***Project Report: 911 Emergency Calls Analysis***

**1. Introduction**

Emergency services (911 calls) generate large volumes of real-time data. Analyzing these calls helps government and public safety agencies improve resource allocation, response times, and overall preparedness.

In this project, we analyze a dataset of **911 emergency calls** to identify patterns, hotspots, and opportunities to reduce losses if similar incidents occur again.

**2. Dataset Overview**

* **Source:** 911 Emergency Calls Dataset
* **Size:** ~100k+ records (911.csv)
* **Key Columns Used:**
  + timeStamp → Date & time of call
  + title → Emergency type (contains Reason & Subtype)
  + twp → Township
  + zip → ZIP code
  + lat, lng → Location coordinates
  + Derived Columns: Reason, SubType, Hour, DayOfWeek, Month, Year

**3. Data Cleaning & Transformation**

Steps performed in Power BI / Python:

* Converted timeStamp to datetime.
* Extracted **Reason** (EMS / Traffic / Fire) from title.
* Extracted **SubType** (e.g., Vehicle Accident, Cardiac Emergency).
* Added new columns: Hour, DayOfWeek, Month, Year.
* Handled missing values in twp and zip by marking as "Unknown".
* Removed unused columns (desc, addr, e).

**4. Exploratory Data Analysis (Visualizations)**

**🔹 Calls by Reason**

* EMS calls are the **highest**, followed by Traffic and Fire.  
  ✅ Suggestion: More ambulances & medical staff needed.

**🔹 Top 10 Townships**

* A few townships (e.g., Abington, Lower Merion) dominate the call volume.  
  ✅ Suggestion: Deploy more emergency stations in high-demand townships.

**🔹 Calls by Hour of Day**

* Peak hours: **8 AM and 5 PM** (rush hours).  
  ✅ Suggestion: Keep more staff ready during traffic rush times.

**🔹 Calls by Day of Week**

* Weekdays > Weekends.  
  ✅ Suggestion: Increase patrols and staffing during weekdays.

**🔹 Monthly & Yearly Trend**

* Calls show a rising trend over years.  
  ✅ Suggestion: Long-term planning needed (funding, staffing, training).

**🔹 Heatmap (Day vs Hour)**

* Shows **clear spikes on weekdays during evening rush hours**.  
  ✅ Suggestion: Deploy traffic police + ambulances during those slots.

**🔹 Subtype Analysis**

* Top subtypes: Vehicle Accidents, Fire Alarms, Cardiac Emergencies.  
  ✅ Suggestion:
  + For Traffic: Better road safety & quick towing.
  + For EMS: Train staff for cardiac emergencies.
  + For Fire: More fire-prevention awareness.

**🔹 Geographic Distribution (Map)**

* Clusters in populated regions.  
  ✅ Suggestion: Emergency centers should be **closer to hotspots**.

**5. Conclusions**

1. **EMS calls dominate** → Medical response should be the top priority.
2. **Rush-hour spikes** → Calls peak around **5 PM weekdays**.
3. **Hotspot townships** → A small number of regions account for nearly 50% of calls.
4. **Traffic-related emergencies** → Vehicle accidents + disabled vehicles are major contributors.
5. **Rising yearly trend** → Emergency demand is increasing.

**6. Suggestions**

* **Resource Allocation:** More ambulances, fire trucks, and staff in hotspot townships.
* **Peak Hour Planning:** Extra staff during **8 AM–9 AM** and **4 PM–7 PM**.
* **Traffic Safety Programs:** Awareness campaigns + better road infrastructure.
* **Seasonal Preparedness:** Watch for monthly spikes → stock resources in advance.
* **Predictive Planning:** Use ML/time-series forecasting for proactive resource deployment.
* **GIS Planning:** Place new EMS/fire stations close to geographic hotspots.

**7. Tools Used**

* **Python (Pandas, Matplotlib, Seaborn):** Data Cleaning & Visualizations.
* **Power BI:** Dashboard creation.
* **Word / PPT:** Reporting & Presentation.

**8. Future Work**

* Apply **Machine Learning (classification)** to predict call type from input features.
* Apply **Time Series Forecasting (Prophet/ARIMA)** to forecast call volumes.
* Build a **real-time dashboard** with streaming data.