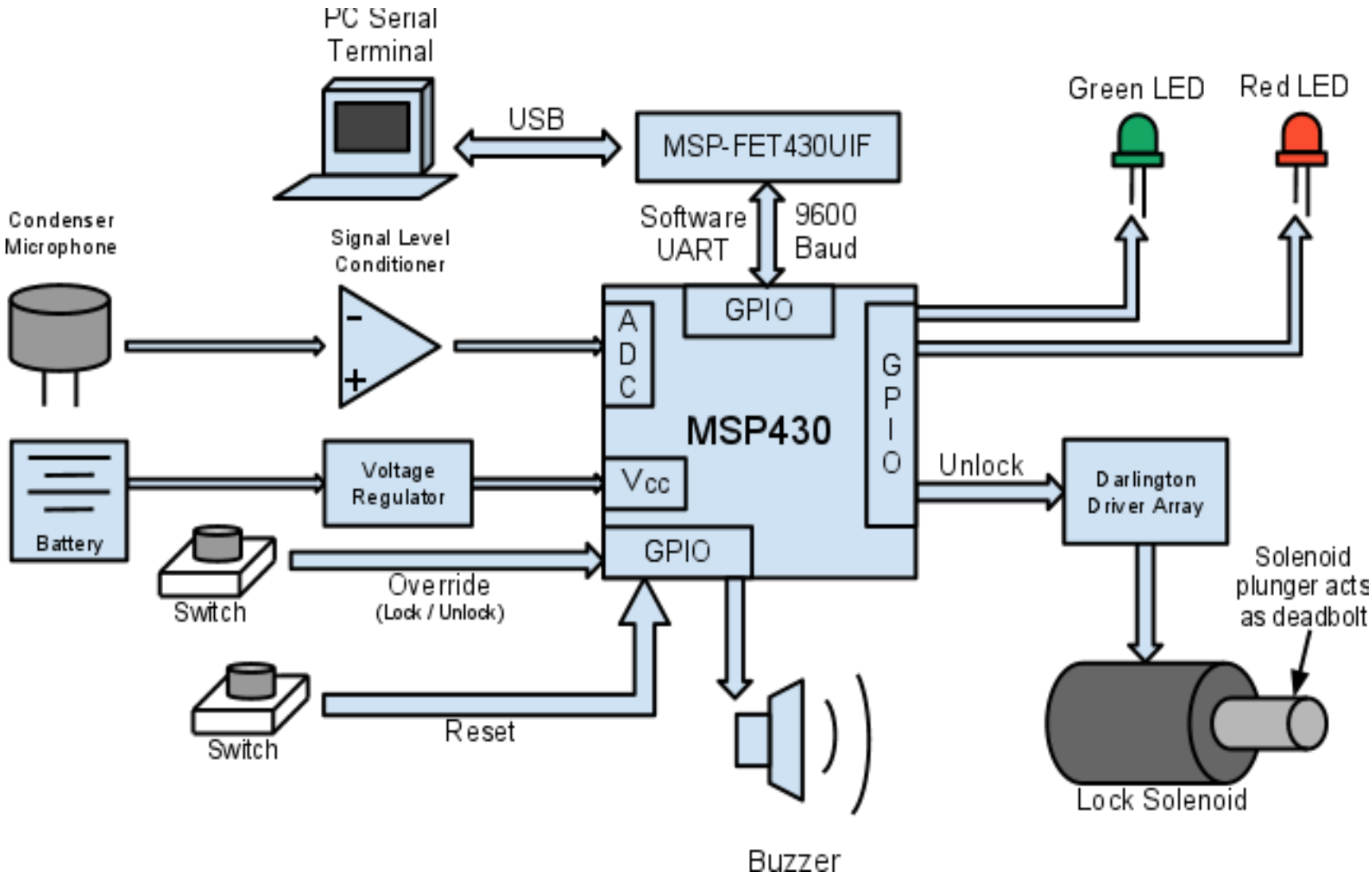
- Allows user to unlock a door with a special "knock rhythm."
- Keeps door locked otherwise.

- System is invisible from the outside.
- Alerts on failed entry attempts.

- Inside:
  - Microphone detects knocks
  - Solenoid deadbolt secures door
  - Button allows override

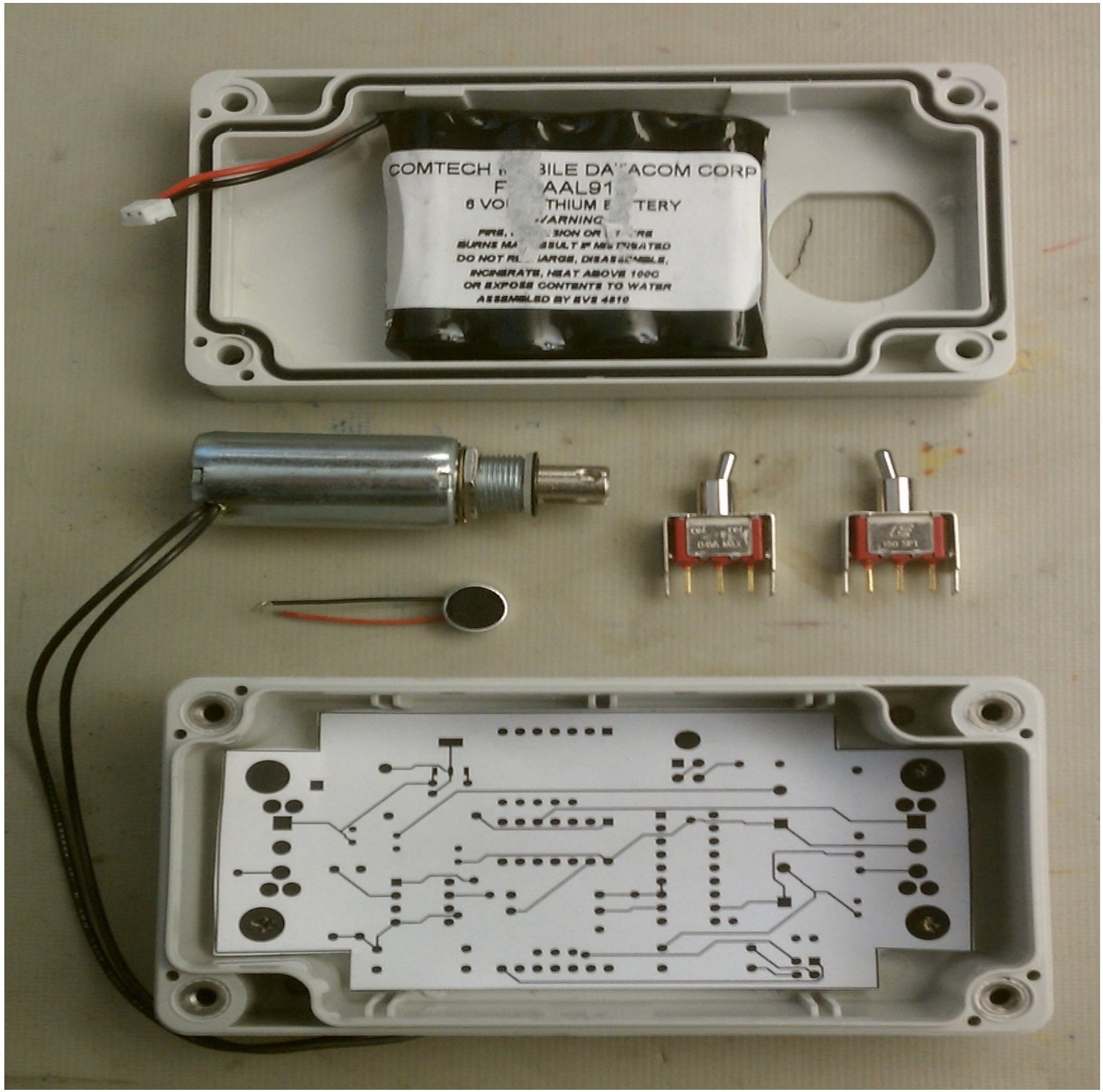


Block Diagram



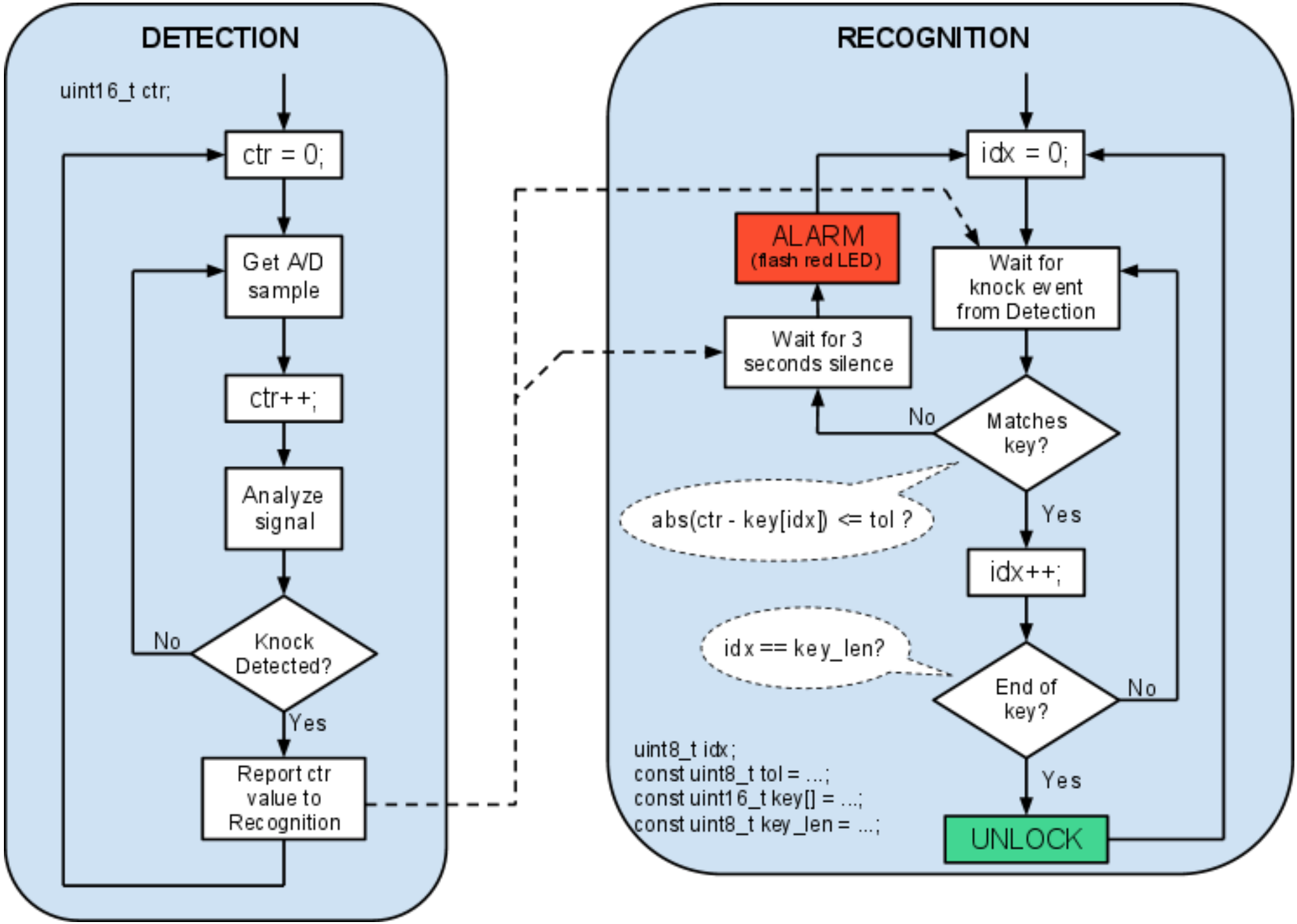
Component List

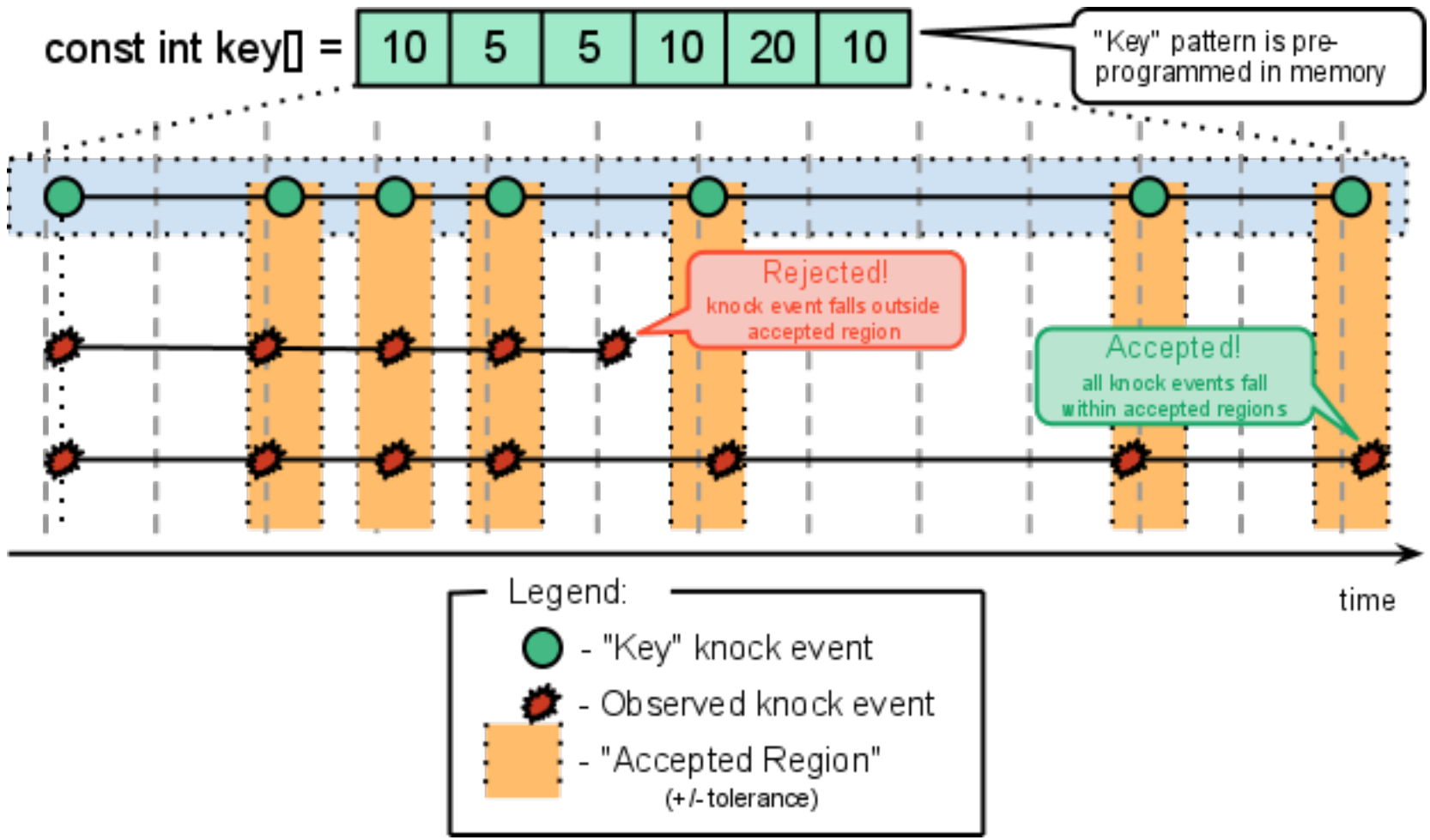
Name	Part Number	Hardware Interface	Software Interface	Progress
Solenoid	690-C24-261012DC-AP 12VDC PUSH	Darlington Driver	GPIO Control	Ordered/ Received/ Tested
Microphone	AOM-4544P-2-R	OPAMP Gain Stage Low Pass Filter OPAMP Buffer ADC pin 1.7	Threshold Detection	Tested
Toggle Switch	100SP1T2B4VS2RE	GPIO	GPIO Monitor	Ordered/ Received/ Tested
LED	HLMP-3680	GPIO	GPIO Control	Ordered/ Received/ Tested
Buzzer	DBX-01PN	Darlington Driver	GPIO Control	Ordered/ Received


COMTECH
ACOM CORP
AAL91
WARNING

Firmware

- Written in C
- Detection algorithm
  - Receives ADC interrupts with microphone voltage samples at a constant frequency
  - Determines when an actual knock has occurred
  - Notifies recognition algorithm of each knock and its timing
- Recognition algorithm
  - Determines if each detected knock matches the knock pattern, within tolerance
  - Provides feedback outputs (pattern acceptance or rejection)
  - Provides lock control outputs


DETECTION
uint16_t ctr;
ctr = 0;
Get A/D sample
ctr++;
Analyze signal
Knock Detected?
No
Yes
Report ctr value to Recognition
RECOGNITION
idx = 0;
ALARM
(flash red LED)
Wait for knock event from Detection
Wait for 3 seconds silence
Matches key?
No
Yes
abs(ctr - key[idx]) <= tol ?
idx++;
idx == key_len?
End of key?
No
Yes
UNLOCK
uint8_t idx;
const uint8_t tol = ...;
const uint16_t key[] = ...;
const uint8_t key_len = ...;


const int key[] =
10
5
5
10
20
10
"Key" pattern is pre-programmed in memory
Rejected!
knock event falls outside accepted region
Accepted!
all knock events fall within accepted regions
time
Legend:
- "Key" knock event
- Observed knock event
- "Accepted Region"
(+/- tolerance)

Timeline & Status

Task	Responsibility	Deadline
Component selection	Russell	10/11/2011
Board fabrication/interfacing circuitry	Russell	11/01/2011
Recognition firmware	Doug	11/15/2011
Detection firmware	Mahmoud	11/15/2011
Debug/UART firmware	Jeremy	11/15/2011
Test/debug firmware	Group	11/22/2011
Final testing	Group	11/25/2011
Project demonstration (miniature door with mounted solenoid and project enclosure)	Group	12/06/2011

- Component investigation and selection
  - Tested each component separately to verify functionality and behavior
- Basic firmware for different components
  - ADC knock detection and recognition
- UART for debugging
  - Printed characters to PC terminal
- Initial testing for hardware and firmware