Agents

1. Victim casualties requiring emergency medical care
2. Ambulances vehicles to transport the victims ; has three EMT skill level
3. DMAT disaster medical assistance team; DMAT consists of EMS physicians and nurses
4. Field EMS mobile ED unit with care personnel and equipment
5. Hospital includes emergency department and operating rooms of different specialties
6. EMA emergency management agency who is in charge of managing response operation

InjuryType: (Itype:int * severity: int)

Patient (ID:int * age:int * Survival:int * numI:int * Injuries:[ ] :Int * symptoms: [ ]:int * Xray:bool * TD:int)

Ambulance (ID:int, type:int, deployed:bool, delay:int, treatmentDelay:int)

# of patients

Posted on: Friday, October 12, 2018 12:24:18 PM EDT

casualties per event ~80 to 120

Survival Rate and Medications

Posted on: Friday, October 12, 2018 12:22:20 PM EDT

the survival rate begins at 100, until injuries are generated. Since injury severity is a score 1, 2 or 3 then for each injury subtract 10*SEVERITY of that injury from the current score.

upon arrival of emergency teams the survival rate should improve. 1) level 1 EMT, 2) level 2 EMT 3) DRT (disaster response team) The survival rate is improved by 5* response team type.

Time until death is hard coded as the survival percentage times (24hours * 60minutes) = Survival % * 1440 minutes until time until death.

1. ID are sequential starting at #1000
2. Age is 1, 2, 3, 1 = young (25%) , 2 = elderly (25%), 3 = adult (50%)
3. Survival is the survival rate (unknown to responders but effected by them)
   When injuries are added the survival rate will be reduced.
4. numI is the number of injuries
5. TD is the time to death without treatment in MINUTES
6. Symptoms [ ] is generated for the patient when the injuries[ ] is generated.
7. %percent chance of mis-triage will either leave out an injury or add one by mistake

Casualties [ ]:patient

Coding Phase 1:

Accept as input the number of casualties and then generate their associated pseudo-random Oct-tuples.

Display ()

Final Coding Phase

Check Patient list for deaths based on survival percentage

Patients [list] -> Event_manager function

Event_manager -> deploy the ambulances (severity =3 if avail → EMT3 (best emergency response team), else send EMT 2, else send EMT 1.)

- ➔ Severity = 2 first send EMT2 if avail, else send EMT1
- ➔ Severity = 1 send EMT1

Ambulance tuple: 21

Id: 1 through 21, 1 EMT3, 8 EMT2, and 12 EMT1

Type 1, 2, 3

Bool deployed

Delay in time steps 5 to 30 (road conditions and distance) + (severity(worst)*5).

Delay to treatment = int(Delay/2)

Once deployed == true we will subtract 1 from the Delay until Delay = 0

When TreatmentDelay = 0, the Survival % is improved by 5*type of ambulance.

Once deployed they are no longer available until the delay is passed then deployed to false.

Ambulance (

1. Patient Profiles
   Age category 1 young, 2 adult, 3 elderly
   Injury Type (IT): 1 injury, 2 infection, 3 disease, 4 poison
   Severity 1, 2 or 3
   Number of injuries, 1 through 4 with reduced chances for multiple injuries.

Time to death w/o care in hours
A function of age, model, and severity.

Symptoms id (1 to 12) as a result of
Injury even id
Infection odd id
Disease Prime numbers
Poison multiples of 5

//optional
Likelihood for mistriage: a function of who is doing the triage & symptoms
Low <3%
Medium <10%
High <20%

ER procedures a function of ID and Severity
X-ray required Boolean

Program Outline:

Time Step

Hd(patients) -> Event manager

Event manager will attempt to deploy ambulances where appropriate

Deployed ambulance -> delay, treatment delay, set deployed to true

Ambulances continue to travel if deployed

Id treatment delay =0 they improve chance of survival.

Once delay is zero , the patient is at the hospital and deployed = false.

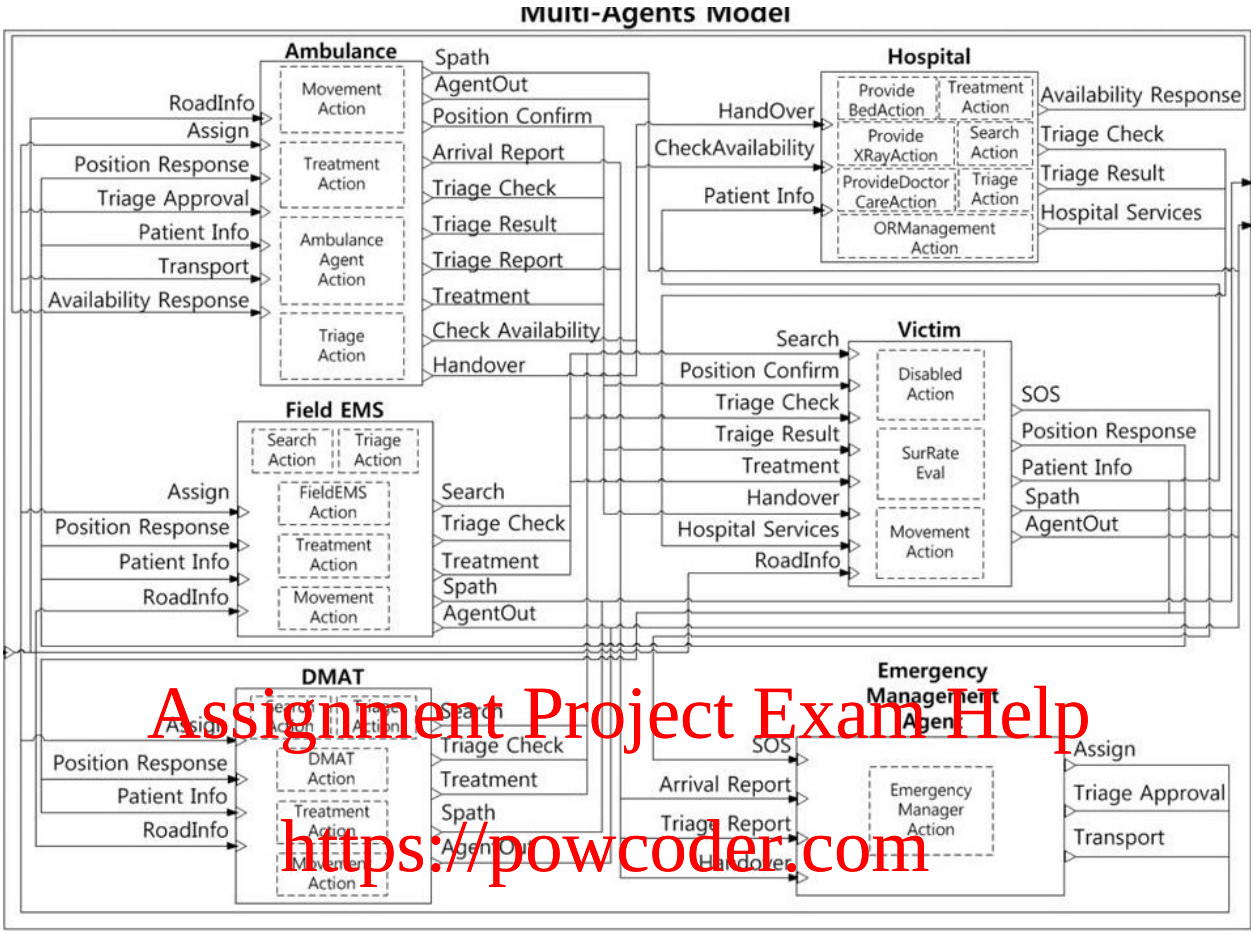

Table 3: EMS resources in the three locales.
Gangnam-district

Area [km2] 39
Emergency care 4 Level-2 EMC 1 Level-3 ED
Ambulances 20
119-operated 10 (9 stations)
Hospital-operated 10

For the Gangnam-district, we choose a large convention center in the downtown area as an MCI site and assume there are 80 casualties – 10 black, 20 red, 30 yellow, and 20 green.

As a main performance measure, we define a preventable death ratio, R as follows:

$$R(\%) = (1 - \frac{\sum_{i=0}^{N} P_f^i}{\sum_{i=0}^{N} P_o^i}) \times 100$$

where P_0^i is the initial survival probability of patient i, while P_f^i is the survival probability of patient i at the moment of care provision. The fraction in the parenthesis is the ratio of the expected number of surviving patients as a result of EMS provision to the expected number of survivors if EMS is immediately provided.

we use three variables related to the pre-hospital phase and four variables for the hospital phase.

The three pre-hospital phase variables are:

1) number of ambulances dispatched,
2) ratio of level-1 and level-2 Emergency Medical Technicians(EMTs),
3) number of DMATs dispatched.

The number of ambulances is varied at three levels: current level, 150% and 50% of the current level.

For the ratio of level-1 and level-2 EMTs, we use 4:6, 6:4 and 8:2 in the experiments.

EMTs carry out three functions in the simulation (triage, first-aid, hospital selection), and we assume level-1 EMTs have a higher probability of success over level-2 EMTs.

A DMAT is a medical assistance team dispatched to a disaster site, and it consists of doctors and nurses. They perform triage at a massive scale and provide treatments to stabilize a patient's condition. We use two levels in the experiments for DMATs: number of DMATs = 1 or 2.

Table 4: L18 orthogonal array used in the experiments.

Experiment Set	Pre-hospital phase factors			Hospital phase factors			
	EMT level-1:level-2	No. of Ambulances†	No. of DMATs	ED capacity	No. of X-ray rooms†	No. of EMS physicians†	No. of ORs
1	4:6	50 %	1	200 %	50 %	50 %	2
2	4:6	100 %	1	250 %	100 %	100 %	3
3	4:6	150 %	1	300 %	150 %	150 %	4