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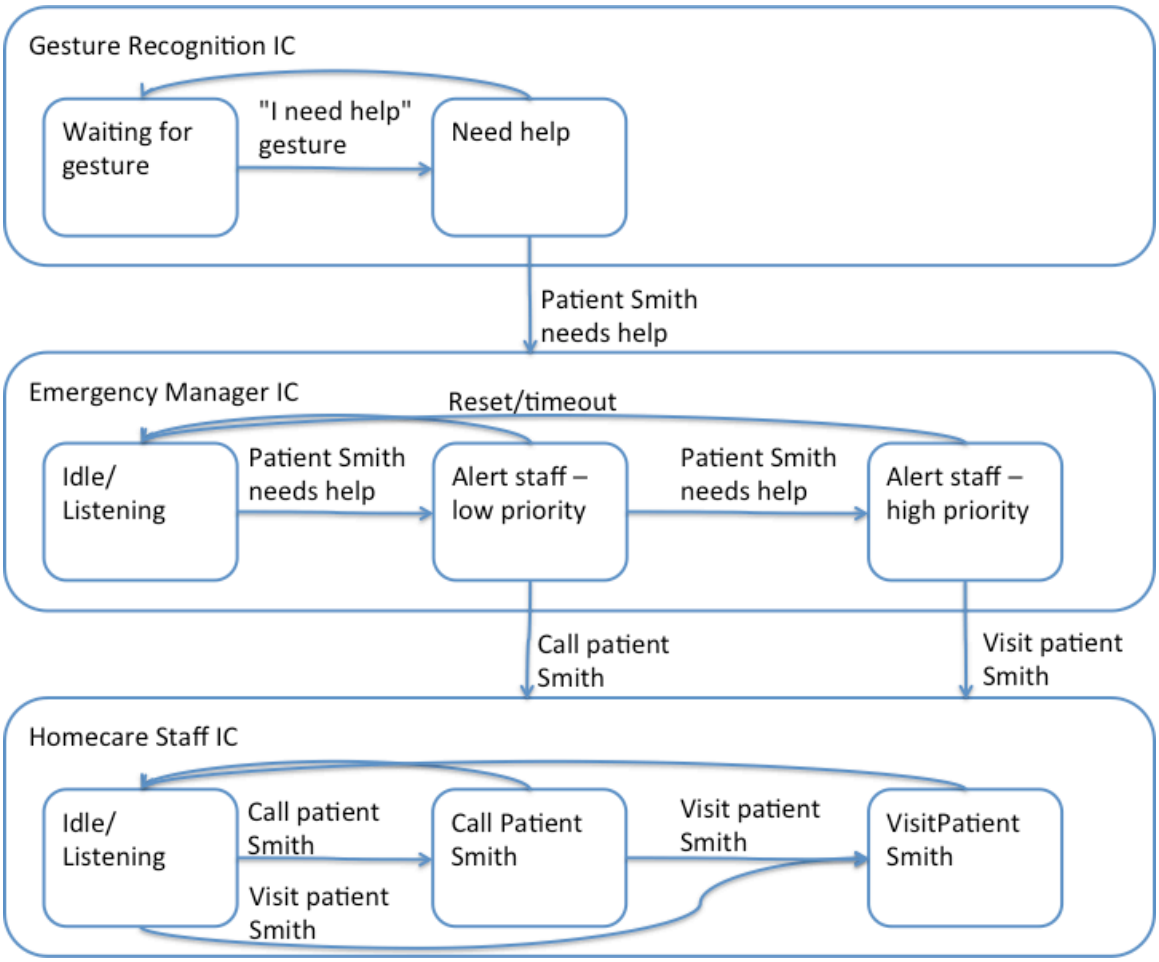
**CS2310 Exercise 2:**

The purpose of this exercise is to enable the students to gain familiarity with the active index approach to active information system design. As discussed in class, the hypermedia model and the active index together can be used to model active distributed multimedia information systems. In this exercise we will first concentrate on the active index component.

Let us consider a Personal Health Care System for a senior citizen living alone at home. The senior citizen may not be computer-literate. Therefore he/she will use gestures to communicate with the system. Let us assume there is a **gesture recognition index cell** that can recognize user's hand gestures. If the gesture index cell detects an "I need help" gesture then it will send a message, "Patient Smith needs help", to the **emergency manager index cell**. The emergency manager cell will send a message, "Call patient Smith", to the **homecare staff index cell**. If the senior citizen makes another "I need help" gesture, which is again sent by gesture index cell to the emergency manager cell, the emergency manager cell will send a message, "Visit patient Smith", to the homecare staff index cell. In other words, multiple "I need help" messages from the gesture index cell will prompt the emergency manager cell to send "Visit patient Smith" to the homecare staff cell. The homecare staff cell will call the patient if he/she receives a message "Call patient Smith" from the emergency manager cell. If the homecare staff cell cannot reach patient Smith by phone, or a message "Visit patient Smith" is received from the emergency manager cell, then the homecare staff will jump into the ambulance and drive to Mr. Smith's home. (Note: Exercise 2 is similar to previous Exercise 2, except the application was changed from distance learning to personal healthcare in 2011).

**(a) Draw state-transition diagrams to define graphically the three index cell types.**



**(b) Specify the three index cell types formally using mathematical notations ic = (X, Y, S, $s_o$, A, $t_{max}$, f, g).**

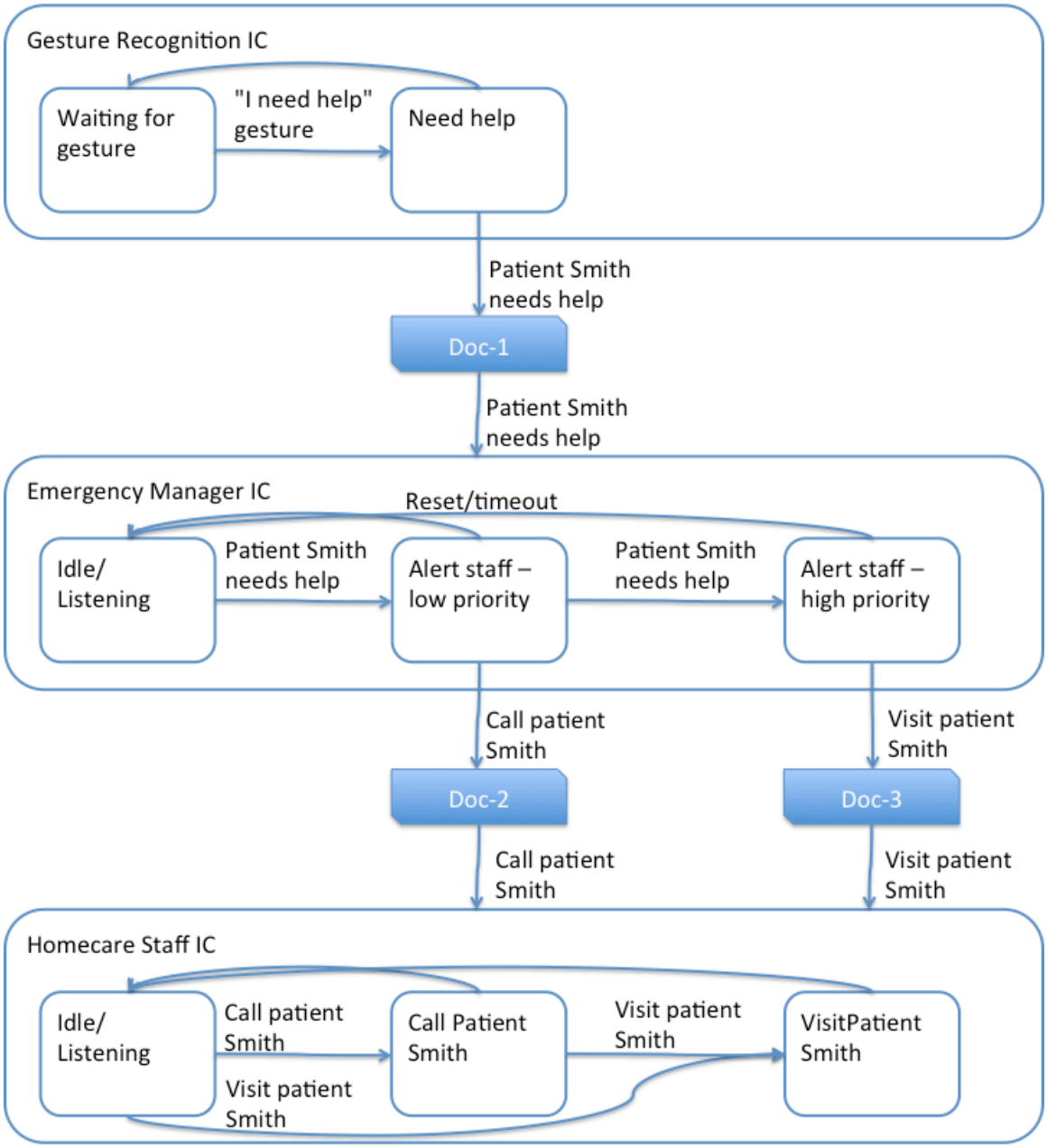
GR_ic = (
X = {d, "I need help" gesture},
Y = {d, "Patient Smith needs help"},
S = {"Waiting for gesture", "Need help", s_dead},
$s_o$ = "Waiting for gesture",
A = {none, "Patient Smith needs help"}
$t_{max}$ = infinity
f : f({"I need help" gesture}, "Waiting for gesture") = 1,
f({d}, "Need help") = 1,
g: g({"I need help" gesture}, "Waiting for gesture") = (EM_ic, "Patient Smith needs help", "Need help", "Patient Smith needs help")
g({d}, "Need help") = (nil, nil, "Waiting for gesture", none)
}

EM_ic = (
X = {d, "Patient Smith needs help"},
Y = {d, "Call patient Smith", "Visit patient Smith"},
S = {"Idle", "Alert low priority", "Alert high priority", s_dead},
$s_o$ = "Idle",
A = {none, "Call patient Smith", "Visit patient Smith"},
$t_{max}$ = infinity
f: f({"Patient Smith needs help"}, Idle) = 1,
f({"Patient Smith needs help"}, "Alert low priority") = 1,
f({d}, "Alert low priority" ) = 1,
f({d}, "Alert high priority" ) = 1,
g: g({"Patient Smith needs help"}, Idle) = (HS_ic, "Call patient Smith", "Alert low priority", "Call patient Smith"),
g({"Patient Smith needs help"}, "Alert low priority") = (HS_ic, "Visit patient Smith", "Alert high priority", "Visit patient Smith"),
g({d}, "Alert low priority" ) = (nil, nil, Idle, none),
g({d}, "Alert high priority" ) = (nil, nil, Idle, none)
}
HS_ic = (
X = {d, "Call patient Smith", "Visit patient Smith"},
Y = {d}
S = {"Idle", "Call", "Visit", s_dead},
$s_o$ = "Idle",
A = {none}
$t_{max}$ = infinity
f : f({"Call patient Smith"}, Idle) = 1,
f({"Visit patient Smith"}, "Call") = 1,
f({"Visit patient Smith"}, Idle) = 1,
f({d}, "Call") = 1,
f({d}, "Visit") = 1,
g: g({"Call patient Smith"}, Idle) = (nil, nil, "Call", none),
g({"Visit patient Smith"}, "Call") = (nil, nil, "Visit", none),
g({"Visit patient Smith"}, Idle) = (nil, nil, "Visit", none),
g({d}, "Call") = (nil, nil, "Idle", none),
g({d}, "Visit") = (nil, nil, "Idle", none),

}

All of these are perennial (always live), since all need to be constantly "at the ready", as emergency systems should be.

**(c) Draw a diagram showing three multimedia interfaces (webpages such as doc-1, ..., doc-3) enhanced with the index cells to illustrate how these index cells work together to form an active index system.**




Doc-1 might be an email notification or other real-time alert to the Emergency Manager IC.
Doc-2 could be an email or text message to the Homecare Staff IC.
Doc-3 could be a text message or automated phone call to the Homecare Staff IC.

**(d) Following the discussion on the concept of patterns, define more clearly the pattern(s) you have identified. If you feel the patterns you have identified are lacking in certain respect, you may replace them by some new patterns.**

1) All ICs have an "Idle" or "Waiting" default state. Every IC goes back to its waiting state when not active.

2) There is an escalation pattern for both the EM_ic and HS_ic. When the GR_ic sends multiple messages in rapid succession, escalation is done at the other ICs.

3) There is a delegation pattern from the EM_ic and HS_ic. The EM informs the HS what needs to be done, and then the HS is expected to perform that duty.

**(e) A visual specification of the identified pattern(s) should be included, using for example visual grammar rules. Remember Alexander's dictum: "If you can't draw a picture of it, it isn't a pattern.")**