MONITORING OF THE MEDICATION DISTRIBUTION AND THE REFRIGERATION TEMPERATURE IN A PHARMACY BASED ON INTERNET OF THINGS (IoT) TECHNOLOGY

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1. Abstract

- Primitive classification of medications on shelves by some pharmacies in underprivileged areas.
- Long queues for medication distribution due to traditional system.
- Difficulties to keep medications at a fixed refrigeration temperature.

2. Objective

- Proposing a simple and reliable approach for medication distribution and pharma-ceutical refrigeration temp. control.
- Cheaper solution for underprivileged businesses.
- User-friendly graphical user interface, based on touch sensor, adequate for even IT illiterates. All records on cloud.

3. Design

- **Intel Galileo board** as brain connected to sensors and cloud.
- **Touch sensors:** used to select a specific shelf of medication.
- **Potentiometer (pot):** loop through product within a shelf.
- **Relay module** triggered the refrigeration system when the sensor observes tempera-tures within certain range.
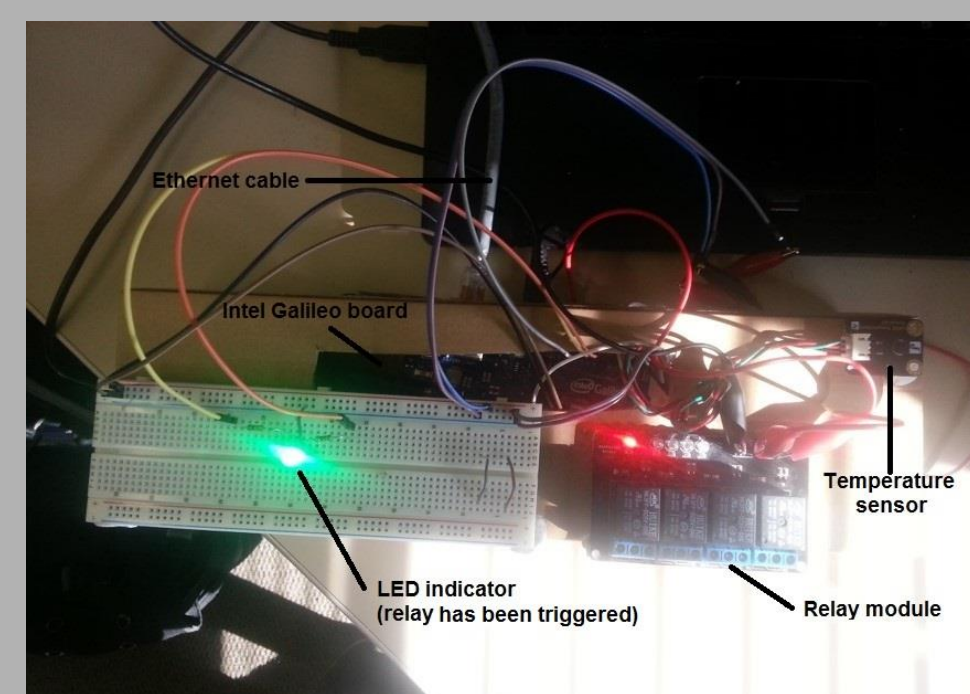- **Xively** and **Zapier** used for cloud repository and online data visualization.
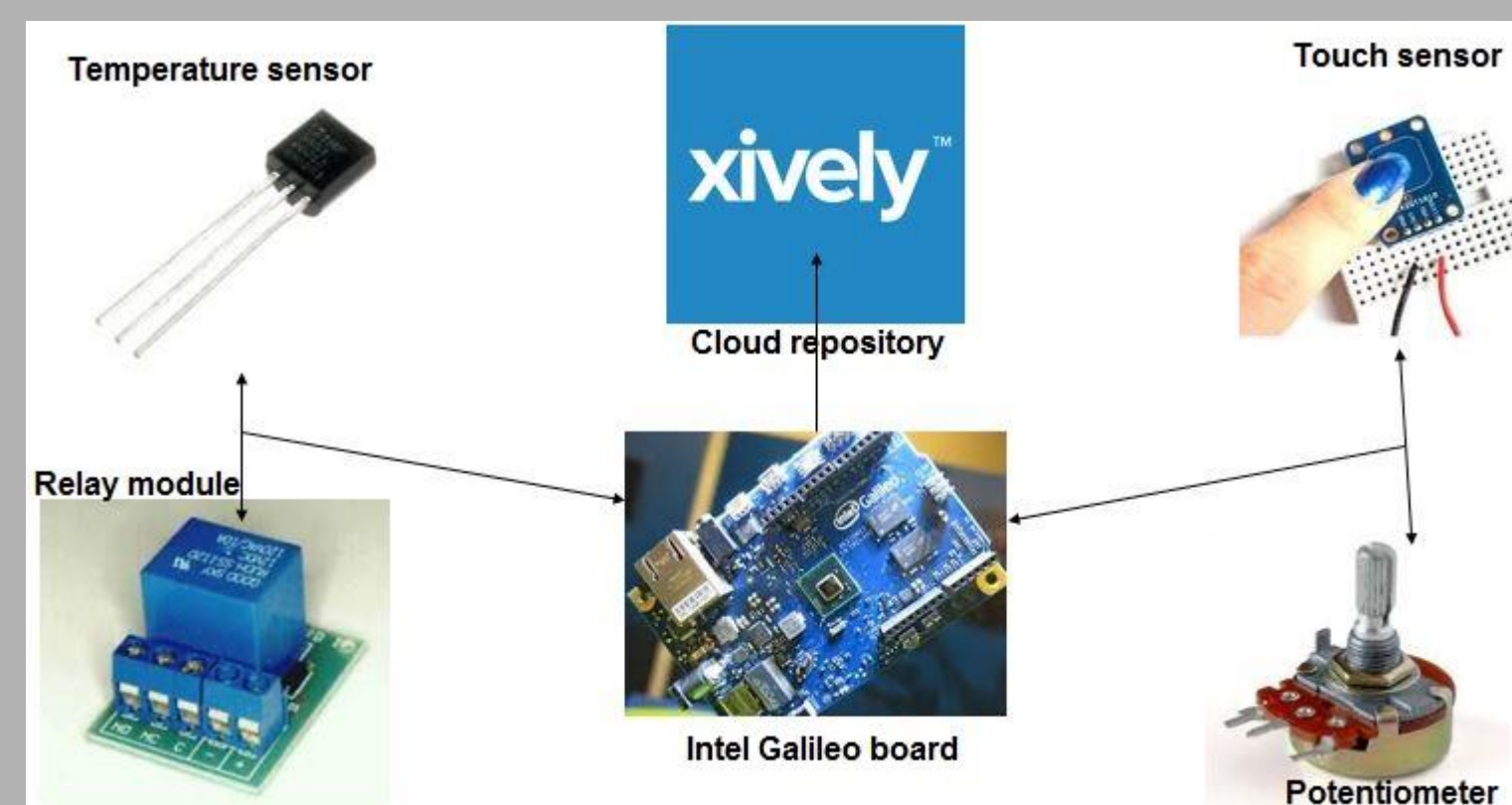
4. Implementation

System divides into 2 subsystems:
- Medication distribution monitoring (MDM) for medication distribution and management
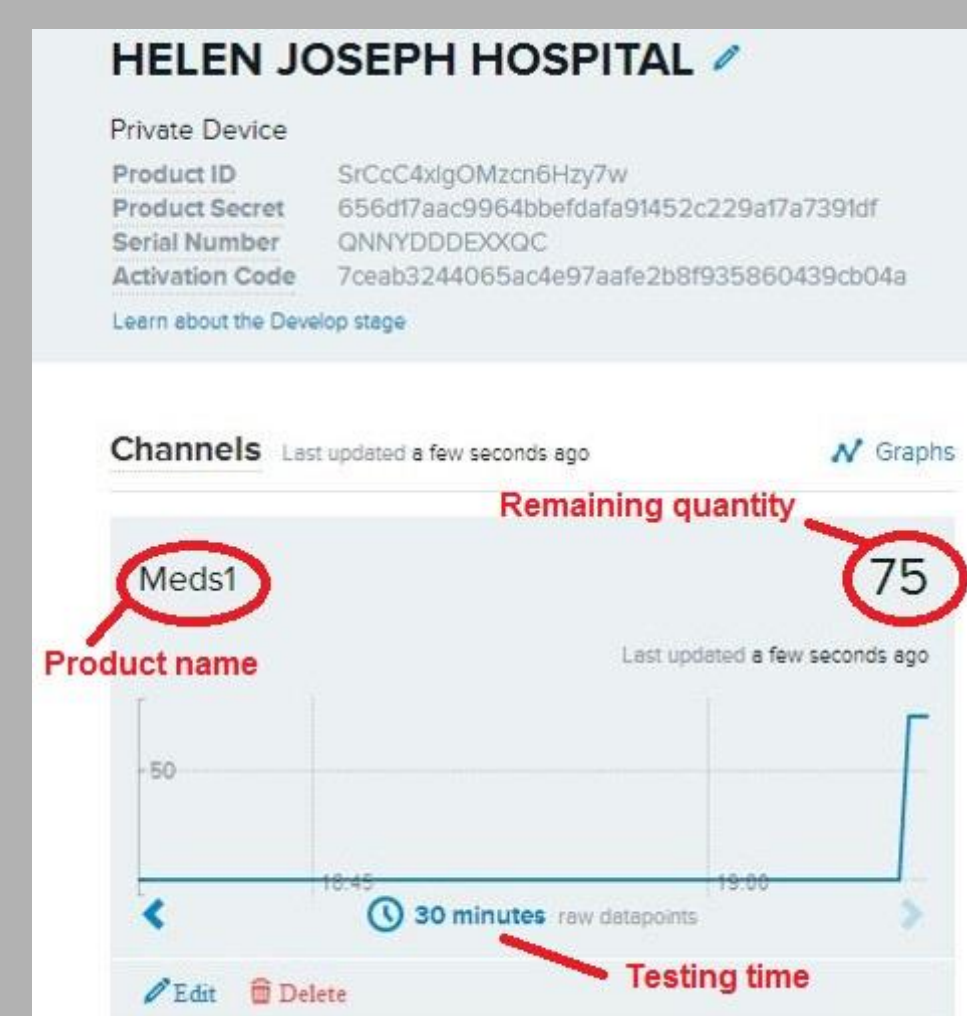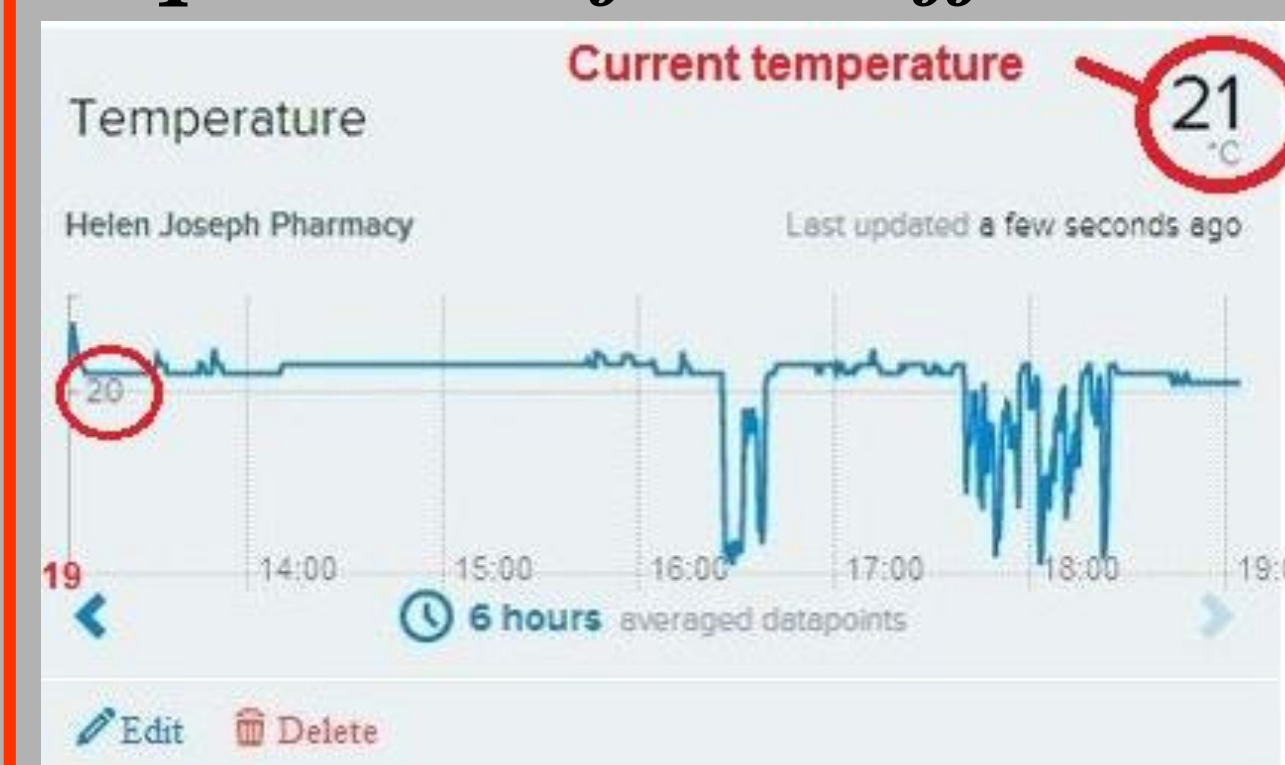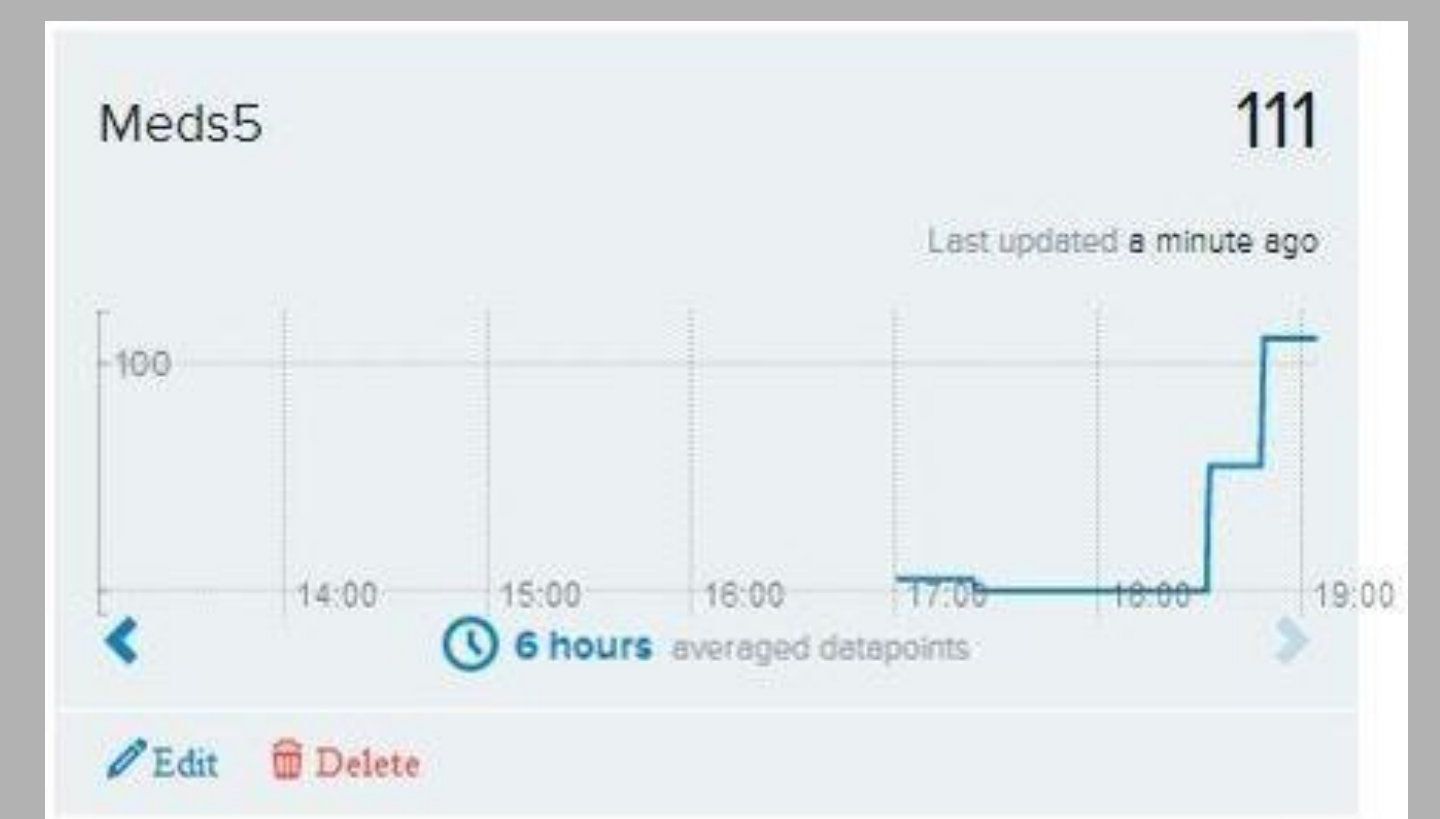- Temperature Control (TC) for monitoring the refrigeration temperature of diverse medications.
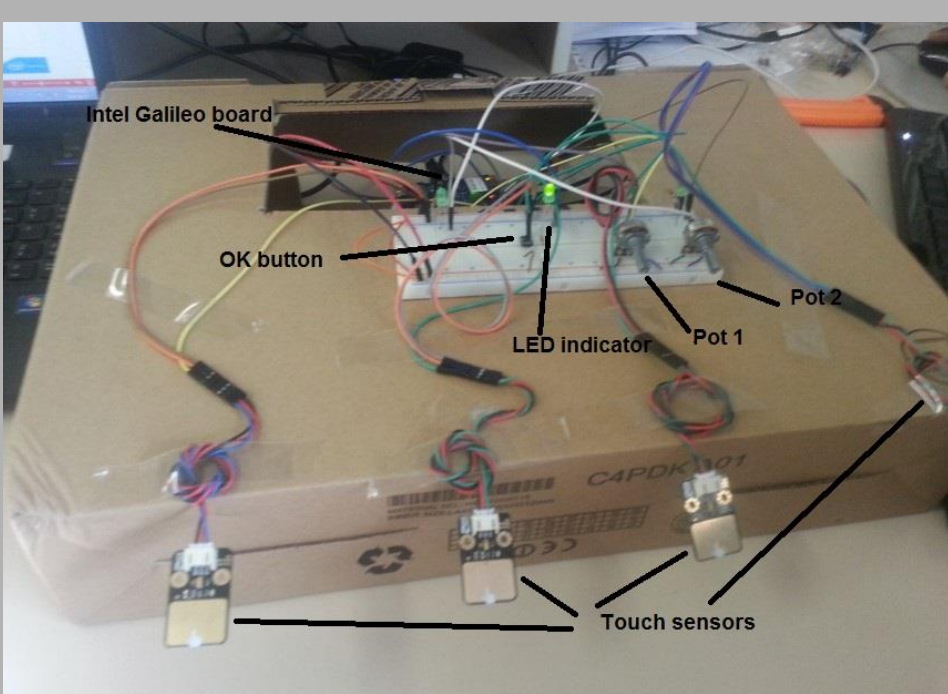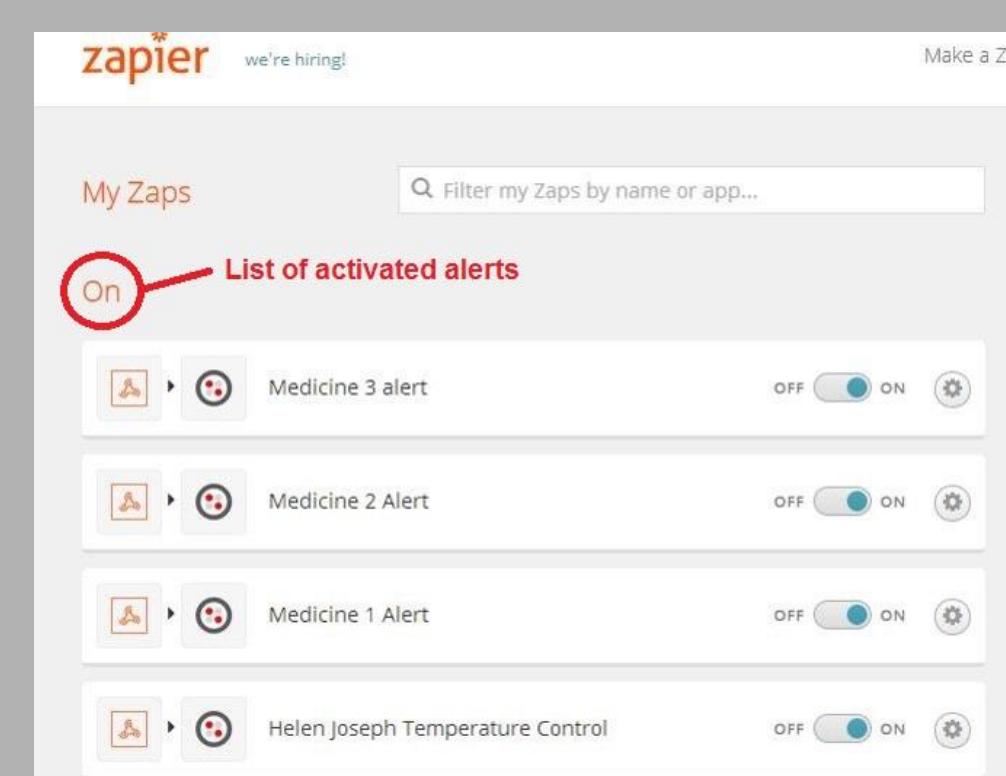
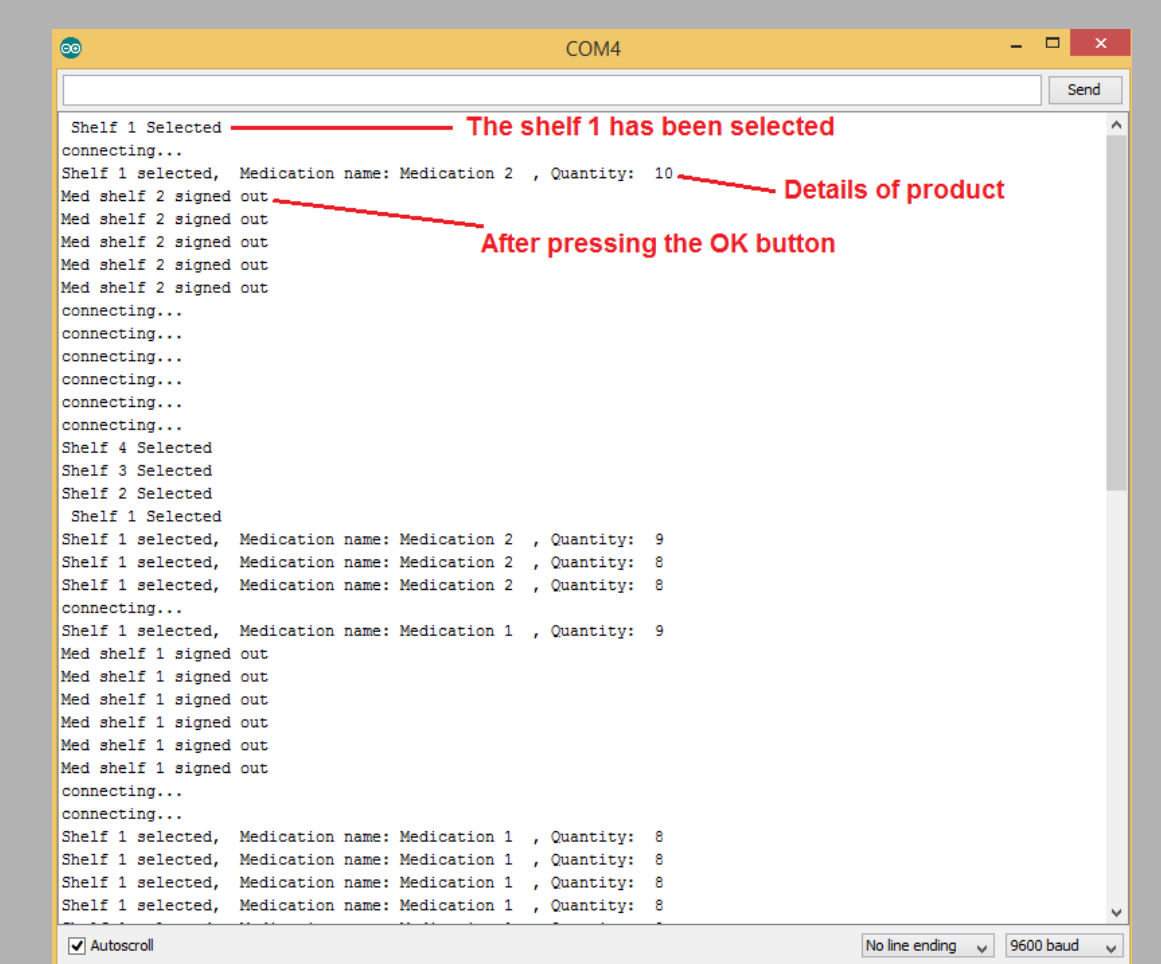*MDM*   *TC*

5. Results

Online monitoring of medications Meds1 and Meds5 quantities from different shelves

Visualization of temperature control within pharmacy

Alert notifications   *Serial monitor GUI recording all transactions*

6. Discussion and conclusion

- Implementation costs cheaper than software-based solutions.
- Reduces paper based work within traditional pharmacies.
- All transactions are recorded on cloud which facilitates monitoring, auditing and accountability.
- System based on electronic sensors making the usage easier and reduces risk of making mistakes.
- Xively and Napier helps protecting the system from online hacking and other bugs.
- This system shows once more the importance of IoT to reach a smart world. But there is still a long way to that goal.

7. References

[1] Y. Huang and G. Li, "Descriptive modes for Internet of things", in *Proc. Int. Conf. Intell. Control Inf. Process.*, Dalian, China, Aug. 13-15, 2010, pp. 483-486.
[2] F. Hu *et al.*, "On the application of the internet of things in the field of medical and health care", in *Proc. IEEE Int. Conf. Internet of Things and IEEE Int. Conf. Cyber, Physical and Social Comput.*, Beijing, China, Aug. 20-23, 2013, pp. 2053-2058.
[3] A. M. Gamundani, "An impact review on Internet of Things attacks", in *Proc. Int. Conf. Emerging Trends Netw. Comput. Commun.*, Windhoek, Namibia, May 17-20, 2015, pp. 114-118.
[4] A. Siri *et al.*, "Comparison of two development boards for embedded system functionalities - Intel Galileo and Intel Atom board SYS9400", in *Proc. IEEE Int. Conf. Internet of Things and IEEE Int. Conf. Cyber, Physical and Social Comput.*, Beijing, China, Aug. 20-23, 2013, pp. 2053-2058.