

Heterogeneous Artificial Agents for Triage Nurse Assistance

D.M. Wilkes, Stan Franklin, Erdem Erdemir, Stephen Gordon, Steve Strain, Karen Miller and Kazuhiko Kawamura

Proceedings of the 2010 IEEE-RAS International Conference on Humanoid Robots

<https://ieeexplore.ieee.org/document/5686839>

DIPARTIMENTO DI INGEGNERIA INFORMATICA
AUTOMATICA E GESTIONALE ANTONIO RUBERTI



SAPIENZA
UNIVERSITÀ DI ROMA

Presented by Cecilia Aponte

Goal of the study

- Propose a system of cognitive robots “TriageBot System” to shorten waiting time in ER, relieve overburden of medical staff, and reduce mistakes
- First to address the use of robots in ER
- Function for less severe case patients (60%):
 - Gather logistical and medial info
 - Take diagnostic measurements
 - Give tentative, possible diagnoses to nurse and recommendation to non-physician care
- Feasible (in principal) with advances in sensor technology and cognitive control architecture



Importance

- Overcrowding in ER is a major public health problem as identified by the Institute of Medicine
- Unpredictability of amount of patients, arrival times, type of illness and future complications
- This increases patient mortality, time to treat infections, blood clots, and pain
- Affecting mainly minorities (African-American, Hispanic), low-income, uninsured, and women
- Robot assistants can therefore improve ER throughput and provide a safer environment

The Concept



Humanoid
Cognitive

Chair
Motor-skills

- **Robot Registration Assistant:** upon arrival gets basic info and some diagnostic data (pain and level with Visual Analog Scores)
- **Robot Triage Nurse Assistant:** takes measurements in a chair instrumented with sensors. Calculates ESI score and priority in the queue

The Concept



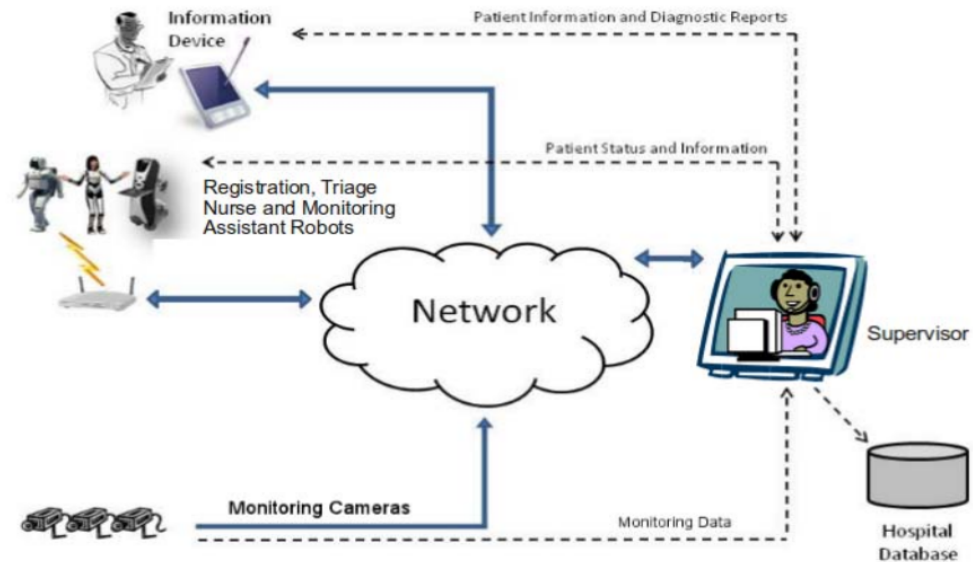
Mobile
Cognitive

N/A
Sensors

- **Robot Monitoring Assistant:** periodically checks patient in waiting room. May take simple measurements and pain level
- **Robot Supervisor:** central manager of robots and check for events such as unconscious patient. May calculate possible diagnoses and suggest early testing

Proposal and Conclusion

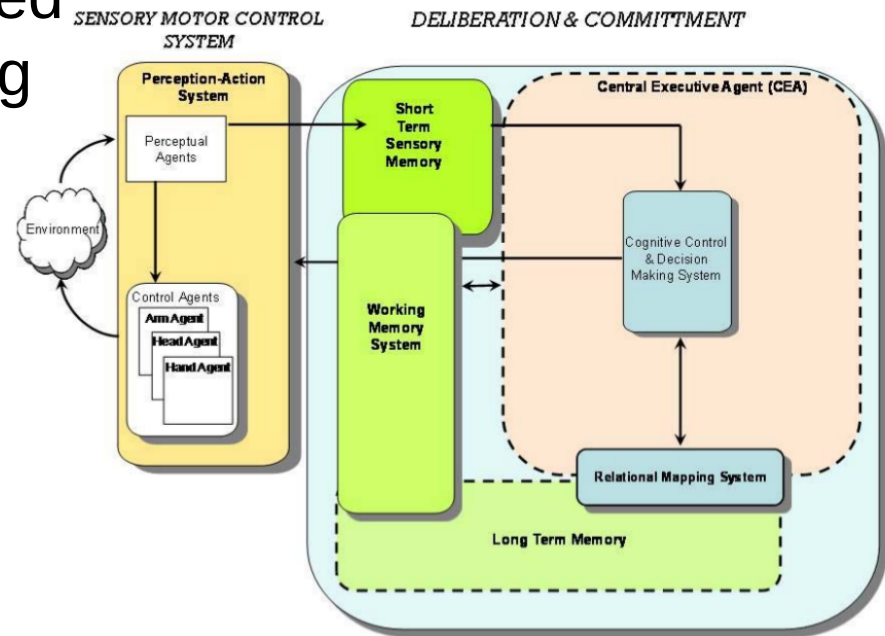
- Agents that communicate and interact with patients, doctors and nurses through LAN



- Capable of learning what to pay attention and know what it doesn't know (to extract it)
- Cognitive control to react correctly to varying situations (rather than precisely)

Proposal and Conclusion

- Awareness of unexpected events and unpredictable behaviors
- Create a plan given current knowledge and state, or interrupt a cycle due to new information, or folded into the currently forming plan if information is consistent with partial plan



Challenges

- ★ • Ethics – model and design system to protect health, safety, and privacy of patient
- ★ • Support NLP with medical emergency vocabulary
- Conventional computer-assisted diagnosis have had limited success in improving practitioner performance and outcomes (LIDA Architecture)
- ★ • Gather reliable measurements
- Interpretation of events during waiting (use patient's record and badge)

Discussion of Paper

- Other challenges not included: handicapped, languages
- Reduction of measurements to only necessary & use of other robots such as Samsung Bot Care Bixby which reads blood pressure and heart rate
- Final decision of proposed diagnosis should be checked and finalized by a medical staff
- Liked: focus on ethics, use of medical record to check on patients and use of badge
- No mention of multi-agent architecture
- Implementation advances?



Relation to my project

- Concept is very similar to what I had envisioned for my project
- Some additional features that can be added:
 - Knowledge of expectation in ER
 - Use of Visual Analog Scores and ESI scores for diagnosis
 - Checking patients through general cameras for events such as unconsciousness (out of scope for project)



Takeaway message

- A lot of work and detail is still necessary for the execution of this concept
- To start, a single robot can be put in place to understand the details and challenges in the initial phase as the patient arrives
- Further advances in AI, Robotics, and sensing will enable this implementation

