

I, Robot, Can Help You, Librarian

MPI Luxembourg Library is paving the way

The Max Planck Institute (MPI) Luxembourg for Procedural Law¹ and its Library started in late 2012. The Library had to quickly build an extensive collection and serve an international community of legal researchers. Books started filling the empty shelves in early 2013 at a rate of 800-900 volumes per month. The library team was comprised of four librarians, who in the absence of a library integrated system, were using a simple but very large Excel spreadsheet for all acquisitions and loans. The data migrated from the Excel file to the SWB union catalogue and in May 2014 to the newly implemented library integrated system. With the introduction of an RFID² self check, a full inventory of the then 18,000 items was necessary in parallel with their tagging. That exercise took two months and involved more than 1000 man-hours. A better way had to be found next time we conduct an inventory, and time and labour intensity were just some of the concerns.

Since the 1980s we all have witnessed libraries to continuously ceding some of their traditional territories. Machine-readable catalogues replaced the card catalogues in the 80s, the Internet enabled the online public access catalogue (OPAC) in the 90s, while the RFID allowed borrowing, returning and sorting library items even in the absence of a librarian. Libraries embrace technology to offer better, faster and continuous services to their users. The contemporary world of mobile communications and disruptive technology creates a new type of library user. Which other services could the libraries delegate to machines or systems, in order to inform, inspire or please³ the modern age user and in a seamless way?

¹ Max Planck Institute Luxembourg for International, European and Regulatory Procedural Law. Web site: www.mpi.lu

² Radio frequency identification

³ Melvil Dewey (1926) "Our great function is to inform, or to inspire, or to please; to give the public in the quickest and cheapest way information, inspiration, and recreation on the highest plane."

In their seminal book 'The Future of the Professions'⁴ Richard and Daniel Susskind explore how the professions of lawyers, consultants, teachers, doctors and other 'traditional gatekeepers' of knowledge will be transformed due to the new technologies in what they call 'Internet society'. The authors mark some existing signs of moving from craft to externalization and commons, as parts of the traditionally delivered services within a profession, are now entrusted to machines, systems and even AI. They conclude, that 'increasingly capable machines will take on many of the tasks, that have been the historic preserve of the professions". The book does not reflect on the future of librarians, however, it is not difficult to reflect on our own profession along those lines. We should ask ourselves what are the tasks that we can delegate to increasingly capable machine, and more importantly, what is the core mission which still remains ours as librarians. I started to think that innovation should be practiced daily, and that the introduction of robots in libraries was imminent.

When you are ready to invite somebody to help you with a work, it is within human nature to start with the tasks you are not very fond of – just remember Tom Sawyer and how he painted the fence.⁵ At his time in 1876 he was not aware of the 'robot', a concept introduced by the Czech writer Karel Capek 45 years later, deriving from 'rabota' (work) and 'rabu' (slave). The word implies that a machine could do your work following your orders and thus be your slave.

In our library environment, the inventory is something that calls for a robot, as it is a robust and repetitive work. One might ask why do libraries perform an inventory and whether they still do it. Apart from confirming the presence of physical items in the collection, the inventory finds out which books are missing or shelved at a wrong place, which practically makes them impossible to find or 'missing' too. If books are missing, but we only discover that after many years, it is much more difficult and costly to replace them. Our recent survey⁶ shows that 47% of the libraries still conduct a full or partial

⁴ Richard Susskind, Daniel Susskind: The Future of the Professions. New York: Oxford University Press, 2015, p. 271

⁵ Mark Twain: The Adventures of Tom Sawyer. Hartford: American Publishing Company, 1876.

⁶ 'Robots in Libraries' survey, conducted by MPI library. The survey covers academic, national and big public libraries in Germany, The Netherlands, Luxembourg, Lichtenstein, Norway, Sweden and Switzerland and currently has 85 respondents.

inventory. According to the survey respondents, that exercise might take 400, 800, or in some cases more than 1,000 hours!

The inventory task was the first library task, that I considered worthy of being done by a robot for the above practical reasons. In addition, many libraries already had in place an RFID system to facilitate the automation of the task. I started looking for such a robot. Surprisingly, after more than 10 months our research showed that only one such robot existed. AuRoSs⁷ (currently called SensorBot) was developed by A*Star and was undergoing tests at the National Library in Singapore. Mr. Ho Chin Keong offered a presentation on it during our 'Innovation in Libraries' Conference in October 2016 at the MPI Luxembourg and reported that SensorBot has a reading accuracy of 99%. There was only one little problem for our library to use it. While our RFID tags are UHF⁸ (ultra high frequency), SensorBot could read tags of a lower frequency range, or HF⁹ (high frequency) only.

The negative results of our research were discouraging, but this made the task of finding a solution for our library even more challenging and attractive. If a robot reading UHF tags in libraries did not exist, perhaps it existed in another field of application and there was a chance to convert him. This is how I became aware of the Tory robot, developed by the German company MetraLabs¹⁰. Tory was at that time, in mid-2016, a night shift robot, performing an inventory in big fashion department stores. He (or she?) discovered, that many tags were cut from the clothes and stored by the clients behind the mirrors of fitting rooms! And he was equipped with such antennas as to read UHF RFID tags, to our delight.

Dr.-Ing. Johannes Trabert, CEO of MetraLabs GmbH, was not hard to be convinced. He has an excellent technical background, combined with an innovative and open mind. As a continuously learning person, he is also fond of libraries. Dr. Trabert gladly accepted

⁷ High-tech librarian knows its books. Automated robot that scans library shelves using laser mapping and radio tags can ensure no book is misplaced again. Available at: <https://www.research.a-star.edu.sg/research/7512/high-tech-librarian-knows-its-books> (Last visited 25.12.2017)

⁸ UHF RFID transponders of MPI books have a frequency of 868 MHz.

⁹ HF RFID frequency commonly used is 13.56 MHz.

¹⁰ MetraLabs. Web site: <http://www.metralabs.com/en/>

to come with Tory to our library and to conduct a test on the 26th of October 2016. We had at that time 35,000 items, shelved in two halls with a total surface 500 sq. m.

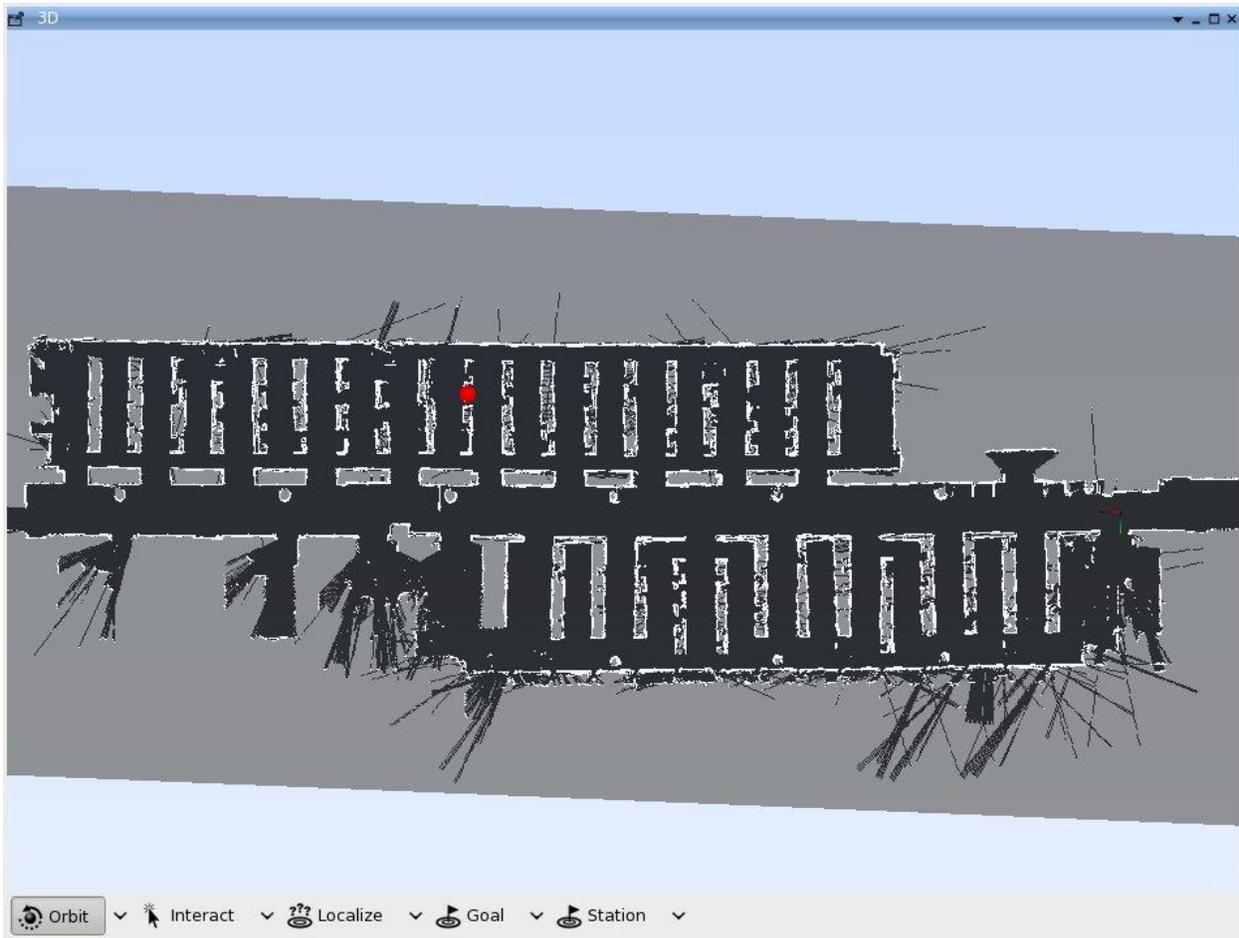
Tory didn't know our library and we didn't provide a map to him. He had to be literally 'pushed' to discover the alleys. The good thing is that he remembered his path and as an autonomous robot was able to walk alone. Many of our users came to meet him and every time someone walked close to him, Tory politely stopped. He confirmed with his actions, that he is certified for safety according to the European standards¹¹. We were curious to follow and observe him at first, but later gave him our confidence to continue doing his task alone. To our great surprise he finished the full inventory of our collection after only one (1) hour!

His findings were exported as an Excel spreadsheet, containing RFID tag numbers. We compared the data with a list of all available tag numbers in our library system, excluding the loaned items. Tory successfully read 34,805 items out of all 35,118 items, which shows an accuracy of 99.1%.

In addition, Tory was entrusted to look for eight missing books. Tory found six of the books and presented his findings as red dots on the map, together with the specific tag number. This help was precious for us, as we found the books shelved in a wrong place. Eighty-one percent (81%) of our survey respondents are willing to delegate the task of locating misplaced books to a robot, especially university librarians who know well the student's habit of hiding books for their own use only.

¹¹ EC Machinery Directive 2006/42/EC of the European Parliament and of the Council. TÜV compliance.

Fig. The red dot represents the specific RFID tag number (or book) that we looked for.



The test of Tory gave very satisfactory results and also a lot of food for thought. I imagined sharing a robot with other libraries in Luxembourg, so that we can optimize the cost and improve our efficiency together. Unfortunately, the two biggest libraries were about to choose a different RFID frequency range, namely HF. This raises two possible solutions. Either libraries join efforts to become compatible by using the same RFID standard, or developers build a robot with changeable antennas to serve both audiences. UHF tag reading was done very fast, but the precision to point an exact location of a book was low – from 0.50 to 1.00 m. MetraLabs has set as a development goal to reach an average value of localization precision 5 cm.

Our research continued to look for other RFID robot implementations in libraries. The Spanish company Keonn is currently testing its AdvanT robot, originally made for department stores, in the Library of Universitat Pompeu Fabra. Infomedis Switzerland is

currently developing its robot. Previously, Infomedis realized the concept of the 'dynamic library' in Sitterwerk, St. Gallen¹², where a machine fixed on the wall has its antennas sliding along the shelves and reading the HF RFID tags of the books.

We started at a very practical level of robot involvement in the library, namely performing an inventory and finding books. However, the robot has a potential to perform a much larger range of tasks in a modern library. Currently, there are no robots conceived especially for libraries¹³, or in the rare cases, they perform only one type of tasks. I envisage, though, the time when robots will be able to multitasking. Let me provide some ideas and examples.

An interesting and easy to implement task will be providing library maps in real time, showing the location of subjects (like law, mathematics, physics) on the library shelves and halls respectively. In the case of MPI library, we are frequently running out of space and fortunately obtaining new spaces. Therefore, we have to move entire sections of the library to new locations. This currently leads to manually changing the shelving plan. It will be more than helpful to obtain the update automatically, by using a robot scanning the surfaces and updating the shelving plan. This is not a new idea, as this is how the term 'Internet of Things' (IoT) started¹⁴. Currently, beyond RFID, objects have a wide range of embedded electronics. Having a robot, equipped with sensors, could provide additional information in libraries – for example humidity, temperature, open windows light comfort, presence of users, etc.

Can we also entrust a robot to interact with the users? Let us call this type of robot a 'social robot', as he is socializing with the users, answering their questions, providing directions and information. The company Alderbaran manufactures the robot Pepper, who is fit to be taught such a task. He needs further programming to better act in your specific environment. Pepper is a humanoid and can walk at the speed of a human. The Technische Hochschule Wildau is teaching Pepper how to understand and answer

¹² Ariane Roth, Marina Schütz: The dynamic library : organizing knowledge at the Sitterwerk - precedents and possibilities. Chicago: Soberscove Press, 2015. 120 p.

¹³ If such robots exist, the author will be very grateful to be informed.

¹⁴ Kevin Ashton first coined the term 'Internet for things' in 1999, as he meant a network of connected RFID objects who can exchange data.

questions. Speech recognition and providing adequate answers are quite a challenging task, but Prof. of robotics Janett Mohnke and Frank Seeliger, Head of the Library, hope that Pepper can become the night shift librarian soon¹⁵.

Japan is a country, which is very open to the introduction of robots in different spheres of life. According to shintoism, every thing, even a non-animated one, has a spirit. This traditional belief may be the reason why robots are so easily accepted. With a quickly growing aging population, the government develops special incentives for the development of nursing and caring robots. The libraries will also soon see robots taking care of the users. According to an article in Robostart¹⁶, the Pepper robot will be deployed in five hundred (500) Japanese libraries.

The introduction of robots in libraries will enable us to stay open 24x7, provide precise and up-to-date information, serve our users in a better way, and even entertain them. A reasonable question is whether the robot will just assist the librarian, or replace her. Asked that question, 89.47% of our survey respondents declare that they do not have such fears. Librarians will be liberated from repetitive tasks and will be able to devote their time to better know and serve their constituency. Tasks involving analysis, innovation, imagination and psychology will still constitute the core of librarian's mission. Our biggest strength is and will be to remain human.

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¹⁵ Wildau Roboter übernimmt Nachtschichten in der Bibliothek - "Hallo, ich bin der neue Mitarbeiter der TH Wildau" <https://www.rbb24.de/wirtschaft/beitrag/2017/02/bibliothek-der-th-wildau-bekommt-humanoiden-helfer.html> (last seen 25.12.2017)

¹⁶ Ryosuke Mochizuki : Pepper answered questions at the library. What is the effort of the library distribution center when aiming to introduce Pepper to 500 libraries operated nationwide? Available at: <https://robotstart.info/2016/08/03/trc-pepper.html> (last seen 25.12.2017)