An IoT-based Real Time Low Cost Monitoring and Notification System for Aged Care

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Motivations

- The elderly population (person 65 years or older) is growing significantly
  - Approximately 14% of the US population (or 50 million, which is more than the population of 25 states combined) reached retirement age in 2016 , and the statistics is expected to double in 2060.
  - Exorbitant cost of nursing homes (~$90500 annually for a private room). Consequently, only 5% of the older population lives there.
  - Most senior citizens live without 24/7 support of caregivers
- Hence, a real time, low-cost and easy-to-implement monitoring and notification system for elderly care will help those senior citizens who lost control of their bladders and bowel movement to get assistance in a timely manner.

Goals

Develop a monitoring and notification system that can continuously monitor the patients' body conditions, detect any significant changes and notify the care-givers automatically.

- This system can monitor multiple patients simultaneously.
- This system can provide instant notification to caregivers whenever any large fluctuation in the users' conditions is detected.
- The solution is affordable for low-income households.

System Architecture

The system consists of:

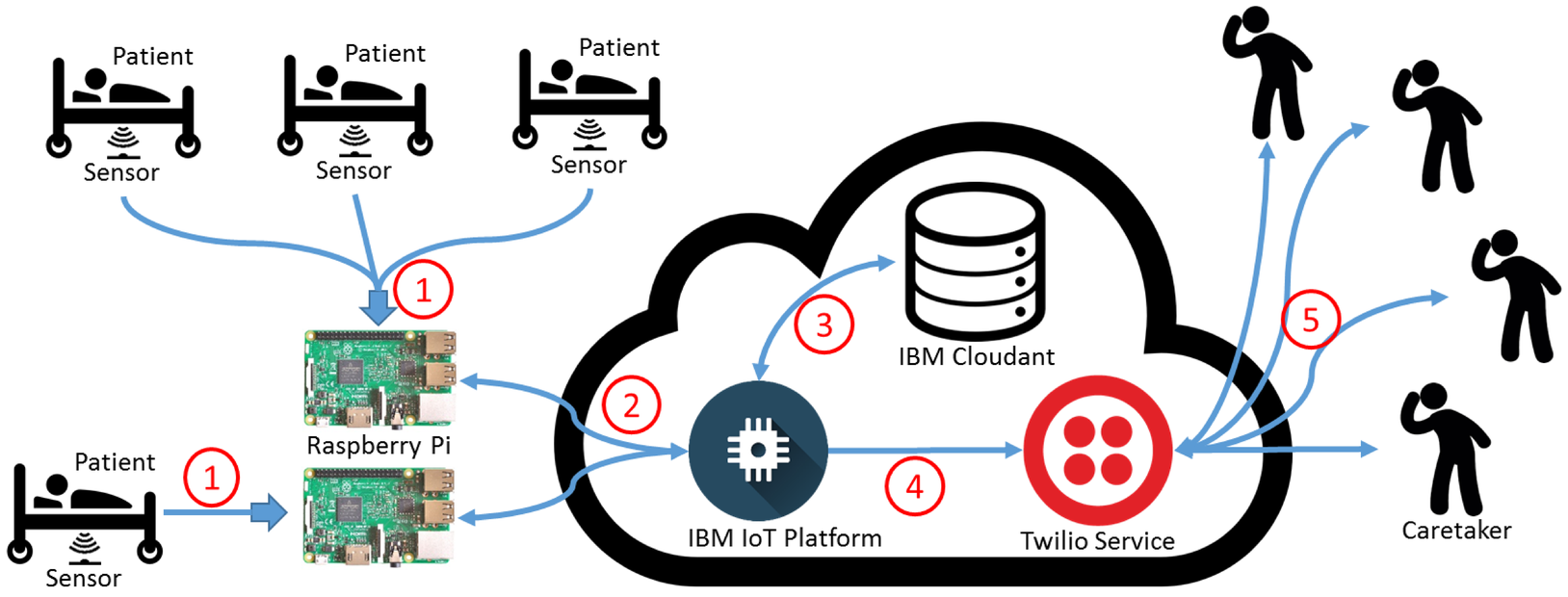
- A Sensing Unit: detects any changes in the patients' body temperature and moisture level.
- A Receiver/Transporter: receives data from sensor and/or transmits data to the Data Processing Unit.
- A Data Processing Unit: interprets data and sends notifications in various methods.

Sensing Unit
- TI Sensor Tag

Receiver/ Transporter
- Raspberry Pi 3

Data Processing Unit
- IBM IoT Bluemix Cloud Platform

Notification
- Phone Call
- Text Messaging
- Email
- Tweeter



1. Raw signal captured by TI SensorTag is sent to a controlling Raspberry Pi. The Raspberry Pi then interprets the signal and converts it into temperature and humidity readings. As shown in the picture above, a Raspberry Pi can simultaneously monitor multiple sensors.
2. A package of temperature and humidity readings, and a unique ID of Raspberry Pi are sent to an IoT Platform on IBM.
3. If temperature and humidity rise above a preset threshold, the system will trigger a database query to search for an appropriate contact.
4. IoT Platform sends a request to Communication Server to start sending out notifications to the caregiver's contact.
5. Communications back and forth with caregivers are handled by the Communication Server, which is powered by Twilio Service on IBM.

Result and Conclusion

- The team have developed a cloud-based system using IBM Bluemix that can
  - Monitor multiple gateway devices, which in turn control multiple sensors.
  - Capture bedding conditions of many patients in real time.
  - Send and receive text messages from caretakers to facilitate instant reaction.

Future Development

- Re-design sensors to be comfortably attachable to patients. Increase measurement accuracy for better data collection of the surrounding conditions.
- Install deployment system on Raspberry Pi to update software automatically.

References

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