

## **APPENDIX C**

### **The MavPad Environment**

### C.1 MavPad Description

The MavPad is an on-campus student apartment located at University Village on The University of Texas at Arlington's campus. The apartment consists of a living/dining room combination, a kitchen, a bathroom, a large bedroom, and a walk-in closet. The living room is shown in Figure C.1 and the dining portion is shown in Figure C.2. The kitchen is small and shown in Figure C.3. The bedroom supports two people and can be seen in Figure C.4. The bathroom contains a sink, toilet, and a shower. The bedroom closet is large enough to hold clothes as well as computer equipment including the network routers and our master server.



Figure C.1. MavPad living room.



Figure C.2. MavPad dining room.

## C.2 Computing Power

The Mavpad hosts four Pentium 4 class SuSe 9.1-based Linux machines. Two machines act as sensor collectors for the ArgusD networks as well as for X-10. These machines are located in the living room and the bedroom. The machine in the kitchen supports X-10, the ArgusM network, and the ArgusMS network. The machine in the closet is the master server which hosts the experimental software systems for decision-making as presented in this dissertation. The system uses a 100bTX network and is connected to the Internet through a 4Mb cable modem donated by Comcast. There currently is not any wireless connectivity in this environment.



Figure C.3. MavPad kitchen.

### C.3 Sensing and Actuation

The MavPad has a deployed ArgusD network with two units supporting up to forty sensors, a single ArgusM network supporting the two mini-blinds in the apartment, an ArgusMS network with three Superslaves and fourteen Dongles total, and an X-10 system covering three zones. This environment is also equipped with an X-10 controlled HVAC system and a water leakage detection system. Figures C.5 and C.6 show some of the ArgusMS Dongles deployed. Figure C.7 shows the ArgusD passive infra-red (PIR) motion sensor array mounted on the ceiling. The X-10 deployment is shown in Figure C.8 along with the ArgusM actuators for the mini-blinds. The ArgusMS and ArgusD sensors are shown in Figure C.9. A complete list of deployed sensors and actuators for the MavPad is presented in Table C.1 and the Argus network deployment costs are shown in Table C.2.



Figure C.4. MavPad bedroom.



Figure C.5. ArgusMS Dongle on the wall.



Figure C.6. ArgusMS Dongle sensors by the window near an X-10 controlled floor fan.



Figure C.7. ArgusD ceiling mounted PIR motion sensors.

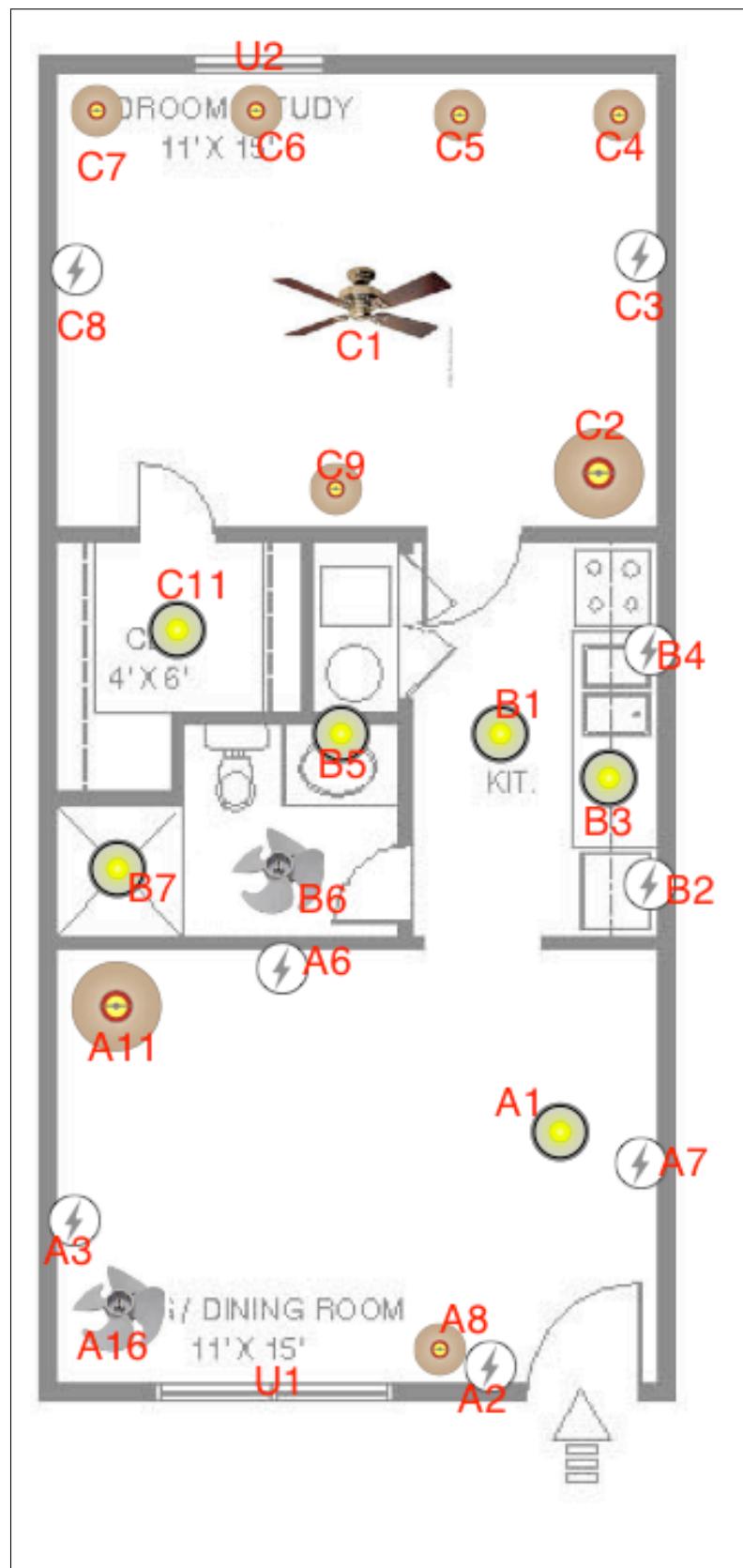


Figure C.8. MavPad X-10 and ArgusM Actuators.

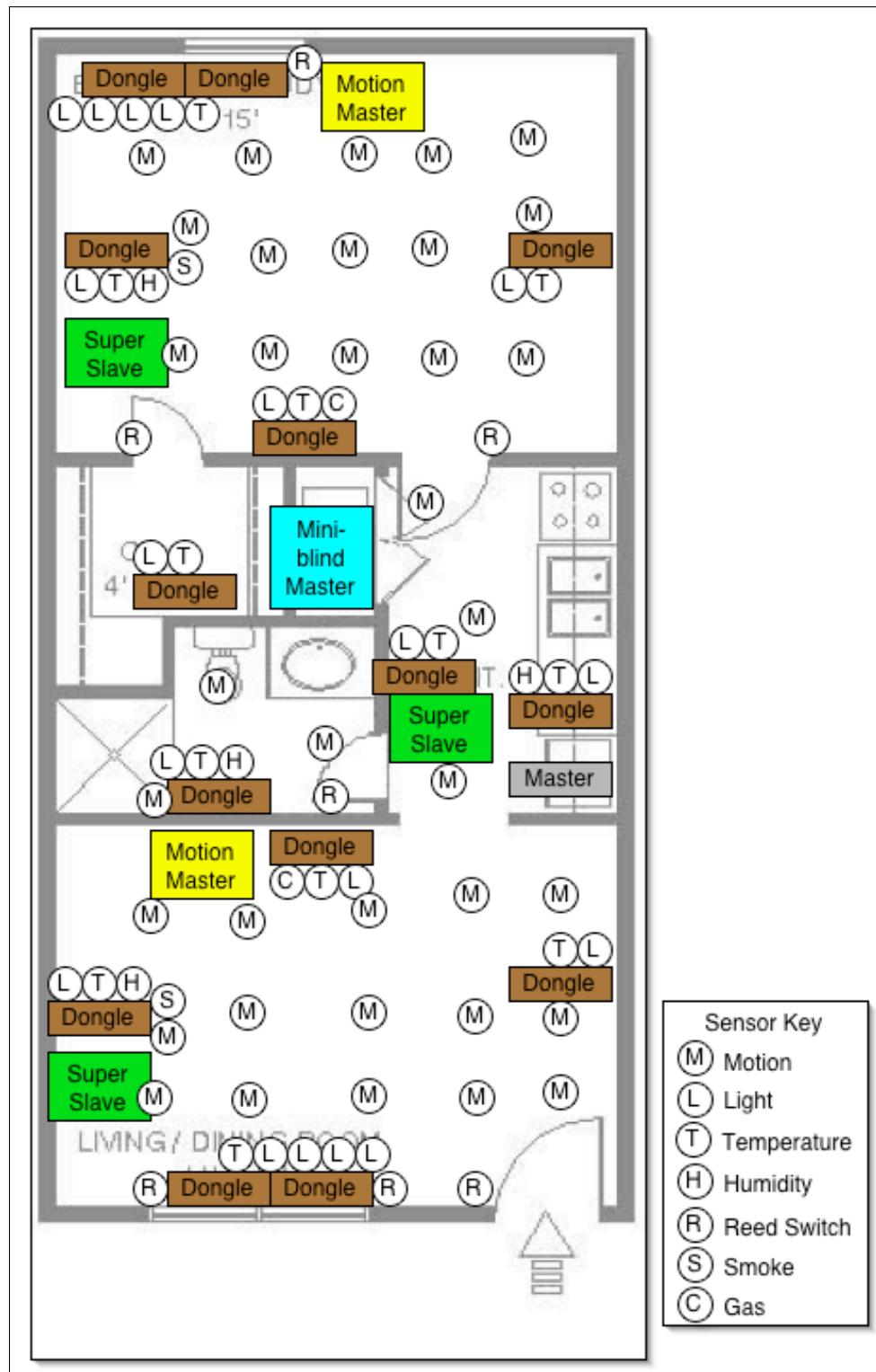


Figure C.9. MavPad ArgusMS and ArgusD sensors.

Table C.1: MavPad Sensors and Actuators.

Zone	ID	Type	Source	Room	Location
A	1	Ceiling light	X10	Living Room	Overhead light near north wall
A	2	Electrical outlet	X10	Living Room	East wall near door, top outlet
A	3	Electrical outlet	X10	Living Room	Southeast corner of room, top outlet
A	6	Electrical outlet	X10	Living Room	West wall behind entertainment center, top outlet
A	7	Electrical outlet	X10	Living Room	North wall near table, top outlet
A	8	Table lamp	X10	Living Room	Near door on side table
A	9	Electrical outlet	X10	Kitchen	North wall over counter, top outlet
A	11	Floor Lamp	X10	Living Room	Southwest corner
A	16	Floor Fan	X10	Living Room	Southeast corner of room, top outlet
B	1	Ceiling light	X10	Kitchen	Overhead in kitchen
B	2	Electrical outlet	X10	Kitchen	Behind refrigerator
B	3	Counter lights	X10	Kitchen	Over counter, under cabinets
B	4	Electrical outlet	X10	Kitchen	Over counter, on left near oven, top outlet
B	5	Bathroom light	X10	Bathroom	Over mirror
B	6	Bathroom fan	X10	Bathroom	On ceiling. Will not turn off with remote.
B	7	Shower light	X10	Bathroom	Over shower

Table C.1 – continued

Zone	ID	Type	Source	Room	Location
B	13	Argus Motor	X10	Kitchen	On top of fridge
C	1	Overhead fan	X10	Bedroom	On ceiling
C	2	Room light	X10	Bedroom	Northeast corner
C	3	Luxo lamp	X10	Bedroom	Attached to north bed
C	4	Luxo lamp	X10	Bedroom	On north computer desk
C	5	Luxo lamp	X10	Bedroom	On south computer desk
C	6	Luxo lamp	X10	Bedroom	Attached to south bed
C	7	Electrical outlet	X10	Bedroom	South wall behind bed, top outlet
C	8	Table lamp	X10	Bedroom	East wall, on dresser
C	10	Closet light	X10	Bedroom	In closet, on ceiling
S	1	Light	ArgusMS	Living Room	In cluster P9, west wall. Facing into room
S	2	Heat	ArgusMS	Living Room	In cluster P9, west wall. Facing into room
S	3	CO	ArgusMS	Living Room	Next to cluster P9, west wall.
S	5	Light	ArgusMS	Living Room	In cluster P10, south wall. Facing into room
S	6	Heat	ArgusMS	Living Room	In cluster P10, south wall. Facing into room
S	7	Humidity	ArgusMS	Living Room	In cluster P10, south wall. Facing into room

Table C.1 – continued

Zone	ID	Type	Source	Room	Location
S	8	Smoke	ArgusMS	Living Room	Next to cluster P10, south wall.
S	9	Heat	ArgusMS	Living Room	In cluster P11, east wall. Facing into room
S	10	Reed switch	ArgusMS	Living Room	Reed switch attached to left window
S	11	Reed switch	ArgusMS	Living Room	Reed switch attached to right window
S	13	Light	ArgusMS	Living Room	On cardboard between window and blinds, facing out
S	14	Light	ArgusMS	Living Room	On cardboard between window and blinds, facing in
S	15	Light	ArgusMS	Living Room	Taped near window, facing miniblinds
S	16	Light	ArgusMS	Living Room	In cluster P12, east wall. Facing into room.
S	17	Light	ArgusMS	Living Room	In cluster P13, north wall. Facing into room.
S	18	Heat	ArgusMS	Living Room	In cluster P13, north wall. Facing into room.
S	19	Reed switch	ArgusMS	Living Room	Reed switch over front door.
S	65	Light	ArgusMS	Bedroom	On cardboard between window and blinds, facing out
S	66	Light	ArgusMS	Bedroom	On cardboard between window and blinds, facing in
S	67	Light	ArgusMS	Bedroom	Taped near window, facing miniblinds
S	68	Light	ArgusMS	Bedroom	In cluster P1, west wall. Facing into room
S	69	Heat	ArgusMS	Bedroom	In cluster P2, west wall. Facing into room

Table C.1 – continued

Zone	ID	Type	Source	Room	Location
S	70	Reed switch	ArgusMS	Bedroom	Reed switch attached to window
S	73	Light	ArgusMS	Bedroom	In cluster P3, south wall. Facing into room
S	74	Heat	ArgusMS	Bedroom	In cluster P3, south wall. Facing into room
S	75	Smoke	ArgusMS	Bedroom	Near cluster P3, south wall.
S	77	Light	ArgusMS	Bedroom	In cluster P4, north wall. Facing into room
S	78	Heat	ArgusMS	Bedroom	In cluster P4, north wall. Facing into room
S	79	Humidity	ArgusMS	Bedroom	In cluster P4, north wall. Facing into room
S	81	Light	ArgusMS	Bedroom	In cluster P5, east wall. Facing into room
S	82	Heat	ArgusMS	Bedroom	In cluster P5, east wall. Facing into room
S	83	Reed switch	ArgusMS	Bedroom	Reed switch over front door.
S	84	CO	ArgusMS	Bedroom	Near cluster P5, east wall.
S	85	Light	ArgusMS	Bedroom	In cluster P6, middle of closet. Facing into room.
S	86	Heat	ArgusMS	Bedroom	In cluster P6, middle of closet. Facing into room.
S	87	Leak detector	ArgusMS	Bathroom	Bioguard 1 - under toilet
S	88	Leak detector	ArgusMS	Bedroom	Bioguard 2 - under sink
S	89	Leak detector	ArgusMS	Utility Closet	Bioguard 3 - in water heater drip pan

Table C.1 – continued

Zone	ID	Type	Source	Room	Location
S	90	Leak detector	ArgusMS	Kitchen	Bioguard 4 - under sink
S	129	Light	ArgusMS	Kitchen	In cluster P8, south wall. Facing into room
S	130	Heat	ArgusMS	Kitchen	In cluster P8, south wall. Facing into room
S	131	Reed switch	ArgusMS	Kitchen	Reed switch over left utility door
S	132	Reed switch	ArgusMS	Kitchen	Reed switch over right utility door
S	133	Light	ArgusMS	Kitchen	In cluster P7, over counter. Facing into room
S	134	Heat	ArgusMS	Kitchen	In cluster P7, over counter. Facing into room
S	137	Light	ArgusMS	Bathroom	In cluster P14, east wall. Facing into room
S	138	Heat	ArgusMS	Bathroom	In cluster P14, east wall. Facing into room
S	139	Humidity	ArgusMS	Bathroom	In cluster P14, east wall. Facing into room
S	140	Reed switch	ArgusMS	Bathroom	Reed switch over door
S	141	Vent position	ArgusMS	Living Room	Inside living room vent
S	142	Vent position	ArgusMS	Kitchen	Inside kitchen vent
S	143	Vent position	ArgusMS	Bedroom	Inside bedroom vent
S	144	Vent position	ArgusMS	Bathroom	Inside bathroom
V	1	Motion	ArgusD	Bedroom	Northwest corner of ceiling

Table C.1 – continued

Zone	ID	Type	Source	Room	Location
V	2	Motion	ArgusD	Bedroom	1 sensor south of V1
V	3	Motion	ArgusD	Bedroom	2 sensors south of V1
V	4	Motion	ArgusD	Bedroom	3 sensors south of V1
V	5	Motion	ArgusD	Bedroom	Southwest corner of ceiling
V	6	Motion	ArgusD	Bedroom	North center of ceiling
V	7	Motion	ArgusD	Bedroom	1 sensor south of V6
V	8	Motion	ArgusD	Bedroom	2 sensors south of V6
V	9	Motion	ArgusD	Bedroom	3 sensors south of V6
V	10	Motion	ArgusD	Bedroom	South center of ceiling
V	11	Motion	ArgusD	Bedroom	Northeast corner of ceiling
V	12	Motion	ArgusD	Bedroom	1 sensor south of V11
V	13	Motion	ArgusD	Bedroom	2 sensors south of V11
V	14	Motion	ArgusD	Bedroom	3 sensors south of V11
V	15	Motion	ArgusD	Bedroom	Southeast corner of ceiling
V	16	Motion	ArgusD	Bedroom	On ceiling in closet
V	17	Motion	ArgusD	Kitchen	West on ceiling

Table C.1 – continued

Zone	ID	Type	Source	Room	Location
V	19	Motion	ArgusD	Kitchen	Center on ceiling
V	20	Motion	ArgusD	Kitchen	East on ceiling
V	21	Motion	ArgusD	Bathroom	On ceiling over toilet
V	22	Motion	ArgusD	Bathroom	On ceiling over shower
V	23	Motion	ArgusD	Bathroom	On ceiling over bathroom door
V	24	Motion	ArgusD	Living Room	Northwest corner of ceiling
V	25	Motion	ArgusD	Living Room	1 sensor south of V24
V	26	Motion	ArgusD	Living Room	2 sensors south of V24
V	27	Motion	ArgusD	Living Room	3 sensors south of V24
V	28	Motion	ArgusD	Living Room	Southwest corner of ceiling
V	29	Motion	ArgusD	Living Room	North center of ceiling
V	30	Motion	ArgusD	Living Room	1 sensor south of V29
V	31	Motion	ArgusD	Living Room	2 sensors south of V29
V	32	Motion	ArgusD	Living Room	3 sensors south of V29
V	33	Motion	ArgusD	Living Room	South center of ceiling
V	34	Motion	ArgusD	Living Room	Northeast corner of ceiling

Table C.1 – continued

Zone	ID	Type	Source	Room	Location
V	35	Motion	ArgusD	Living Room	1 sensor south of V34
V	36	Motion	ArgusD	Living Room	2 sensors south of V34
V	37	Motion	ArgusD	Living Room	3 sensors south of V34
V	38	Motion	ArgusD	Living Room	Southeast corner of ceiling
V	39	Couch Seat Switch	ArgusD	Living Room	Couch - east wall
V	40	Chair Seat Switch	ArgusD	Living Room	Chair - southeast corner

Table C.2. MavPad Argus Sensor Components

Component	Quantity	Unit Price	Total Price
Master	1	\$57.04	\$57.04
Mini-blind Master	1	\$69.76	\$69.76
Motion Master	2	\$78.20	\$78.20
Super Slave	3	\$92.28	\$276.84
Dongles	14	\$8.87	\$124.18
Light Sensor	18	\$1.56	\$28.08
Temperature Sensor	12	\$1.26	\$15.12
Reed Switch	6	\$2.47	\$14.82
Humidity Sensor	4	\$20.00	\$80.00
Motion Sensor	36	\$12.00	\$432.00
Grand Total			\$1,176.04