



MIT Wake-up Call System



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Features

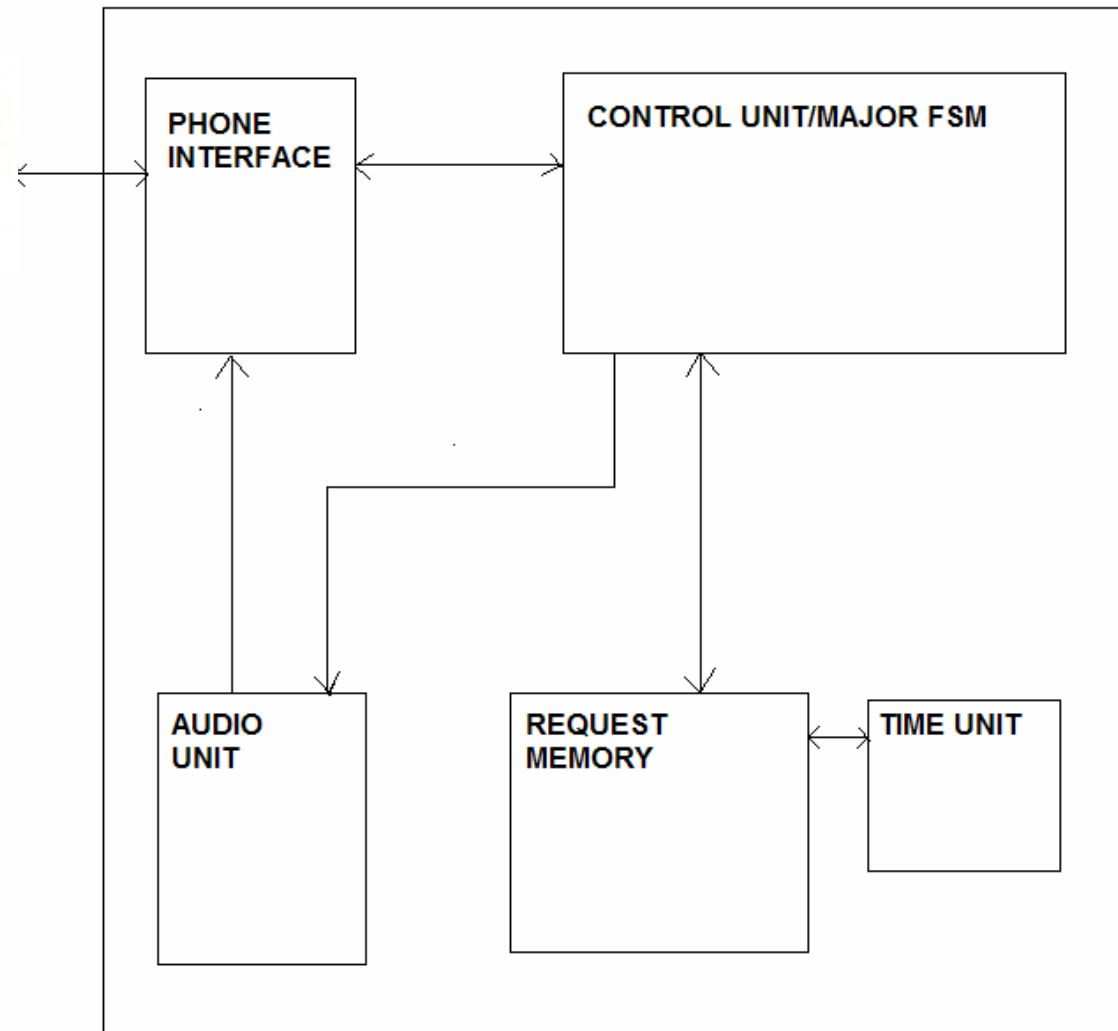
■ Security PIN

- Each user is assigned a PIN associated with his telephone number
- When a user calls in, the system verifies his PIN before allowing the user to proceed to the menu.

■ Menu Options

- Request wakeup call
- Cancel requested wakeup call
- Check scheduled requests for his phone number
- Hear the system time to synchronize with the user's watch

Basic Block Diagram





Phone Interface Functions

- detect incoming call
- pick up/hang up phone
- dial numbers
- detect/interpret dialed numbers
- send prerecorded audio over phone line



Phone Terminology

- **loop**: twisted wire pair connection between phone and central office
- individual wires: **tip** and **ring**

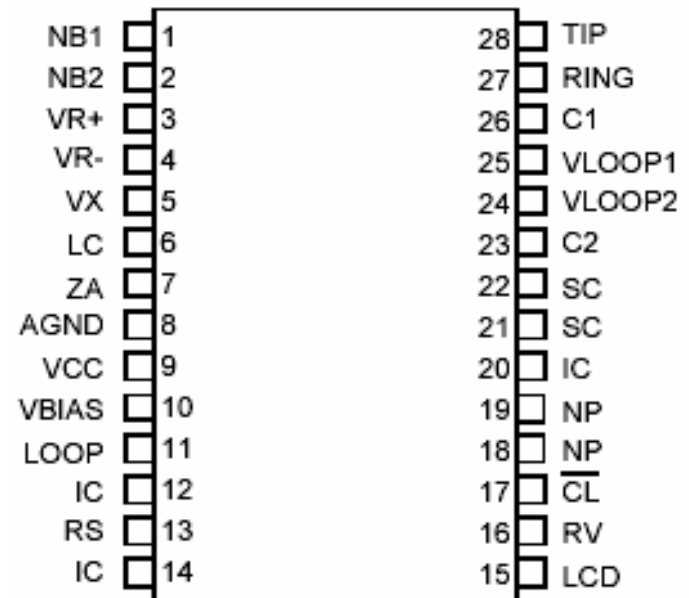


Phone Dialing

- Two types: pulse and tone
- Our system uses tone
 - each digit dialed generates two tones (frequencies)
 - also called dual tone multi frequency (**DTMF**)

Phone Interface: MH88437

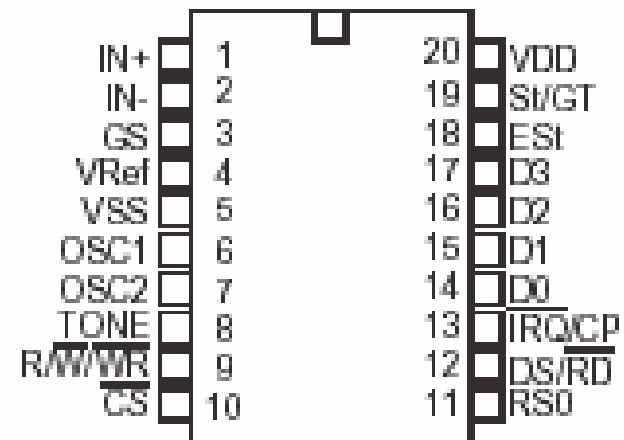
- Data Access Arrangement Chip
- provides complete interface between audio/data transmission equipment and phone line
- Tip and Ring connections
- Functions:
 - detect incoming call
 - pick up/hang up phone
 - send prerecorded audio



Phone Interface: MT8889C

■ DTMF transceiver

- convert binary digit to DTMF (outgoing call)
- convert DTMF to binary digit (incoming data)



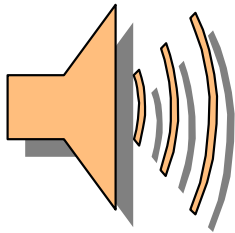
Audio Overview

■ Record Mode:



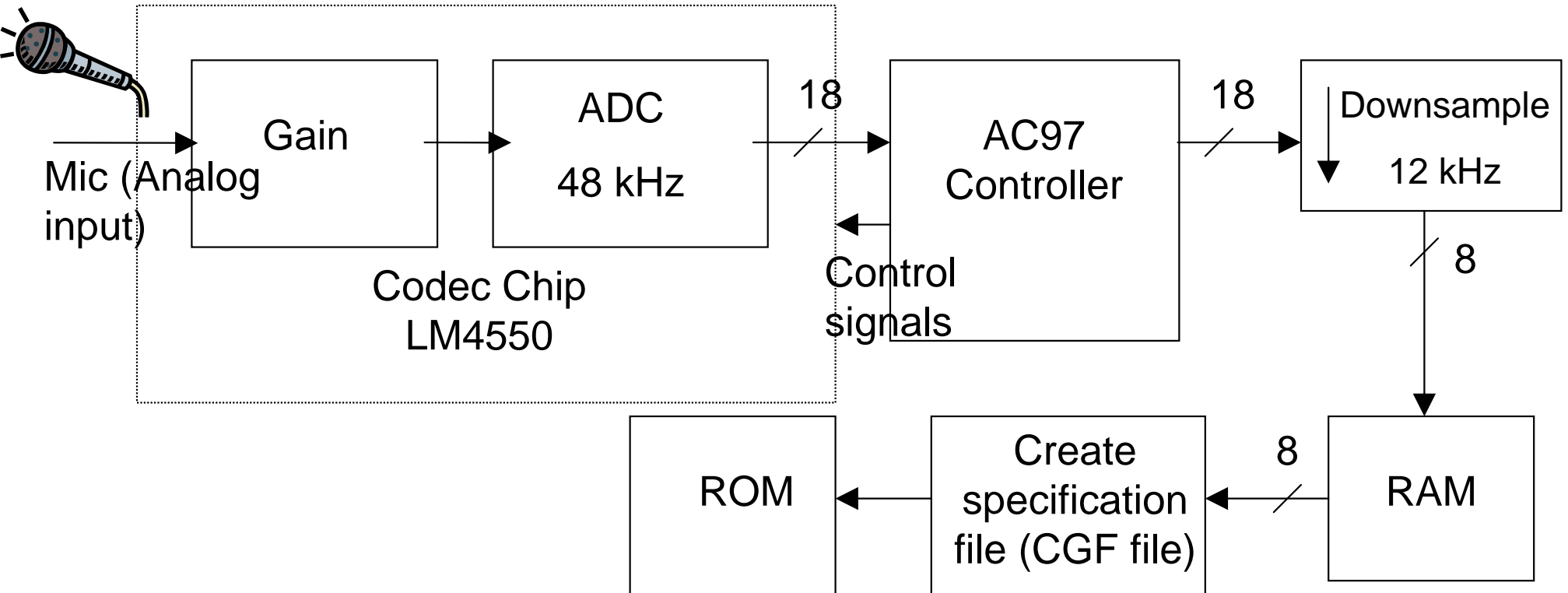
- Takes audio input from microphone
- Samples the analog input
- Store the samples in RAM
- Store the samples in ROM by creating specification file from data in RAM

■ Playback Mode:



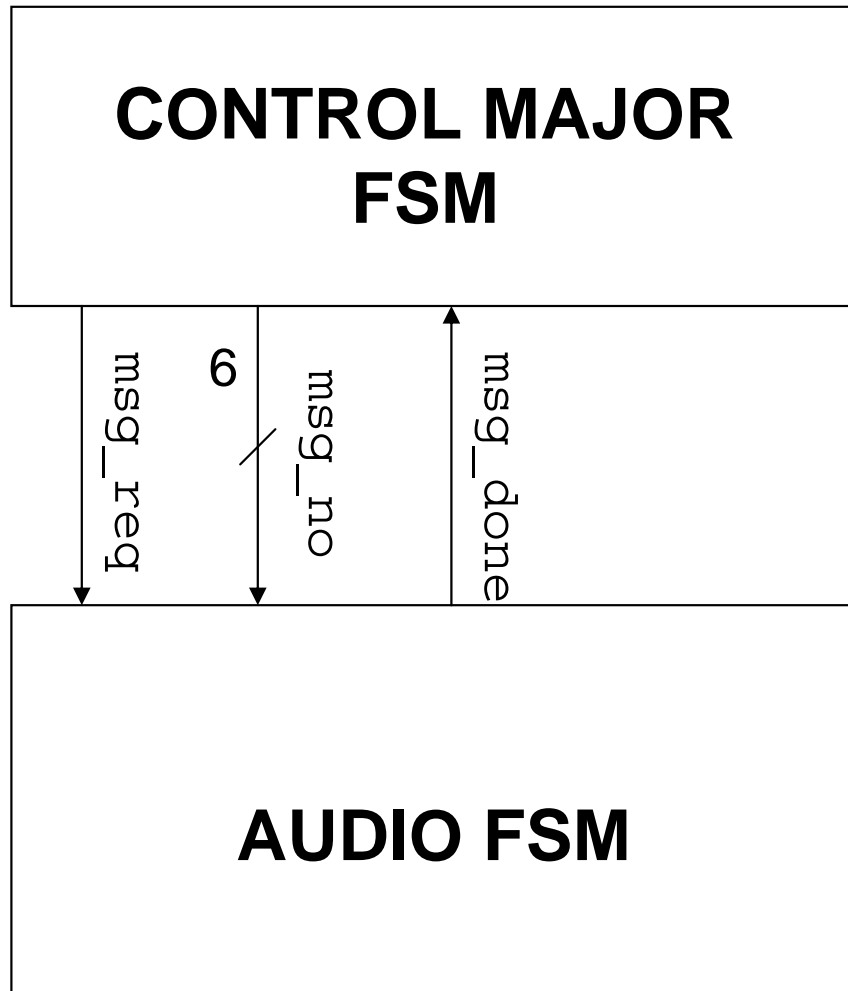
- Retrieves digitized samples from ROM upon requests from audio major FSM
- Converts it to analog outputs
- Amplifies and sends to the speaker

Record Mode – Audio Path



- The AC97 Controller controls the codec chip by supplying frames to the codec at rate 48,000 frames/sec.
- A frame consists of 13 slots (1 tag slot, and 12 data slots).
- One 18-bit digitized sample is received per an incoming frame to the AC97 controller

Playback Mode: Interface with Control Unit

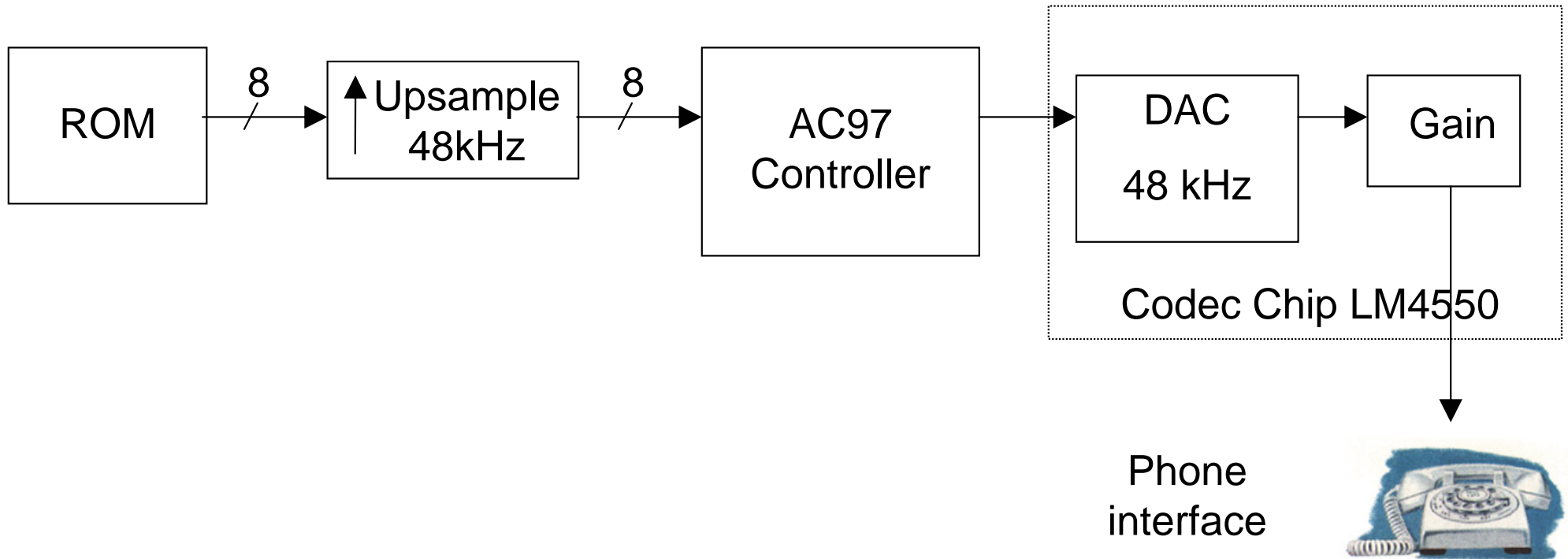


- Waits for the enable signal `msg_req` from Major FSM
- Plays 8-bit voice messages according to the input signal `msg_no`
- Outputs `msg_done` signal to notify Major FSM that the playback has finished



(Phone interface)

Audio Path – Playback Mode



- Digitized samples in ROM are upsampled to match with the sampling rate of the codec by replicating the same sample 4 times

Phone Number/PIN LUT

- Each phone # has a unique PIN #
- PIN # is preassigned

PHONE #	PIN #
56407	3579
58834	0891
52660	4687
38994	1244
87619	8107



Time Unit

- Holds the current system time
 - Extension of the behavioral 1 second timer in Problem Set 2
- Stored as month, day, time
04 25 23:40
- Sends output to Request Memory Unit

Request Memory Unit

- Combined with the Time Unit, it acts as the timer for every wake-up call

- Receives wake-up requests such as:

Wake-up call for: 04 26 07:30

PIN #: 9876

- Collects requests in memory
 - Sends 'call' signals at the appropriate times

Request Memory Unit

- Requests are stored in a RAM, sorted by priority

EVENT {month, day, time}	PIN #
04 26 07:30	9876
04 26 07:50	4385
04 26 08:30	1929
04 26 08:45	1103
04 26 09:45	4385
04 26 10:00	0321
04 26 10:12	8430

20 bits

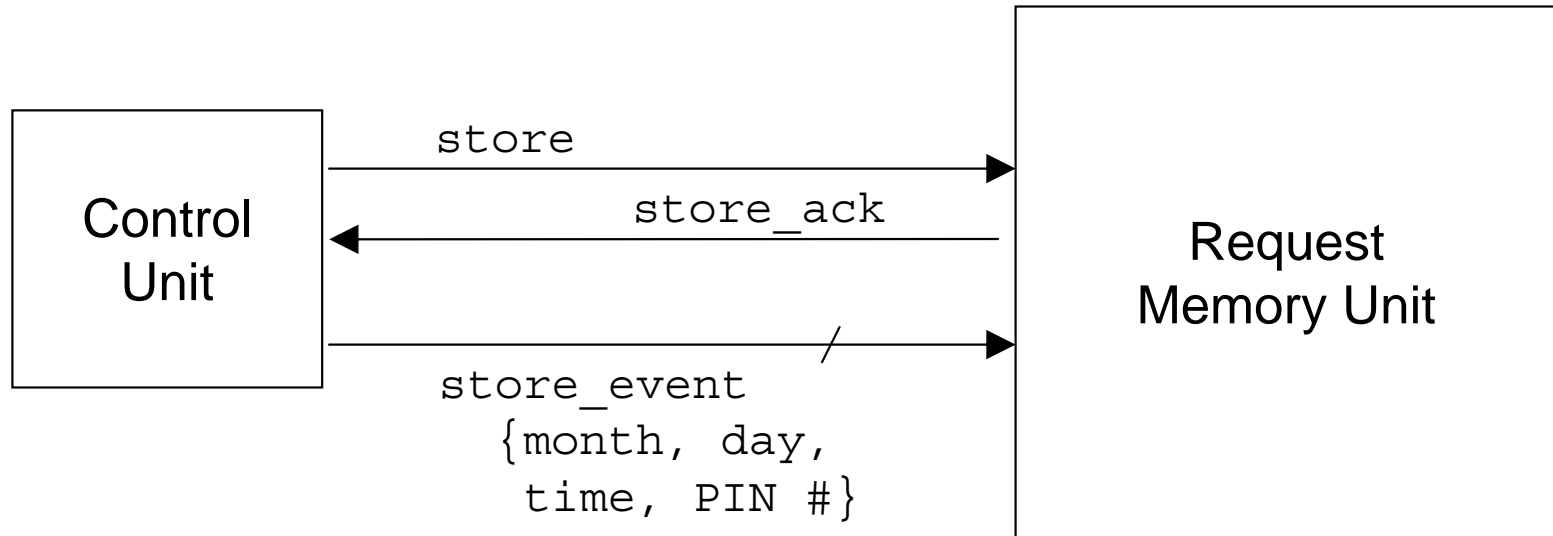
14 bits



Request Memory Unit

- 3 basic operations:
 - **Store** a new wake-up request
 - As time passes, **retrieve and send** the request(s) that are ready for calling
 - **Cancel** wake-up requests for a particular person

Storing a Wake-up Request

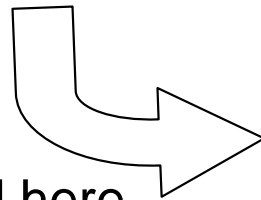


Control Unit sends the new request data & a store signal

Storing a Wake-up Request

04 26 08:00	0004
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New request
must be inserted here

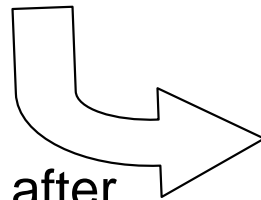


EVENT {month, day, time}	PIN #
04 26 07:30	9876
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Storing a Wake-up Request

04 26 08:00	0004
-------------	------

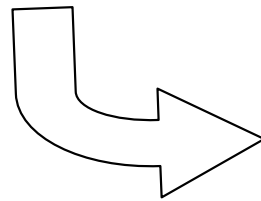
Requests after
insertion point
get shifted down



EVENT {month, day, time}	PIN #
04 26 07:30	9876
04 26 07:50	4385
04 26 08:30	1929
04 26 08:45	1103
04 26 09:45	4385
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Storing a Wake-up Request

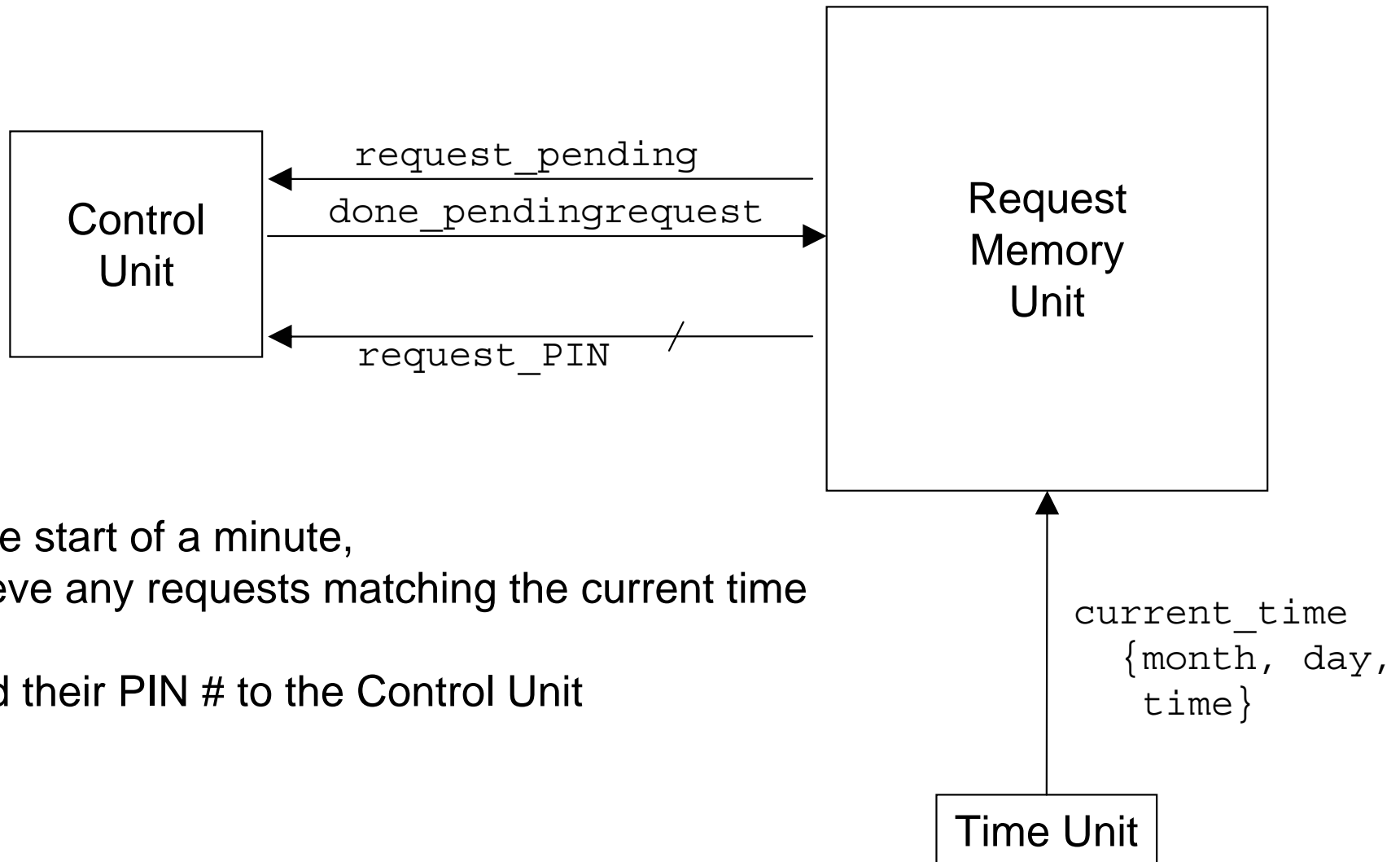
04 26 08:00	0004
-------------	------



New request
has been stored!

EVENT {month, day, time}	PIN #
04 26 07:30	9876
04 26 07:50	4385
04 26 08:00	0004
04 26 08:30	1929
04 26 08:45	1103
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Retrieving a Wake-up Request



Retrieving a Wake-up Request

Current time: 07:30

The current time
matches the first listing

EVENT {month, day, time}	PIN #
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04 26 07:50	4385
04 26 08:30	1929
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04 26 10:12	8430

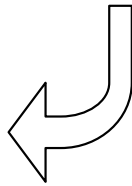
Retrieving a Wake-up Request

Current time: 07:30

First listing is deleted;
PIN of first listing is sent
to main control unit

9876

To control unit



EVENT {month, day, time}	PIN #
04 26 07:50	4385
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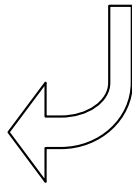
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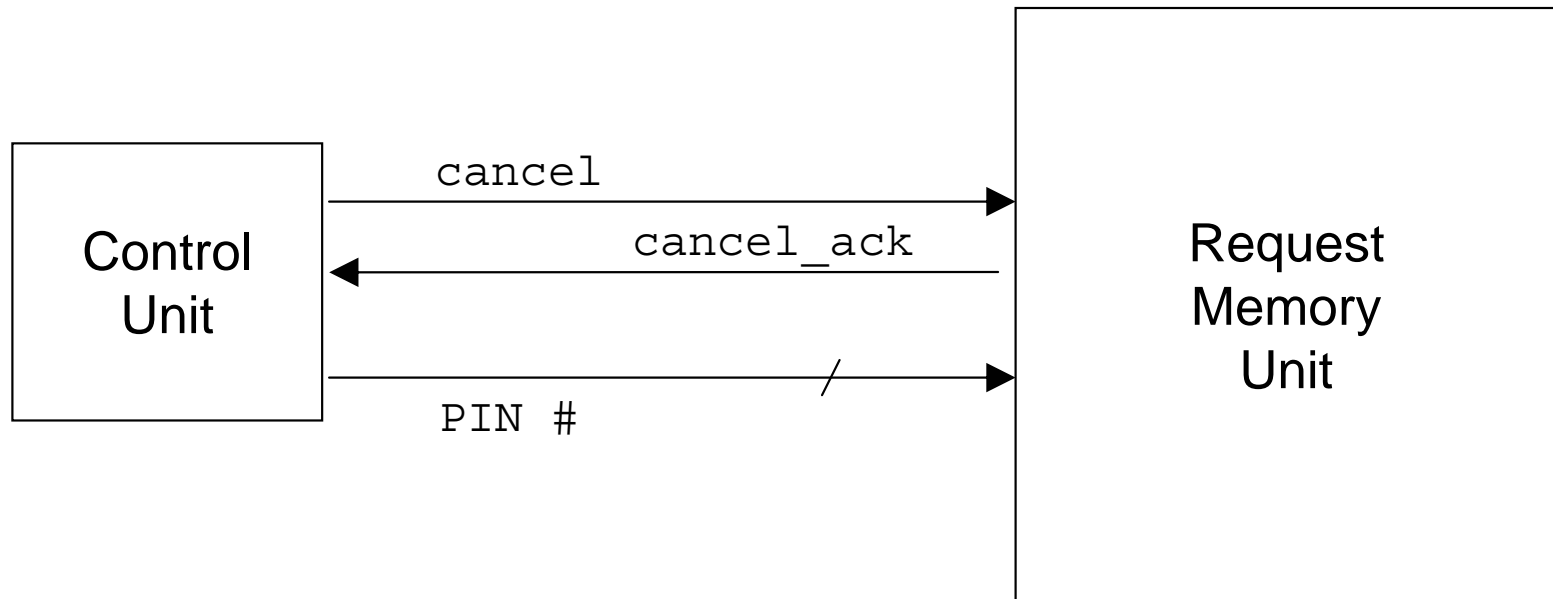
9876

To control unit



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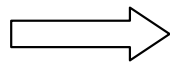
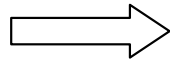
Canceling Requests for a Given PIN



Canceling Requests for a Given PIN

4385

Cancel all requests
for PIN # 4385



EVENT {month, day, time}	PIN #
04 26 07:30	9876
04 26 07:50	4385
04 26 08:30	1929
04 26 08:45	1103
04 26 09:45	4385
04 26 10:00	0321
04 26 10:12	8430

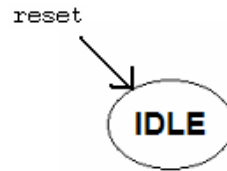
Canceling Requests for a Given PIN

4385

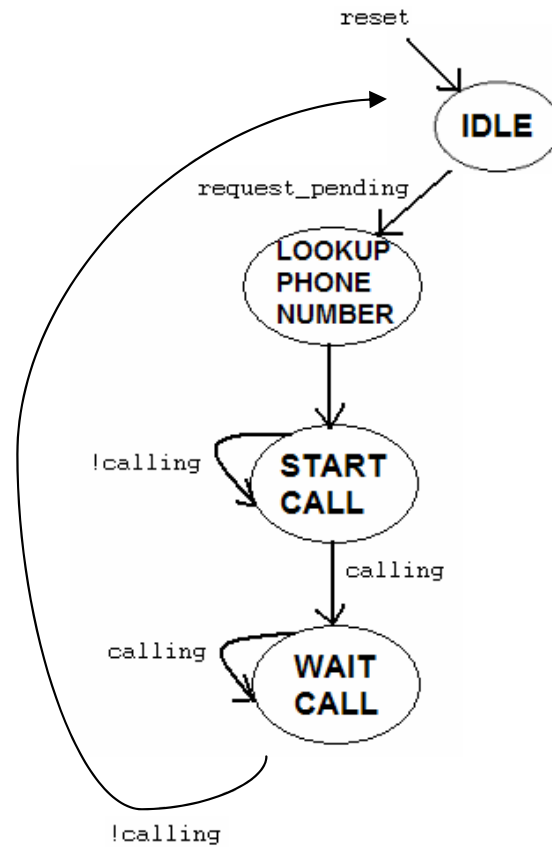
Done!

EVENT {month, day, time}	PIN #
04 26 07:30	9876
04 26 08:30	1929
04 26 08:45	1103
04 26 10:00	0321
04 26 10:12	8430

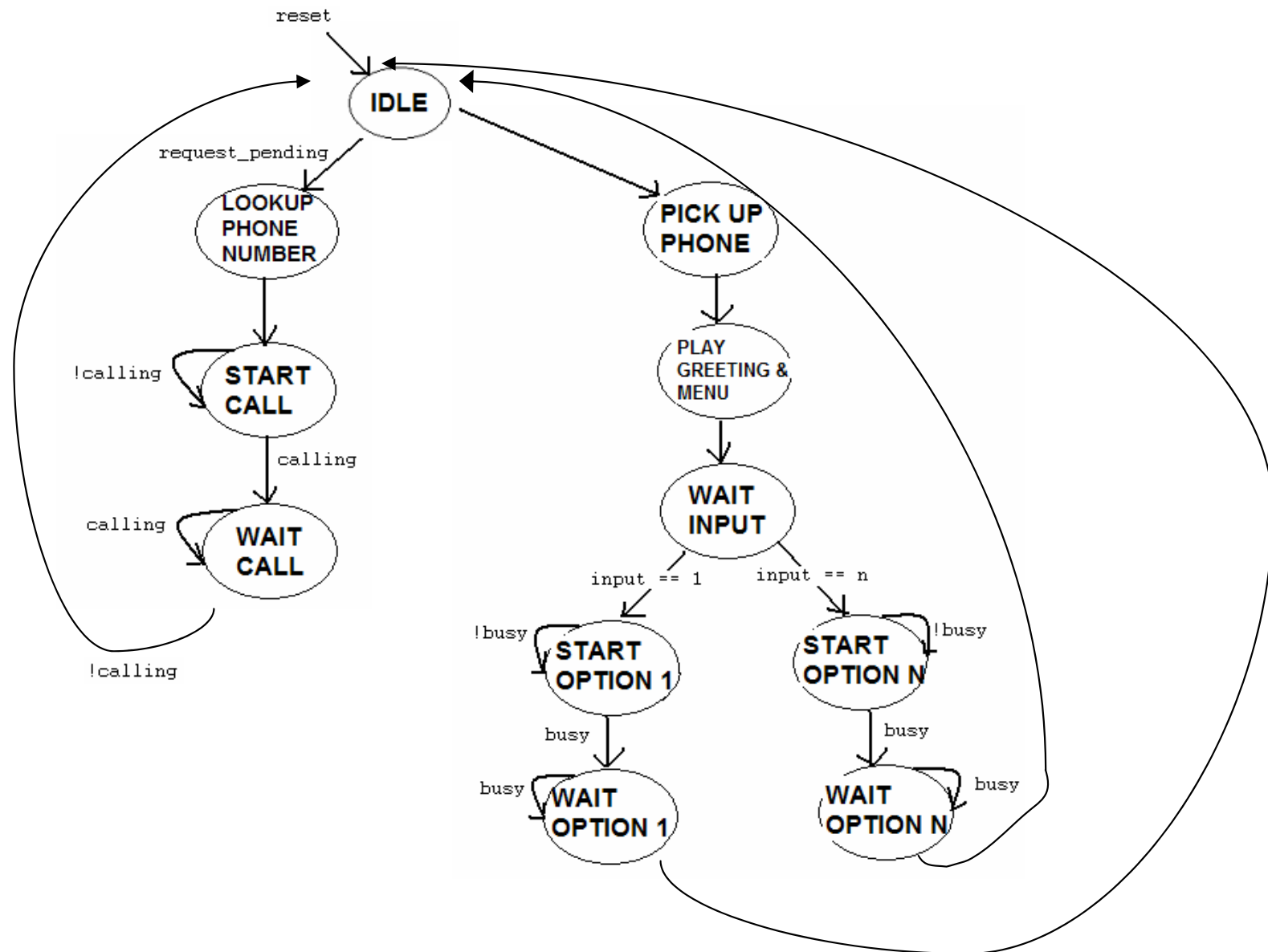
Control Unit/Major FSM



Control Unit/Major FSM



Control Unit/Major FSM



Thank You

- Any questions?

