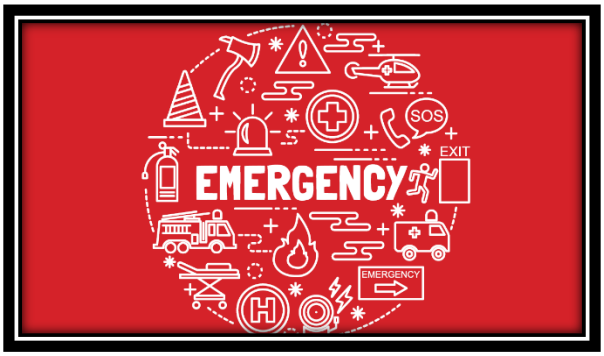
INFO6210: Data Management and Database Design

Database Design Document **Group 15**



Database Topic

Massachusetts Emergency Response System

Team Members

1. Aviral Agrawal
2. Vaibhavi Khamar
3. Zichun Wang

Database Purpose

The purpose of this database is to maintain the data used for the Massachusetts Emergency Response System related to Fire, Medical, and Police emergencies. This database can be used by Federal Services to track the emergencies, availability of vehicles and officers, their response time, and incident casualties.

Business Problems Addressed

- Ensures the most complete and up-to-date information about an incident, which would allow a reliable decision-making process.
- Allows all different emergency responder services and federal services to generate descriptive reports.
- To provide insights based on each department's response time. It will help departments to improve their response.
- To analyze the number of emergencies in each county, which will help to improve the overall emergency response system county-wise.
- Provides insights about the number of emergencies, officers responded to.
- Provides information about the vehicle's conditions & availability.

Business Rules

- An emergency can have one or more departments involved and each department can respond to multiple emergencies
- Each department (Medical, Police, Fire) must have one or more dedicated officers (Medical, Police, Fire) and each officer must be associated with one of the departments
- A patient must be assigned to a Hospital (Medical Department) and each hospital may have zero or many patients
- A police department can have zero or more suspect/victims and suspects/victims must be assigned to a police station
- Officers from all departments may be assigned to a particular vehicle and a vehicle must have one or more officers assigned to it
- A vehicle can respond to multiple emergencies and an emergency can be responded by multiple vehicles

Design Requirements

- Crow's foot notation is used to construct the ERD
- The primary key in each table is specified by placing "PK" beside the fields
- Dashed lines are used to represent Non-identifying relationships and solid lines to represent identifying relationships
- Crow's feet symbol is placed next to the table where the relationship line ends to specify the many sides of the relationship
- "One" was placed next to the tables where the relationship ends to specify the one side of the relationship
- A primary key is chosen such that they uniquely identify or represent each entity and is always non-null
- Foreign key within entities contain values that are in the referenced parent primary key and thus ensures referential integrity of the data

Design Decisions

No.	Entity Name	Purpose of The Entity	Relationship with Other Entities
1.	**Emergency**	• Emergency entity is one of the key entities of this database. This entity maintains all the details about the emergencies of all departments. • Each emergency is uniquely identified by EID. Additionally, it also contains attributes such as Type of emergency, location, time and status of emergency.	• Emergency entity is connected to Medical Department entity, Police Department entity and Fire Department entity via Associative Entity Department & Vehicle entity via Associative Entity VehicleAssigned. • Emergency entity to Patient, Victim, Suspect entity are a non-identifying and one-to-zero or many relationships. Emergency may have zero or more patient, victim or suspect. One patient, victim or suspect however belongs to one emergency at a time.
2.	**Department**	• Department is an associative entity that maintains mapping details between Emergency and different department entities. • It uses the Emergency entity's primary key as primary key and Medical, Police, Fire departments primary keys as foreign keys. It also contains response time attributes for all 3 departments.	• Department entity shares non-identifying relationships with MedicalDepartment, PoliceDepartment & FireDepartment entities. Also, they are one-to-zero or many relationships.
3.	**MedicalDepartment**	• MedicalDepartment entity maintains data about medical emergencies and hospitals. • Each hospital is uniquely identified by HID. It contains attributes such as Hospital	• MedicalDepartment entity is related to the Emergency entity through an associative entity due to the many-to-many relationship. Multiple emergencies responded by multiple departments.

		name, Hospital zip code & county.	• It also shares an identifying relationship with MedicalOfficer entity & a non-identifying with Patient entity. • MedicalDepartment entity to MedicalOfficer entity is one-to-one or many relationships as an emergency must be assigned to one or more officers. • MedicalDepartment entity to Patient entity is one-to-zero or many relationships as an emergency may have zero or more patients.
4.	**MedicalOfficer**	• MedicalOfficer entity maintains data about officers assigned to emergencies. • Each officer is uniquely identified using composite key made up of 2 keys namely OID & HID. A unique combination of these 2 keys(composite) represents each record in the table. • It contains details about officers such as their name, designation, DOB, Identity Document Number and contact information. Also, contains HID and VID as Foreign keys.	• MedicalOfficer entity shares an identifying relationship with MedicalDepartment entity & a non-identifying with vehicle entity. • MedicalOfficer entity to Vehicle entity is zero or one-to-one or many relationships. • MedicalOfficer may be assigned to zero or one vehicle, a vehicle however, must have one or more officers assigned to it.
5.	**Patient**	• Patient entity maintains data about patients associated with emergencies. • Each patient is uniquely identified by patID and details about patients such as their name, county, DOB, contact information & their status (recovered or not recovered). It also contains HID and EID as Foreign keys.	• Patient entity shares a non-identifying relationship with the MedicalDepartment entity and Emergency entity. • Patient entity to a MedicalDepartment entity is one-to-zero or many relationships. • Patients must be assigned to a hospital, a hospital however, may have zero or more patients.
6.	**PoliceDepartment**	• Police department is the most important department of all 3 department. All the information of suspects and victims will be collected in police department. • Each Police Department is uniquely identified by PID and it also contains	• Police department is belonging to department, and also parallel to other 2 department. Victim, Suspect and PoliceOfficer belongs to police department.

		attributes zip code & county.	
7.	**PoliceOfficer**	• PoliceOfficer entity belongs to PoliceDepartment entity. It will collect all the police officer info and show they are free or not. If some problems happen around their police stations, the department will send them to handle the problems. • Each officer is uniquely identified using composite key OID & PID. It also contains PID and VID as Foreign keys.	• Police officer entity belongs to PoliceDepartment entity. It is also parallel to suspect entity and victim entity. • At the same time, police officer entity is connected to the vehicle entity using zero or one-to-one or many, non-identifying relationships.
8.	**Victim**	• Victim entity belongs to PoliceDepartment entity. It collects the information of victims. Police officers will handle the case according to the victims' information. • Each Victim is uniquely identified by VicID. It also contains PID and EID as Foreign keys.	• Victim entity belongs to PoliceDepartment entity. It is also parallel to suspect entity and PoliceOfficer entity. • It shares a non-identifying relationship with Emergency entity and PoliceDepartment entity.
9.	**Suspect**	• Suspect entity belongs to PoliceDepartment entity. It collects the information of suspects. • Each Suspect is uniquely identified by SID. It also contains PID and EID as Foreign keys.	• Suspect entity belongs to PoliceDepartment entity. It shares a non-identifying relationship with Emergency entity and PoliceDepartment entity. • It is also parallel to victim entity and PoliceOfficer entity.
10.	**FireDepartment**	• FireDepartment entity only have power to handle the problems which is about fire emergency. All the information of victims and suspects in the fire emergency will be send to the police department. The officers in police department will take care of victims and arrest suspects.	• Fire department is belonging to Department, and also parallel to other 2 departments. FireOfficer belongs to fire department.

		• Each Fire Department is uniquely identified by FID and it also contains attributes zip code & county.	
11.	**FireOfficer**	• FireOfficer entity belongs to FireDepartment entity. It will collect all the fire officer info and show they are free or not. If some problems happen around their fire stations or officers' vehicles, the department will send them to handle the problems. • Each officer is uniquely identified using composite key OID & FID. It also contains FID and VID as Foreign keys.	• FireOfficer entity belongs to FireDepartment entity. It is connected to the vehicle entity using zero or one-to-one or many, non-identifying relationships.
12.	**VehicleAssigned**	• VehicleAssigned is an associative entity that maintains mapping details between Emergency and Vehicle entities. • It uses the parent entity's primary keys as foreign keys. Each record is uniquely identified using composite key EID & VID.	• VehicleAssigned entity shares an identifying relationship with Vehicle entity & Emergency entity. Also, they are one-to-zero or many relationships.
13.	**Vehicle**	• Vehicle entity maintain data about vehicles assigned to emergencies. • Each Vehicle is uniquely identified by VID. It contains attributes such as the Department name it belongs to, Type of vehicle & Mileage of vehicle.	• Vehicle entity is directly related to the Emergency entity through an associative entity due to the many-to-many relationship. Multiple emergencies responded by multiple vehicles. • Vehicle entity to MedicalOfficer, PoliceOfficer & FireOfficer entity are one or many-to-zero or one relationship. Officers may have zero or one vehicle assigned to them at a time, vehicle however, must have one or many officers assigned while responding to emergency.