Intelligent Mobile Agent for Future of First Response*

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Rapid Growing Number and Types of Internet of Things (IoT) Sensors

Fixed Sensors

Mobile Sensors

Body-Worn Sensors

Specialized Hazmat Sensors

First Responder Drone Sensors

* Image source: google.com

https://www.youtube.com/watch?v=IBE-DxQwyjw
AUDREY for DHS Next Generation First Responder (NGFR)

- Keep them safe
- Keep them healthy
- Make IoT simple
- Make communication reliable
- Turn data into intelligence
- Support decision making
- Improve performance
- Enable collaborations

1. Collect first responder streaming data (GPS, temp., etc.)
2. Correlate relevant data with Internet of Things (IoT) data
3. Analyze FR data, contextual information, operations details, general knowledge, etc.
4. Synthesize, learn, interpret, react
5. Deliver insight to first responder
AUDREY for NGFR
Why is this a hard problem?

- Decision Making with Incomplete / Difficult Observations and Communications
- Rule / Policy-based Systems Fail with Real-World Problems
- Model-based Approaches Fail with Complex Problems
- Human-System Interface in High Stress Environments
- Need to Make Predictive Recommendations in Real-time
- Learning with Few Examples
- Collaborate Across Jurisdictions

AUDREY needs to Fuse, Analyze, Reason, Predict, Advice, Learn, Collaborate
AUDREY (Assistant for Understanding Data through Reasoning, Extraction, & sYnthesis)

- AUDREY use bio-inspired Neural Symbolic Processing
  - Mixed neural and symbolic processing by achieving neural processing at symbolic level for higher level cognitive reasoning
- AUDREY leverage human intelligence to achieve better machine intelligence
- AUDREY capabilities:
  - Reasoning and learning new knowledge at the same time
  - Deal with missing or contradictory data
  - Automatically synthesize workflows to answer questions
  - Learn from human and a community of Audrey nodes

Image source: google.com

The Evolution of AI

Achieves unprecedented levels of reasoning for previously unsolvable problems

* Image source: google.com
Audrey – Artificial General Intelligence Assistant

(Assistant for Understanding Data through Reasoning, Extraction, & Synthesis)

NGFR Needs:
- Improve First Responder Safety & Performance
- Process Huge Amount of IoT and Other Data

Audrey AI Personal Assistant

★ Reads
★ Thinks like a person
★ Data Fusion

★ Learns
★ Uses tools to Solve Problems
★ Discover Unknowns

Audrey Software

High-Speed Tool Interface Bus

Library of Analytic Functions

Workflow Execution (KNIME, Hadoop, MapReduce)

Data Source Pub-Sub Distribution

NGFR Needs:

- Process Huge Amount of IoT and Other Data

Audrey Automates Data Analytics
ATAK Audrey Plugin Development (ATAK- Android Team Awareness Kit)

Audrey Plug-in

Live Deployment to Android

Live GPS Coordinates at JPL Campus

JPL Audrey Plugin for ATAK

JPL Campus
Audrey in the Cloud and on ATAK

Continuous Data Processing and Sensor Data Fusion

Audrey in the Cloud

Live Situational Insight Specific to each First Responder

First Responder Out on the Field

Discovered available Sensors Relevant to Live First Responders

Sensor Observation Service (Discovery)

Gas Sensor

Environmental Module

Sensor Module

OGC®

Temperature etc.
Physiological Sensors and Patches

MVSS applied to the temple

Vital Signs Sensor (VSS)
- Battery
- Sensor Head
- On/Off Switch
- Wireless Micro-Controller
- Real Time Clock

Choice of Sensor Position
- Placement Near Arteries for PPG Sensing and Assessment

Smart Phone GUI
- Wireless Data
- Event History

Field Monitoring and Assessment
- Patient Monitoring
- Dive Training
Augmented Reality Display

EPSON BT-300 Augmented Reality Glass
Wearable Alert and Monitoring System (WAMS)

- The Controller builds upon an Android-based “plug-in” framework to enable on-demand updates to core functionality

- Allows Audrey to download IoT sensor processing software to Audrey Controller based on the discovered sensors
- Reduce communication bandwidth needs from IoT sensors by pushing intelligence to the edge
- Manage communication priorities based on type of traffic (ex. vital signs can take priority over video when bandwidth is limited)
- Enables Audrey to perform limited vital function when communication is not available
- Intelligently manage Comm Hub based on the conditions of the networks
- Manage and maintain ad-hoc networking under highly disruptive environments
- Enables intelligent IoT networking
- Support goal-driven automatically IoT sensor composition
Each component is built and deployed into a Docker container.

So each one is primed to run on a cloud environment.
The section below defines all the tidbit rules as specified by the ESM scientists:

* The Tidbit rule T1 applies frequently if Freq, PRI, PW, and Time of the record are contained in the activity.
* If Freq, PRI, and Time of the record are contained in the activity, this Tidbit rule T2 sometimes applies.
* If Freq, PW, and Time of the record are contained in the activity, this Tidbit rule T3 sometimes applies.

```xml
<Audrey>
  <Define_Tidbit_Rule Name='T2' Given_Confidence='0.6' Audrey_Confidence='0.6' Frequency='1' English='When the [Freq, Pw, and Time] of the record are contained in the activity, then the Tidbit Rule [T2] Applies with the confidence [0.6]'>
    <If>
      <And>
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          <Symbol Name='Freq_In_Record_Activity'/>
          <Number VALUE='0.5'/>
        </Call>
        <And>
          <Call>
            <Symbol Name='Pw_In_Record_Activity'/>
            <Number VALUE='0.5'/>
          </Call>
          <Call>
            <Symbol Name='Time_In_Record_Activity'/>
            <Number VALUE='0'/>
          </Call>
        </And>
      </And>
    </If>
  </Define_Tidbit_Rule>
</Audrey>
```
Knowledge Populated in Cortex
Potential Audrey Data Sources

- First Responder Wearable Sensors

- IoT, Smart City sensors

- Emergency Management Centers

- Internet, Social Media
Teaching Audrey Operational Process
Audrey Knowledge Editor
Audrey Learn About User

User Profile

User Preferences
DHS S&T Next Generation First Responder (NGFR) Program
AUDREY Artificial Intelligence Agent and Internet of Things (IoT)

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Situationally relevant sensors & data is autonomously discovered

Neural nets learn and classify sensor data

Ontologies used by Audrey to autonomously classify and reason over their environments

Fuse situationally relevant information in real-time to provide insight to decision makers and first responders to enable them to make the best possible decisions relative to their role.

Audrey / Audrey Agent

Situational Awareness Reasoning Process

OGC

(4) Fuse situationally relevant information in real-time to provide insight to decision makers and first responders to enable them to make the best possible decisions relative to their role.
Questions?

* Source: fullhdpictures.com

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