

Developing a Surveillance System to Track Disease and Pollution

2007 ESRI Health GIS Conference

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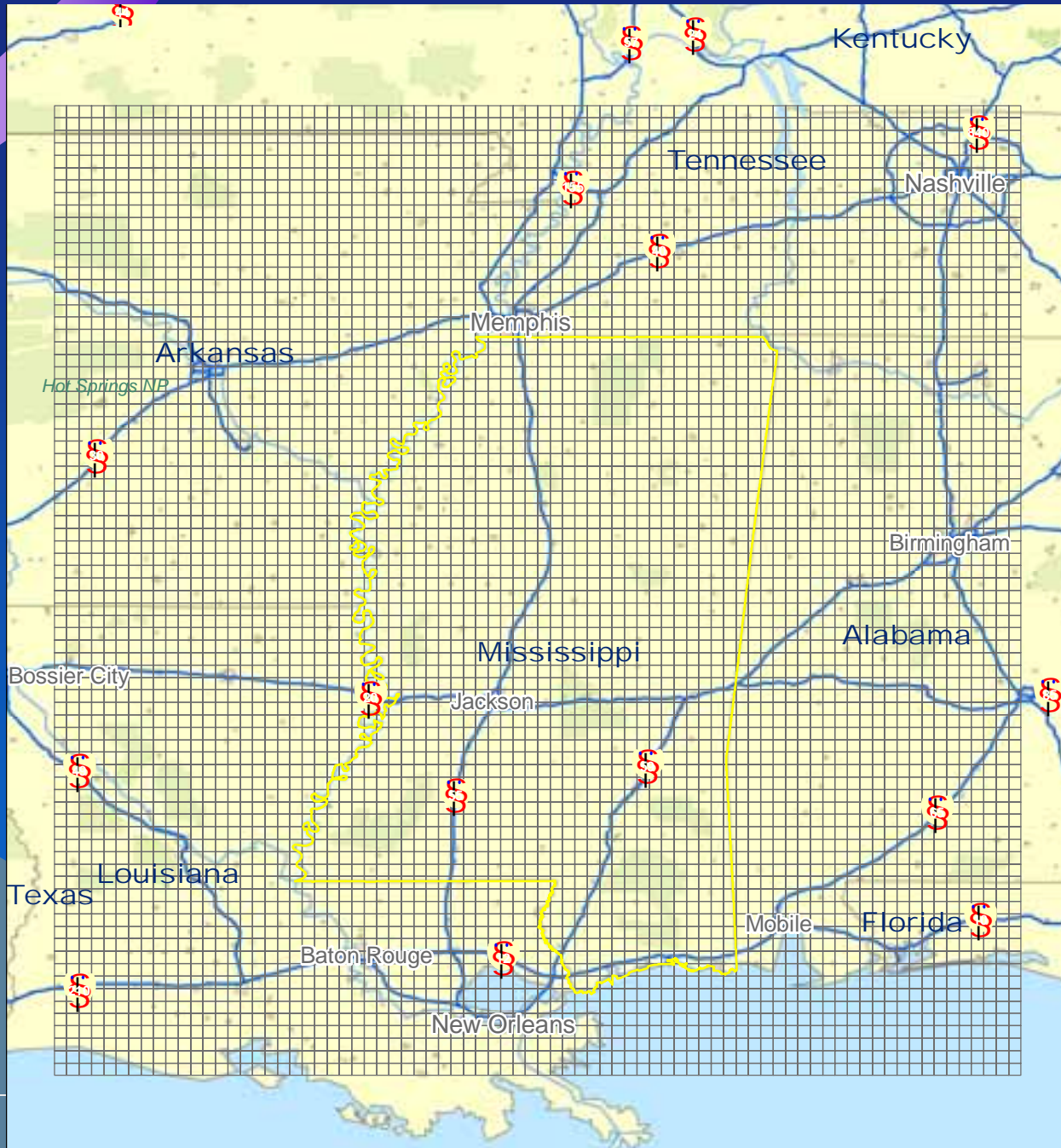
INTRODUCTION



- **Background**

NASA funded project: “Integration of NASA Research Results to Enhance Decision Support Tool for Asthma Surveillance, Prediction, and Intervention”

- **Grid level resolution**





Goals

- **Develop a system to track environmental related diseases and pollution over space and time on a real-time basis**
- **Facilitate study of health effects of air pollution on pollution-related diseases**



Data Sources

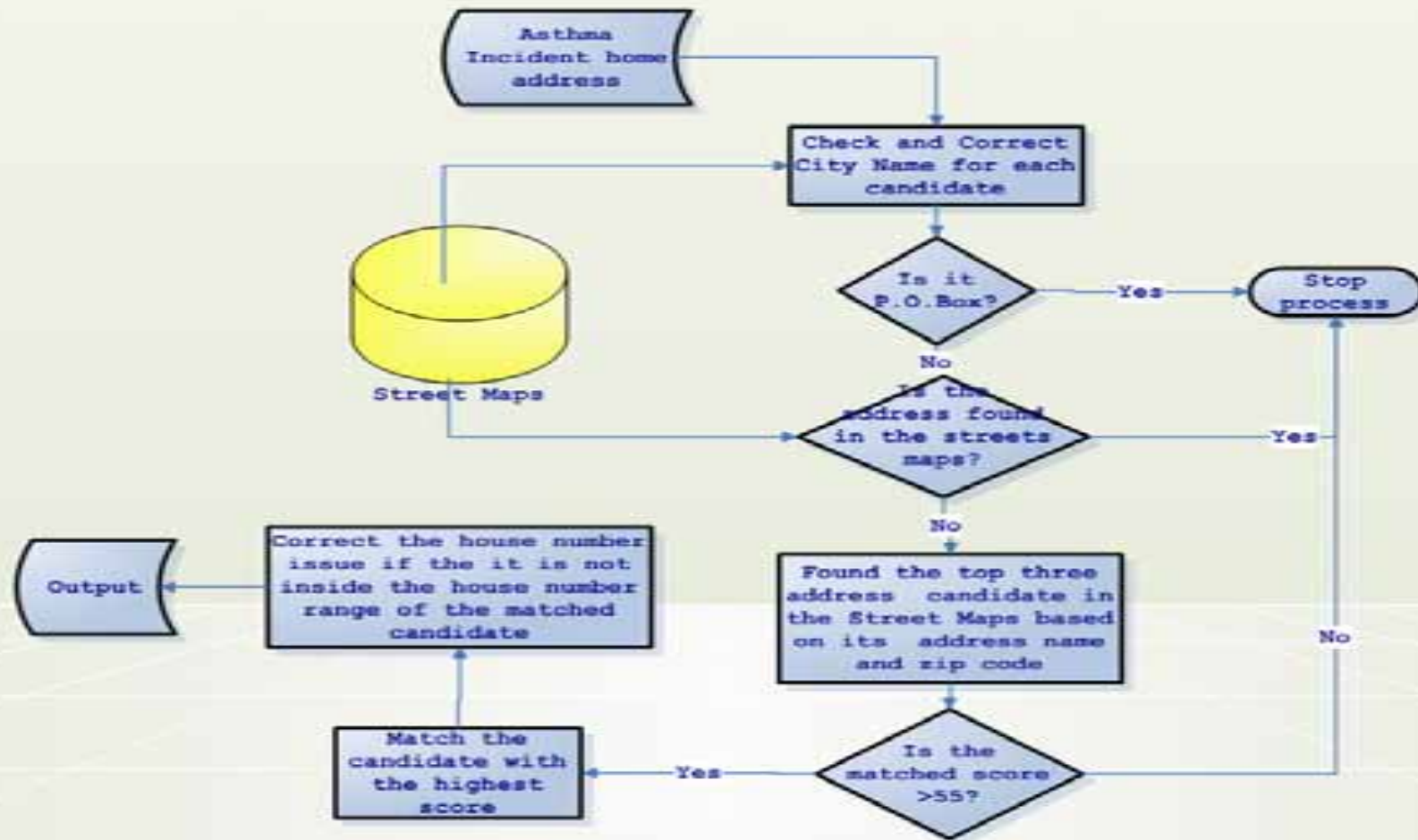
- Historic Data
 - Statewide Asthma Data: 2003-2005 from MS Hospitals
- Real-Time Data
 - Health: Patient Admission-Discharge Transfer (ADT) data from UMC Hospitals, Clinics, and ED Department
 - Air Quality: Daily Ground PM_{2.5} and Ozone Data from AirNow Gateway web site
 - Satellite: Daily MODIS AOD from NASA Goddard Earth Sciences Level 1 and Atmosphere Achieve and Distribution System (LADDS)
- Demographic Data
 - ESRI 2005 Community Tapestry data



Methodologies

- Pollution estimation
 - Pollutant-AOD linear regression model
 - Pollution surface: B-Spline surface models
- Health data collection
 - HL7 interface
- Patient ADT data Geocoding
 - Web service geocoding using ArcGIS Server ArcObjects API
 - Spatial join for spatial ID using ArcGIS ArcObjects API
- Geocoding solution improvement (next slide)

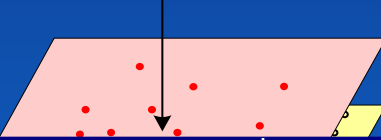
Improved Geocoding Solution (Diagram)





Methodologies

- Integration approach: Spatial scale levels
 - GRID
 - ZIP CODE
 - COUNTY



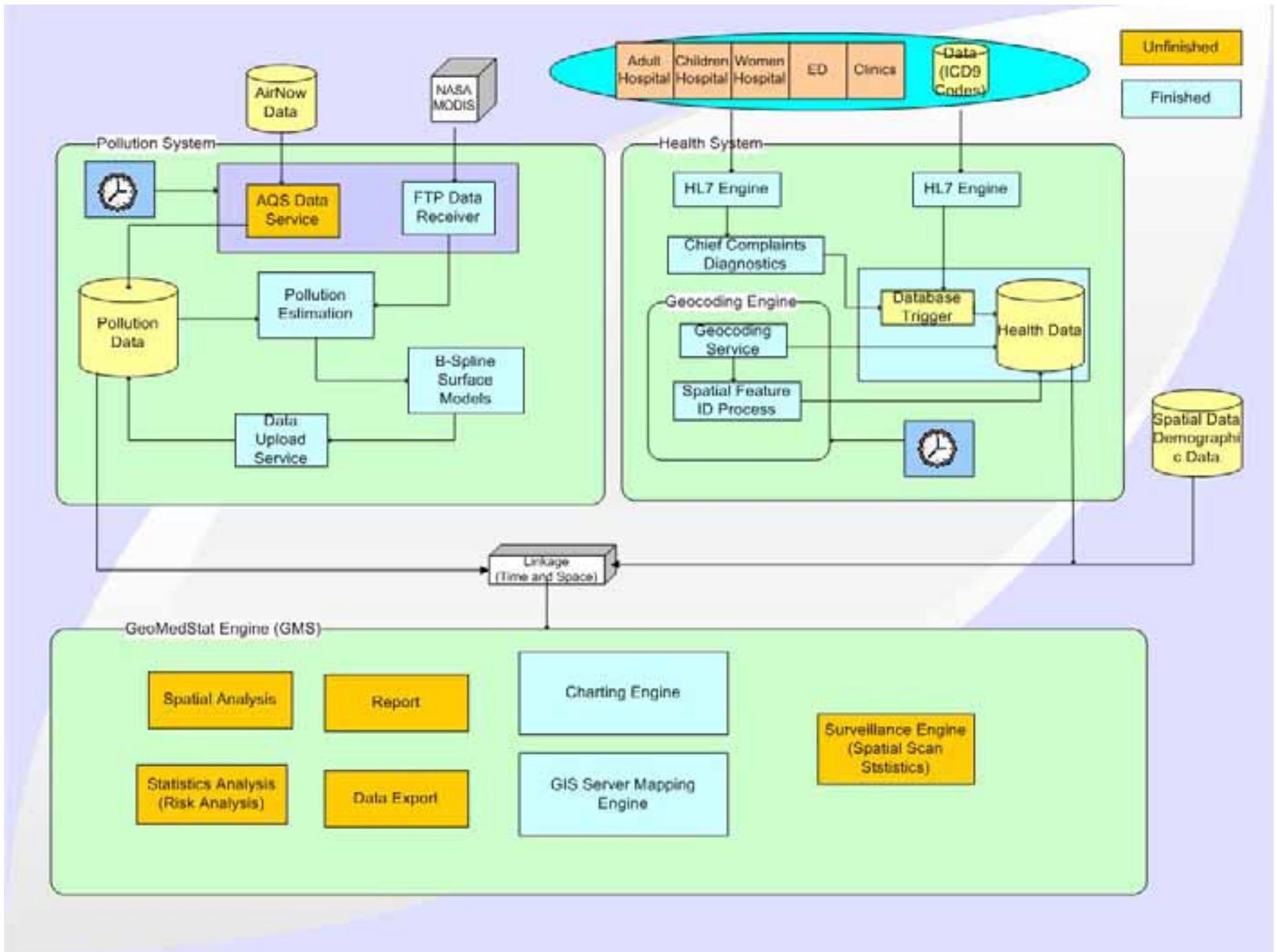
Pollutant	Date	GRID_ID	Value
PM _{2.5}	12/02/2003	1	23.34
PM _{2.5}	12/02/2003	2	12.34
PM _{2.5}	12/02/2003	3	32.12
PM _{2.5}	12/02/2003	4	3.2
...

Grid Extrapolation



Methodologies

- Demographic Data Interpretation
- Mapping approach
 - ArcGIS Server Pooled Mapping Service
 - ArcGIS Server Web ADF Framework for .NET
 - Database views for data aggregations
 - ArcGIS Server Common API for switch views
- Graphic display
 - Dundas Chart for ASP.NET





Results

- Pollution system
- Health system
- Automated geocoding system
- Mapping system
- Graphic display system



Discussion

- Pollution estimation
 - AOD and $PM_{2.5}$ relationship
 - Satellite data time: Coordinated Universal Time (UTC)
 - Satellite MODIS data for the study area of interest
 - Project system
- Respiratory Related Pollutants
 - PM_{2.5}, Ozone
 - Mold, Pollen and others
- Patient ADT data
 - Admitted date
 - Duplicate records:
 - First level: multiple identical records
 - Second level: inpatient, outpatient, and emergency visits
 - ICD9 codes: rank and person in charge



Discussion

- Mapping
 - Spatial scales
 - Temporal scales
 - Data sources and data aggregation levels
 - Mapping method: single day vs. multiple days
 - Mapping against different time period
 - Performance



Discussion

- Firewall issue between the database server and the application server
- Geocoding
 - Improved geocoding solution
 - Real-time geocoding service



Discussion

- ArcGIS Server Application
 - Rapid application development
 - Scalability
 - Mapping
 - Spatial analysis
 - Challenges
 - Uncertainty
 - Performance
 - Technical support



Conclusion

- We have developed a surveillance system capable of tracking pollution and pollution-related diseases on a real-time basis



Acknowledgements

- **CDC/MDH:** Spatial Data Visualization and Electronic Surveillance of Patient Database
- **NASA/MRC:** Integration of NASA Research Results to Enhance Decision Support Tool for Asthma Surveillance, Prediction, and Intervention



Team Members

- **UMMC:**
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- **Worth Williams** - Sr. Programmer/Analyst

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- .
- **Collaborators:**
- NASA Marshall Space Flight Center
- Mississippi Department of Health
- Asthma Coalition of Mississippi / American Lung Association of Mississippi
- Mississippi Department of Environmental Quality

Thank You!

