Emergency Response: A Multi-Agent System

Team 05

January 12, 2025

Overview

- Task 1 focused on environment and agent design
- Task 2 explored coordination mechanisms
- Now, we integrate these into a practical implementation
- Implementation utilizes **CrewAI** and **Ollama**
- In this presentation, we will cover:
  - Agents and their tasks
  - Crews module and data models
  - Database and tools
  - Scripts
  - Testing
  - Integration in `main.py` and `data/` folder

Agents and Tasks

- For each crew, we define agents and tasks using `.yaml` files.
- Each crew is represented as a Python class, with agents and tasks defined as methods within the class.
- Agents are instantiated with configuration settings, and tasks are created by linking them with specific tools and data models.

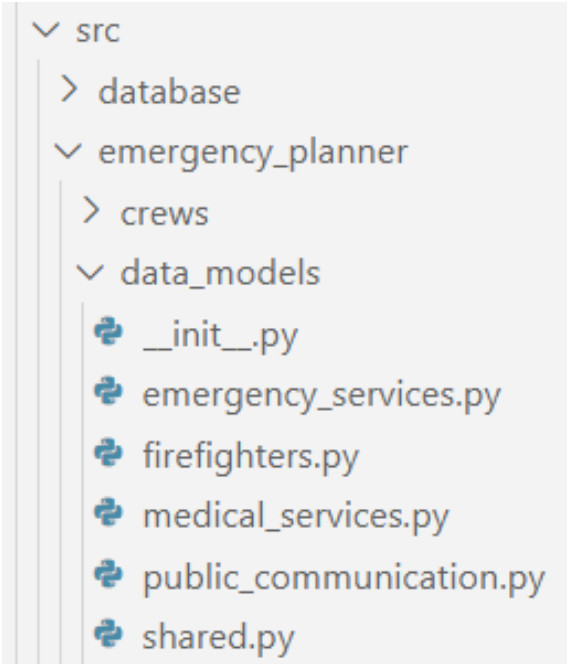
`medical_services/agents.yaml`

```yaml
hospital_coordinator:
  role: Hospital Coordinator
  goal: >
    ...
  backstory: >
    ...
  allow_delegation: false
  verbose: true
  llm: ollama/llama3.1
  temperature: 0.4
  max_tokens: 800
```

`medical_services/tasks.yaml`

```yaml
rank_hospitals:
  description: >
  ...
  expected_output: >
  ...
  agent: hospital_coordinator
  context:
    - fetch_hospital_information
```

src/emergency_planner/data_models/



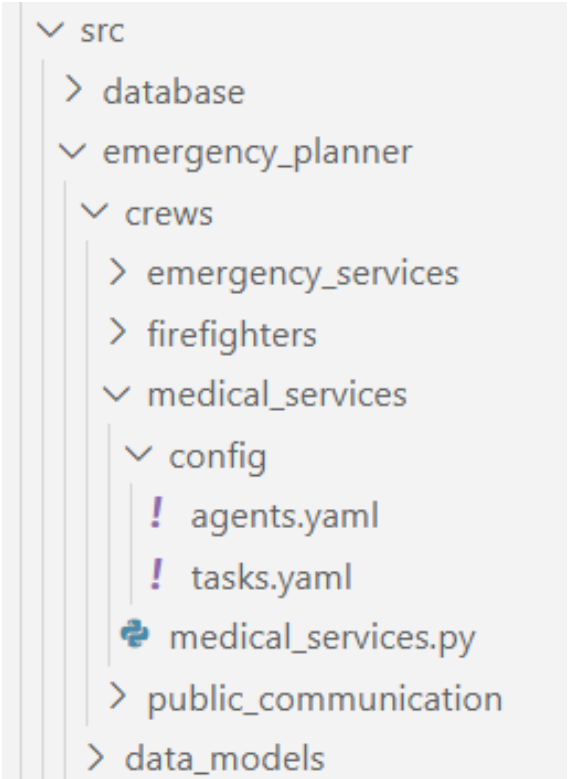
shared.py

```
FireType = Literal["ordinary",..., "other"]
FireSeverity = Literal["low", "medium", "high"]
...
def add_schema_to_task_config(task_config, schema):
   ...
    return task_config
```

public_communication.py

```
from pydantic import BaseModel
from .shared import FireSeverity, FireType
from .medical_services import MedicalResponseReport
...
class EmergencyReport(BaseModel):
  medical_response_report: MedicalResponseReport
  fire_type: FireType
  fire_severity: FireSeverity
  ...
```

src/emergency_planner/crews/



medical_services.py

```python
@CrewBase
class MedicalServicesCrew:
    """Medical Services Crew"""
    @agent
    def medical_services_operator(self) -> Agent:
        return Agent(config=self.agents_config["
            medical_services_operator"])
        ...
    @task
    def fetch_hospital_information(self) -> Task:
        config = add_schema_to_task_config(
            self.tasks_config["
                fetch_hospital_information"],
            HospitalsInformation.model_json_schema(),
        )
        return Task(config=config, tools=[
            hospital_reader_tool])
```

Scripts

Map Analysis

```
places = ["Barcelona, Spain",
    "Seville, Spain",
    "Salamanca, Spain",
    "Tossa de Mar, Spain",
    "Lloret de Mar, Spain",
    "New York, NY, USA"]
...
columns = ["n",
    "m",
    "k_avg",
    "edge_length_total",
    "edge_length_avg",
    "streets_per_node_avg",
    "intersection_count",
    "edge_density_km",
    "street_density_km",
    "clean_intersection_density_km"]
...
df = pd.DataFrame(mapp_stats, index=
     places)
```

Database Initialization

populate_incident_table()

```
CREATE TABLE incidents (
    summary TEXT,
    timestamp TEXT,
    fire_severity TEXT,
    fire_type TEXT,
    location_x REAL,
    location_y REAL)
```

populate_hospital_table()

```
CREATE TABLE hospitals (
    hospital_id TEXT,
    location_x REAL,
    location_y REAL,
    available_beds INTEGER,
    available_ambulances INTEGER,
    available_paramedics INTEGER)
```

GPS Tool

```
from crewai.tools import BaseTool
import osmnx as ox

class RouteDistanceTool(BaseTool):
    def __init__(self, **kwargs):
        super().__init__(**kwargs)
        self.city_map = ox.load_graphml(GRAPHML_FILENAME)

    def _find_distance(self, x_origin, y_origin, x_destination, y_destination):
        origin_node = ox.distance.nearest_nodes(self.city_map, x_origin, y_origin
            )
        destination_node = ox.distance.nearest_nodes(self.city_map, x_destination
            , y_destination)
        route = ox.shortest_path(self.city_map, origin_node, destination_node,
            weight="travel_time")
        edge_lengths = ox.routing.route_to_gdf(self.city_map, route)["length"]

        return round(sum(edge_lengths)) / 1000
```

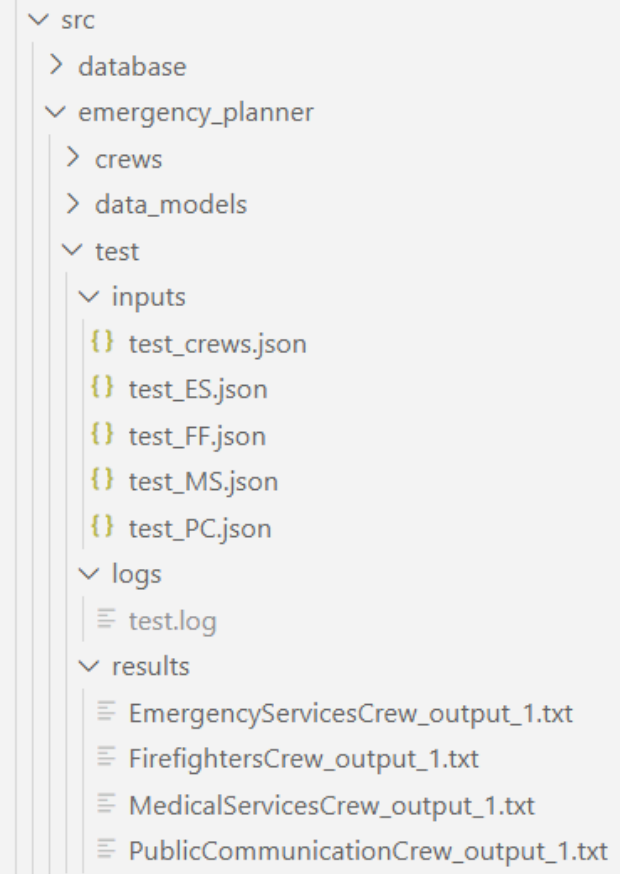
Database Tools

Tool	**Input**	**Output**
Hospital Reader	None	List of hospitals with their available resources
Hospital Updater	Hospital ID Beds Reserved Ambulances Dispatched Paramedics Deployed	None
Incident Retrieval	Location X Location Y Fire Severity Fire Type Summary	Related cases

src/emergency_planner/test.py

```
def process_crew_test(crew_name: str, crew_inputs: Dict[str, Any], test_index:
     int) -> None:
    ...
    crew = instantiate_crew(crew_name)
    logger.info("Agents loaded")
    for agent in crew.crew().agents:
        logger.info(f"Role: {agent.role}")
    ...
    for task in crew.crew().tasks:
        result = task.execute_sync(agent=task.agent, context=task.context, tools=
            task.tools)
    ...
    final_result = crew.crew().kickoff(inputs=crew_inputs)
    ...
def main() -> None:
    ...
    test_cases = load_test_cases(JSON_FILE)
    for i, test_case in enumerate(test_cases, start=1):
        ...
        # Input model validation
        ...
        process_crew_test(crew_name, crew_inputs, i)
    ...
```

src/emergency_planner/test/



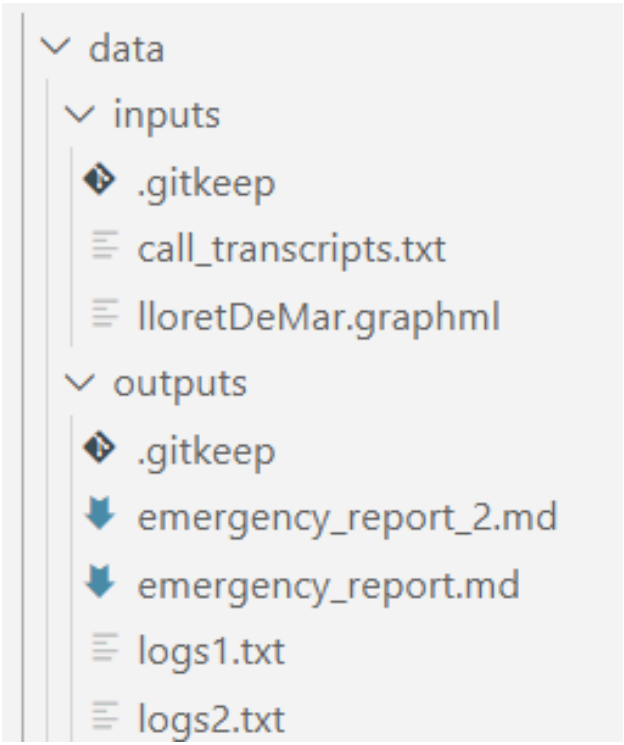
test_crews.json

```
{
    "test_cases": [
        {
            "crew_to_test": "EmergencyServicesCrew",
            "crew_inputs": {
                "transcript":
                    "A fire of electrical..."
            }
        }
    ]
    ...
}
```

src/emergency_planner/main.py

```
class EmergencyPlannerFlow(Flow[EmergencyPlannerState]):
    @start()
    def get_call_transcript(self): ...

    @listen(get_call_transcript)
    def emergency_services(self): ...

    @listen(emergency_services)
    def firefighters(self): ...

    @listen(emergency_services)
    def medical_services(self):
        if not self.state.call_assessment.medical_services_required:
            return
        ...

    @listen(or_(and_(firefighters, medical_services), "
         retry_public_communication"))
    def public_communication(self): ...

    @router(public_communication)
    def check_approval(self): ...
```

data/



src/emergency_planner/main.py

```
@start()
def get_call_transcript(self):
    with open(EMERGENCY_CALL_TRANSCRIPTS_FILENAME, "r"
        ) as f:
        self.state.call_transcript = f.readlines()[
            TRANSCRIPT_INDEX]
```

```
@listen("save full emergency report")
def save_full_emergency_report(self):
    full_emergency_report = f"""
# Emergency Report

## Call Transcript
{self.state.call_transcript}
...
"""
    with open(EMERGENCY_REPORT_FILENAME, "w") as f:
        f.write(full_emergency_report)
```

Thank you!

Questions?